PSYCHOSOCIAL RISK FACTORS IN THE DEVELOPMENT AND MAINTENANCE OF EATING DISORDERS

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Editorial: Psychosocial Risk Factors in the Development and Maintenance of Eating Disorders

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Editorial on the Research Topic
Psychosocial Risk Factors in the Development and Maintenance of Eating Disorders

Eating disorders (EDs) are disabling mental disorders (Treasure et al., 2020) responsible for increased risk of mortality, high rates of years lived with disability, poorer quality of life, higher costs and family burden (van Hoeken and Hoek, 2020).

Researchers and clinicians agree that a multifactorial model that includes predisposing, precipitating and maintenance factors, is the most suitable for explaining the etiopathogenesis of EDs, instead of a single cause model (Fairburn and Harrison, 2003). Although the predisposing factors (i.e. genetic, psychological, environmental) for EDs are typically more common among patients with an ED than in people from general population, they do not necessarily predict the onset of the disorder (Jacobi et al., 2004). However, the more ED risk factors are present, the more likely an individual will develop an ED. Thus, identification of risk factors can help clinicians to determine high-risk groups for targeted interventions, designing prevention program content, and informing public policy (Striegel-Moore and Bulik, 2007). Moreover, research work continuing to examine ED risk factors is warranted given that the COVID-19 pandemic has exacerbated risk for ED pathology and dysfunctional eating behaviors (Fernández-Aranda et al., 2020; Sideli et al., 2021; Linardon et al., 2022). Unfortunately, the investigation of risk factors that may lead to the onset and maintenance of EDs is challenging.

Therefore, the aim of this Research Topic is to deepen our understanding about how individual psychological characteristics can influence EDs, often worsening the clinical course of illness and resulting in less effective treatments. The primary goal of this

Research Topic is to bring together researchers and clinicians from different theoretical approach to promote and improve discussion between different models psychopathology in the field of EDs.

It is noteworthy that the majority of contributions (80%, 14 out of 18) to this collection focused on clinical samples of patients with EDs.

In this Research Topic, Muzi et al. evaluated the mediating role of personality variables on pre-treatment ED symptomatic impairment and treatment outcome. Their results exhibited that Clusters A and B of the Shedler Westen Assessment Procedure-200 (Shedler and Westen, 2004) were positively associated with higher levels of overall ED symptomatic impairment at treatment intake and worse therapy outcome, with Cluster B showing an additional association with more severe baseline bulimic symptoms. These findings suggest that personality functioning and disorders may predict baseline symptomatic expression and treatment outcome in EDs.

In line with this,Meneguzzo et al., reported no differences in personality traits due to the presence of any trauma during childhood, but their most striking result was that the early maladaptive schema "disconnection and rejection" appears to be a specific mediator in the relationship between childhood trauma and eating psychopathology. The study by Telléus et al. also focused on traumatic events, and found that 67% of the patients with an ED reported traumatic life events, whereby 19% reporting sexual abuse or negative sexual experiences. However, authors stated that a sexual trauma does not necessarily play a causal role in the onset of EDs.

Three studies provide data on the role of the parents' personality traits and attachment in the EDs. Cortés-García et al. considered that the distal risk influence of insecure attachment to the mother in the onset of ED symptoms might be explained by high clinical perfectionism and low self-esteem, after controlling for depressive symptoms. Monteleone et al. deepened the discussion about the parents' coping strategies with anorexia nervosa (AN) by providing evidence that mothers display higher avoidance and seeking information than fathers. Interestingly, lower illness duration predicted higher collusion with the illness in both parents. Cooperativeness, self-directedness, and harm avoidance positively predicted collusion, parental coercion, and seeking information strategies with some differences between fathers and mothers. In sum, illness duration and personality traits of parents affected the type of parental coping strategies developed to face AN in adolescents. Also about the role of parents, Basile et al. reported that safety/protection, care/nurturance, and emotional expression were the most frequently reported unmet needs within the childhood memories of patients, in particular, with regard to the maternal figure. Besides, mothers were described as more abandoning, but at the same time mostly enmeshed in the relationship with their daughters. Conversely, patients perceived their fathers as more emotionally inhibited and neglecting.

Four studies investigated samples of patients suffering from AN. Ramos et al. explored the clinical utility of considering the illness duration at presentation for treatment in AN and clinical impairment as markers of severity. Clinical impairment seems to be the strongest predictor of poor outcome in terms of eating psychopathology, depressive symptoms, emotion dysregulation, and symptom distress. Weineck et al. evaluated the discrepancy between explicit feelings of power and implicit power motives and its relationship to anxiety. Patients with AN displayed significantly lower explicit feelings of power, however, they showed similar implicit power motives compared to healthy controls (HC). The authors consider that the discrepancy between explicit feelings of power and implicit power motives is related to anxiety and may represent a risk factor to the illness maintenance in AN. Mikhaylova and Dokuka conducted interesting research using a concentric circle methodology analyzing 50 ego networks constructed with data drawn from interviews with Russian-speaking bloggers previously diagnosed with AN that write about this condition. The authors reported that young women with AN tend to have a limited number of social ties, and prefer not to connect with family members. Finally, Leslie et al. evaluated differences in the neural correlates of Theory of mind pathways in young women with AN, and young women weight-restored (WR) from AN, as compared to HC. Their results suggest that the neural processing of theory of mind remains more intact in young women with AN than previously thought.

A stimulating study by Gagliardini et al. explored the role of mentalization in EDs. Through a latent profile analysis, the authors found four different profiles in relation to impairments in the dimensions of mentalization: (1) affective/self/automatic imbalances, characterized by the prevalence of affective mentalization that overwhelms the capacity to reflect on mental states with an imbalance on the self-dimension; (2) external imbalance, characterized by excessive focus on the external cues of mentalization; (3) cognitive/self/automatic imbalances, characterized by over-involvement on the cognitive and self-facets of mentalization, with an impairment in adopting the other mind viewpoint; and (4) cognitive/other/automatic imbalances, indicating those patients who have similar impairments compared to profile 3 but with deficits in self-reflection and an excessive focus on others. These profiles were heterogeneous in terms of EDs represented in each group and were related to significant differences on specific domains such as empathy, attachment style, emotion dysregulation, reflective function, and, interpersonal reactivity.

Another interesting article in our Research Topic concerns the role of emotions and psychophysiological responses across the main EDs diagnosis. French and Chen measured respiratory sinus arrhythmia (RSA), skin conductance (SC), and self-reported emotions at baseline and after film clips that elicited either a neutral, sad, happy, or fearful emotional state. They found that ED groups compared to individuals without EDs

generally reported more negative emotions (e.g sadness and anxiety) but were not more emotionally reactive to the film stimuli, which lacked ED-specific content. That is, those with AN reported more fear, those with binge eating disorder (BED) reported more frustration, and those with BED and with bulimia nervosa (BN) reported more tension than healthy controls. Furthermore, patients with BN and BED showed decreased urges to binge during all film clips compared to baseline, suggesting that non-ED specific emotion-eliciting stimuli may at least temporarily decrease urges to binge, even while inducing negative affect.

Gender is a relevant factor in the etiology of ED and the prevalence of the ED show that women are excessively affected, compare to men (Keski-Rahkonen and Mustelin, 2016; Udo and Grilo, 2018). Springmann et al. expand the discussion of gender and ED. They suggest that understanding the role of gender for ED relies on adequate methodological and theoretical access to the construct of gender.

Concerning non-clinical samples, Conceicao et al. evaluated a model representing the interplay between the main aspects of the ED psychopathology and different dimensions of emotion and behavior regulation and self-criticism to understand loss of control (LOC) of eating among 341 college campus students. Their findings showed that LOC of eating occurred for individuals with higher ED psychopathology who experienced depressive symptoms. Moreover, self-criticism was a mediator between emotion regulation and disorder eating, which was significantly associated with LOC eating via increased negative urgency.

Aouad et al. investigated the relationship between defense-style (coping strategies) and ED outcomes over a 5-years period. They found that immaturity and neuroticism but not maturity were the defense-style variables that predicted psychological distress over a 5-years period, while psychological distress predicted only neurotic defense styles. These results may suggest that without treatment, mature, immature and neurotic defense-styles may largely remain immutable to significant shifts over time.

It is well-known that participating in specific activities like dance could be an ED risk factor. Santo André et al. explored how a group of classical ballet dancers perceived their eating attitudes and their bodies, looking for possible EDs symptoms and body image (dis)satisfaction. The constant restrictive diets and other weight-loss strategies to achieve a leaner body were associated with ED symptoms and body dissatisfaction. Remarkably, 50% of the sample were dissatisfied with their current body shape, and for 57% of them the desired body shape was a leaner figure than the one they considered healthy.

Finally, a study explored the psychological correlates of excessive healthy and orthorexic eating in a convenience sample of 399 adults. Strahler et al. found increased difficulties in regulating their emotions and more insecure attachment pattern among people with higher pathological orthorexic eating. According to the authors differentiating between pathological (i.e. clinically relevant) and healthy (i.e. merely a healthy interest in nutrition) orthorexic eating behaviors can be helpful for the diagnosis of orthorexia nervosa.

As an ideal conclusion of the present Research Topic, the article by Pellegrini et al. proposed a reflection on the functioning of EDs that include the impact of early relational trauma on emotion regulation strategies, the role of attachment relationships in the development and maintenance of these disorders, the narrative construction of the self and the symptom, and connections with somatic memories. For a better understanding of eating disorders, they propose the model of Multiple Access Psychotherapy (MAP). MAP focuses on the self-referential modalities through which the individual tends to build the representation of the self and of oneself in the world, adapting the own preferred "access route" to deal with suffering.

The present Research Topic was designed to promote a scientific discussion around, and e fforts to address the complex issue of the psychosocial risk factors of EDs. Relevant manuscripts were collected to increase our knowledge on several aspects of these risk factors in EDs. A major part of clinical research is currently directed toward trying to identify the underlying factors of different psychological disorders, moving beyond any reductionist approach. The identification of such factors provide crucial information for the development of effective prevention and treatment programs.

All the manuscripts in this Research Topic provided a broad description and explanation of the psychosocial risk factors in ED, and sought to provide practical and useful information on their evaluation and usefulness in different treatment options. We believe that identifying risk factors in EDs still represents a challenge for all health and mental health professionals.

Overall, we hope that this Research Topic dedicated to the psychosocial risk factors in EDs will contribute to further improvements in the field, providing interesting insights and help clinician and researchers to grasp the complexity of this topic.

Author contributions

MA wrote the first draft of the manuscript. CS-G, GLC, AC, GN, and GT provided critical revision of the manuscript and important intellectual contributions. All authors read and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Neural Correlates of Theory of Mind Are Preserved in Young Women With Anorexia Nervosa

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People with anorexia nervosa (AN) commonly exhibit social difficulties, which may be related to problems with understanding the perspectives of others, commonly known as Theory of Mind (ToM) processing. However, there is a dearth of literature investigating the neural basis of these differences in ToM and at what age they emerge. This study aimed to test for differences in the neural correlates of ToM processes in young women with AN, and young women weight-restored (WR) from AN, as compared to healthy control participants (HC). Based on previous findings in AN, we hypothesized that young women with current or prior AN, as compared to HCs, would exhibit a reduced neural response in the medial prefrontal cortex (mPFC), the inferior frontal gyrus, and the temporo-parietal junction (TPJ) whilst completing a ToM task. We recruited 73 young women with AN, 45 WR young women, and 70 young women without a history of AN to take part in the current study. Whilst undergoing a functional magnetic resonance imaging (fMRI) scan, participants completed the Frith-Happé task, which is a commonly used measure of ToM with demonstrated reliability and validity in adult populations. In this task, participants viewed the movements of triangles, which depicted either action movements, simple interactions, or complex social interactions. Viewing trials with more complex social interactions in the Frith-Happé task was associated with increased brain activation in regions including the right TPJ, the bilateral mPFC, the cerebellum, and the dorsolateral prefrontal cortex. There were no group differences in neural activation in response to the ToM contrast. Overall, these results suggest that the neural basis of spontaneous mentalizing is preserved in most young women with AN.

Keywords: anorexia nervosa, theory of mind, autism spectrum disorder, neuropsychology, functional magnetic resonance imaging

Anorexia nervosa (AN) is a severe eating disorder characterized by food restriction and compensatory behaviors leading to body weight which is excessively low for the individual's height and development status (American Psychiatric Association, 2013). AN has a complex etiology, with a number of genetic and environmental risk factors contributing to onset of the disorder. Recent theoretical models have highlighted the importance of interpersonal difficulties in contributing to the onset and maintenance of AN (Schmidt and Treasure, 2006).

Theory of mind (ToM) has been defined as the ability to infer information about others' emotions, intentions, knowledge, and beliefs from social interactions or given information (Frith and Frith, 2005). ToM abilities are therefore critical in most social situations to effectively understand and respond to the behaviors and intentions of others. Problems in ToM have been well-documented in autism and recent research has also found problems in ToM among people with AN, including difficulties with emotional and cognitive ToM (Bora and Köse, 2016; Leppanen et al., 2018; Kerr-Gaffney et al., 2019; Sedgewick et al., 2019). It is possible that ToM processes may hinder individuals' response to talking therapies, such as by contributing to poor self-insight, and may impact affected individuals' ability to access and utilize social support networks in the recovery process (Bora and Köse, 2016). It is, therefore, pertinent to better characterize the nature of ToM difficulties in AN and its underlying biological mechanisms in order to better understand the development of AN and possible social-cognitive targets for treatment intervention (Russell et al., 2009).

In the general population, ToM is associated with a complex network of brain regions. In particular, the temporo-parietal junction (TPJ) has been highlighted as a putative region that supports the formation of mental representations (Abu-Akel and Shamay-Tsoory, 2011; Döhnel et al., 2012). Following initial detection and representation of mental states, previous authors have hypothesized that the TPJ subsequently relays this information via the superior temporal sulcus (STS) to limbic and paralimbic regions for emotional processing (Abu-Akel and Shamay-Tsoory, 2011; Gao et al., 2019).

The bulk of neuroimaging research administering a ToM task during scanning has found different patterns of activation in autistic people[1] compared to control participants. For example, research has found lower levels of activation in the right TPJ (Castelli et al., 2002; Kirkovski et al., 2016) and altered functional connectivity between anterior and posterior brain regions among autistic people during ToM tasks (Kana et al., 2009). However, more recent evidence has suggested that these differences may be specific to men, with autistic women exhibiting similar activation in the right TPJ and ventromedial prefrontal cortex (mPFC) during a mentalizing task compared to that of typically developing women (Kirkovski et al., 2016; Lai et al., 2019).

By contrast, recent evidence has highlighted differences in the brain networks recruited during ToM tasks in women with AN versus healthy controls (HCs), which may underpin functional differences in ToM abilities. McAdams and Krawczyk (2011), for example, found that, when compared to the HC participants, participants with a history of AN exhibited lower neural activation in brain regions forming part of the social cognition network, including the right inferior frontal gyrus, the bilateral TPJ, and the left fusiform gyrus during an implicit social attribution task. Schulte-Rüther et al. (2012) conducted a functional magnetic resonance imaging (fMRI) study using a similar ToM task in female adolescent inpatients with AN and HC participants. The authors found reduced neural activation in the middle and anterior temporal cortex and mPFC during the ToM task, as compared to the HC group. Furthermore, the level of hypoactivation in the mPFC was correlated with clinical outcome 1 year following discharge.

The current study aimed to expand on previous neuroimaging research into ToM in AN in a more highly powered study, thus enabling us to draw more confident conclusions about the degree of difference in the neural underpinning of ToM in young women with AN, and those weight-restored from AN, as compared to age-matched controls. We also sought to investigate the relationship between ToM-related neural activation and autistic features in young women with AN. Whilst undergoing an fMRI scan, participants completed the Frith-Happé task, which is a commonly used measure of ToM with demonstrated reliability and validity (Abell et al., 2000; White et al., 2011). Based on previous findings in AN, we hypothesized that the mPFC, the inferior frontal gyrus, and the TPJ would be associated with a reduced blood-oxygenated-level-dependent (BOLD) response in young women with, and weight-restored from, AN as compared to HCs, whilst completing the Frith-Happé task. We also hypothesized that greater levels of autistic characteristics in participants with AN would be associated with reduced ToM-related neural activation in the mPFC and related circuits extending to the TPJ.

MATERIALS AND METHODS

Participants

A total of 188 young women between 16 and 25 years old participated in the current study. Seventy-three women met DSM-5 criteria for AN at the time of the study, 23 women were weight-restored from AN but exhibited continuing elevated levels of eating disorder symptoms, 22 women were in full recovery from AN, and 70 comparison women had no current or prior history of an eating disorder. Given the low sample sizes for the weight-recovered and fully recovered participant samples, these groups' data were pooled into a single weight-recovered (WR) participant group for all analyses. The BMI range of HC participants was 18.29–33.39, the BMI range of participants with acute AN (AAN) was 12.65–18.50, and the BMI range of WR participants was 18.36–26.81. The average duration of illness for participants with current AN was 3.10 years (SD = 2.56 years) and the average duration of illness for WR participants was 4.53 years (SD = 2.78 years). Demographic statistics and

[1]Identity-first language (i.e., autistic person), opposed to person-first language (i.e., person with autism), is preferred by many autistic people and their allies. Therefore, in this article, the authors use predominantly identity-first language to describe this population (Kenny et al., 2016).

clinical characteristics associated with each participant sample are presented in **Table 1**. Full inclusion and exclusion criteria for the study and details of the participants' medication use are presented in the **Supplementary Material**.

Participants with AAN were recruited from the South London and Maudsley National Health Service Foundation Trust. The HC and WR participant groups were recruited via social media, via the website for BEAT (the UK's charity for eating disorders), and through advertisements in the local community. All participants provided written informed consent to take part in the study and, for participants under the age of 18, parental consent was also obtained. Ethical approval for the study was granted by the London – Surrey Borders Research Ethics Committee (REC Reference: 17/LO/0271). All study activities were in completed in accordance with the Declaration of Helsinki.

Measures

The Eating Disorders Examination – Questionnaire version (Fairburn et al., 2009), the Hospital Anxiety and Depression Scale (Zigmond and Snaith, 1983), the National Adult Reading Test (Nelson, 1982), Autism Quotient-10 item version (Allison et al., 2012), and the Autism Diagnostic Observation Schedule (Lord et al., 2000) were administered to the participants. Details about these measures are presented in the **Supplementary Material**.

The Frith-Happé Animations

The Frith-Happé animations depict a series of cartoons in which a red triangle and a blue triangle can be seen to move around a central open box, often in a way that implies they are animate and interacting (Abell et al., 2000). The Frith-Happé animations fall into three categories: (1) Random movement, in which the two triangles appear to float across the screen, occasionally bumping into each other, but displaying no symbolic social interaction; (2) Goal-directed movement, in which the triangles move in the same direction, and may appear to chase each other, but do not exhibit mentalizing behavior; and (3) ToM interactions, in which the triangles appear to take the other shape's thoughts and beliefs into account, such as by tricking or coaxing the other triangle to do something. The Frith-Happé animations are sensitive to difficulties with ToM even in autistic people with an IQ within the normal range, who pass standard first- and second-order false belief tasks (Abell et al., 2000). The Frith-Happé animations have a standardized coding system that produces an accuracy measure and a language measure for each of the three types of trials. Each trial's accuracy is rated as 0 if the participant's narrative contains a plainly wrong description and/or focuses on an unimportant aspect, 1 if the participant's narrative contains a partial description of the sequence, but is imprecise or incomplete, and 2 if the participant's narrative is a spot-on description of the story or the actions represented. Each trial's language was coded as 0 if the participant describes a simple action with no interaction between the triangles, 1 if the participant describes interaction between the triangles without reference to mental states, and 2 if the participant uses mental state verbs to describe reciprocal interactions between the triangles.

TABLE 1 | Descriptive demographic and clinical statistics.

	Healthy Control (n = 70)			Acute AN (n = 67)			Weight-restored AN (n = 49)			K–W Test Statistic	P
	Mean (SD)	Median (IQR)	Skew	Mean (SD)	Median (IQR)	Skew	Mean (SD)	Median (IQR)	Skew		
Age (Years)	19.64 (3.30)	18.54 (17.39–22.72)	0.52	18.70 (2.78)	18.40 (16.53–20.90)	0.44	19.72 (3.27)	18.94 (17.31–22.41)	0.23	3.85	0.278
BMI	22.82 (3.31)	22.26 (20.68–24.35)	1.03	16.61 (1.41)	16.82 (15.77–17.77)	−0.65	20.84 (2.26)	19.96 (19.17–21.87)	1.20	123.81	<0.001
IQ	109.05 (6.86)	110.35 (104.78–113.66)	−0.85	111.55 (7.79)	110.77 (106.22–117.17)	−0.06	111.80 (7.52)	111.18 (107.46–117.38)	−0.63	4.63	0.201
EDE-Q Global Score	0.60 (0.83)	0.30 (0.14–0.60)	2.82	3.33 (1.47)	3.62 (2.14–4.55)	−0.46	2.83 (1.67)	2.97 (1.13–4.30)	−0.25	81.41	<0.001
AQ10	2.31 (1.72)	2.00 (1.00–3.00)	0.95	3.98 (2.41)	4.00 (2.00–6.00)	0.36	3.54 (2.16)	3.00 (2.00–5.00)	0.75	20.81	<0.001

AN = anorexia nervosa; AQ10 = Autism Quotient-10 item version; BMI = body mass index; EDE-Q = Eating Disorder Examination – Questionnaire version; K–W = Kruskal–Wallis; IQ = intelligence quotient; IQR = interquartile range.

Procedure

Each participant attended two study sessions. During the first session, participants completed the self-report questionnaires and structured clinical interviews (e.g., the ADOS). Participants were screened for MRI safety prior to proceeding to the second session.

Upon presentation to the second study session, participants completed a narrative version of the Frith-Happé animations outside of the scanner. During each trial of the Frith-Happé animations, the participants were asked to describe what they thought the triangles were doing. Participants' descriptions of each trial were audio-recorded and these behavioral data, collected outside of the scanner, were later analyzed. Participants subsequently underwent an fMRI scan in which they completed a battery of neuropsychological tests. The Frith-Happé task was repeated inside the scanner as before except that, rather than the participant describing what the triangles were doing, at the end of each trial participants were instead asked to use a button box to indicate whether the triangles had exhibited random, goal-directed, or ToM movements. The multiple-choice version of the Frith-Happé animations has previously been validated in adults within the context of fMRI scanning paradigms (White et al., 2011).

fMRI Scan Acquisition

A total 307 volumes were acquired during the Frith-Happé task. Images within the fMRI scans were acquired with a slice thickness of 4 mm and a slice gap of 0.5 mm. A total of 28 slices were acquired in a top to bottom order. The field of view was 192 mm^2 with a 64 × 64 matrix size. The resulting voxel size was therefore 3 mm × 3 mm × 4 mm. The scan was conducted with an echo time of 30 ms and a repetition time of 2,000 ms. The flip angle was set to 80 degrees. A 3D high- spatial-resolution, Magnetization-Prepared Rapid Acquisition (3D MPRAGE) T1-weighted scan was also acquired. Field of view was 270 mm^2, TR/TE/TI = 7.312/3.016/400 ms. Two dummy scans were acquired at the start of the task and were subsequently discarded.

Statistical Analysis

Behavioral Data Analysis

The audio recording of each trial in the Frith-Happé task was coded by one researcher, and then checked by a separate researcher. Initial inter-rater reliability was 92.23%. Discrepancies were subsequently reviewed by the lead author, such that instances of agreement with the second coder were confirmed and instances of disagreement were resolved by discussion. We planned to compare the accuracy and language scores of the three participants groups for random, goal-directed, and ToM trials on the Frith-Happé task using between-groups ANOVAs in line with the analyses previously conducted by Abell et al. (2000). However, as the residuals for the between-groups ANOVAs were not normally distributed, we instead conducted a Kruskal–Wallis test for each comparison and subsequently controlled for multiple corrections using an alpha rate of $p < 0.05_{\mathrm{FWE-corrected}}$.

MRI Data Pre-processing

We conducted pre-processing of the MRI data using fMRIprep 1.2.6-1 (Esteban et al., 2017, 2019), which is based on Nipype 1.1.7 (Gorgolewski et al., 2011; Gorgolewski, 2017). The full boilerplate associated with fMRIPrep, containing extensive details of pre-processing, is presented in the **Supplementary Material**.

MRI Data Analysis

We conducted both first- and second-level processing using FSL FEAT (FMRI Expert Analysis Tool) Version 6.00 (Smith et al., 2004; Jenkinson et al., 2012). At the single subject level, the data were modeled using the general linear model framework. We operationalized the "ToM" regressor as a linear contrast increasing in value from random trials, to goal-directed movements, to ToM trials and a separate contrast decreasing in social value from ToM trials, to goal-directed movements, to random trials. The BOLD signal was modeled by convolving our design matrix with a Double Gamma function. We included global signal, derivatives of motion parameters, squares of motion parameters, and a scrubbing variable excluding volumes with a framewise displacement >0.9 as confound variables at the single-subject level.

At the group level, we conducted region-of-interest (ROI) analyses using FSL featquery. We constructed the ROI masks based on peak coordinates from previous relevant studies. ROIs were 10 mm spheres based on coordinates identified by previous ToM research for the right inferior frontal gyrus [MNI coordinates [52 28 8] (McAdams and Krawczyk, 2011)] and the right TPJ [MNI coordinates [54, −52, 26] (Krall et al., 2015)]. As a 10 mm sphere localized in the mPFC crossed the brain boundary, we instead constructed a 9 mm spherical mask within the mPFC in order to avoid extracting null data from outside of the brain [MNI coordinates [4 60 20] (Schulte-Rüther et al., 2012)]. We subsequently conducted exploratory whole brain analyses using cluster level inference with a cluster threshold of $Z > 3.1$ and $p < 0.05$, corrected for multiple comparisons using Gaussian random field theory.

Four participants did not complete the ToM task and two participants had scans of unusable quality, resulting in a total of 182 participants' data included in the final analysis. A power analysis conducted in G*Power revealed that our between-groups analyses were powered to detect small to medium effect sizes ($f = 0.23$) (Erdfelder et al., 1996).

RESULTS

Behavioral Data Analyses

Descriptive statistics associated with the accuracy and language scores of the Random, Goal-Directed, and ToM trials for each participant group and results of the Kruskal–Wallis tests comparing the participant groups are presented in **Table 2**. There were no significant between-group differences in accuracy for any of the three trial types. The analysis initially identified differences in the level of social language used for the random and ToM trials, such that HC participants tended to use greater levels of social language to describe random trials than participants with AAN and WR participants tended to use greater levels of social language to describe ToM trials than participants with

TABLE 2 | Descriptive statistics associated with the accuracy and language scores of the Random, Goal-Directed, and Theory of Mind trials for each participant group.

	Healthy Control M (SD)	Acute AN M (SD)	Weight-Restored AN M (SD)	Kruskal test statistic	*p*-value	FWE-corrected *p*-value
Random Accuracy	1.62 (0.612)	1.73 (0.477)	1.70 (0.434)	1.05	0.591	0.591
Random Language	0.53 (0.610)	0.23 (0.460)	0.42 (0.679)	9.47	0.009	0.052
Goal-Directed Accuracy	1.52 (0.311)	1.45 (0.320)	1.57 (0.308)	4.23	0.121	0.288
Goal-Directed Language	1.02 (0.169)	0.96 (0.119)	1.04 (0.193)	5.91	0.052	0.192
Theory of Mind Accuracy	1.25 (0.434)	1.12 (0.325)	1.24 (0.366)	4.47	0.107	0.288
Theory of Mind Language	1.32 (0.351)	1.21 (0.277)	1.37 (0.338)	7.06	0.029	0.138

AN = anorexia nervosa; FWE = familywise error.

AAN. However, these differences did not survive correction for multiple comparisons.

ROI Analyses

We conducted a between-groups ANOVA comparing mean BOLD activation within the mPFC, the TPJ and the inferior frontal gyrus. There were no significant differences between the three participant groups for any of the ROIs. We subsequently added psychiatric medication use as a covariate in a between-groups ANCOVA. This ANCOVA also did not reveal significant differences between the three participant groups for any of the ROIs.

Exploratory Whole-Brain Analyses

An initial one-sample *t*-test revealed 19 significant clusters associated with increasing complexity of the ToM contrast and a separate one-sample *t*-test revealed 20 significant activation clusters associated with decreasing complexity of the ToM contrast. These task-activated regions conform with previous norms reported within the ToM literature, including activation within the TPJ, mPFC, and inferior frontal gyrus. The full results of these one-sample *t*-tests are presented in **Supplementary Tables 1, 2**.

A between-groups ANOVA comparing the ToM contrast between the three participant groups did not reveal any significant clusters associated with increasing or decreasing social complexity of the ToM contrast. We next conducted a sensitivity analysis excluding participants taking psychoactive medication to account for any suppression of between-group differences driven by psychotropic medication. This between-groups ANOVA also failed to detect any significant between-groups differences associated with increasing or decreasing complexity of the ToM contrast.

Finally, we conducted exploratory whole brain analyses within the AAN participant group including the AQ10, ADOS Communication and Social subscale, ADOS interaction subscale, ADOS imagination and creativity subscale, the ToM accuracy and language scores, BMI, global EDE score, and illness duration as covariates in nine separate one-sample *t*-tests. The ADOS communication and social subscale and the ADOS interaction subscale were both correlated with BOLD response to decreasing complexity of the ToM contrast within the right extrastriate cortex (i.e., higher ADOS scores were associated with lower BOLD response to ToM trials). Cluster peaks for the ADOS interaction subscale were located at MNI coordinates [23.5, −78.5, −10.5] and [15.5, −82.5, −16.5]. The cluster peak for the ADOS Communication and Social subscale was located at MNI coordinate [23.5, −78.5, −12.5]. The ToM imagination and creativity subscale was associated with decreasing complexity of the ToM contrast within the left dorsal posterior cingulate cortex. The cluster peak was located atMNI coordinate [−6.5, −42.5, 41.5]. Illness duration was correlated with the BOLD response to increasing complexity of the ToM contrast in the left parahippocampal gyrus, MNI coordinate [−22.5, −22.5, −14.5] and to decreasing complexity of the ToM contrast in the left premotor cortex, MNI coordinates [−22.5, −4.5, 55.5] and [−26.5, −0.5, 63.5]. There were no significant associations between any of the other covariates and BOLD response to the ToM contrast amongst participants with current AN.

DISCUSSION

The current study aimed to test for differences in the brain correlates of ToM processing in young women with AN, young women weight-restored from AN, and healthy comparison participants. We hypothesized that participants with, or weight-restored from, AN would exhibit reduced activation in the mPFC, the TPJ, and the inferior frontal gyrus in response to a ToM task, when compared to those without history of an eating disorder. Our manipulation check revealed that task-activated regions conformed with previous norms reported within the ToM literature, including activation within the TPJ, mPFC, and inferior frontal gyrus. However, the data did not support any of these hypotheses, as there were no significant between-group differences in BOLD response to a spontaneous mentalizing task. We also hypothesized that neural activation within the mPFC, the TPJ, and the inferior frontal gyrus would be negatively correlated with autistic traits amongst participants with AN. The latter hypothesis was not supported by the results, as autistic traits were not associated with task-related activation in these three hypothesized regions. However, the ADOS communication and interaction scales were associated with task-related neural response in early visual processing regions. Furthermore, illness duration was found to be associated with task-related neural response in the left parahippocampal gyrus and left premotor cortex.

Our behavioral findings corresponded with previous studies which also found no evidence of differences in accuracy between women with a history of AN and HC participants on spontaneous mentalizing tasks (McAdams and Krawczyk, 2011; Schulte-Rüther et al., 2012). However, the lack of group differences

in brain response to the ToM task was an unexpected result, which contrasts with previous studies finding altered patterns of BOLD responses to a very similar task among adult women in recovery from AN (McAdams and Krawczyk, 2011) and in a previous study conducted in adolescents with AN (Schulte-Rüther et al., 2012). There are several potential explanations for this difference in findings. First, it may be the case that differences in the neural underpinning of ToM develop progressively throughout the course of the illness and remain for some time after recovery, which might explain why a different pattern of neural response to a similar ToM task has previously been observed amongst older adult women in weight recovery from AN, as compared to age-matched control participants, but not in our sample of young adults with AN (McAdams and Krawczyk, 2011). However, this explanation does not account for the failure to replicate previously documented differences in BOLD responding to a ToM task amongst adolescents with AN (Schulte-Rüther et al., 2012).

It is possible that the present results may reflect no true differences in the neural underpinnings of ToM across the entire population of young adults with AN. Indeed, our relatively large sample size of 188 young adults, including 73 young adults with current AN, 45 young adults in weight recovery from AN, and 70 HC participants, is likely to be associated with more stable effect sizes and reduced confidence intervals than the previous study conducted in young people with AN, which recruited only 19 participants with current AN. This is consistent with the notion that ToM impairments are present in a subgroup of those with AN, but do not feature on average across cases with adolescent onset (Stewart et al., 2017).

The current results suggest that differences are specifically observed in individuals with AN who are high in autistic characteristics. That is, higher levels of communication and interaction difficulties were associated with increased neural response in the extrastriate cortex to decreasing complexity of the ToM contrast. This finding may be explained by previous research demonstrating that, in contrast to neurotypical participants, autistic participants demonstrate a lack of attentional modulation when viewing social stimuli, which is associated with differences in the activation of early visual regions, including the primary visual cortex and extrastriate cortex (Bird et al., 2006). Previous evidence suggests that this between-groups effect is particularly pronounced for subtle, versus overt, social cues (Zürcher et al., 2013), which are exemplified by the representational social cues depicted by triangles in the Frith-Happé task.

The association between duration of AN and task-related activation in the left parahippocampal gyrus and left premotor cortex is, however, more difficult to explain on the basis of previous literature in populations with AN. In the general population, parahippocampal gyrus activation has been observed in response to completing empathy and face recognition tasks (Völlm et al., 2006; van Veluw and Chance, 2014). It may be that the effects of more prolonged malnourishment disrupt circuits related to social memory and the perception of social stimuli mediated by the parahippocampal gyri. However, further evidence is needed to more clearly establish the functional significance of this finding.

The current findings add to our understanding of the complex pattern of differences exhibited by people with AN across different domains of ToM. A recent meta-analysis of ToM abilities in people with AN found that, while affected individuals exhibit statistically significant differences in the domains of emotional ToM, understanding simple social interactions, and understanding complex social interactions, there was no significant difference in the domain of implicit social attribution, measured in the current study (Leppanen et al., 2018).

Indeed, the extent of blanket differences in spontaneous mentalizing abilities and gross differences in associated neural activation has more recently been questioned, even in autistic populations. For example, a recent large study recruiting more than 300 autistic participants found no differences in performance or neural activation on the Frith-Happé task, when compared to HC participants (Moessnang et al., 2020). Furthermore, previous evidence, which did find differences in the neural correlates of ToM in autistic men, did not find similar differences in autistic women (Kirkovski et al., 2016; Lai et al., 2019). These previous findings are difficult to reconcile with our current observation that some components of autistic traits are, indeed associated with neural response to a ToM task. Further research in large samples of autistic women will help to clarify whether such differences may be specific to those with the greatest levels of communication and social interaction difficulties, as suggested by our current findings in young women with AN.

Strengths of the current study include the large sample size of women completing both behavioral and fMRI tasks, allowing greater confidence in the effect sizes found within the current set of analyses. However, this study is not without limitations, including the specific component of ToM measured within the Frith-Happé task. Thus, while the current study provided no evidence for differences in the brain underpinnings of spontaneous mentalizing in young women with a history of AN versus HCs, problems in this population have previously been observed for other components of ToM (Leppanen et al., 2018), and may be associated with a different pattern of neural activation on other ToM tasks. Additionally, it is possible that presenting a descriptive version of the task prior to the neuroimaging scan resulted in a "training" effect, perhaps resulting in the recruitment of a greater degree of memory processes and lesser degree of ToM processes than would have been observed had participants viewed the task for the first time during the fMRI scan. Further research will therefore be required to corroborate these results and examine potential differences in the neural underpinnings of emotional ToM and complex social interactions. Finally, as this study was conducted exclusively in young women, the current findings should not be generalized to men or older adults with AN.

While the current study has replicated consistent findings in brain regions that underpin ToM processing, including within the rTPJ and mPFC, we did not find evidence for between-group differences in the neural underpinnings of spontaneous mentalizing in young women with a history of AN versus HC

participants. It should be noted that this null finding may be due, in part, to the specific ROI masks analyzed in the current study. We based our ROIs on previous studies conducted in AN to maximize applicability to the population recruited in the current study. However, these previous activation peaks were observed in relatively small samples, and a different pattern of results may have been observed had we based our ROIs on regions that are generally activated during the Frith-Happé task in HC participants. Future research will help to clarify whether different patterns of neural activation underpin behavioral performance in other domains of ToM and more clearly establish the functional significance of the association between illness duration and task-related neural response. Overall, the current set of findings suggests that the neural processing of spontaneous mentalizing remains more intact in young women with AN than previously thought.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by The London – Surrey Borders Research Ethics Committee (REC Reference: 17/LO/0271). Written consent to participate was provided by participants. Written consent was also provided by the participant's legal guardian where participants were under the age of 18.

AUTHOR CONTRIBUTIONS

KT, KL, JL, LF, MS, WM, DN, and SW contributed to the conceptualization and design of the study. JL and FS conducted the study. ML and DH conducted the analyses reported in the current study and wrote the current manuscript. JL, FS, and KS also contributed to data analysis. JL, FS, KS, HH, KL, LF, MS, WM, DN, DM, SW, and KT edited the current manuscript. All authors contributed to the interpretation of the results.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2020.568073/full#supplementary-material

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CORRECTION
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Corrigendum: Neural Correlates of Theory of Mind Are Preserved in Young Women With Anorexia Nervosa

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A Corrigendum on

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In the original article, there was an error. The ADOS subscales included as covariates in exploratory fMRI analyses were mislabeled.

A correction has been made to *Results, Exploratory Whole-Brain Analyses, Paragraph 3.*

The corrected paragraph is presented below:

Finally, we conducted exploratory whole brain analyses within the AAN participant group including the AQ10, ADOS Communication and Social subscale, ADOS interaction subscale, ADOS imagination and creativity subscale, the ToM accuracy and language scores, BMI, global EDE score, and illness duration as covariates in nine separate one-sample *t*-tests. The ADOS communication and social subscale and the ADOS interaction subscale were both correlated with BOLD response to decreasing complexity of the ToM contrast within the right extrastriate cortex (i.e., higher ADOS scores were associated with lower BOLD response to ToM trials). Cluster peaks for the ADOS interaction subscale were located at MNI coordinates [23.5, −78.5, −10.5] and [15.5, −82.5, −16.5]. The cluster peak for the ADOS Communication and Social subscale was located at MNI coordinate [23.5, −78.5, −12.5]. The ToM imagination and creativity subscale was associated with decreasing complexity of the ToM contrast within the left dorsal posterior cingulate cortex. The cluster peak was located at MNI coordinate [−6.5, −42.5, 41.5]. Illness duration was correlated with the BOLD response to increasing complexity of the ToM contrast in the left parahippocampal gyrus, MNI coordinate [−22.5, −22.5, −14.5] and to decreasing complexity of the ToM contrast in

the left premotor cortex, MNI coordinates [−22.5, −4.5, 55.5] and [−26.5, −0.5, 63.5]. There were no significant associations between any of the other covariates and BOLD response to the ToM contrast amongst participants with current AN.

The authors apologize for this error and state that this does not change the scientific conclusions of the article in any way. The original article has been updated.

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PERSPECTIVE
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Theoretical and Methodological Considerations for Research on Eating Disorders and Gender

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Gender is a relevant factor in the etiology of eating disorders (ED) as evidenced by gender-specific components of disordered eating and by the high risk of ED among transgender individuals, in addition to other factors. However, research on connections between ED and gender identity are limited. Researchers who produce explanatory models, content themselves with faulting the sociocultural ideal of slimness for women, but they fail to grasp the connection between culture, gender and the body and they fall short of integrating this perspective into existing psychological knowledge about ED. Psychological research informed by feminist theory has begun to bridge this gap, but this growing area of research needs to be further developed and should include an understanding of ED in persons with all gender identities. This article expands the discussion of gender and ED, by grounding ED in an understanding of gender itself and by discussing methodological implications of this understanding.

Keywords: eating disorders, gender, LGBTIQ, etiology, interdisciplinary research, feminist theory, methodology

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INTRODUCTION

Data on the prevalence of eating disorders (ED) indicate that women are disproportionately affected, relative to men (Keski-Rahkonen and Mustelin, 2016; Udo and Grilo, 2018). It has been argued that ED in males might be underdiagnosed due to stigmatization and different symptomatology (Stanford and Lemberg, 2012; Strother et al., 2012). Body dissatisfaction in males is concerned with a well-defined muscular body ideal rather than with slimness *per se*, which suggests different patterns of eating and exercise (Murray et al., 2017). ED in persons whose gender identity and/or sexual orientation does not match binary (e.g., male and female) and heterosexual norms have received increased attention. For example, researchers found a higher risk for disordered eating among gay or bisexual men relative to heterosexual men (Gorrell and Murray, 2019). Research results for lesbian or bisexual women are less clear, but data point to a risk that is comparable to or even higher than has been found among heterosexual women (Meneguzzo et al., 2018). Transgender or non-binary persons have shown an especially high risk for intense body dissatisfaction and for ED

(Jones et al., 2016; Feder et al., 2017). Thus, data show that the levels of risk for ED, as well as symptomatology, differ between genders and sexual orientations. Yet, a comprehensive explanation for the role of these factors is missing from explanatory models.

EXPLANATORY MODELS AND THE QUESTION OF GENDER

Decades ago, publications informed by feminist perspectives drew attention to the high value society places on physical beauty when determining a women's social status, as well as to the increasingly rigid standards of slimness and their effects on women's self-evaluations (Boskind-Lodahl, 1976; Rodin et al., 1984; Striegel-Moore et al., 1986). In today's multicausal model of ED etiology (Culbert et al., 2015), slimness idealization has been established as a sociocultural factor that fosters body dissatisfaction and dieting, especially in women. As MacSween (1995) has pointed out, psychological models employ this sociocultural factor as an add-on to biological, cognitive, or psychodynamic explanations that in themselves cannot account for prominent gender differences and that do not provide an integrated understanding of the role of gender.

Cognitive-behavioral models focus on the cognitive experience of eating disordered persons and frame their behaviors as logical consequences of a pattern of self-evaluation based on their ability to control eating, shape and weight (Fairburn et al., 2003). There is evidence that the transdiagnostic model of ED maintenance can be applied to men with ED (Dakanalis et al., 2014). Concerning etiological assumptions and the question of gender, it makes sense that a sociocultural ideal of slimness is a relevant factor in cognitive patterns of self-evaluation, but scholars have not further examined if and/or how this ideal actually explains the gender specificity of ED. Indeed, intraindividual explanations of cognitive models fail to answer the question, "Why it is predominantly women who feel that their personal worth is determined by their bodies and that they can access power and control by suppressing their own needs?"

Sociocultural models have provided solid empirical evidence for the relevance of sociocultural ideals of attractive bodies (body ideals), their mediation and internalization, and offer explanations for differences in symptom presentation between females and males based on different body ideals (Tylka, 2011; Stice, 2016; Klimek et al., 2018). Although the development of sociocultural models is influenced by and overlaps with research specifically addressing the question of gender (Striegel-Moore et al., 1986), the perspective of people who work with sociocultural models is often limited by their focus on beauty ideals alone and by their oversight of other ways that sociocultural context might be relevant, especially when addressing the question of gender.

Concerning biomedical models, scholars working with feminist or sociocultural models have often criticized that this perspective does not live up to the complexity of ED (Levine and Smolak, 2014). In fact, there is no compelling evidence for a gender-specific biological causality. However, there is strong evidence for the relevance of biological factors in the etiology and symptomatology of ED (Bulik et al., 2015; Culbert et al., 2015; Steinglass et al., 2019). We argue that advances in understanding of the interactions between sociocultural factors and gender specific biological developmental processes could provide promising insights (Klump et al., 2012; Murnen and Smolak, 2015; Riva et al., 2015).

Thus, although body ideals may be the most obvious connection to gender, the relevance of gender for ED could be analyzed more in depth. Extensive feminist literature on ED in social sciences postulates interrelations between social structures, gender norms and body image (Bordo, 1993; MacSween, 1995). Feminist scholars often work with social constructionist and poststructuralist accounts, whereas most psychological research is based on a rather positivist research paradigm, which often relies on a medical risk-disease model of ED. Therefore, bringing these lines of research together touches many fundamental theoretical and methodological debates. The strong focus of feminist theories on the social structures and discourses in which disordered eating occurs (and is considered as such) is in conflict with the notion of ED as an intraindividual problem that is inherent in a medical model, even if this model acknowledges social factors. Feminist authors have therefore criticized the medicalization of ED and the inherent power dynamics (MacSween, 1995; Gremillion, 2003; Walsh and Malson, 2010). This article cannot resolve these issues, but aims to point out ways in which feminist theory could further enrich current theories and research.

FEMINIST PERSPECTIVES AND PSYCHOLOGICAL RESEARCH

The basis of a feminist viewpoint is to understand gender as a social construct that ties certain meanings and expectations to different bodies. Gender in this perspective viewed as more of a social position than as an individual trait. Based on their bodily features, people are placed in different categories (e.g., male and female) that are associated with different social experiences. Understanding what it means to be male, female, transgender or non-binary is not possible without analyzing social structures and discourses that give meaning to these terms and influence the lived experience of a person from the very start.

Orbach's theory (Orbach, 1986) is based on the psychodynamic approach to ED: in this perspective, ED are based on a failure to develop an autonomous self and represent a struggle to experience control. However, Orbach expands on this approach by applying a feminist framework that acknowledges gender specific social demands and developmental processes (see also Gilligan and Richards, 2018): Orbach's theory of ED centers on an ideal of femininity that demands that women define themselves in relation to others and that that they address the needs and expectations of others. The suppression of one's own needs or aims is therefore necessary to fulfill the female gender role. Accordingly, a position of relative social powerlessness is

inscribed in the female psyche through socialization, despite the fact that women are technically, legally equal to men. Although a focus on gender roles may seem outdated, research indicates that people today still attribute communal traits to women and agentic traits to men (Ellemers, 2018). Relations between female gender role and ED symptomatology has been studied to some extend in the 1980s and 1990s. In a metaanalysis, Murnen and Smolak (1997) detected a significant, small positive effect of female gender role orientation and a small negative effect of male gender role orientation, despite very heterogeneous results of the individual studies. As has been argued elsewhere (Murnen and Smolak, 1997; Springmann, 2018), results of the individual studies were dependent on the operationalization of gender in specific questionnaires whose suitability to reflect all important aspects of such a complex construct can be contested. Here, we argue that it is less the personal acceptance of a given gender role that is important, but rather, the specific psychological traits that are fostered by socialization according to that role. Psychological research has gathered cross-sectional evidence of the importance of silencing one's own emotions and needs in order to maintain relationships as a factor in disordered eating (Buchholz et al., 2007; Geller et al., 2010; Norwood et al., 2011), although longitudinal data are needed.

The definition of gender as a social position into which a person is placed, based on their body, informs the ways that gendered expectations and restrictions may foster a body-centered psychopathology such as ED. Feminist authors like sociologist MacSween (1995) and philosopher Bordo (1993) have written extensively about the entanglement of social constructions of bodies, selfhood, and gender. Both draw on a dualism between mind and body that is deeply rooted in Western philosophy and that values the control of mind over body. This dualism is also gendered, associating masculinity with the mind and femininity with the body. Historically, in Western culture, men are associated with reason, agency and an instrumentalized, controlled body, whereas women are depicted as more entangled in the biological sphere, passive, and irrational (MacSween, 1995). Therefore, women are more defined by their bodies and seen as objects for the active male to act on. In this perspective, it makes sense that women would consider bodily self-control as a way to achieve agency and subjectivity. Controlling their bodies could be seen as compensating for the passive and objectified qualities they are attributed due to their female bodies. The value of slimness for women is then to embody socially idealized autonomy without violating the demands of the female gender role to be desirable and submissive. Psychological work on ED and gender by Striegel-Moore et al. (1986) has already acknowledged gender differences in the way women and men relate to their bodies (appearance evaluation versus functionality). Yet, the connection between beauty ideals and the pursuit of control or autonomy remained an unanswered question. Feminist theories like those of Bordo (1993) and MacSween (1995) illustrate how gendered body ideals are the embodiment of meanings, attributed to a gender, that change with historical circumstances, rather than random ideas of beauty produced by the media.

Psychological research and theory is needed to transform ideas like these from the level of abstract cultural dynamics to concrete individual experiences that are empirically accessible and that can guide prevention and treatment. This has been done by Fredrickson and Roberts (1997), who reviewed data on social processes by which women are objectified and theorized about the psychological consequences. They proposed that girls learn to constantly view themselves through an evaluating outside perspective and to monitor their bodily appearance. This objectified self-awareness is expected to lead to feelings of anxiety and shame, to a disconnection from inner bodily signals and to a reduced capacity for other mental processes (see also Way et al., 2018). Evidence for the relevance of objectification for ED has been gathered in cross-sectional as well as a longitudinal research (Piran and Cormier, 2005; Dakanalis et al., 2015). Riva (2012); Riva et al. (2015) proposed a theoretical integration of objectifying social experiences and neurocognitive processes that result in a body perception that is 'locked' to a negative outside perspective.

The developmental theory of embodiment (Piran, 2016, 2017) adds fundamentally to the psychological understanding of interactions between social dynamics, gender and the body. Most psychological research draws on a biomedical understanding of the body and studies the relationship persons have with their bodies via a cognitive-perceptual concept of body image. In contrast, the phenomenological concept of embodiment refers to the lived bodily experience of engaging with the world and describes the integration of body and self (McBride, 2019). The urge to control or even fight against one's own body, therefore, is characteristic for disembodiment. The development of embodiment in women has been found to relate to three social factors: physical freedom, mental freedom and social power (Piran, 2017). Thus, restrictions on movement and bodily expression, sexual violation, stereotyping and marginalization are theorized as destructive social processes. Namely, such social processes serve as a conduit through which gendered body ideals and sexism contribute to a disintegration of the body and the self and shape negative experiences of the body and bodily needs. This perspective adds to objectification theory by focusing less on the evaluation of bodily appearance and broadening the scope of social processes relevant for bodily experience.

THEORETICAL IMPLICATIONS FOR DIVERSE GENDERS AND SEXUAL MINORITIES

Risk factors for males discussed in the literature include higher than average BMI, sexual abuse and other victimization, engagement in sports that emphasize weight and body shape, or belonging to sexual or ethnic minorities (Ricciardelli and McCabe, 2004; Murray et al., 2017). Applying embodiment theory, it seems that men develop ED when they are in positions of bodily evaluation, objectification, social disempowerment and discrimination. The lower prevalence of ED in males than in females could be explained by the general assumption that female

gender, as a social position, is more likely to be impacted by social dynamics of objectification and disempowerment. Psychologists may benefit from initiatives to gather more knowledge on embodiment processes in males in order to understand how the discussed risk factors might influence ED symptomatology. Moreover, cultural constructions of masculinity could be relevant to embodiment processes: In a qualitative study, Quiniones and Oster (2019) discussed striving for muscularity or weight loss as ways to deal with constructions of masculinity.

Researchers of ED in sexual and gender minorities stress the relevance of stigmatization and its psychological consequences (Bell et al., 2019). Scholars have established the fact that minority stress leads to psychological strain (Meyer, 2003), but in terms of ED, it is important to understand how minority stress influences a person's relationship with their body (Bosley, 2011). The high risk of ED for gay men is often attributed to the high relevance of physical attractiveness in the gay community. More qualitative studies, like the one conducted by Drummond (2005), that acknowledge the subjective experience of affected persons, may help increase granularity and precision of scholars' understanding about how bodily appearance becomes crucial for social minority men to navigate between different norms and social expectations. Gendered body ideals and the embodiment of gender roles may have different relevance to gay persons of all genders, given that normative gender roles are based on a heterosexual bisection of masculinity and femininity as complementary constructs. For example, a "butch lesbian" with a rather male gender expression may be perceived as highly attractive in her community, but may face devaluation or even hostility in normative culture. Therefore, the way she physically expresses herself might be liberated from normative beauty ideals, but arriving at the place of free expression may not have come easy for her. For others, it might be important to express their female or male gender in accordance with normative beauty ideals despite the underlying assumption that their homosexual or bisexual identity exempts them from compliance with these ideals. Alignment with gender norms might match their personal preferences and/or might enable them to avoid homophobic aggression. Concerning gay women, social factors relevant for the development of ED include experiences associated with belonging to a sexual minority group as well as experiences associated with female gender (Mason et al., 2018).

For transgender persons, the experience of incongruence between their gender identity and their bodies is associated with body discomfort that can be reduced by gender confirming medical interventions (Jones et al., 2016). Yet it might not be satisfaction with one's bodily appearance *per se* that is relevant here, but the social meaning of being able to embody one's core identity. Understanding the experience of being transgender or non-binary in a society with precise norms of masculinity, femininity, and the appropriate bodies for these two categories, is crucial. Otherwise, scholars risk framing the high risk for body discomfort as part of the non-normative gender identity, that is understood as an individual factor, instead of a problem grounded in the social context (Springmann, 2018). As Testa et al. (2017) demonstrated, the effect of gender confirming interventions on body satisfaction is mediated by reduced non-affirmating social experiences (e.g., being referred to with incorrect pronouns). Various studies have highlighted the general importance of social acceptance versus discrimination for ED pathology in transgender and non-binary persons (Watson et al., 2017; Bell et al., 2019). Goldhammer et al. (2019) have outlined ways to address minority stress issues in interventions.

Thus, for the same reasons that feminist authors have criticized a medical model of intraindividual psychopathology for ED in women, a lack of understanding of the social experience of sexual and gender minorities and their own perspective on their eating behaviors might foster pathologization of these persons. Although there has been increased attention to ED mental health literacy (Bullivant et al., 2020) little is known about awareness and understanding of ED in these specific populations. Further research along these lines is needed to improve prevention and health education.

CONCLUSION

Understanding the role of gender for ED relies on adequate theoretical and methodological access to the construct of gender. Feminist theory has presented gender as a key construct that is not just a trait of an individual. Rather, the construct of gender is only understandable by integrating the levels of cultural structures and discourses, specific social processes that are embedded in a given cultural context, the individual experience and engagement with the sociocultural context, and the body as the basis and central medium for this engagement. The suggested transdisciplinary approach to ED in this paper allows researchers to identify specific processes or experiences related to gender that might be important for ED (e.g., objectification), but that do not necessarily affect all persons with similar gender identities in the same way. Psychological research on ED could benefit from the proposed transdisciplinary feminist approach when it is used as a starting point to better understand the relevance of social structures in the etiology and maintenance of ED. Qualitative methods could enrich the understanding of ED because they allow access to subjective experience and meaning by documenting how social pressures get translated into real life experiences. When operationalizing gender in quantitative measures, it is important to take into account: which level of the gender construct is reflected by the chosen measure, if this is actually the adequate approach for the research question, and if it contains normative biases (e.g., not reflecting gender diversity). Thus, theoretical complexity and diversity of methods are likely to advance scholars' etiological understanding of ED in general, since they allow for important integration of social, psychological, and biological factors.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

AUTHOR CONTRIBUTIONS

M-LS drafted the article. JS and MK contributed to several critical revisions. All authors approved the final version.

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Mentalizing Subtypes in Eating Disorders: A Latent Profile Analysis

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Background: Mentalizing, the mental capacity to understand oneself and others in terms of mental states, has been found to be reduced in several mental disorders. Some studies have suggested that eating disorders (EDs) may also be associated with impairments in mentalizing. The aim of this work is to investigate the possible presence of mentalizing subtypes in a sample of patients with EDs.

Method: A sample of patients with eating disorders ($N = 157$) completed a battery of measures assessing mentalization and related variables, including the Reflective Functioning Questionnaire (RFQ), the Difficulties in Emotion Regulation Strategies (DERS), the Interpersonal Reactivity Index (IRI). Clinicians rated patients in relation to imbalances in different dimensions of mentalization to prementalizing modes and attachment style by using the Mentalization Imbalances Scale, the Modes of Mentalization Scale (MMS), and the Adult Attachment Questionnaire. A latent profile analysis was conducted to test the possible presence of different subgroups. MANOVA was used to test the possible differences between the four mentalizing profiles in relation to emotion dysregulation (DERS), empathy (IRI), and adequate and impairments in mentalizing (MMS and RFQ).

Results: The latent profile analysis suggested the presence of four different profiles in relation to impairments in the dimensions of mentalization: (1) affective/self/automatic imbalances, (2) external imbalance, (3) cognitive/self/automatic imbalances, and (4) cognitive/other/automatic imbalances. Patients belonging to profile 1 are characterized by the prevalence of affective mentalization that overwhelms the capacity to reflect on mental states with an imbalance on the self-dimension; profile 2 patients are excessively focused on the external cues of mentalization; profile 3 patients are characterized by an over-involvement on the cognitive and self-facets of mentalization, with an impairment in adopting the other mind perspective; and profile 4 patients have similar impairments compared to profile 3 patients but with an excessive focus on others and deficits in self-reflection. These profiles were heterogeneous in terms of EDs represented in each group and presented significant differences on various variables such as attachment style, emotion dysregulation, empathy, interpersonal reactivity, and

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reflective function. This study represents, so far, the first work that confirms the presence of different mentalizing patterns in ED patients.

Conclusions: ED patients can be classified in relation to impairments in different dimensions of mentalization above and beyond ED diagnosis.

Keywords: mentalization, eating disorders, reflective functioning, anorexia, bulimia

INTRODUCTION

(Tasca, 2019) in recent years, the concept of mentalization has attracted increasing research interest in the field of eating disorders (EDs), and several studies have reported findings of mentalizing difficulties in adults with EDs (Russell et al., 2009; Rothschild-Yakar et al., 2010; Oldershaw et al., 2011; Dejong et al., 2013; Morris et al., 2014). Moreover, some authors have suggested that ED symptomatology may be related to specific, peculiar difficulties in mentalization (Skårderud, 2007). Mentalization can be defined as "the mental process by which an individual implicitly and explicitly interprets the actions of himself and others as meaningful on the basis of intentional mental states such as personal desires, needs, feelings, beliefs, and reasons" (Bateman and Fonagy, 2004, p. 21) and is considered as a multifaceted ability related to eight different dimensions: automatic mentalization, controlled mentalization, mentalization toward self, mentalization toward others, cognitive mentalization, affective mentalization, internally focused mentalization, and externally focused mentalization (Luyten et al., 2012). The automatic dimension refers to the implicit and unconscious processes of recognizing and understanding inner mental states in oneself and others, while controlled mentalization refers to a conscious and deliberate action, such as when we talk about our feelings or motivations. The self and others dimensions are related to the object of mentalizing. Mentalization can, in fact, refer to the capacity to reflect on our own inner experiences, such as when we describe our emotions and/or feelings in a particular situation (the "mentalizing toward self" dimension), but it can also be focused on other people. The cognitive dimension of mentalization refers to the activity of understanding the representational nature of thoughts, while affective mentalization is a particular type of affective regulation that is composed of three different domains (Jurist, 2005): identifying, processing, and expressing affective mental states. Mentalization can be focused either on the external manifestations of mental states (e.g., prosody, body posture, face expressions, etc.) or on the inner world of individuals (e.g., beliefs, desires, etc.).

The literature on EDs and mentalization has theoretically suggested the presence of specific failures of mentalization in these patients (Skårderud, 2007). From an empirical standpoint, different authors have enlightened the presence of mentalizing problems in patients with ED (see, e.g., Aloi et al., 2017; Maxwell et al., 2017; Simonsen et al., 2020). A previous study on 25 patients with EDs ($n = 13$ with anorexia-restricting type, $n = 7$ with anorexia binge/purge type, and $n = 5$ with bulimia nervosa) has suggested how these patients are characterized by lower levels of mentalization regarding the self and higher levels of alexithymia, using more emotional suppression and less cognitive reappraisal than controls (Rothschild-Yakar et al., 2018). Several studies have examined the mentalizing ability with the Reflective Functioning (RF) Scale (Fonagy et al., 1998) and have shown that patients with anorexia nervosa (AN) exhibit a less developed ability to mentalize compared to individuals without EDs (Ward et al., 2001; Rothschild-Yakar et al., 2018). The ability to understand mental states in these patients seems to be related to emotional mental states and not to un-emotional mental states (Brockmeyer et al., 2016). In a previous study, Aloi et al. (2017) found that patients with binge eating disorder showed a deficit in recognizing their own emotions, with higher levels of alexithymia and problematics in interoceptive awareness.

Moreover, patients with AN have problems in relation to the ability to self mentalize and present imbalances on the cognitive dimension of mentalization as expressed by a high level of alexithymia compared with patients with bulimia nervosa (BN) and controls (Corcos et al., 2000; Speranza et al., 2005). Furthermore, a recent meta-analysis has reported that emotion recognition in others is impaired both in AN and BN patients. However, more severe deficits were found in acute AN, while BN was associated with only a small impairment (Bora and Köse, 2016).

A recent review and meta-analysis has suggested that patients with ED may show specific problematics in different dimensions of mentalization, with more severe difficulties on the self dimension of mentalization (Simonsen et al., 2020). The results of this analysis are consistent with the study of Adenzato et al. (2012), who found that patients with AN scored significantly lower on mentalization ability about themselves than healthy controls but exhibited a mentalization ability about others comparable with the healthy subjects. Aloi et al. (2017) likewise found that patients with binge eating disorders scored significantly lower on mentalization ability about themselves than healthy subjects but showed a comparable mentalizing ability about others.

In another study on a sample of 53 patients with BN with borderline features compared to a healthy control group, the authors found that patients with BN had significantly different scores compared to healthy controls on all tests of mentalizing. More specifically, BN patients showed significantly lower levels on RFQc (excessive certainty) and significantly higher levels on RFQu (excessive uncertainty), compared to healthy controls, on the Reflective Functioning Questionnaire (RFQ, see measures section), with moderate to large between-group effect sizes. These differences were related both to bulimic symptoms and to borderline personality disorder (BPD) features, suggesting that

poor mentalizing may be a significant factor in BN patients and should be addressed in treatment, regardless of the presence of BPD features (Sacchetti et al., 2019). On the contrary, other studies have failed to find mentalizing impairments in BN (Pedersen et al., 2012), and some studies have shown that bulimic patients tend to have average or even high mentalizing abilities (Kenyon et al., 2012; Pedersen et al., 2015).

A study on 70 patients with BN has shown a bi-modal distribution of RF in these patients: The authors have hypothesized that these patients may be divided in two groups, one being more defended against mental states (with low RF scores) and one being more focused on the effort to understand others' behaviors (with higher RF scores) (Pedersen et al., 2012). On the whole, the abovementioned studies seem to suggest that ED patients show a specific pattern of problematics in emotion recognition and in mentalizing toward self, with some patients showing even high levels of mentalization.

The results of the studies mentioned so far seem to suggest that ED patients have problematics in mentalization but that these problematics are quite heterogeneous or not coherent across different studies. This partial incoherence in the results could be explained in relation to the different measures used in the various studies: for example, the RFS (Fonagy et al., 1998) represents a multidimensional measure of mentalization which provides only a global score ranging from −1 to +9 on the basis of a semi-structured interview focused on the patients' attachment relationships. This method has been used in previous studies (see, e.g., Taubner et al., 2013); however, a single global score does not provide information on the specific failures of mentalization and thus fails to encompass all the nuanced facets of mentalization which have been developed and studied over time. Therefore, while the RFS may not be so adequate at distinguishing good mentalization and hypermentalization, the RFQ seems to be more sensitive to these differences. Moreover, in the aforementioned studies, the rating of the different dimensions of mentalization (self, other, cognitive, affective, internal, external, implicit, explicit) or of the prementalizing modalities of thought described in the theoretical literature (pseudomentalization, concrete comprehension, teleological thought, good mentalization) was accomplished by using indirect methods (e.g., by using measures for the assessment of alexithymia to rate the self and affective dimension of mentalization) and not with *ad hoc* measures.

During the past few decades, the vast majority of research on mental illness has focused on investigating manifestations and correlates of categorical psychiatric diagnoses as defined by the DSM-5 (American Psychiatric Association, 2013). During recent years, however, concerns have been raised that categorical diagnoses are heterogeneous (i.e., subsuming clinically relevant subgroups of patients; Lilienfeld and Treadway, 2016). In the case of EDs, for example, several reviews have demonstrated that symptom presentations can vary to a relatively large extent within the diagnostic categories (Wildes and Marcus, 2015). Additionally, it has been shown that individuals cross over and shift between ED diagnoses over time, and some authors suggested that there may be common denominators, such as emotion dysregulation (Eddy et al., 2008; Lavender et al., 2015) or mentalization (Vann et al., 2014). The attempt to classify ED patients above and beyond symptoms and categorical diagnosis is not new, but these attempts focused generally on personality styles (Westen and Harnden-Fischer, 2001) or according to their evolution within the framework of care (Montourcy et al., 2018) rather than on specific factors that could be implicated in the etiology and maintenance of the disorders: e.g., previous research on the relationship between EDs and personality disorders has identified three personality subtypes in patients with EDs (Westen and Harnden-Fischer, 2001): a dysregulated/undercontrolled pattern, characterized by emotional dysregulation and impulsivity; a constricted/overcontrolled pattern, characterized by emotional inhibition, cognitively sparse representations of the self and others, and interpersonal avoidance; and a high-functioning/perfectionistic pattern, characterized by psychological strengths alloyed with perfectionism and negative affectivity.

The first aim of this work was to investigate the characteristics of mentalization in a sample of patients with EDs in order to identify different groups characterized by specific impairments in mentalization, independent from the ED symptoms. The second aim of this work was to investigate the relationship between these empirically derived mentalizing profiles and clinical, personality, and ED variables. In doing so, we focused on specific variables which have been previously found to be compromised in EDs and which are theoretically and empirically related to mentalization, i.e., personality pathology, attachment style, emotion dysregulation, cognitive and affective empathy interpersonal abilities, and reflective function. These variables are differently related to specific facets of mentalization which, in previous studies, were found to be compromised in patients with EDs, more specifically the recognition of emotions and the understanding of others and own's mental states. This is an exploratory study which aimed at filling the literature gap on the presence of specific mentalizing profiles in ED patients. Given the exploratory nature of this study and since the available literature on the topic does not allow for specific conclusions and points out the necessity to have further studies before being able to identify specific mentalizing problematics in ED patients (Simonsen et al., 2020), no specific hypotheses on the profiles were made.

MATERIALS AND METHODS

Sampling Procedure

From the rosters of the major societies of psychodynamic and cognitive–behavioral psychotherapy and from centers that specialized in the treatment of eating disorders, we contacted 700 psychotherapists and asked for their willingness to participate in the study. We requested that they select a patient who was at least 18 years old, had had no psychotic disorder or psychotic symptoms for at least the last 6 months, had seen the therapist for a minimum of eight sessions and a maximum of 18 months, and had an ED diagnosis. Following the same procedure adopted in similar studies (Betan et al., 2005; Colli et al., 2014), we asked clinicians to rate each randomly ordered criterion for each of the DSM-5 ED diagnoses (American Psychiatric

Association, 2013) as present or absent. This procedure provided both a categorical diagnosis (by applying DSM-5 cutoffs) and a dimensional measure (number of criteria met for each disorder). To minimize selection biases, we directed the clinicians to consult their calendars to select the last patient they had seen during the previous week who met the study criteria. To minimize rater-dependent biases, each clinician was allowed to describe only one patient. We contacted 700 clinicians, of whom 157 returned their measures, for an overall response rate of 22.5%. The clinicians received no remuneration. The final sample is composed of 157 therapeutic dyads. The present study was approved by the Institution Review Board (Ethics Committee) of the "Carlo Bo" University of Urbino (Italy).

Patients

The sample was composed of 157 Caucasian patients with ED, treated in psychotherapy. One hundred forty-nine (94.9 %) were female and eight (5.1%) were male (mean age = 30.88; SD = 11.95; min. = 18; max. = 65). The patients were diagnosed with different EDs, more specifically: AN ($n = 64$, 41.4%; of which 44 with AN restricting type and 20 with AN binge purge type), BN ($n = 41$, 26.3%), binge eating disorder (BED) ($n = 27$, 16.2%), other specified feeding or eating disorder ($n = 13$, 8.4%), and unspecified feeding or eating disorder ($n = 12$, 7.7%). Sixty-nine patients (44%) had at least one previous hospitalization. Seventeen patients (10.8%) had attempted suicide at least once, and 33 were reported with self-harming behaviors (21%). Eighty-nine (57.8%) were, by the time of the assessment, undergoing a pharmacotherapy. Fifty-one patients also had a personality disorder (PD) diagnosis according to the DSM-5 (American Psychiatric Association, 2013), alone or in comorbidity, and fifty-seven patients had sub-threshold personality problems. The average length of treatment at the moment of the evaluation was 10.31 months (SD = 12.13; min. = 3; max. = 70).

Therapists

The sample was composed of 157 Caucasian therapists, of which 116 (73.9%) were female and 41 (26.1%) were male (mean age = 43.21; SD = 8.61; min. = 30; max. = 65). Four theoretical and clinical approaches were represented in this sample: psychodynamic ($n = 61$), systemic ($n = 33$), integrative ($n = 30$), cognitive ($n = 19$), and other approaches (e.g., humanistic, bioenergetic, interpersonal; $n = 14$). The clinicians had an average of 15.22 years of previous clinical experience as psychotherapists (SD = 8.07; min. = 2; max. = 35). Thirty-five therapists (22.3%) were seeing the selected patients in public health services, 31 (19.8%) in hospitals, 30 (19.1%) a private setting, 22 (14%) in residential structures, and 35 in different settings (schools, universities, forensic, *etc.*).

Measures/Instruments

The therapists were asked to fill out different measures. The clinician report measures included:

- Mentalization Imbalances Scale (MIS) (Gagliardini et al., 2018): The MIS represents a clinician report assessment measure of mentalizing imbalances in adult patients. It is composed of 22 items rated on a Likert scale from 0 ("absolutely not descriptive") to 5 ("absolutely descriptive") and represents an assessment measure of mentalizing imbalances on the basis of six subscales: imbalance toward self (four items), indicating an excessive focus on patient's own mind which prevents from the possibility to connect with others' thoughts and feelings and perspectives; imbalance toward others (three items), indicating an excessive focus on other peoples' mental states rather than the patient's own; affective imbalance (four items), indicating a hyper-activation of affects and emotions not adequately balanced by cognition; cognitive imbalance (five items), indicating an excessive focus on the cognitive facets of mentalization (which can lead to intellectualizing) that is not balanced by the affective facets of experience; automatic imbalance (three items), indicating the ability to automatically and implicitly recognize mental states, which, however, is not paired by the capacity to explicitly and declaratively reflect on them, even when actively solicited by others (e.g., a therapist); and external imbalance (three items), indicating those cases in which a person excessively relies on the external cues of mental states (i.e., facial expressions, body postures, *etc.*) without reflecting on inner mental states (e.g., beliefs, desires, thoughts, emotions). The MIS has been used in previous studies (Carrera et al., 2018; Gagliardini et al., 2018, 2020) in which it has shown a good reliability. In the present study, the scale has shown sufficient to good psychometric properties (Cronbach, 1951), with alphas of 0.84 (imbalance on the self), 0.80 (cognitive imbalance), 0.79 (automatic imbalance), 0.78 (affective imbalance), 0.61 (imbalance on the others), and 0.60 (external imbalance).
- Modes of Mentalization Scale (MMS) (Gagliardini and Colli, 2019): The MMS is a clinician report assessment measure of the modes of mentalization on five different subscales: (1) excessive certainty (six items), indicating an over-activation of mentalization, in which patients show an excessive certainty about mental states and think that they can provide all of the answers regarding other people's inner worlds; (2) concrete thinking (six items), indicating the tendency to interpret reality on the basis of heuristics and prejudices and/or on the basis of physical or invariant constraints, to use common sense explanations or clichés to explain emotions, and to adopt bizarre explanations of behaviors; (3) good mentalization (five items), indicating a good capacity to recognize and coherently describe mental states, united with a curious stance toward the same and an awareness that people can experience contrasting feelings and desires; (4) teleological thought (three items), indicating a tendency to rely more on the physical manifestations of mental states (i.e., actions) rather than interpreting the world in terms of beliefs, desires, or thoughts, to focus more on what people do (and not on what they think or feel), and to be more focused on the physical, practical, resolution of a problem rather than on the meanings related to the situation; (5) intrusive pseudomentalization (four items), related to a more malign form of hyper- or pseudo-mentalization, indicating a tendency to intrude on and manipulate other people's life, in which the reflections of one's inner world do not seem to be genuine. The factor structure and reliability of the scale was explored

in previous studies (Gagliardini and Colli, 2019; Gagliardini et al., 2020) that enlightened good psychometric properties, with alphas ranging from 0.91 to 0.67 (Gagliardini and Colli, 2019). In the present study, alphas were ranging from sufficient to good (Cronbach, 1951) and were, respectively, 0.88 (excessive certainty), 0.86 (good mentalization), 0.83 (concrete comprehension), 0.75 (teleological thought), and 0.71 (intrusive pseudomentalization).

- Eating disorders: Following the same procedure adopted in similar studies (Betan et al., 2005; Colli et al., 2014), we asked the clinicians to rate each randomly ordered criterion for each of the DSM-5 ED diagnoses (American Psychiatric Association, 2013) as present or absent. This procedure provided both a categorical diagnosis (by applying DSM-5 cutoffs) and a dimensional measure (number of criteria met for each disorder).
- Clinical questionnaire: The clinical questionnaire was constructed *ad hoc* for clinicians in order to obtain general information about them, their patients, and the therapies they used. Clinicians provided basic demographic and professional data, including discipline (psychiatry or psychology), theoretical approach, hours of work, and gender as well as patients' ages and other concomitant therapies (e.g., pharmacotherapy). Clinicians provided additional data on the therapies, such as length of treatment and number of sessions per week. To provide a more comprehensive assessment of patients' problems that may be connected to EDs and/or to mentalizing deficits, the respondents were also asked to use the items of the clinical questionnaire to rate the presence or the absence of a list of clinical problems (American Psychiatric Association, 2013), such as dissociative symptoms, self-harming behaviors, and obsessive symptoms.
- Personality disorders checklist: Following the same procedure adopted in similar studies (Betan et al., 2005; Colli et al., 2014), we asked the clinicians to rate each randomly ordered criterion for each of the DSM-5 PD diagnoses (American Psychiatric Association, 2013) as present or absent. This procedure provided both a categorical diagnosis (by applying DSM-5 cutoffs) and a dimensional measure (number of criteria met for each disorder).
- Adult Attachment Questionnaire (AAQ) (Westen and Nakash, 2006): The AAQ is a 37-item clinician report measure designed to assess patients' attachment styles. It is based on a seven-point Likert scale and codifies patients' attachment styles into four different dimensions: secure ("tends to expect that s/he can rely on the availability and responsiveness of the people who are important to him/her"), insecure-dismissing ("tends to minimize or dismiss the importance of close relationship with others"), insecure-preoccupied ["seems to be mired in, or preoccupied with, past attachment relationships (*e.g.*, seems still to be fighting old battles with mother, father, *etc.*)"] and incoherent/disorganized ["tends to use vague, meaningless, or empty words when describing interpersonal events (*e.g.*, may insert nonsense words such as 'dadadada' into sentences or use psychobabble such as 'she has a lot of material around that issue')"]. The AAQ has been used in previous studies on Italian samples, in which it showed good psychometric properties (see, *e.g.*, Gagliardini and Colli, 2019). In the present study, alphas were, respectively,0.85 (secure),0.83 (insecure-preoccupied),0.80 (disorganized), and.69 (insecure-dismissing).

The patients' self-report measures included:

- Difficulties in Emotion Regulation Strategies (DERS) (Gratz and Roemer, 2004): The DERS is a self-report measure filled out by patients and is composed of six subscales for the assessment of emotional regulation: (1) lack of acceptance of the emotional responses ("non-acceptance"), (2) difficulty in distracting from emotions and engaging in goal-oriented behaviors ("goals"), (3) limited access to emotion regulation strategies ("strategies"), (4) lack of control when experiencing intense emotions ("impulse"), (5) difficulties in recognizing emotions ("clarity"), and (6) limited awareness of emotion ("awareness") (Weinberg and Klonsky, 2009; Neumann et al., 2010; Perez et al., 2012; Ritschel et al., 2015). In this study, we adopted the Italian version of the scale, which has been validated by Sighinolfi et al. (2010). In the present study, the scale has shown good psychometric properties (Cronbach, 1951), with alphas ranging from 0.91 to 0.83.
- Basic Empathy Scale (BES) (Jolliffe and Farrington, 2006; Albiero et al., 2009): The BES is composed of 20 items assessed on a Likert scale from 1 ("strongly disagree") to 5 ("strongly agree"). The scale provides a measure for empathic concern on two dimensions: affective empathy and cognitive empathy. The scale has shown a good internal consistency and reliability in relation to different measures for the assessment of related constructs (Carré et al., 2013). Empathy, as assessed with the BES, correlates with intelligence, extroversion, and neuroticism. The Italian validation of the BES (Albiero et al., 2009) has also indicated a positive correlation between the BES and interpersonal reactivity as assessed with the Interpersonal Reactivity Index (Davis, 1980); moreover, higher empathy scores are related to prosocial behaviors. In this study the scale has shown good psychometric properties, with alphas of 0.82 (affective empathy) and of 0.83 (cognitive empathy).
- Interpersonal Reactivity Index (IRI) (Davis, 1980; Albiero et al., 2006): The IRI represents a measure for the assessment of empathic responsiveness and is composed of 28 items rated by patients on a five-point Likert scale. It is composed of four subscales: (1) fantasy, which assesses the tendency to transpose one's self imaginatively into the feelings and actions of fictitious characters; (2) empathic concern, covering feelings for others such as sympathy and concern for their welfare; (3) perspective taking, which describes one's tendency to spontaneously adopt the psychological point of view of others; and (4) personal distress, which is related to feelings of distress, unpleasantness, and anxiety resulting from tense interpersonal situations. The factor structure of the scale has been confirmed in different studies (Chrysikou and Thompson, 2016). In this study, the scale has shown good psychometric properties, with alphas of 0.83 (perspective taking), 0.75 (personal distress), 0.72 (empathic concern), and 0.71 (fantasy).
- Reflective Functioning Questionnaire (RFQ) (Fonagy et al., 2016; Morandotti et al., 2018): The RFQ is a self-report for the assessment of mentalization. The RFQ assesses mentalization or reflective function by asking the patient

TABLE 1 | Descriptive statistics for the MIS, MMS, AAQ, DERS, BES, RFQ, and IRI ($N = 157$).

MIS	*M*	SD
Cognitive imbalance	2.32	1.08
External imbalance	2.24	1.06
Affective imbalance	2.59	1.28
Imbalance toward others	2.40	1.16
Imbalance toward self	2.28	1.22
Automatic imbalance	2.28	1.22
MMS		
Excessive certainty	1.59	1.05
Concrete comprehension	1.76	1.01
Good mentalization	2.80	1.10
Teleological thought	2.50	1.19
Intrusive pseudomentalization	1.25	1.00
AAQ		
Secure	3.14	1.01
Insecure dismissing	2.41	0.92
Insecure preoccupied	2.74	1.21
Disorganized	1.87	1.03
DERS		
Non-acceptance	3.07	1.13
Goals	3.58	1.00
Strategies	3.19	0.83
Impulse	2.87	1.04
Clarity	3.11	0.94
Awareness	2.65	1.10
BES		
Affective empathy	3.68	0.69
Cognitive empathy	3.85	0.52
RFQ		
Uncertainty	5.88	3.86
Certainty	5.29	3.64
IRI		
Fantasy	3.05	0.75
Empathic concern	3.79	0.69
Perspective taking	3.30	0.73
Personal distress	3.15	0.70

MIS, Mentalization Imbalances Scale; MMS, Modes of Mentalization Scale; AAQ, Adult Attachment Questionnaire; DERS, Difficulties in Emotion Regulation Scale; BES, Basic Empathy Scale; IRI, Interpersonal Reactivity Index; RFQ, Reflective Functioning Questionnaire.

to answer eight items on a Likert scale from 1 ("strongly disagree") to 7 ("strongly agree"). Scores are then recoded and collapsed into two different subscales: RFQ_certainty (RFQ_c), which reflects an excessive certainty about mental states, and RFQ_uncertainty (RFQ_u), which reflects an excessive uncertainty about self and others' mental states. The factor structure of the scale has been tested on a sample of patients with eating disorders and borderline PD (Fonagy et al., 2016). In this study, the scale has shown sufficient psychometric properties, with alphas of 0.65 (RFQ_u) and 0.70 (RFQ_c), respectively.

TABLE 2 | Fit statistics of the latent profile analysis ($k = 1{:}5$).

Number of profiles (*k*)	BLRT	AIC	BIC	Entropy
1	/	2,503.95	2,598.29	
2	81.48*	2,470.96	2,640.40	0.61
3	77.13*	2,434.71	2,631.25	0.80
4	51.20	2,378.34	2,622.97	0.86
5	46.95	2,450.65	2,646.38	0.92

*$p < 0.05$.
BLRT, bootstrapped likelihood ratio test; AIC, Akaike Information Criterion; BIC, Bayesian Information Criterion.

Statistical Analysis

To empirically discriminate the presence of specific profiles in relation to mentalizing impairments in patients with Eds, we performed a latent profile analysis (LPA) according to their scores on the six subscales of the Mentalization Imbalances Scale. Previously to this analysis, outliers and univariate normality were checked. The following criteria were used for deciding the best number of profiles to be retained: non-significant *p*-values for the bootstrapped likelihood ratio test (BLRT), lower values of Akaike Information Criterion (AIC) and of Bayesian Information Criterion (BIC), and entropy value higher than 0.80 (Wang et al., 2017). MANOVA and ANOVA were used to detect differences among the empirically determined profiles in the self-report measures. Zero-order correlations were calculated to test associations between study variables and profile posterior probabilities. Chi-square test was used to investigate differences in the distribution of ED diagnosis among the profiles. LPA was conducted through the R package "TidyLPA"; all other analyses were performed using SPSS Statistics 21 for Windows (IBM, Armonk, NY, USA).

RESULTS

Descriptive Statistics

Table 1 shows the descriptive statistics for MIS, MMS, BES, DERS, IRI, and RFQ in the whole sample ($N = 157$). Preliminary analyses showed that none of the MIS subscales contained outliers. Further data inspection showed no violations of normality for all the subscales (standardized |skewness| and |kurtosis| <1.0), with the exception of the BES cognitive empathy scale (kurtosis = 2.32). **Table 1** shows the means and standard deviations for MIS, MMS, BES, DERS, IRI, and RFQ in the whole sample ($N = 157$).

Latent Profile Analysis

To identify the optimal number of profiles, models with one through five profiles ($k = 1$–5) were compared. Fit statistics, including the BLRT, AIC, BIC, and entropy values are presented in **Table 2**. An analytic hierarchy process, based on these fit indices (Akogul and Erisoglu, 2017), suggested that the best solution was the model with four profiles. The comparisons between overall mean for each scale score of mentalization and within-profile mean were used to assign labels to the four empirically derived profiles (**Table 3**). **Figure 1** presents the

TABLE 3 | Comparison between overall mean and within-profile means.

	Overall mean	"E" profile ($N = 26$)		"CAO" profile ($N = 24$)		"ASA" profile ($N = 87$)		"CAS" profile ($N = 20$)	
		Mean difference	*t*	Mean difference	*t*	Mean difference	*t*	Mean difference	*t*
MIS cognitive	2.32	−1.30	−8.35*	*0.62*	*3.78**	0.01	0.06	*0.90*	*5.00**
MIS extern	2.24	*0.86*	*3.89**	0.08	0.43	−0.09	−0.89	−0.84	−4.54*
MIS affective	2.59	−0.92	4.63*	−0.29	−1.44*	*0.63*	*5.36*	−1.21	−6.26*
MIS other	2.16	−0.55	−5.42*	*0.87*	*7.20**	0.09	1.05	−0.74	−4.27*
MIS self	2.40	−1.78	−24.62*	0.29	1.91	*0.28*	*2.76**	*0.73*	*3.57**
MIS auto	2.28	−1.70	−17.53*	*0.43*	*2.17**	*0.27*	*2.42**	*0.49*	*2.45**

*$p < 0.05$.

MIS, Mentalization Imbalances Scale; cognitive, cognitive imbalance; extern, external imbalance; affective, affective imbalance; other, imbalance toward others; self, imbalance toward self; auto, automatic imbalance; E, external; CAO, cognitive automatic other; CSA, cognitive self-automatic; ASA, affective self-automatic. MIS, Mentalization Imbalances Scale; E, External; CAO, Cognitive Automatic Other; CSA, Cognitive Automatic Self; ASA, Affective Self-Automatic.

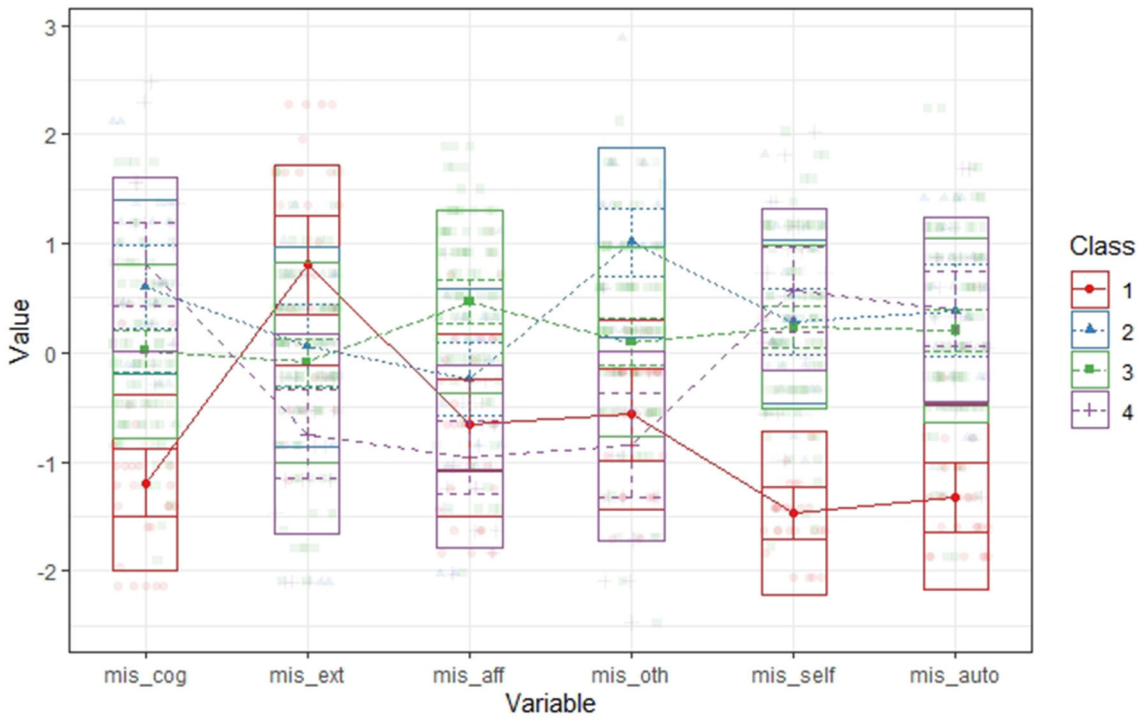

FIGURE 1 | Standardized group averages on MIS subscales for a four-profile solution. MIS, Mentalization Imbalances Scale; cog, cognitive imbalance; ext, external imbalance; aff, affective imbalance; oth, imbalance toward others; self, imbalance toward self; auto, automatic imbalance; E, external; CAO, cognitive automatic other; CSA, self-cognitive automatic; ASA, affective self-automatic.

standardized group averages on MIS subscales for a four-profile solution.

The proportions of subjects within each profile showed that more than half of patients (55%) had higher-than-average score on affective, self, and auto imbalances; in this group, patients' emotions overcome his/her capacity to think, and they may feel that emotions are out of control (ASA). The second most numerous profile included 17% of patients and was focused on external imbalance (E); in this profile, the patient tends to focus more than sample's average on others' facial expressions and/or non-verbal cues when communicating with other; he/she may easily be influenced by other peoples' emotions. The last two profiles shared high scores on cognitive and automatic scales, but their imbalances were oriented toward different objects being focused to understand their own (CSA; 12%) or other people's (COA; 15%) mental states more on a cognitive level than on an affective one and throughout implicit and uncontrolled processes. **Table 4** presents a narrative prototype based on the most descriptive MIS items for each profile.

The four profiles identified were heterogeneous in terms of ED distribution (see **Table 5**). We found no statistical difference in

TABLE 4 | Narrative prototypes based on the most descriptive MIS items for each profile.

Profile 1 "E"
The patient seems to preverbally intuit people's feelings or thoughts (3.29) and is excessively focused on others' facial expressions and/or non-verbal cues when communicating with others (including the therapist) (3.06). The patient seems to have a "sixth sense" about other people's (including the therapist) mental states (2.77). Moreover, the patients' emotions seem to overcome their capacity to think (2.69), and they may easily be influenced by other peoples' emotions (2.64). The patient feels that emotions are out of control (2.33) and seems to be unconsciously attuned to other people's emotions (2.23).
Profile 2 "CAO"
The patient seems to understand people more on a cognitive level than on an affective one (3.60), and when speaking, he/she seems to be detached from emotions (3.17). The patient often seems to lack words to describe feelings (3.11), and they may easily be influenced by other peoples' emotions (3.11). Moreover, the patient seems to inhibit the expression of (positive and/or negative) emotions (3.06) and seems to be unconsciously attuned to other people's emotions (2.97).
Profile 3 "ASA"
The patients' emotions overcome his/her capacity to think (3.78), and they may feel that emotions are out of control (3.69). In turn, the patients may act impulsively (3.52) and may misinterpret other people's behavior (3.45). The patients can easily be influenced by others' emotions (3.34) but may have problems at understanding others' perspective when interpreting their behaviors (3.33). The patients' emotions can change rapidly (3.29).
Profile 4 "CSA"
The patient seems to understand people more on a cognitive level than on an affective one (3.60), and when speaking, he/she seems to be detached from emotions (3.17). The patient often seems to lack words to describe feelings (3.11) and fails to assume others' perspective when interpreting behaviors (3.11). Moreover, the patient seems to inhibit the expression of (positive and/or negative) emotions (3.06). The patient fails to consider points of view that differ from his/her own (2.97) and may misunderstand other people's behaviors (2.94).

MIS, Mentalization Imbalances Scale; E, external; CAO, cognitive automatic other; CSA, cognitive self-automatic; ASA, affective self-automatic.

relation to eating disorders' diagnoses among the profiles, X^2 ($df = 15$) $= 24.10$, $p = 0.06$.

Profiles and Other Variables

In order to give a deeper description and characterization of profiles and testing their clinical utility, we were interested in comparing the four profiles in relation to different facets of mentalization such as prementalizing modes (Modes of Mentalization Scale), certainty/uncertainty about mental states (RFQ), and other variables related with mentalization such as attachment (AAQ), emotional regulation (DERS), empathy (BES), and interpersonal sensitivity.

Multivariate ANOVA was routinely used to compare the profiles in relation to other study variables (see **Supplementary Table 1**). However, because of the small sample size ($N < 30$) of three out of the four profiles that would have reduced the power of the study, we chose to treat the data as continuous variables. In fact, in the LPA, the assignment of the participants to the classes is based on their posterior modal probabilities; in other terms, each subject has a membership probability value for each of the k profiles identified. Therefore, we calculate the correlations between the posterior probabilities for each profile and the above-mentioned study variables (**Table 6**).

In relation to the MMS, higher probabilities of being in ASA profile result in being significantly associated with several prementalizing modes (concrete, teleological, and excessive certainty); the CAO profile results in being associated with intrusive pseudomentalization. Higher probabilities of belonging to the CSA and the ASA profile results in being negatively associated with good mentalization. Conversely higher membership or assignment probabilities in E profile result in being associated in a positive way with good mentalization and negatively with all prementalizing modes. Moreover, higher membership in ASA group was associated with higher RFQ uncertainty and lower RFQ certainty.

In relation to emotion regulation, higher membership in ASA profile results in being associated with several dimensions of DERS, confirming that this profile was composed of patients with greater difficulties in emotion regulation. Conversely, the two profiles characterized by imbalances on the cognitive dimension (CAO and CAS) higher membership result in being negatively associated with the non-acceptance and impulse DERS scale, respectively.

In relation to empathy (IRI), the perspective taking dimension results in being negatively associated with higher membership in CAO profile but positively with the external profile, while the empathic concern resulted higher when the probability of being in ASA profile was higher and lower for higher membership in CAS profile. Finally, the fantasy scale results in being associated with the E profile and negatively with the CAO. Concerning attachment styles, secure attachment results in being positively associated with higher membership in E profile and negatively associated with the other profiles, while preoccupied and disorganized attachment was positively associated with higher membership in ASA profile.

DISCUSSION

The aim of the present study was to investigate the possible presence of different groups of mentalization impairments in adult patients with EDs. Our results suggest the presence of four different profiles in relation to elevation in mentalization imbalances (MIS scores): external (E), cognitive-other-automatic (CAO), affective-self-automatic (ASA), and cognitive-self-automatic (CAS). The four profiles were heterogeneous not only in terms of mentalizing impairments but also in terms of different clinical aspects. This result seems to confirm findings of previous studies which have enlightened how patients with EDs may be more clearly identified by using different variables other than eating problematics and symptoms, variables which

TABLE 5 | ED and PD distributions among the four profiles.

	"E" profile (*N* = 26)		"CAO" profile (*N* = 24)		"ASA" profile (*N* = 87)		"CSA" profile (*N* = 20)	
	n	%	*n*	%	*n*	%	*n*	%
AN (restrictive)	5	19.2	13	56.5	18	21.2	8	40.0
AN (binge/purge)	2	7.7	2	8.7	13	15.3	3	15.0
BN	9	34.6	1	4.3	26	30.6	4	20.0
BED	7	26.9	2	8.7	3	15.3	3	15.0
Other specified ED	1	3.8	4	17.4	7	8.2	1	5.0
Not specified ED	2	7.7	1	4.3	8	9.4	1	5.0
PD	2	1.3	10	7.2	34	22	8	5.1

AN, anorexia nervosa; BN, bulimia nervosa; BED, binge eating disorder; ED, eating disorder; PD, personality disorders.

TABLE 6 | Correlations between mentalization profiles and prementalizing modes, attachment, emotion regulation, and empathy.

	"E" profile	"CAO" profile	"ASA" profile	"CSA" profile
MMS				
Excessive certainty	−0.271***	0.019	0.195*	−0.002
Concrete comprehension	−0.443***	0.157	0.271***	−0.064
Good mentalization	0.542***	−0.114	−0.218**	0.173*
Teleological thought	−0.445***	0.111	0.212**	0.073
Intrusive pseudomentalization	−0.359***	0.206**	0.157	−0.042
AAQ				
Secure	0.581***	−0.118*	−0.182*	−0.192*
Insecure dismissing	−0.397***	0.093	0.073	0.224**
Insecure preoccupied	−0.229**	−0.021	0.243**	−0.076
Disorganized	−0.339***	0.076	0.254***	−0.071
DERS				
Non–acceptance	−0.048	−0.229**	0.236**	−0.058
Goals	−0.057	−0.150	0.159	−0.016
Strategies	−0.161	−0.061	0.255**	−0.126
Impulse	−0.054	−0.046	0.294***	−0.319***
Clarity	−0.117	0.025	0.127	−0.077
Awareness	−0.169*	0.018	0.173*	−0.082
RFQ				
Uncertainty	−0.135	−0.091	0.250**	−0.118
Certainty	0.091	0.042	−0.174*	0.108
BES				
Affective empathy	0.093	−0.004	0.036	−0.155
Cognitive empathy	0.177*	−0.109	−0.032	−0.041
IRI				
Fantasy	0.171*	−0.137**	0.108	−0.108
Empathic concern	0.091	−0.071	0.173*	−0.280***
Perspective taking	0.194*	−0.203*	−0.023	0.023
Personal distress	−0.064	0.035	0.134	−0.158

$^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$.
MIS, Mentalization Imbalances Scale; AAQ, Adult Attachment Questionnaire; MMS, Modes of Mentalization Scale; DERS, Difficulties in Emotion Regulation Scale; RFQ, Reflective Functioning Questionnaire; BES, Basic Empathy Scale; IRI, Interpersonal Reactivity Index.

are more closely related to personality or mental functioning and less related to weight attention on the body and attitude toward food.

The profile we labeled ASA (with higher imbalances in affective, self-oriented, and automatic facets) seems to collect ED patients characterized by greater problematics in emotional regulation that have difficulties in accepting and trusting their own feelings, as also confirmed by their low certainty about their own mental states. Patients of the ASA profile, rather than adopting high-functioning or controlled reflection, tend to shift to prementalizing modes of thought such as teleological and concrete comprehension. In other words, these patients tend to interpret reality in terms of physical reality rather than considering complex mental states. Moreover, the affective focus of these patients probably allow them to have "other oriented" feelings and sympathy, but this is not associated with an ability in perspective taking. These patients showed greater problematics in relation to attachment, especially in relation to preoccupied and disorganized attachment. Finally, into the ASA profile, it falls more than half of the patients in our sample. This data can partially be explained by the fact that this seems to be the profile that is characterized by the more compelling problematics in mentalization and our patients have shown high levels of comorbidity with PDs. Many of the patients of the ASA profile, in fact, have a comorbid PD. A different explanation could be related to the fact that 75 of the patients of our sample have problematics in the control of impulses and have a diagnosis of AN binge/purge type, BN, and BED, and these problematics may be related to the affective and automatic facets of mentalization. This data is also in line with previous works which have enlightened the presence of problematics in emotion regulation in ED patients (Monell et al., 2018; Prefit et al., 2019).

Two profiles had results characterized by a greater focus on the cognitive facets of mentalization but differed on the basis of the focus on the self (CSA) or the others (CAO). It is worth of note that anorexia was the prevalent diagnosis in both of these two profiles. This seems to support the picture of a "cold" anorexic patient, cognitively rigid and affectively constricted (Schmidt and Treasure, 2006). However, these imbalances were also present in bulimic or binger individuals, suggesting that poor mentalization should be considered as a transdiagnostic impairment. Regarding the interpersonal area of functioning, it is interesting to note that the focus on the self and on the cognitive dimension of the CSA patients seems to reduce their capacity to feel what the others are experiencing (a reduced empathic concern), and this is also confirmed by the significant association with the dismissing attachment style. Moreover, the CAO patients' profile results in being negatively associated with perspective taking: this result seems to confirm that, in these patients, the difficulty at mentalizing and the subsequent incapacity to fully differentiate self and others do not allow for them to feel the authentic capacity to connect with others empathetically. In line with this consideration, this profile was associated with intrusive preseudomentalization, in which the opaqueness of the other mind is not respected.

A separate discussion is related to the results on the external profile, which is characterized by subjects that excessively rely on the external signs of mental states (i.e., facial expressions, body postures, etc.) (Luyten and Fonagy, 2015). In our study, this profile results in being associated with secure attachment, good mentalization, and perspective taking: in other words, this profile seems to be associated with several signs of high functioning in patients. Bateman and Fonagy (2016) has recently recalled that, in many studies, poor facial emotion recognition and communication, increased facial avoidance, and reduced understanding of mental states were all associated with eating disorder pathology. Moreover, there is empirical evidence of impaired recognition of facial emotions in AN in comparison to healthy individuals (Kucharska-Pietura et al., 2004). Therefore, the preference of this group of patients on external cues could indicate a higher functioning in this profile. However, from our point of view, this does not mean that the patients in this group are totally free of any mentalizing impairment, but they somehow seem to compensate them. These patients could be excessively focused on the external facets of mentalization, perhaps in order to vigilate on the external environment and control it. This result may explain the contradictory results on the relationship between BN and mentalization: It is possible that there are different mentalizing styles in bulimic patients, with one group showing higher mentalizing functioning and another group being more dysregulated and impaired in terms of mentalization. Therefore, this result seems to confirm the presence of a group of patients with ED that is characterized both by a focus on the effort to understand others' behaviors and high RF scores (Pedersen et al., 2012).

A different explanation is related to the validity of the external scale of the MIS, which probably fails to distinguish between a pathological and excessive external focus on the external facets of mentalization and the capacity to understand others' mental states on the basis of external cues such as face expression. In a previous study (Gagliardini et al., 2018), the authors have suggested that two of the items of this subscale [i.e., "Patient seems to preverbally intuit people's feelings or thoughts" and "The patient seems to have a "sixth sense" about other people's (including the therapist) mental states"] could be interpreted by clinicians as positive capacities and therefore could indicate the adaptive capacity of patients to connect and comprehend on a procedural basis others' mental states. Moreover, this is the only MIS scale which has not an opposite dimension of the pole (e.g., cognitive vs. affective). While it is quite easy to think about an affective imbalance as associated to difficulties in the cognitive facets of mentalization and *vice versa*, the same is not true for the internal/external dimension. From a phenomenological and clinical perspective, in fact, we may conceptualize an imbalance on the external facet of mentalization (e.g., a patient who sees the therapist frowning and therefore hypothesizes that he or she is bored); it is more difficult to hypothesize that the patients overestimate the internal facets of mentalization without considering the external cues of mentalizing, and this is more true for cognitive processes. For example, whereas the differentiation internal/external seems easily applicable to emotions, which have both external expressions and internal feeling qualities, this does not seem to be the case with cognitions, which do not have bodily expressions to any similar degree (Liljenfors and Lundh, 2015). In the future, it will be necessary to address the issue of the validity of this subscale.

The four-profile solution found in our study seems to be consistent with the findings of previous studies that tried to categorize eating disorders in different personality subtypes (Westen and Harnden-Fischer, 2001; Thompson-Brenner and Westen, 2005): the ASA profile, characterized first of all by the affective imbalance and an impairment in controlled mentalization, seems close to the dysregulated/undercontrolled pattern described in literature; the COA and CSA profiles that are both characterized by an excessive focus on the cognitive facets of experience and a form of detachment from emotions seem to echo the constricted personality subtype, and finally the external profile seems similar to the high-functioning personality group.

More generally, an interesting result of this study regards the distribution of mentalization imbalances between the different diagnoses of ED. This result can lead to various speculations: one could explore the existence of ED subtypes with different mentalization characteristics/difficulties; mentalization problem heterogeneity and transdiagnostic occurrence may also mark different etiological pathways for eating psychopathology. In line with this, it would be interesting to explore how mentalization impairments in ED patients are associated with the outcome of the therapy.

This study has some limitations. First and foremost, the distribution of EDs in our sample is heterogeneous but not balanced (41% of our patents were diagnosed with AN, restrictive or binge/purge type). Future studies should involve more balanced samples in which each ED is equally represented. The ED diagnoses provided in this study rely on the clinical judgement of the therapists included in the study, of whom were asked to rate each DSM-5 (American Psychiatric Association, 2013) ED criterion as present or absent. This procedure, which allows for us to have both dimensional and categorical diagnoses for each ED, has a major limitation of not being based on a structured interview, which would have increased the accuracy of the ED diagnoses. Moreover, there is a high comorbidity of PDs in the sample, and this could impact on the generalizability of our results: for example, we could not exclude that the profiles we found were largely influenced by the patients' personality problematics. However, it is important to observe that comorbidity with personality disorders is quite frequent in the case of EDs and that the comorbidity we observed in our sample is similar to the ones described in literature (Godt, 2008; Martinussen et al., 2017). Similarly, several patients were under pharmacological therapy, and this could affect their mental functioning and the profiles that we observed. The Cronbach alpha of some scales was below 0.70, and so the reliability of some results could not be sufficient.

Finally, the age range of the sample is quite wide (min. = 18, max. = 68), and so is the chronicity of the disorder. Unfortunately, our sample size did not allow for us to perform different latent profile analyses in different age groups; however, future studies should consider this possibility in order to provide more detailed information on the possible presence of different clusters related to the chronicity of the disease.

Despite these limitations and the exploratory nature of our study taken together, these results seem to suggest that a comprehensive assessment of patients with EDs should also be focused on the patients' mentalizing impairments since patients with the same ED could be characterized by opposite patterns of mentalizing impairments: for example, patients with AN were characterized by imbalances on both the cognitive and the affective dimensions of mentalization. From our point of view, this could also change the focus of clinicians' interventions, which should be in one case the affective facets of mentalization and on the other the cognitive dimension, by promoting emotion regulation strategies. The four profiles that have been identified in this study must be further investigated, and future studies should also investigate the treatment outcome of therapeutic interventions of these profiles in order to see if different profiles are associated with different outcomes.

CONCLUSIONS

ED patients can be classified in relation to impairments in different dimensions of mentalization above and beyond ED diagnosis. This preliminary investigation suggests to clinicians to take in consideration mentalization from a multidimensional approach when treating ED patients.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Institutional Review Board of the University of Urbino. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

GG and AC were the principal investigators of the study, planned the research, analyzed data and prepared the manuscript. SG helped with the manuscript revision and provided significant contributions to the methodological and statistical sections of the manuscript. VT collected data. MBai, MBal, and PT collected data and completed evaluations. TS helped in revising the manuscript. All authors contributed to the article and approved the submitted version.

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Discrepancies Between Explicit Feelings of Power and Implicit Power Motives Are Related to Anxiety in Women With Anorexia Nervosa

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Background: Several studies identified low subjective feelings of power in women with anorexia nervosa (AN). However, little is known about implicit power motives and the discrepancy between explicit feelings of power and implicit power motives in AN.

Aim: The study investigated the discrepancy between explicit feelings of power and implicit power motives and its relationship to anxiety in patients with AN.

Method: Fifty-three outpatients and inpatients with AN and 48 participants without AN were compared regarding subjective feelings of power and anxiety. Explicit power [investigated with the Personal Sense of Power Scale (trait focus) and a visual analog scale (state focus)], implicit power motives [investigated with the Multi-Motive Grid (MMG)] and trait anxiety [measured with the State-Trait Anxiety Inventory (STAI)], were assessed.

Results: Explicit feelings of power (state and trait level) were lower in patients with AN compared to non-AN participants. No differences in implicit power motives were found when comparing the groups against each other. However, looking at the groups separately, women with AN had similar levels of implicit fear of losing power and hope for power, whereas woman without AN had significantly lower fear of losing power than hope for power. Focusing on discrepancies between powerful feelings and power motives, results were mixed, depending on the subscale of the MMG. Lastly, discrepancies between implicit power motives and explicit feelings of power were positively correlated with trait anxiety in AN patients.

Conclusion: These findings underline that individuals with AN display significantly lower explicit feelings of power, however, they show similar implicit power motives compared to individuals without AN. The discrepancy between explicit feelings of power and implicit power motives is related to anxiety in AN and may represent a vulnerability factor to illness maintenance.

Keywords: anorexia nervosa, power, implicit motives, anxiety, powerlessness, eating disorders

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INTRODUCTION

A *motive* has been defined as a predisposition to either approach particular incentives such as power, achievement or affiliation, or to avoid particular threats such as rejection, failure, or domination by others (Thrash et al., 2019). Previous research on human motivation has made a distinction between implicit- and explicit motives (Brunstein, 2018). Explicit motives refer to concrete self-assigned goals an individual strives for Brunstein et al. (1998). They are consciously and verbally expressed and can, therefore, be assessed with self-reports (Kollner and Schultheiss, 2014). In contrast, implicit motives describe spontaneously recalled and dispositional preferences for affective incentives that are assessed indirectly with picture-story exercises, such as the semi-projective Multi-Motive Grid (Sokolowski et al., 2000; Job et al., 2010). Thus, an individual's explicit motives can be seen as consciously set goals while implicit motives refer to affect-driven motive dispositions that the individual is mostly unaware of (Schuler et al., 2019).

Implicit and explicit motives can diverge from one another (Schultheiss et al., 2009). This discrepancy between implicit- and explicit motives has been found to negatively impact an individual's physical health and psychological wellbeing (Kehr, 2004; Schüler et al., 2008). For example, it has been linked to a decrease in volitional strength (Kehr, 2004) and life satisfaction (Hofer et al., 2006), as well as a higher rate of job burnout (Rawolle et al., 2016) and negative affect (Job et al., 2010). Baumann et al. (2005) consequently referred to the discrepancy between implicit- and explicit motives as a "hidden stressor" which affects the individuals' health. The stressful impact of motive discrepancies can be explained as a consequence of a behavioral conflict: self-assigned goals are influenced by social demands and may not always align with unaware motives, leading to behavioral tendencies that diverge (Job et al., 2010). Consequently, motive discrepancy may represent a vulnerability factor to psychopathology (Hofer and Chasiotis, 2003; Brandstatter et al., 2016). Despite this assumption, the impact of motive incongruence has rarely been studied in clinical samples.

The few studies that have focused on this issue in a clinical context have highlighted that motive incongruence may play a crucial role in symptom generation and maintenance (Langan-Fox et al., 2009; Langan-Fox and Canty, 2010). Regarding anorexia nervosa (AN), for example, Frank et al. (2019) proposed a model linking motive discrepancy to anxiety, which in turn affects negative eating behavior. The conscious goal to restrict food intake and to lose weight in AN patients conflicts with the implicit basic instinct to gain weight for survival, causing an internal conflict and, consequently, anxiety (Frank et al., 2019). This, in turn, might reinforce food restrictive behavior in order to avoid losing control (Frank et al., 2019). A similar pattern has been observed in non-clinical samples. For example, Job et al. (2010) found that motive incongruence was associated with unhealthy eating behavior in college students, mediated by negative affect. Based on these findings, continuing the investigation of implicit motives in AN patients seems crucial to gain a deeper understanding of potential internal conflicts that may generate and maintain anxiety and disordered eating. Anxiety is a particularly important outcome variable to investigate, as it represents one of the key comorbidities in AN, with studies reporting rates as high as 56% (Blinder et al., 2006). It also represents a factor that enhances the severity, chronicity and treatment resistance of the eating disorder (Kaye et al., 2004) and can persist after recovery from AN (Federici and Kaplan, 2008).

One motive that may be particularly relevant in the context of eating disorders is the *power* motive. Several studies have shown that women with AN display lower subjective (i.e., explicit) feelings of power than women without AN (Wolff and Serpell, 1998; Schwitzer et al., 2001; Troop et al., 2003; Woolrich et al., 2008). They also assign themselves a low social rank and tend to feel inferior to others (Troop et al., 2003; Bellew et al., 2006). A perceived low social rank and feelings of inferiority are associated with negative affect, such as shame (Ferreira et al., 2015), self-criticism (Pinto-Gouveia et al., 2014), and anxiety (Bellew et al., 2006). These, in turn, may further contribute to feelings of perceived powerlessness (Woolrich et al., 2006).

In this context, it is important to highlight that perceived power seems to be highly relevant regarding food consumption and disordered eating. For example, Guinote (2010) found that hunger predicted food intake in powerful but not in powerless individuals and powerful individuals consumed more appetizing- and less non-appetizing food compared to powerless individuals. Furthermore, Kunstman et al. (2014) found that experiencing power could increase caloric intake in participants with AN symptoms and high self-oriented perfectionism.

Despite strong evidence for low subjective feelings of power in women with AN and its proposed link to pathology, little is known about *implicit* power motives in this clinical cohort. It is, for example, uncertain whether women with AN have a higher, lower, or similar implicit power motive compared to women without AN. However, it is likely that they have a similar implicit power motive to women without AN as previous research has suggested that the eating disorder serves an attempt to defeat feelings of powerlessness (Bruch, 1979; Wolff and Serpell, 1998), which could be reflected in a high implicit power motive.

Furthermore, it is noteworthy that research on powerlessness in AN has mainly relied on qualitative data (Woolrich et al., 2006; Duncan et al., 2015) and has not integrated validated quantitative measurements that focus specifically on power, such as the Personal Sense of Power Scale by Anderson et al. (2012) or the Multi Motive Grid power-subscale by Sokolowski et al. (2000). In this study, we would like to breach this gap in the literature by examining whether there is a discrepancy between implicit power motives and explicit feelings of power in AN and by investigating how a possible discrepancy between these two variables might relate to feelings of anxiety. Based on existing theoretical models and previous research, we propose four hypotheses:

1. Women with AN display significantly lower explicit feelings of power on the state and the trait level than women without AN.

2. Women with AN have similar implicit power motives as women without AN.
3. Women with AN show a higher discrepancy between explicit feelings of power (trait level) and implicit power motives than women without AN.
4. Discrepancies between implicit power motives and explicit feelings of power are positively correlated with anxiety in AN patients.

MATERIALS AND METHODS

Sample Characteristics

Fifty-three female patients with AN were recruited in two different outpatient clinics for eating disorders in Munich, Germany [ANAD e.V. and the Treatment Centre for Eating Disorders (TCE) at Dritter Orden Hospital] as well as the inpatient ward of Schoen Clinic Roseneck in Rosenheim, Germany. All patients had to be diagnosed with AN as defined by the DSM-5 criteria, determined by a semi-structured interview [SKID-5 cv (Beesdo-Baum et al., 2019)] by a clinical psychologist. Another inclusion criterion was that participants had to be over 18 years old. Patients with AN had a mean age of 24.70 years (*SD* = 7.12) and a mean body mass index (BMI) of 15.51 kg/m^2 (*SD* = 2.09). 42 patients were diagnosed with restrictive AN, nine with binge/purging AN, and two with atypical AN.

The control sample consisted of 48 women without AN, recruited via advertisement at Ulm University. In the control group, mean age was 22.58 years (*SD* = 4.12), and mean BMI was 21.89 kg/m^2 (*SD* = 2.73). Inclusion criteria were (1) no present psychiatric or somatic disorder and age over 18 years. Groups did not differ in age [$t(84.824) = -1.848$; $p = 0.068$] but, expectedly, differed in BMI [$t(99) = 13.089$; $p < 0.001$]. Further demographic information such as trait anxiety scores, illness duration, number of previous hospital admissions and scores of the Eating Disorder Inventory-2 are presented in **Table 1**.

Measures

Subjective Feelings of Power

Personal Sense of Power Scale (SOPS)

To assess the explicit trait power of participants, the Personal Sense of Power Scale by Anderson et al. (2012) was used. It comprises eight items on a six-point scale, ranging from strongly disagree (=1) to definitely agree (=6). In our study, the McDonalds ω was excellent (ω = 0.909) indicating that the SOPS is as an internally reliable measurement (Hayes and Coutts, 2020). An example of a statement was "I think I have a great deal of power." Some of the statements were reverse-scored to prevent response bias.

Visual Analog Scale (VAS) (state level)

To investigate participants' explicit state power, they had to indicate how powerful they felt at the present moment on a visual analog scale. They had to mark their answer with a pen on a line, ranging from *no power at all* (=0) to *high power* (=100). The VAS for the power scales was embedded between a scale assessing current energy level and strength to avoid priming the participants with the focus of the study.

Multi-Motive Grid (MMG)

The MMG by Sokolowski et al. (2000) was used to assess implicit power. This semi-projective assessment aims to evaluate an individuals' implicit motivation for affiliation, achievement, and power. Each motive has two dimensions. For example, regarding the power motive, the MMG distinguishes between *hope for* power (HP) and *fear of losing* power (FP). The HP dimension primarily represents an individuals predisposition to influence other people or to gain power and status over others (Schmalt et al., 2010). On the other hand, the FP dimension is concerned with avoiding the loss of standing and the fear of being overpowered by other people (Schmalt et al., 2010). Fourteen drawings with different ambivalent social situations were presented. Below the picture, a range of statements was shown referring to each motive and its dimension. Participants were instructed to judge whether the presented statement fitted the given situation or not, by circling "yes" or "no." Examples of power statements were "anticipating to lose standing" or "hoping to acquire a good standing." For each picture, a single motive score was calculated to obtain a global score for each of the six motive components. Scores ranged from zero to twelve. For our study, only the power scores were used. The MMG has demonstrated good internal consistency and reliability in previous research (Sokolowski et al., 2000; Kehr, 2004). In our study, both MMG power subscales showed acceptable reliability (MMG HP: α = 0.762; MMG FP. α = 0.712).

Anxiety Level

The State-Trait Anxiety Inventory (Laux et al., 1981) is a widely used and validated questionnaire for the assessment

TABLE 1 | Descriptive statistics.

	Control group		Anorexia nervosa		Test statistics		
Variable	M	*SD*	M	*SD*	*T*	df	*p*
Age	22.58	4.12	24.70	7.12	−1.848	84.824	0.068
BMI	21.80	2.73	15.51	2.09	13.089	99	0.000
STAI trait	40.69	7.82	60.23	10.86	−10.279	99	0.000
Length of eating disorder	–	–	9.03	8.23	–	–	–
No. hospital admissions	–	–	3.59	3.07	–	–	–
EDI 2	–	–	314.19	63.39	–	–	–

of anxiety symptoms. For this study, only the trait anxiety scale was used to assess individuals' dispositional anxiety level. The reason, therefore, was that the MMG and the Personal Sense of Power Scale (that were used to calculate power motive discrepancies) both also focus on trait-like constructs rather than situational feelings of power. The trait anxiety scale consists of 20-items and a four-point scale ranging from *almost never* (=1) to *almost always* (=4). Sum scores can range from 20 to 80, with higher scores indicating higher anxiety. In our study the McDonalds ω was excellent (ω = 0.920) indicating that the trait scale was as an internally reliable measurement.

Procedure

The study was conducted in accordance with the Declaration of Helsinki and ethical approval was obtained from the Institutional Review Board of Ulm University (Protocol Nr 109/15). In a first step, participants were informed about the study procedure and signed an informed consent to take part. The AN patient sample was assessed in a separate, quiet therapy room of the outpatient clinics ANAD e.V., and TCE in Munich, as well as Schoen Clinic Roseneck in Rosenheim. The non-AN sample was tested in the laboratories of the Clinical- and Health Psychology Department of Ulm University. The participants completed the different questionnaires in their own time with the experimenter present. At the end of the study, participants received either course credit or monetary compensation.

Statistical Analyses

Data analyses were performed using the program IBM SPSS Statistics 26 (SPSS, Chicago). Group differences (AN vs. non-AN) in implicit and explicit power variables (hypothesis 1–3) were investigated using independent samples *t*-tests. Homogeneity of variance was tested using Levene's Test. When the assumption of homogeneity was violated, Welch's *t*-test was used. Regarding hypothesis 3, MMG scores and SOPS scores were *z*-standardized and then absolute differences between the *z*-scores were calculated (Rawolle et al., 2016). Pearson correlations were conducted for the different power measures and anxiety separated by the groups (hypothesis 4). *P*-values less than 0.05 defined significant results. Two-sided tests were used for all hypotheses.

RESULTS

Confirming hypothesis 1, women with AN (M = 3.35; SD = 0.78) showed significantly lower Personal Sense of Power (SOPS) values than women without AN (M = 4.40, SD = 0.49), [$t(88.888)$ = 8.136, $p < 0.001$, d = 1.726, see **Figure 1**. Regarding the VAS power scores, women with AN also displayed significantly lower scores (M = 21.08, SD = 20.64) than women without AN (M = 41.38, SD = 21.55), $t(97)$ = 4.786, $p < 0.001$, d = 0.972 (see **Figure 2**). Thus, women with AN showed significantly lower explicit feelings or power than women without AN (on the state and the trait level).

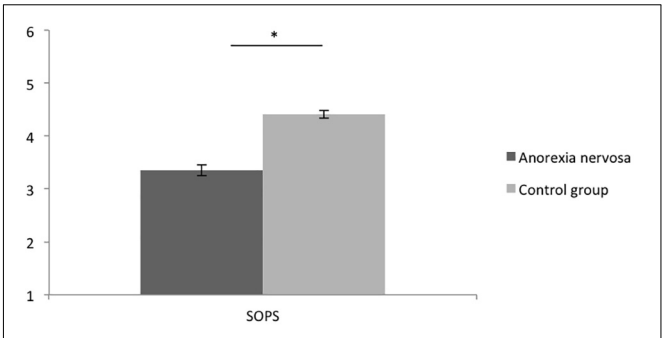

FIGURE 1 | Means of the Personal Sense of Power Scale (SOPS) of women with and without AN. Error bars represent SE.

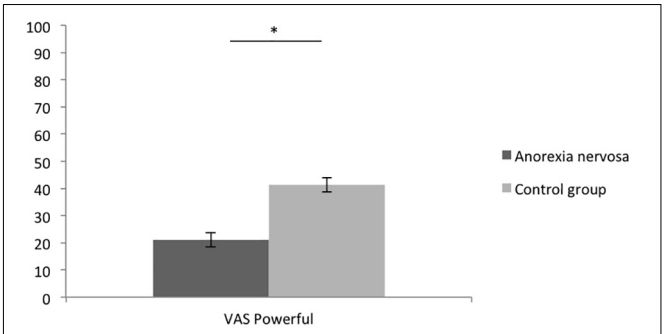

FIGURE 2 | Means of the Visual Analog Scale of Power (VAS) of women with and without AN. Error bars represent SE.

As expected, there was no significant difference between groups regarding the MMG hope for power dimension, $t(99)$ = -0.289, p = 0.773, d = 0.058, (see **Table 2** and **Figure 3**) and no significant difference between groups regarding the MMG fear of losing power dimension, $t(99)$ = -1.472, p = 0.144, d = 0.296. Thus, the implicit power motives did not differ between groups (hypothesis 2).

Regarding hypothesis 3, women with AN (M = 1.43, SD = 0.97) displayed significantly higher discrepancies between the MMG fear of losing power dimension and the SOPS than women without AN (M = 1.05, SD = 0.78), $t(99)$ = -2.157, p = 0.033, d = 0.434. No differences between the groups regarding discrepancies between the MMG hope for power dimension and the SOPS were found, $t(99)$ = -1.027, p = 0.307, d = 0.206) (please refer to **Table 2** and **Figure 2**). Thus, this hypothesis was partially supported. Further analysis revealed that there was no significant difference between the MMG hope for power dimension and the MMG fear of losing power dimension in the AN-group (**Table 3**). However, in the non-AN group, the MMG fear of losing power dimension was significantly lower than the MMG hope for power dimension (**Table 3**).

Regarding hypothesis 4, there was a significant positive correlation between the MMG FP/SOPS discrepancy and trait anxiety (r = 0.271, p = 0.050) (**Figure 4**) as well as a significant positive correlation between the MMG HP/SOPS discrepancy and trait anxiety (r = 0.307, p = 0.025) for the anorexia nervosa

TABLE 2 | Means and standard deviations of power measurements and MMG/personal sense of power scale discrepancies.

	Control group		Anorexia nervosa		Test statistics		
Variable	**M**	***SD***	**M**	***SD***	***T***	**df**	***p***
SOPS	4.40	0.49	3.35	0.78	8.136	88.888	0.000
VAS powerful	41.38	21.55	21.08	20.64	4.786	97	0.000
MMG hope for power (HP)	7.71	2.69	7.87	2.85	−0.289	99	0.773
MMG fear of losing power (FP)	6.81	2.42	7.58	2.81	−1.472	99	0.144
MMG HP/SOPS discrepancy	0.92	0.74	1.07	0.74	−1.027	99	0.307
MMG FP/SOPS discrepancy	1.05	0.78	1.43	0.97	−2.157	99	0.033

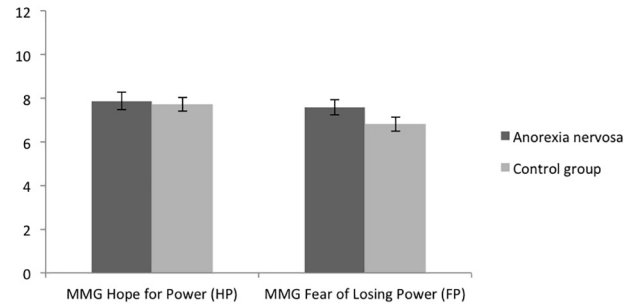

FIGURE 3 | Means of the Multi-Motive Grid (MMG) fear of losing power and hope for power dimension of women with and without AN. Error bars represent SE.

group (**Figure 5**). No significant correlations were found for the control group regarding the MMG FP/SOPS discrepancy and trait anxiety (r = -0.229, p = 0.118) and the MMG HP/SOPS discrepancy and trait anxiety (r = 0.044, p = 0.767).

Exploratory analysis also revealed a significant positive correlation between the MMG FP/SOPS discrepancy and the EDI-2 in the AN group, (r = 0.29, p = 0.035). No significant positive correlation between the MMG HP/SOPS discrepancy and the EDI-2 was found (r = 0.184, p = 0.186). Regarding the MMG FP variable on its own, it significantly correlated with the EDI-2 in the AN group (r = 0.372, p = 0.006).

DISCUSSION

The study aimed to evaluate the discrepancy between implicit power motives and explicit feelings of power and its relationship with anxiety in women with- and without AN. As expected, the AN sample displayed significantly lower explicit power (on the trait- and state level) than the non-AN sample. In comparison, no differences between implicit power were found when comparing the groups against each other. However, looking at the groups separately, women with AN had similar levels of implicit fear of losing power and hope for power, whereas woman without AN had significantly lower fear of losing power than hope for power. Regarding the explicit- and implicit power discrepancies, results were mixed. Whereas there was a higher discrepancy between the Personal Sense of Power Scale and the MMG fear of losing power dimension in patients with AN, no significant differences were found regarding the discrepancy between the Personal Sense of Power Scale and the MMG hope for power dimension. Lastly, higher discrepancies between implicit power motives and explicit feelings of power were associated with higher levels of anxiety in patients with AN. No correlations were found regarding the non-AN sample.

The finding that individuals with AN displayed lower explicit feelings of power is in keeping with previous research findings highlighting that women with AN report feelings of powerlessness during their illness (Schwitzer et al., 2001; Troop et al., 2003; Woolrich et al., 2006; Duncan et al., 2015). It also fits in with theoretical models that highlight the presence of powerlessness as a key factor of illness pathology (Bruch, 1979; Wolff and Serpell, 1998). To our knowledge, this is the first study that employed the Personal Sense of Power Scale (Anderson et al., 2012) in AN patients. As it showed good internal consistency, it could be valuable to integrate as a diagnostic tool during clinical treatment, to assess the individuals' explicit power level before and after interventions.

Furthermore, our finding showed that no differences between both groups were found for the implicit power motives, indicating that women with AN have similar predisposition to approach power and fear of losing power, as women without AN. Although no previous study used the MMG in an AN sample, our finding is congruent with studies that employed the MMG in other clinical samples, such as individuals with remitted major depression- and bipolar disorder (Fuhr et al., 2014) that also found no difference between individuals with and without psychopathology.

Regarding discrepancies between implicit power motives and explicit feelings of power in AN, the results were mixed. The finding that women with AN showed a significantly higher discrepancy between their explicit feelings of power and the fear of losing power dimension of the MMG, compared to women without AN, is in keeping with our expectation. This finding is concerning, as discrepancies in implicit- and explicit motives have been linked to psychopathology and stress (Baumann et al., 2005; Job et al., 2010; Rawolle et al., 2016). As the fear of losing power dimension was also significantly positively correlated with trait anxiety and eating pathology (EDI-2) in the AN group, decreasing the fear of losing standing and being overpowered by others could represent an important therapy goal.

Considering the findings further, individuals with AN did not show a significantly higher discrepancy between explicit feelings of power and the hope for power dimension of the MMG than women without AN. In this context, we found that the hope for power was significantly higher than the fear of losing power

TABLE 3 | Differences between MMG HP and MMG FP.

Group	Variables	*N*	M	*SD*	*T*	df	*p*
Control group	MMG hope for power (HP)	48	7.71	2.69	2.170	47	0.035
	MMG fear of losing power (FP)	48	6.81	2.42			
Anorexia nervosa	MMG hope for power (HP)	53	7.87	2.85	0.534	52	0.595
	MMG fear of losing power (FP)	53	7.58	2.81			

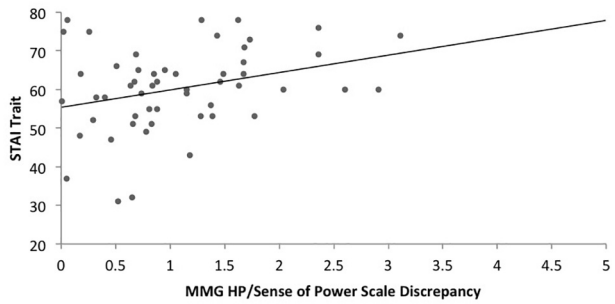

FIGURE 4 | Scatterplot of the correlation between the Hope for Power (MMG)/Personal Sense of Power Scale discrepancy and trait anxiety in women with AN.

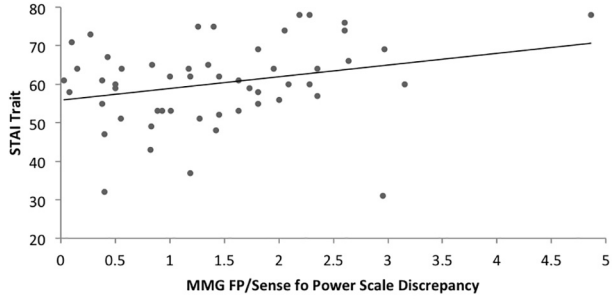

FIGURE 5 | Scatterplot of the correlation between the Fear of Losing Power (MMG)/Personal Sense of Power Scale discrepancy and trait anxiety in women with AN.

in the non-AN group. On the other hand, implicit approach tendencies toward power and the fear of losing power were similar in the AN group. Having similarly high levels of fear of losing power and hope for power has been described as a vulnerability factor for an approach-avoidance conflict (Schmalt et al., 2010). Therefore, future research should put particular emphasis on ways in which similar levels of approaching power and avoiding the loss of power can relate to eating pathology and disadvantageous behavior in individuals with AN.

In keeping with our prediction, the discrepancy between implicit power motives and explicit feelings of power was linked to trait anxiety, only in the AN group. This finding is in line with previous research highlighting that the discrepancy between implicit- and explicit motives is associated with anxiety in women with AN (Frank et al., 2019). This observation further underlines the importance of developing strategies to reduce the discrepancy between implicit- and explicit power motives in AN. However, little is known about how this can be achieved (Job, 2007). As the explicit power motive in AN is significantly reduced compared to non-AN women, it would be beneficial to firstly increase subjective feelings of power in women with AN. This idea is congruent with a systematic review meta-synthesis of qualitative research by Duncan et al. (2015) that identified regaining subjective feelings of power as crucial for illness recovery. One promising approach could be to practice power posing with individuals with AN. Power posing refers to the adoption of an expansive bodily posture (Carney et al., 2010, 2015). It is a non-verbal, body-focused technique that has repetitively been found to increase individuals' feelings of power (Cuddy et al., 2018). It may be particularly helpful as recent studies in the field of eating disorders highlighted beneficial effects integrating body-centered interventions into treatment (Artoni et al., 2020).

To our knowledge, this is the first study investigating discrepancies between explicit feelings of power and implicit power motives and their relationship with anxiety in AN patients. However, our research needs to be interpreted, considering some limitations. Firstly, our AN sample was heterogeneous. For example, the participants differed regarding the AN subtype, comorbidities (e.g., depression and anxiety), as well as stages of recovery (in- and outpatients). Therefore, the study could be replicated and refined differentiating between the subtypes of AN and comparing participants during the acute illness and after recovery. Secondly, these data are cross-sectional. They should be extended by experimental and longitudinal data such as an ecological assessment to understand how subjective feelings of power and/or power motives fluctuate (e.g., throughout the day, with food intake as well as over the course of standardized treatment).

Furthermore, the investigation of the implicit power motive was based on the Multi Motive Grid by Sokolowski et al. (2000). Other tests that investigate implicit motives include the Picture Story Exercise (PSE) (McClelland et al., 1989), the Operant Motive Test (OMT) (Kuhl and Scheffer, 1999) or the Pictorial Attitude Implicit Association Test (PA-IAT) (Slabbinck et al., 2011). Thus, it could be valuable to replicate the study using an alternative implicit motive assessment. In this context, we mainly focused on the power dimension. Consequently, it would be interesting to investigate how individuals with and without AN differed regarding their implicit achievement- or affiliation motives.

Regarding clinical implications, our study has highlighted that low explicit feelings of power (on the state- and trait level) are present in AN patients. They should be explored in

therapy, as they could represent a vulnerability factor regarding disordered eating and illness maintenance. In a therapeutic context, one could for example track explicit feelings of power (state level) using the visual analog scale at different points during the day or during episodes of disordered eating (e.g., before food intake, after food intake, during starvation, after purging etc.). Doing this could underline the connection between the individuals' incentive to obtain power and avoid feelings of powerlessness through disordered eating. As our exploratory analysis also revealed a significant positive correlation between the MMG FP/SOPS discrepancy and the EDI-2, future studies should put a particular focus on how motive incongruence could be linked to eating pathology. Furthermore, one could assess individuals' discrepancies between explicit feelings of power and power motives before, during and after treatment, to get a better understanding of possible inner conflicts and whether therapy is successful in reducing this incongruence.

CONCLUSION

To sum up, our data provide evidence that explicit feelings of power are lower in women with AN than women without AN. However, there seems to be no significant difference regarding implicit power motives when comparing the groups against each other. Looking at the groups separately, women without AN display a significantly lower implicit fear of losing power than hope for power. In women with AN, the fear of losing power is similarly high as the hope for power. Moreover, the discrepancy between explicit feelings of power and implicit power motives is positively associated with anxiety in AN. It seems worthwhile to focus on the assessment of power in AN patients and to develop interventions that can address feelings of powerlessness.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author, (FW), upon reasonable request.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Institutional Review Board of Ulm University. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

FW, DS, GH, KL, AS, and OP conceptualized the research idea and planned the experiments. FW carried out the experiments. FW, DS, and AM contributed to data analysis. FW, DS, GH, AM, UV, and OP contributed to the interpretation of the results. FW, DS, and FD wrote the manuscript. All authors provided critical feedback and helped shape manuscript.

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Associations Between Trauma, Early Maladaptive Schemas, Personality Traits, and Clinical Severity in Eating Disorder Patients: A Clinical Presentation and Mediation Analysis

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Background: The literature has shown a significant association between traumatic experiences and eating psychopathology, showing a greater symptomatology in patients with trauma history. Less is known about the associations between trauma and cognitive schemas, and personality traits and the differences between childhood and adulthood trauma experiences. Thus, this paper aims to assess the clinical and psychological characteristics of eating disorder (ED) patients, looking for differences between patients without a history of trauma and patients with trauma experiences, as well as at possible differences between exposure in childhood, adulthood, or repeated events. Another aim of the paper is to evaluate the possible mediation role of cognitive schemas and personality traits in the relationship between early trauma and eating psychopathology.

Methods: From January to November 2020, 115 consecutive inpatients admitted for a specific multidisciplinary ED treatment in a dedicated Unit were evaluated for trauma, differentiating between trauma occurring in childhood and adulthood. The subjects were evaluated for early maladaptive schemas (EMS), personality traits, trauma symptomatology, quality of life, and specific psychopathologies linked to EDs. Mediation analyses between childhood and adulthood trauma and eating psychopathology were performed, with EMS and personality traits as mediators.

Results: Patients with a history of trauma showed higher physical and psychological symptomatology scores, with a more impaired clinical profile in patients with both childhood and adulthood trauma exposure. The mediation analysis showed a specific mediator role for the "disconnection and rejection (DR)" EMS factor in the relationship between childhood trauma (cT) and eating psychopathology.

Conclusion: Trauma experiences are associated with more severe clinical symptomatology in EDs and may need a specific assessment in patients with failed outpatient standard treatments. Specific cognitive schemas linked to DR domain should be evaluated in treatments for ED patients with history of trauma due to the mediation role between trauma

and eating psychopathology. The need for outcome studies about treatment approaches for ED patients with history of trauma is discussed.

Keywords: eating disorders, trauma, early maladaptive schema, personality traits, anorexia nervosa, bulimia nervosa, binge eating disorder, dissociation

INTRODUCTION

Eating disorders (EDs) are serious mental illnesses characterized by persistent unhealthy eating behaviors, distorted beliefs, and extreme concerns about weight and shape (American Psychiatric Association, 2013; Solmi et al., 2018a). Psychological impairments have been correlated with clinical, interpersonal, and biological elements, showing the complexity of the biopsychosocial model of EDs (Troop and Treasure, 1997; Frank, 2016; Solmi et al., 2018b). Recently, a growing body of literature has underlined the possible role of traumatic life events in the development of EDs, suggesting the possible presence of a specific echophenotype subgroup of patients with a history of trauma (Monteleone et al., 2020b).

Trauma is defined by event(s), experience(s), and effect(s) – the "three E's" (Brewerton, 2019). The literature has pointed that adverse events are experienced differently depending on personal factors including race, culture, genetic, gender, and social support, which requires specific focus during the assessment and treatment of EDs due to the presence of a vulnerability to criticism, misperception of social cues, and neuropsychological impairments (Harrison et al., 2010; McFillin et al., 2012). Many studies have documented the trauma history of patients with EDs and have shown the importance of these events in the development and maintenance of the disorders during both childhood/adolescence and adulthood (Dalle Grave et al., 1996; Backholm et al., 2013; Monteleone et al., 2020b; Scharff et al., 2021). A recent comprehensive meta-analysis reviewed the existing literature, showing that the prevalence of childhood maltreatment is higher in all the ED diagnoses relative to healthy controls and other psychiatric patients (Molendijk et al., 2017). The ED behaviors have been pointed out as a dysfunctional way to escape and avoid trauma-related emotions and thoughts, acting as a maintenance factor for both ED and trauma-related symptomatology (Trottier and MacDonald, 2017). The presence of trauma has a biological impact on the management of stress, with a dysregulation of the body stress response system and the development of dysfunctional responsive behaviors (e.g., impulsivity), which have a negative impact on treatment outcome (Corstorphine et al., 2007; Monteleone et al., 2015, 2020a). Traumatic events also have a negative impact on the ED patients' quality of life, increasing symptomatology and requiring specific treatments (Brewerton et al., 2020). With reference to clinical presentation, childhood sexual abuse has been correlated in EDs to multi-impulsivity, with the presence of binge-purging behaviors, substance abuse, and self-harm behaviors, while childhood physical abuse was associated with underweight (Caslini et al., 2016; Trottier and MacDonald, 2017).

Moreover, the presence of an internal critical "voice" has been linked to childhood trauma (cT), showing its meaningful role in the severity of the disorder as a maintaining factor with impacts on low self-esteem and high criticism levels (Pugh et al., 2018). Fewer studies have examined the relationship between EDs and traumatic events during adulthood, showing a specific association between EDs and sexual abuse, and more recently, between EDs and lockdown experience (Dubosc et al., 2012; Trottier and MacDonald, 2017; Monteleone et al., 2021a,b). Therefore, some authors have suggested that some cases need two treatment levels: one to control harmful and compromising behaviors and a second one to change the specific psychopathology (Corstorphine et al., 2007; Castellini et al., 2018; Todisco et al., 2020). If the extended psychopathological core of ED seems to remain stable and is characterized by an overestimation of weight and shapes, depression (D), anxiety, and interpersonal ineffectiveness, patients with and without a history of trauma history seem to show different psychological phenotypes that require a different specific focus (Solmi et al., 2018b; Rodgers et al., 2019). However, more longitudinal studies are needed to evaluate the specific needs linked to patients' traumatic personal histories to achieve higher rates of effectiveness in treatments, which are now unsatisfactory (Backholm et al., 2013; Olofsson et al., 2020; Scharff et al., 2021).

Traumatic experiences have also been included in the multifactorial causes of dysfunctional personality traits – people's characteristic patterns of thoughts, feelings, and behaviors – and cognitive schemas, such as the early maladaptive schemas (EMS) – which are pervasive principles used for the interpretation of reality and originate from unmeet universal psychological core needs (Young et al., 2003; Jovev et al., 2004; Sansone and Sansone, 2007; Carvalho et al., 2015). Indeed, patients with traumatic histories have exhibited higher levels of personality traits and EMS than patients without a history of trauma (Unoka et al., 2010; Trottier and MacDonald, 2017; Scharff et al., 2021). Previous findings have shown that both personality traits and EMS have a role in the development of clinical profiles that are closely correlated with the emotional factors targeted in EDs treatment (Moulton et al., 2015; Trottier and MacDonald, 2017; Aloi et al., 2020; Meneguzzo et al., 2020a). Personality traits linked to multi-impulsivity behaviors like borderline, antisocial, and paranoid personality have been linked to the cascade effects of traumatic events in ED patients, with dysfunctional coping behaviors adopted in order to avoid thoughts, emotions, and memories (Sansone and Sansone, 2007). Moreover, different traits emerged as strongly linked to eating psychopathology with relevant effects on prognosis and treatment, such as: insecure attachment, high-functioning/perfectionistic trait, constricted/overcontrolled tendency, and emotional dysregulation (Westen and Harnden-Fischer, 2001; Tasca and Balfour, 2014). On the other side, specific EMSs

such as disconnection and impaired autonomy have shown a robust association with specific psychopathology such as EDs, supporting the use of specific cognitive-behavioral interventions that target core beliefs (Karatzias et al., 2016). Cognitive distortion such as a lack of autonomy, emotional regulation difficulties, and interpersonal problems are pervasive elements of chronic mental illness, and early detection could positively impact recovery (Pauwels et al., 2016; Pilkington et al., 2020). For these reasons, a growing body of literature has started to report the results of the integration of elements from third-wave therapies with cognitive-behavioral treatment protocols, with encouraging results (Öst, 2008; Ben-Porath et al., 2020; Pisetsky et al., 2020; Todisco et al., 2020). However, a recent meta-analysis found that there is still a lack of understanding of the effect of trauma on the psychological features and outcomes of ED patients, showing that more longitudinal studies are needed (Molendijk et al., 2017).

Given this background, this study's first aim was to assess whether specific psychopathology, psychosocial impairments, and quality of life in EDs patients with traumatic experiences showed worse levels than patients without a traumatic history. We aimed to determine if there were any differences between patients with trauma exposure during childhood, adulthood, or multiple traumatic life events. Based on the literature data, the second hypothesis was that traumatic exposure could affect eating psychopathology and that EMSs and personality traits could act as mediators of this effect. From this perspective, the paper also aims to evaluate the direct and indirect effects of traumatic events on eating psychopathology, looking for possible specific mediators that might represent specific therapeutic targets.

MATERIALS AND METHODS

Clinical Sample

From January 2020 to November 2020, consecutive patients admitted to the Eating Disorders Unit of the Casa di Cura Villa Margherita (Arcugnano, Vicenza, Italy) were included in this study after being admitted for inpatient treatment. The inclusion criteria were: (a) age between 15 and 60 years; (b) no severe psychiatric (e.g., schizophrenia, schizoaffective disorder, and intellectual disability) or medical acute comorbidity, neurological trauma or disorder, or drug addiction; (c) the ability to fulfill psychometric evaluations; and (d) the sign of the informed consent by the participant (or by the parents for individuals below 18 years of age). The ED diagnoses were made according to DSM-5 criteria by fully trained psychiatrists, with a specific clinical interview before the beginning of the inpatient treatment (American Psychiatric Association, 2013).

The study was part of a clinical evaluation of ED patients hospitalized in the Unit, and it was approved by the internal revision commission; it complies with the provisions of the Declaration of Helsinki and amendments.

Measurements

The patients completed a series of self-administered questionnaires during the 1st week after their inpatient admission. Several self-report questionnaires were included in the battery to evaluate different aspects of participants' psychopathology.

General and Specific Psychopathology

General psychopathology was evaluated with the Symptom Checklist-90-Revised (SCL-90R), a 90-item self-reported inventory with a five-point Likert scale with 0 indicating "not at all" and four indicating "extremely often"; higher scores indicate higher psychopathology (Derogatis and Lazarus, 1994). Psychosocial functioning was evaluated with the Clinical Impairment Assessment Questionnaire (CIA), a 16-item self-reported questionnaire with a four-point Likert scale with a 0 indicating "not at all" and three indicating "a lot"; the obtained scores range between 0 and 48, and a higher score reflects more significant impairment (Bohn et al., 2008). The specific eating psychopathologies were evaluated with the Eating Disorder Examination Questionnaire (EDE-Q), a self-reported measure composed of 28 items rated on a Likert rating scale ranging from 0 to 6, with higher scores indicating greater eating-related psychopathology (Fairburn and Beglin, 1994). The EDE-Q generates a total score and four subscales: Restraint, Eating Concern, Shape Concern, and Weight concern. The Italian Eating Disorder Quality of Life test (IEDQOL) is a 33-item scale rated on a five-point Likert scale and was used to assess the health-related quality of life perceived, with higher scores indicating poorer quality of life (Meneguzzo et al., 2020b).

Trauma

The Childhood Trauma Questionnaire (CTQ) is a 25-item self-reported questionnaire with a five-point Likert scale (from "never" to "frequently") and was used for the assessment of traumatic experiences in infancy (Innamorati et al., 2016). The total score varies from 25 (no trauma) to 125 (extreme trauma), and the presence of a significant trauma was considered when scores were moderate or severe in at least one of the subscales (emotional abuse $\geq$13, physical abuse $\geq$10, sexual abuse $\geq$8, emotional neglect $\geq$15, and physical neglect $\geq$10; Bernstein et al., 2003). For the evaluation of lifetime traumatic experiences, the Brief Trauma Questionnaire (BTQ) was used; this is a 10-item questionnaire used to evaluate the exposure to 10 traumatic events that were classified as a cT if they occurred before the patient was 14 years old or as an adult trauma (aT) otherwise (Schnurr et al., 1999). The BTQ score is from 0 (no trauma; nT) to 10 (traumatic experiences in each investigated category). The Trauma Symptoms Inventory (TSI) was used to evaluate the specific symptomatology linked to the trauma history; the TSI has a 4-point forced response (Briere et al., 1995). Higher scores indicate greater symptomatology linked to trauma, both for the 10 standard subscales (AA: anxious arousal; D: depression; AI: anger/irritability; IE: intrusive experiences; DA: defensive avoidance; DIS: dissociation; SC: sexual concerns; DSB: dysfunctional sexual behavior; ISR: impaired self-reference; and TRB: tension-reduction behavior) and for the three factors considered: trauma, dysphoria-self, and sex problems (Gambetti et al., 2011).

For the aim of the study, patients were asked if the trauma reported was before and/or after the adolescence using the BTQ, allowing to include the participant into a specific trauma subgroup: nT, cT, aT, and both childhood and adult trauma (bT). Both BTQ and CTQ were included in the study to evaluate trauma history and quantify the severity of childhood trauma.

Cognitive Schemas and Personality Traits

Early maladaptive schemas were evaluated with the short version of the Young Schema Questionnaire (YSQ-S3), a 90-item self-reported instrument used for assessing four domains: disconnection and rejection (DR), impaired autonomy and performance (IAP), excessive responsibility and standards (ERS), and impaired limits (IL; Young et al., 2005; Aloi et al., 2020). The evaluation of the personality traits was performed with the short version of the Temperament and Character Inventory (TCI-140), a 140-item questionnaire with a five-point Likert-like scale from "absolutely false" to "absolutely true," and the results were reported using the seven subscales: novelty seeking (NS), harm avoidance (HA), reward dependence (RD), persistence (P), self-directedness (SD), cooperativeness (C), and self-transcendence (ST; Vespa et al., 2015).

Statistical Analysis

Participants were divided into four subgroups according to the presence (trauma+) or the absence (trauma−) of traumatic experiences during their life and the period of the life that they happen (cT, aT, and bT). Different *t*-tests were applied to evaluate differences between trauma+ and trauma− subgroups regarding demographic data and self-report results, and chi-square analysis for evaluating possible differences in diagnosis distribution. Different ANOVAs were calculated to evaluate the differences between trauma+ subgroups, using *post hoc* analysis with Bonferroni correction for multiple comparisons. Results were confirmed with General Linear Model (GLM) analysis with age, BM, and diagnosis as covariates. Partial eta-squared was used for the effect size evaluation. Mediation analysis was performed using the SPSS PROCESS macro-extension (version 3.5), applying Model 4 (Hayes, 2017). For mediation analysis, according to the second aim of the study, CTQ total score and BTQ were used as independent variables in different mediation analyses. The EMS domains and TCI subscales were evaluated as mediators of specific eating disorder psychopathology (EDE-Q total score was the dependent variable). The bootstrapping sampling distributions of the indirect effects were set to 5,000, and the bias level was set to 95%. Sobel test analysis was performed as a confirmatory analysis showing the overall indirect effect of the mediation analysis. The alpha was set at $p < 0.05$ for all analyses. The entire analysis was conducted with IBM SPSS Statistics 25.0 (SPSS, Chicago, IL, United States).

RESULTS

Clinical Presentation

A total sample of 115 patients was included. The sample was composed of five men and 110 women, 68 patients (59%) met the criteria for anorexia nervosa (AN), of whom 37 with a restrictive AN and 31 with a binge-purge subtype, 37 patients (32%) met the criteria for bulimia nervosa (BN), 10 subjects (9%) met the criteria for binge eating disorder (BED). Pharmacological treatment was already present at the admission of 98 patients (85.2% of the sample), and all participants failed at least one ED outpatient treatment protocol. The participants had a mean age of 26.30 ± 10.27 years (14–59) and a mean body mass index (BMI) of 18.83 ± 6.75 kg/m^2 (11.46–50.49).

Eighty-seven patients out of 115 (75.6%) reported some significant traumatic event during their lives, but between the trauma+ and trauma− subgroups, no significant differences were found in terms of age [trauma− 23.74 ± 9.94, trauma+ 27.09 ± 10.29 years, $t(112) = -1.489$, $p = 0.139$, $d = 0.331$] and BMI [trauma− 16.74 ± 3.68, trauma+ 19.47 ± 7.34, $t(112) = -1.857$, $p = 0.066$, $d = 0.053$]. Looking at the distribution of the diagnosis, 48 out of 68 AN patient were included into the trauma+ subgroup (70.6%), 30 out of 37 BN patients were included into the trauma+ subgroup (81.1%), and all the patients with BED diagnosis. The comparison between trauma− group vs. trauma+ subgroups considered as a whole showed lower scores in all the psychopathological scales included in the study [SCL90R total: 131.26 ± 50.37 vs. 172.68 ± 59.71, $t(110) = -3.253$, $p = 0.002$, $d = 0.750$; EDE-Q total: 3.37 ± 1.32 vs. 4.36 ± 1.07, $t(110) = -3.579$, $p = 0.001$, $d = 0.824$; CIA: 28.70 ± 9.88 vs. 35.71 ± 9.48, $t(111) = -3.315$, $p = 0.001$, $d = 0.724$; IEDQOL: 1.65 ± 0.65 vs. 2.16 ± 0.48, $t(110) = -3.817$, $p = 0.002$, $d = 0.893$].

Table 1 shows the clinical presentation of the included sample divided by trauma history. The GLM analysis partially confirmed the presence of differences between EDE-Q total scores between subgroups controlling for age [$F(3,111) = 0.3.201$, $p = 0.027$], BMI [$F(3,111) = 1.811$, $p = 0.151$], diagnosis [$F(3,111) = 0.2.074$, $p = 0.109$], and their interaction [$F(4,111) = 0.2.684$, $p = 0.036$]. Also CIA results were partially confirmed controlling for age [$F(3,112) = 4.432$, $p = 0.006$], BMI [$F(3,112) = 0.530$, $p = 0.663$], diagnosis [$F(3,112) = 3.926$, $p = 0.011$], and their interaction [$F(4,112) = 4.031$, $p = 0.005$]. Differently, EDQOL showed no significant differences between subgroups controlling for age [$F(3,82) = 1.850$, $p = 0.147$], BMI [$F(3,82) = 0.744$, $p = 0.530$], diagnosis [$F(3,82) = 0.796$, $p = 0.501$], and their interaction [$F(4,82) = 1.754$, $p = 0.150$].

As for trauma symptomatology, the data indicate that trauma+ patients had more severe symptomatology than the trauma− subgroup for all the subscales of the TSI [A: 21.30 ± 6.11 vs. 17.56 ± 5.76, $t(113) = -2.820$, $p = 0.006$, $d = 0.630$; D: 17.64 ± 4.74 vs. 13.63 ± 5.34, $t(113) = -3.728$, $p < 0.001$, $d = 0.200$; AI: 14.10 ± 6.33 vs. 10.78 ± 5.51, $t(113) = -2.456$, $p = 0.016$, $d = 0.559$; IE: 14.16 ± 5.91 vs. 11.11 ± 5.21, $t(113) = -2.406$, $p = 0.018$, $d = 0.547$; DA: 12.89 ± 5.39 vs. 10.41 ± 4.43, $t(113) = -2.173$, $p = 0.032$, $d = 0.503$; DIS: 16.67 ± 5.73 vs. 13.74 ± 5.44, $t(113) = -2.349$, $p = 0.020$, $d = 0.524$; SC: 11.92 ± 6.04 vs. 8.22 ± 4.53, $t(113) = -2.933$, $p = 0.004$, $d = 0.693$; DSB: 9.31 ± 5.97 vs. 5.74 ± 4.59, $t(113) = -2.854$, $p = 0.005$, $d = 0.670$; ISR: 12.09 ± 5.81 vs. 6.48 ± 4.82, $t(113) = -4.555$, $p < 0.001$, $d = 1.051$; TRB: 11.56 ± 4.76 vs. 8.52 ± 3.86, $t(113) = -3.023$, $p = 0.003$, $d = 0.701$].

TABLE 1 | Clinical presentation of the sample.

	nT	aT	cT	bT	F	*p* η^2_p GLM*p*	*Post hoc*
	***n* = 27**	***n* = 22**	***n* = 23**	***n* = 43**			
Age, years	23.74 (9.94)	21.27 (3.44)	26.26 (9.22)	30.60 (11.81)	5.311	**0.002** 0.127 **<0.001**	nT < bT (0.031) aT < bT (0.002) nT < bT (0.002)
BMI, kg/m^2	16.74 (3.68)	16.13 (2.89)	17.30 (4.80)	22.41 (8.88)	7.467	0.169 **0.003**	aT < bT (0.001) cT < bT (0.012) nT < cT (0.017)
SCL-90R tot	131.26 (50.37)	149.95 (73.69)	180.83 (50.92)	179.05 (55.38)	4.984	0.122 **0.001**	nT < bT (0.006)
EDE-Q restraint	3.11 (2.00)	4.16 (1.85)	4.14 (1.41)	3.74 (1.78)	1.856	0.141 0.049 0.219	
EDE-Q eating concern	2.95 (1.44)	3.30 (1.35)	3.59 (1.12)	3.92 (1.37)	3.058	**0.031** 0.078 0.079	nT < bT (0.025)
EDE-Q shape concern	4.01 (1.42)	4.88 (1.37)	5.56 (0.49)	5.11 (1.16)	8.048	**<0.001** 0.183 **0.005**	nT < cT (<0.001) nT < bT (0.001)
EDE-Q weight concern	3.39 (1.64)	4.57 (1.50)	4.96 (0.70)	4.50 (1.39)	6.290	**0.001** 0.149 **0.018**	nT < aT (0.030) nT < cT (0.001) nT < bT (0.007)
EDE-Q tot	3.37 (1.32)	4.23 (1.31)	4.56 (0.68)	4.32 (1.14)	5.570	**0.001** 0.134 **0.018**	nT < cT (0.002) nT < bT (0.006)
CIA	28.70 (9.88)	34.55 (9.26)	37.35 (6.40)	35.37 (10.94)	3.986	**0.010** 0.098 **0.025**	nT < cT (0.012) nT < bT (0.034)
IEDQOL tot	1.66 (0.65)	2.06 (0.38)	2.17 (0.51)	2.20 (0.51)	4.994	**0.003** 0.159 **0.001**	nT < cT (0.033) nT < bT (0.003)
CTQ tot	30.96 (4.75)	33.18 (4.64)	50.13 (12.75)	58.53 (16.90)	37.507	<0.001 0.503 <0.001	nT < cT (<0.001) nT < bT (<0.001) aT < cT (<0.001) aT < bT (<0.001)

BMI, body mass index; SCL-90R, Symptom Checklist-90-Revised; EDE-Q, eating disorder examination questionnaire; CIA, clinical impairment assessment; IEDQOL, Italian eating disorder quality of life; CTQ, childhood trauma questionnaire; nT, no trauma; aT, adult trauma; cT, child trauma; bT, both trauma; F = ANOVA with Bonferroni-corrected post hoc tests, results were considered significant for $p < 0.05$; η^2_p, partial eta-squared; GLMp = significance of the ANCOVA with age, diagnosis, and BMI as covariates. Significant p-values are reported with bold characters.

Regarding different trauma subgroups, data showed higher scores in bT group as reported in **Table 2**. Interestingly, there were significant differences between the aT group and bT group, with aT group scoring less than bT group.

Clinical features of the personality traits and EMS of ED patients were also evaluated. In comparisons of the trauma+ and trauma− subgroups, our data showed significantly greater presence of EMS in the trauma+ [EMS-DR: 1.82 ± 1.09 vs. 1.10 ± 0.86, $t(113) = 3.122$, $p = 0.002$, $d = 0.733$; EMS-IAP: 2.00 ± 1.09 vs. 1.19 ± 0.89, $t(113) = 3.507$, $p = 0.001$, $d = 0.814$; EMS-ERS: 1.48 ± 1.09 vs. 0.95 ± 0.71, $t(113) = 2.391$, $p = 0.018$, $d = 0.576$; EMS-IL: 1.93 ± 1.16 vs. 1.07 ± 0.95, $t(113) = 3.495$ $p = 0.001$, $d = 0.811$]. Personality traits showed no significant differences due to the presence of any trauma. As for the different kinds of trauma, specific differences emerged between subgroups as showed in **Table 3**.

Mediation Analysis

Different mediation analyses were performed to determine whether any personality traits or factors related to EMS had a mediator effect on the relationship between traumatic events exposure and eating psychopathology. Mediation analysis with all four EMS domains and all six TCI traits dides not result significantly with BTQ score as an independent variable. Looking at childhood

TABLE 2 | Trauma symptom inventory.

	nT	aT	cT	bT	F	*p* η^2_p GLM*p*	*Post hoc*
AA	17.56 (5.76)	17.50 (7.10)	21.39 (6.44)	23.19 (6.21)	7.731	**<0.001** 0.173	nT < bT (0.001) aT < bT (0.001)
D	13.63 (5.34)	15.41 (3.89)	16.48 (4.76)	19.40 (4.54)	9.232	**0.002** **<0.001** 0.200	nT < bT (<0.001) aT < bT (0.009)
AI	10.78 (5.51)	12.18 (5.92)	13.22 (6.77)	15.56 (6.08)	3.789	**<0.001** **0.012** 0.093	nT < bT (0.010)
IE	11.11 (5.21)	12.18 (5.72)	13.09 (6.63)	15.74 (5.26)	4.328	**0.012** **0.006** 0.105	nT < bT (0.007)
DA	10.41 (4.43)	11.64 (5.38)	12.35 (6.16)	13.81 (4.90)	2.561	**0.012** 0.059 0.065	
DIS	13.74 (5.44)	13.86 (5.13)	15.70 (5.81)	18.63 (5.78)	6.078	0.118 **0.001** 0.141	nT < bT (0.002) aT < bT (0.007)
SC	8.22 (4.53)	8.68 (5.24)	10.57 (5.68)	14.30 (5.72)	9.261	**0.018** **<0.001** 0.200	nT < bT (<0.001) aT < bT (0.001)
DSB	5.74 (4.59)	6.82 (3.87)	8.17 (5.62)	11.19 (6.49)	6.456	**<0.001** **<0.001** 0.149	cT < bT (0.049) nT < bT (0.001) aT < bT (0.017)
ISR	6.48 (4.82)	10.41 (5.05)	10.52 (5.17)	13.79 (6.12)	10.024	**<0.001** **<0.001** 0.213	nT < bT (<0.001)
TRB	8.52 (3.86)	10.09 (4.47)	10.39 (4.26)	12.93 (4.86)	5.895	**<0.001** **0.001** 0.137	nT < bT (0.001)
Trauma	39.07 (13.86)	41.32 (16.49)	46.83 (11.79)	52.74 (11.79)	5.981	**0.001** **0.001** 0.139	nT < bT (0.001) aT < bT (0.019)
Dysphoria-self	70.70 (27.06)	79.45 (28.19)	87.70 (28.56)	103.49 (30.04)	8.928	**0.005** **<0.001** 0.194	nT < bT (<0.001) aT < bT (0.007)
Sex problems	22.48 (11.38)	25.59 (11.77)	29.13 (13.64)	38.42 (15.09)	9.294	**<0.001** **<0.001** 0.201 **<0.001**	nT < bT (<0.001) aT < bT (0.002) cT < bT (0.050)

nT, no trauma; cT, child trauma; bT, both trauma; η^2_p, partial eta-squared; AA, anxious arousal; D, depression; AI, anger/irritability; IE, intrusive experiences; DA, defensive avoidance; DIS, dissociation; SC, sexual concerns; DSB, dysfunctional sexual behavior; ISR, impaired self-reference; TRB, tension-reduction behavior; F = ANOVA with Bonferroni-corrected post hoc tests, results were considered significant for p < 0.05; GLMp = significance of the ANCOVA with age, diagnosis, and BMI as covariates. Significant p-values are reported with bold characters.

trauma, the overall model results significant, but the only mediator that showed a significant effect was EMS-DR among all EMS and TCI variables [95% CI: EMS-IAP (−0.002, 0.017), EMS-ERS (−0.012, 0.003), EMS-IL (−0.001, 0.021), TCI-NS (−0.019, 0.006), TCI-HA (−0.003, 0.004), TCI-RD (−0.004, 0.003), TCI-P (−0.004, 0.004), TCI-SD (−0.001, 0.013), TCI-C (−0.001, 0.012), TCI-ST (−0.008, 0.002)]. The effect of childhood trauma on eating psychopathology was significantly mediated by EMS-DR [β = 0.007, SE = 0.003, 95% CI (0.002, 0.014)]. Furthermore, the CTQ score had a significant direct effect on EDE-Q [β = 0.012, SE = 0.304, 95% CI (0.001, 0.024)], childhood trauma had a direct effect on the EMS-DR score [β = 0.014, SE = 0.006, 95% CI (0.002, 0.026)], and EMS-DR had a direct effect on eating psychopathology levels [β = 0.470, SE = 0.095, 95% CI (0.282, 0.658)]. The overall proportion of the indirect effect was 35%. The mediation analysis is shown in **Figure 1**.

TABLE 3 | Personality traits and early maladaptive schemas (EMS) domains.

	nT	aT	cT	bT	F	*p* η^2_p GLM*p*	*Post hoc*
TCI-NS	51.15 (10.36)	45.23 (8.51)	47.74 (5.52)	59.56 (7.45)	19.696	**<0.001** 0.349 **<0.001**	nT < bT (<0.001) aT < bT (<0.001) cT < bT (<0.001)
TCI-HA	70.73 (13.33)	77.32 (8.99)	79.09 (5.89)	72.77 (11.92)	3.294	**0.023** 0.082 **0.050**	nT < cT (0.048)
TCI-RD	65.23 (10.80)	60.18 (7.68)	59.87 (6.75)	62.93 (7.67)	2.282	0.083 0.059 0.120	
TCI-P	62.38 (14.67)	69.59 (13.59)	62.78 (13.57)	62.35 (12.65)	1.655	0.181 0.043 0.627	
TCI-SD	59.77 (11.91)	52.59 (10.46)	49.91 (9.25)	51.49 (10.99)	4.306	**0.007** 0.105 **0.001**	cT < nT (0.011) bT < nT (0.015)
TCI-C	77.85 (8.11)	77.23 (11.29)	74.30 (5.29)	73.16 (7.16)	2.425	0.070 0.062 0.284	
TCI-ST	31.65 (9.23)	28.68 (7.29)	31.00 (7.82)	35.91 (9.62)	3.850	**0.012** 0.095 **0.005**	aT < bT (0.013)
EMS-DR	1.11 (0.86)	1.63 (1.08)	2.07 (1.25)	1.79 (1.01)	3.962	**0.010** 0.097 **0.006**	nT < cT (0.009)
EMS-IAP	1.19 (0.89)	1.92 (1.13)	2.23 (1.11)	1.91 (1.07)	4.576	**0.005** 0.110 **0.005**	nT < cT (0.004) nT < bT (0.035)
EMS-ERS	0.95 (0.71)	1.53 (1.01)	1.22 (0.97)	1.60 (1.84)	2.657	0.052 0.067 0.053	
EMS-IL	1.07 (0.95)	1.98 (0.96)	1.98 (1.23)	1.88 (1.24)	4.060	**0.009** 0.101 **0.006**	nT < cT (0.034) nT < aT (0.042) nT < bT (0.024)

TCI, temperamental and character inventory; NS, novelty seeking; HA, harm avoidance; RD, reward dependance; P, persistence; SD, self-directedness; C, cooperativeness; ST, self-transcendence; EMS, early maladaptive schema; EMS-DR, disconnection and rejection; EMS-IAP, impaired autonomy and performance; EMS-ERS, excessive responsibility and standards; EMS-IL, impaired limits; nT, no trauma; cT, child trauma; bT, both trauma; η^2_p, partial eta-squared; F = ANOVA with Bonferroni-corrected post hoc tests, results were considered significant for $p < 0.05$; GLMp = significance of the ANCOVA with age, diagnosis, and BMI as covariates. Significant p-values are reported with bold characters.

DISCUSSION

This paper's main goal was to evaluate the differences in the psychopathological and psycho-functional profiles of ED patients with and without exposure to traumatic events at admission into a specialized inpatient ward. Different exposure times were considered to evaluate the difference among childhood, adulthood, or both childhood and adulthood exposures to traumatic events. The second goal was to evaluate possible psychological factors that could act as mediators of the effect of childhood trauma on the clinical severity of ED psychopathology.

From a clinical perspective, the patients who experienced traumatic events in this study had a more impaired psychopathological profily than the others, reportingmore severe ED psychopathology and psychological symptoms and a poorer quality of life. This evidence is in line with the recent literature from various different countries that has revealed a more complex profile in patients with traumatic experiences and various EDs (Backholm et al., 2013; Brewerton et al., 2020; Longo et al., 2021), and it corroborates the evidence of a specific adverse effect of trauma with a possible specific ecophenotype for ED patients with traumatic experiences (Chami et al., 2019). We confirmed the presence of a poorer quality of life and an impaired psychosocial domain (Backholm et al., 2013; Brewerton et al., 2020) in ED patients with traumatic events, supporting the importance of evaluating traumatic

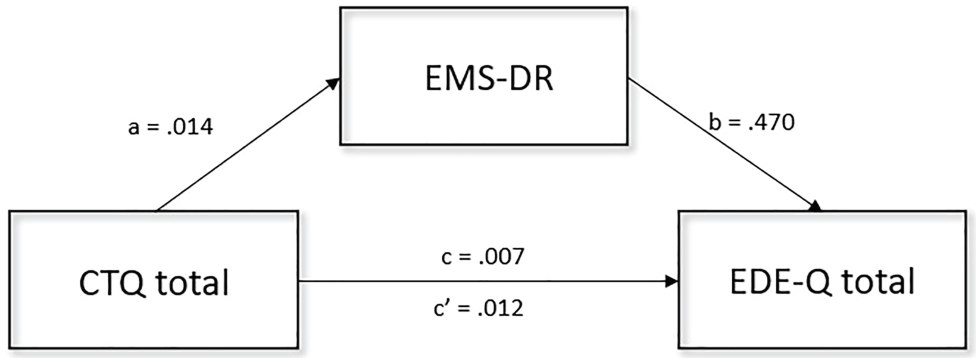

FIGURE 1 | Graphical representation of the mediation analysis performed between CTQ total score (independent variable), EDE-Q total score (dependent variable), and EMS-DR (mediator). Confirmatory Sobel test confirmed the mediation effect represented (t = 2.152, SE = 0.003, p = 0.031). EDE-Q, eating disorder examination questionnaire; EMS-DR, early maladaptive schema disconnection and rejection; CTQ, childhood trauma questionnaire; a, b, c, and c' are path coefficients.

history in ED patients (Brewerton, 2019). Our data showed no significant differences between trauma subgroups (aT, cT, and bT) regarding psychopathology. Patients with traumatic experiences during childhood showed higher levels of specific psychopathology, more clinical impairment, and lower quality of life. Looking at specific trauma symptoms, significant differences raised between aT and other trauma-subgroups. Indeed, patients with only trauma exposures during adulthood reported fewer trauma symptoms than patients with also childhood trauma. This remark is in line with the idea that traumatic events have an impairment effect on individuals' developmental life trajectories (Agorastos et al., 2019), extending the opinion that vulnerability is linked to childhood and early adulthood. Trauma could have a larger effect when people cannot rely on fully-developed psychological defenses (Waldinger et al., 2006) and its effect could also be amplified if it is recurrent or repeated (Clemmons et al., 2007; Cloitre et al., 2009). Our data partially corroborates this view because we have only quantified the trauma exposure and have not evaluated its quality. However, patients with cumulative trauma showed a more impaired clinical profile with higher psychopathology scores and higher physical symptomatology levels (Lin et al., 2016). This clinical profile could be linked to inflammation that has been a potential mediator between different trauma exposure and physical and mental well-being; in fact, people who reported a cumulative trauma exposure showed higher inflammation levels (Lin et al., 2016).

From a psychological perspective, our data indicated that in EDs patients an association between traumatic events and the EMS could be highlighted. In our study, patients with traumatic life-events showed higher EMSs without any differences attributable to the timing of exposure. The literature has already shown EMS's potential role in the development and maintenance of psychopathology (Karatzias et al., 2016) and ED behaviors (Pugh, 2015). However, the ED's EMS literature is still preliminary (Pugh, 2015), even though cognitive-behavioral approaches are considered the gold standard of treatments. Our data corroborate the evidence of a relationship between EMS and trauma (Pilkington et al., 2020), suggesting, however, that the time of trauma exposure does not influence them, even if the presence of the larger span between both cT and bT with respect to nT could be considered as an indicator for further studies, with larger samples, that could evaluate the relationship between childhood trauma and EMS, as already stated in general and clinical populations (Meyer et al., 2001; Messman-Moore and Coates, 2007). As for personality traits, our data provided weak evidence of differences between patients with and without trauma experiences, while the literature on healthy subjects has shown a robust connection between dysfunctional personalities and trauma (Carvalho et al., 2015). This evidence could confirm that personality is an essential aspect of the ED patients' profiles (Wonderlich and Mitchell, 2001; Lilenfeld et al., 2006) and that personality could be only partially negatively affected by traumatic life events.

Finally, the mediation analysis showed a potential role for EMS in modifying the effect that early trauma has on eating psychopathology. This relationship has already been evaluated (Kong and Bernstein, 2009), however, the role of specific cognitive schemas as maintenance factors of specific psychopathology is still unclear. Specifically, our data showed the mediation role of the DR domain in the relationship between childhood trauma and eating psychopathology. However, it has to be noted that the direct effect of EMS-DR on EDE-Q was more significant than the indirect effect, showing the independent contribution that the domain "disconnection and rejection" has to eating psychopathology. Indeed, this domain is associated with attachment bonds and higher scores are linked to insecure attachment and the inability to form a secure connection, and these difficulties in the relationship with others were already largely reported in the ED literature, showing the perpetuation role of dysfunctional core beliefs exert (Jones et al., 2007; De Paoli et al., 2017). Our data adds to the evidence about the relationships between cognitive schema and eating psychopathology using a clinical sample and corroborating the idea that abandonment, mistrust/abuse, emotional deprivation,

social isolation, and defectiveness could be dysfunctional coping strategies that characterized ED patients and that might be taken under consideration, especially in people with traumatic history (Sarin and Abela, 2003; Dakanalis et al., 2014; Pauwels et al., 2018; Meneguzzo et al., 2020a).

CLINICAL IMPLICATION

The results of the present study suggest that traumatic experiences should be investigated in ED patients, especially when the severity of the psychopathology required hospitalization or led to the failure of different outpatient treatments. Indeed, traumatic experiences are associated with more severe ED psychopathology and more severe physical symptomatology. The presence of traumatic events should also be considered during the ED treatment, especially for the possible presence of cognitive schemas that should be taken into consideration. The role of trauma in cognitive schemas and personality traits requires to be investigated in further studies with different methodologies. However, our data showed the relevant presence of worse psychological profiles in patients with trauma exposure, especially in the interpersonal domains. Interpersonal schemas have indicated a significant association with eating psychopathology, supporting the interpersonal model for eating disorders and suggesting possible treatment approaches (Ivanova et al., 2015).

Moreover, core beliefs could be changed with specific treatment approaches, obtaining an improvement of the symptomatology with a personalized treatment approach (De Paoli et al., 2017). Finally, Scharff et al. (2021) reported that ED patients with a history of trauma could benefit from treatments focused on improving emotional functioning, including third-wave treatments. These treatments could help to improve the poor treatment outcome that standard cognitive behavior therapy has in ED patients with trauma, but more studies are needed (Castellini et al., 2018; Ke and Barlas, 2020; Serra et al., 2020). Our data add that specific cognitive schema should be treated in patients with early traumatic experiences, focusing on abandonment, mistrust/abuse, emotional deprivation, social isolation, and defectiveness.

LIMITS AND CONCLUSION

Some limitations of the present study need to be highlighted. Firstly, the study's cross-sectional nature and the small samples size should be considered: it is not possible to evaluate any causal relationships among variables, and future studies should be longitudinal with bigger samples to replicate results and to evaluate interventions. Secondly, this study mostly relied on self-reported measures, which are open to bias. Thirdly, no control group was included due to the clinical origin of the data, and future studies should compare ED patients with healthy peers regarding the role of traumas in behaviors, thoughts, and specific concerns. Fourthly, our results' generalization is limited by our sample's characteristics: the unbalanced presence of men (5% of the sample), the recruitment of inpatient subjects of a rehabilitation facility and with drug therapy, the absence of a structured evaluation of the intelligence quotients, and severe ED psychopathology. Drug therapy was composed of SSRI, second generation of antipsychotics, and/or mood stabilizers, but none of the treatments used affected the participants' ability to answer self-report questionnaires.

Despite these limitations, the current study highlights the relevance of traumatic events in the clinical presentation of ED patients. Trauma evaluation should be part of ED patients' assessment and should be included in specific treatment protocols focused on specific cognitive maladaptive schemas. More studies are needed to identify the treatment outcome of patients with trauma exposure, and these studies should measure the effectiveness of addressing possible targets.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors upon motivated request.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Internal Committee of the Casa di Cura Villa Margherita. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

AUTHOR CONTRIBUTIONS

PM and PT have equally contributed to the structure, theoretical position, data analysis, and led manuscript writing. All authors have equally contributed to the data collection. All authors contributed to the article and approved the submitted version.

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Associations Between Defence-Style, Eating Disorder Symptoms, and Quality of Life in Community Sample of Women: A Longitudinal Exploratory Study

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Background and Aim: Eating Disorders (EDs) impact an estimated 15% of the global population and are linked to maladaptive defence-styles (coping strategies) and poorer mental health outcomes. Defence-styles have been grouped into immature, neurotic, and mature behaviours. Studies have yet to examine all three defence-styles in ED symptomatic individuals over an extended period of time. The current study aimed to investigate using converse analysis the relationships between defence-style and ED outcomes over a 5-years period.

Methods: Participants (n = 216, mean age 33 years) were recruited through the Women's Eating and Health Literacy study, with the current study examining a 5-years period of two waves (year-4 and year-9). The current study tested associations over time between eating pathology (EDE-Q), psychological distress (K10), mental and physical health related quality of life (M/PHRQoL, SF-12), and defence-style (DSQ-40).

Results: Mature, immature and neurotic defence-styles did not significantly change over 5 years. Over the same period, only PHRQoL significantly predicted mature defence-styles having positive effect. Both MHRQoL and PHRQoL significantly predicted immature defence-styles having positive and negative effects, respectively. Psychological distress, PHRQoL and weight concern significantly predicted neurotic defence-styles having positive effects except for psychological distress. PHRQoL, MHRQoL, restraint and eating concern significantly predicted overall eating pathology having positive effects except for PHRQoL and MHRQoL. Conversely, among the defence-style variables, over 5 years, both immature and neurotic defence-styles significantly predicted psychological distress having positive effects, immature and mature defence-styles significantly predicted MHRQoL having negative and positive effects, respectively, while only immature defence-styles significantly predicted overall eating pathology having positive effect.

Conclusions: The results of the current study suggest that immaturity and neuroticism but not maturity were the defence-style variables predicting psychological distress over a 5-years period while conversely psychological distress predicted only neurotic defence styles. The findings of the current study may suggest that without intervention, mature, immature and neurotic defence-styles may largely remain immutable to significant shifts over time. Limitations in the current study included limited demographic representation. The current study is anticipated to generate considerations into treatments that could strengthen defence-styles in individuals with increased eating pathology.

Keywords: defence-style, eating disorders, quality of life, disordered eating, women

INTRODUCTION

Overview

The impact of an Eating Disorder (ED) on an individual's life can hinder their ability to cope with stressful situations (Ziegler, 2016). How a person copes with stressors (defence-style) in their environment is said to be a result of their subconscious mind, and can be altered by the presence of psychiatric illness (Vaillant, 1994). While research into the influence of eating disorders on defence-styles has been explored empirically, there appears to be a dearth in knowledge in determining if defence-styles influence eating disorders. If there is a relationship between eating disorders and defence-styles, it may stand to provide insight into potentially enhancing ED therapies and treatments to produce more effective outcomes. This paper is an exploratory study reporting on the relationship between EDs and defence-styles in a community sample of women.

Defence-Styles

Defence-styles, or defence mechanisms, are coping strategies at varying levels of adaptive coping (Ziegler, 2016). Defence-styles are anchored in psychological processes that occur subconsciously in order to reduce negative emotional responses caused by undesirable stimuli (Steiger and Zanko, 1990). Defence-styles were first hypothesised by Freud (1894), and to date include those of displacement, intellectualisation, projection, denial, rationalisation, reaction formation, repression, regression and sublimation (Ziegler, 2016). American psychiatrist Vaillant (1994) reorganised Freud's defence-styles into varying levels of: pathological, mature, immature, and neurotic styles, which scholars extensively use as a theoretical framework in current research to postulate underlying mechanisms that may explain certain behaviours (see **Table 1**) (Cramer, 2000; Cheng et al., 2015; Sala et al., 2015). Broadly, immature defence-styles often centre on distancing or ignoring one's response to a negative stimulus; mature defence-styles are centred around actively redirecting emotions in response to a negative stimuli to more adaptive situations or interactions; and neurotic defence-styles focus on controlling the emotional response to a negative stimuli.

Healthy and unhealthy consequences may result to the individual, dependant on the frequency and circumstance the defence styles are used (Weiten, 2007; Costa and Brody, 2008). Psychoanalytic theory indicates that the subconscious mind can manipulate, deny or distort a person's perception of reality in order to protect against inappropriate impulses, anxieties, stimuli or emotions, and to maintain one's self-schema or other schema's (perceptions), an individual may have of the world (Bond et al., 1983; Steiger et al., 1989, 1990; Steiner, 1990; Schmidt et al., 1993; Peteet, 2001; Hart et al., 2011; Ziegler, 2016).

Measuring Defence-Styles

The construct of defence-style can be difficult to measure; however, over the years there have been several tools developed to assess defence-styles (Laor et al., 2001). Laor et al. (2001) indicate that among the more commonly known measures are the: Defence Mechanism Inventory (Gleser and Ihilevich, 1969); Hierarchy of Defence Mechanisms (Vaillant, 1976); Defence Style Questionnaire (DSQ) (Bond et al., 1983); Defence Mechanism Rating Scale (Perry and Cooper, 1989); Defence Mechanism Manual (DMM) cram (Cramer and Blatt, 1990); and Comprehensive Assessment of Defence-Style (CADS) (Laor et al., 2001). However, given its brevity, simplicity, specificity, and strong validations the modified version of the DSQ, the DSQ-40, is perhaps one of the current and commonly used self-reported measures of defence-styles (Andrews et al., 1993).

Current Understanding of the ED and Defence-Style Link

Bond and Perry (2004) conducted a study on defence-style relationships with various psychopathology and change in

TABLE 1 | Vaillant (1994) defined defence mechanisms.

Pathological (level I)	Immature (Level II)	Neurotic (Level III)	Mature (Level IV)
Psychotic denial	Fantasy	Intellectualisation	Humour
Delusional projection	Projection	Reaction formation	Sublimation
	Passive aggression	Dissociation	Suppression
	Acting out	Displacement	Altruism
		Repression	Anticipation

Different variations exist of Freud's defence-styles, however all often have the core groups of immature, neurotic, and mature defence-styles. In the DSQ pathological are grouped with immature.

outcomes, and found that variations in the utilisation of defence-styles may be seen in particular patient groups with specific disorders. For example, anxiety and depression appear to both be positively associated with immature and neurotic defence-styles, but negatively associated with mature defence-styles (Spinhoven and Kooiman, 1997). Nonetheless, while adaptive defence-styles are often seen to improve with symptom reduction, the author argues that defence-styles may also be an indicator or even a predictor of the intervention (therapy) being provided to the patient (Bond, 2004).

Individuals with Eating Disorders (EDs) are often seen to utilise variants of these defences, which may contribute to their ED and the maintaining of disordered eating behaviours (Zeigler-Hill et al., 2008; Goulia et al., 2015). Alternatively, it may also be that ED symptoms have some impact on an individual's defence style (Gitzinger, 1993; Sullivan et al., 1994; Vidović et al., 2003). Nonetheless, research into such relationships between eating pathology and defence-styles has yet to be explored. Hay and colleagues (Hay et al., 2010) began to longitudinally examine the natural history and possible predictors, including defence-styles, of various outcomes in college-age females with common eating disorders. Participants who exhibited eating disorder symptoms appeared to score higher on immature and neurotic defence styles, and lower on mature defence styles (Hay and Williams, 2013). Specifically, participants who had higher baseline scores for immature and neurotic defence-styles had a higher level of ED symptomatology and poorer MHQoL at 2-years follow-up; when compared to participants who scored lower on baseline immature and neurotic defence styles (Hay et al., 2010).

In a continuation of the above study, Hay and Williams (2013) reported that at year-4 and year-5 follow-up participants with higher immature and neurotic defence-style scores continued to report higher levels of ED symptomology compared to community norms. Analysis using multivariate linear modelling showed that perceived stress, immature defence-style, and psychological distress were still significantly associated with ED symptoms at both year-4 and year-5 (Hay and Williams, 2013). According to Hay and Williams (Hay and Williams, 2013), women at year-5 follow-up continued to show signs of pathological eating significantly associated with immature defence-styles at baseline. Conversely, given that defence-styles are capable of influencing an individual's psyche, it may stand to reason that this may extend to an individual's psychopathology influencing their defence-style; but to our knowledge, no examination of this converse relationship with regard to ED symptoms and defence-style has been done. Investigating this relationship may offer other avenues of ED treatment, such as focusing on improving defence-style to improve eating pathology in individuals who may not respond to conventional treatments that target the maintaining behaviour (Fairburn et al., 2003). Moreover, although studies have found that mature and neurotic defence-styles are less variable over time than immature defence-styles, the opposite relationship between defence-style changes over time has also yet to be examined.

Therefore, the current study will aim to extend on Hay and Williams (2013) previous findings to see if these continue to be seen over an extended period of time (from baseline year-4 to follow-up at year-9). To address the limitations of Hay and Williams (2013) study, the current study will examine the opposite relationships in time in all three defence-styles with ED symptoms and will also investigate the predictors of defence-style changes overtime in relation to MHRQoL, as well as psychological distress. Based on previous research we anticipated that a more immature defence-style would be associated with higher ED symptoms overtime. The converse relationship between ED symptoms at baseline and defence-styles at a follow-up time period is exploratory and thus no hypotheses are made.

METHODOLOGY

Study Design and Procedure

The present study was nested in The Women's Eating and Health Literacy longitudinal study (hereafter WEHL), with initial ethics approval granted by James Cook University, and subsequent approvals/reviews approved by the Western Sydney University (WSU) Human Research and Ethics Committee (HREC; approval: H9283). Written informed consent was obtained from all participants prior to the commencement of the current study. Data were collected over 9-years in six waves (baseline, year-1, year-2, year-4, year-5, and year-9), to date. The WEHL study used pooled data from two cohorts that purposively oversampled for adult women with high levels of ED symptoms. The first cohort were ED symptomatic participants who were initially recruited from the general population of women aged 18–42 in the Australian Capital Territory (ACT), Australia (Mond et al., 2004; Mitchison et al., 2013). The second cohort were women aged over 18 years who were recruited from various Universities and Technical and Further Education (TAFE) Institutes across Queensland and Victoria, Australia. The cohorts were recruited over 24 months. The current study examined year-4 (Time 1; T1) and year-9 (Time 2, T2) data only.

For additional information on the larger study please see Mitchison et al. (2015) and Holtzhausen et al. (2020).

Mail-Out and Email Surveys

Invited individuals who preferred email contact were emailed electronic versions of the study and others sent paper copies by post. In order to ensure maximum response rate, surveys were sent out to non-responders at two, three and 4 months for both aforementioned cohorts (Mitchison et al., 2013, 2015). This procedure was repeated at each follow-up time-point.

Participants

Of 828 baseline participants, 434 (52.4%) completed T1 follow-up, and 364 (44.0%) completed T2 follow-up. The mean age of the sample was 32.47 years old ($S.E = 0.86$) at T1. Over half (51.41%) of the sample indicated they had studied an undergraduate level bachelor's degree or higher at T1, with 77.7% indicating they had attained a bachelor's degree or higher at T2. Moreover, 35% of females indicated having a child/ren at T1, with an increase to 45% of participants indicating they had a child/ren at T2.

Of the sample, 50.71% indicated being married at T1, which dropped to 32.4% at T2. The average time-out of their regular role (study or work) at T1 and T2 remained unchanged, with the average being three days for reasons unspecified (Median = 1.00). Mean BMI at T1 was 26.09 kg/m^2, which increased to 27.22 kg/m^2 at T2. Additional sociodemographic characteristics and information can be found in **Supplementary Tables 1, 2**.

Measures

To determine the demographic characteristics of the participants and their change-over time, the same questions relating to employment status, highest education, marital status, days out of their regular role (e.g., work or study), as well as self-reported height and weight were asked at each testing interval. Further to this, several measures were administered to determine eating pathology, psychological distress at the time of the study, and both Mental and Physical HRQoL components.

For the baseline demographic characteristic year four age there were no dropouts at year nine and were therefore unable to test whether mean year four age differed significantly between dropouts and study completers. However, for year four employment status there were some dropouts ($n = 110$) at year nine, using this variable it was noted that there was a significant difference between dropouts and study completers. Specifically, there was non-significant difference between year nine dropouts and completers for year four employment status ($p = 0.6405$ for Fisher's exact test), year four education ($p = 0.5894$ for Fisher's exact test), year four marital status ($p = 1.00$ for Fisher's exact test), and median days out of role (Z statistic $= -0.5836$, $p = 0.5595$ for Wilcoxon sum rank test). In summary, no differences were found between dropouts and completers for the baseline demographic characteristics.

Eating Pathology (EDE-Q)

To assess eating disorder symptomology the Eating Disorder Examination Questionnaire (EDE-Q) was used (Fairburn et al., 2008; Mond et al., 2014). The EDE-Q measures eating disorder pathology (behaviour) in the preceding 28-days period and instructs participants to rate their severity and frequency of weight and shape concerns using a seven-point Likert scale (0 = No days/Not at all to 6 = Everyday/Markedly). The EDE-Q has four quantifiable subscales: (1) Weight Concern—a measure of the amount of worry an individual has about their weight; (2) Shape Concern—determines the impact of worrying about one's body figure (shape); (3) Eating Concern—the amount of anxiety surrounding eating; and (4) Restraint—a measure of how avoidant an individual is around food (Fairburn et al., 2008). Global (overall) eating pathology is calculated as a mean of the combined subscale scores, with higher global scores being more indicative of disturbed eating pathology (Fairburn et al., 2008). Global scale scores $\geq$2.3 together with any objective binge eating occurrences or the use of exercise for weight control purposes, is suggestive of ED pathology. Furthermore, the EDE-Q has good internal reliability across subscales: restraint ($\alpha = 0.82$, five-items), eating concern ($\alpha = 0.86$; five-items), shape concern ($\alpha = 0.92$; eight-items), weight concern ($\alpha = 0.84$; five-items) (Rose et al., 2013).

Defence-Style (DSQ)

The Defence-Style Questionnaire (DSQ-40) was used to assess defence-styles of participants (Andrews et al., 1993). This is a 40-item measure using a nine-point Likert response scale ranging from "strongly agree" to "strongly disagree," and derives defence-style subscale scores by assessing 20 defence-mechanisms (Andrews et al., 1993). It should be noted that defence-styles and defence-mechanisms are different. Defence-mechanisms may be considered as individual behaviours as opposed to defence-styles, which may be thought of as a collection of behaviours in response to particular stimuli or events (Andrews et al., 1993). Defence-mechanisms are organised into three subscales (defence-styles): Mature (eight-items), Neurotic (eight-items), and Immature (24-items). Scores for defence-styles are calculated using the mean ratings for relevant items. Higher scores for a particular subscale indicate higher use of that particular defence-style in response to stimuli. The DSQ had good reliability across each of the three subscales for the current study; mature ($\alpha = 0.70$), neurotic ($\alpha = 0.61$), and immature ($\alpha = 0.83$) defence-styles and the scale has been very well-validated across multiple cohorts (Andrews et al., 1993).

Psychological Distress (K10)

Psychological Distress, was measured using the Kessler Psychological Distress Scale (K10) (Andrews and Slade, 2001; Kessler et al., 2002). This scale was selected due to the brevity of administration time, simplicity of questions asked, and the ability of the K-10 to discriminate between clinical and non-clinical cases of psychological distress (Mitchison et al., 2013). Items used a 5-point Likert scale (ranging from 1. "None of the Time" to 5. "All of the Time"), and items were summed to provide a total score out of 50—where the higher the score, the higher the occurrence of psychological symptomatology. The K10 had very good internal consistency ($\alpha = 0.87$), and has been validated for both individual and populous use (Kessler et al., 2002).

Health Related Quality of Life (SF-12)

Mental Health Related Quality of Life (MHRQoL) and Physical Health Related Quality of Life (PHRQoL) were assessed using the Short-Form-12 (SF-12) (Ware et al., 1996). The SF-12 assesses multiple dimensions of HRQoL including physical functioning, physical role, body pain, general health, vitality, social functioning, emotional role, and mental health—grouping these into two composite scores: Physical Composite Score (PCS) and Mental Composite Score (MCS) in order to provide the M/PHRQoL scores. Each of the domains is scored from 0 to 100, with higher scores indicating better QoL. The SF-12 had good reliability for both PCS (Cronbach's $\alpha = 0.87$) and MCS (Cronbach's $\alpha = 0.77$), and has been well-validated (Ware et al., 1996).

Data Analysis

SAS 9.4 (SAS Version 9.4, 2013) was used for all data analyses except for delta method for which the R package 'msm' (Jackson, 2011) was used. Datasets from year-4 (T1) and year-9 (T2) were combined, and duplicate cases (where responses were matched for T1 and T2) were combined or

removed entirely if no data were entered for the duplicate entry. Prior to analysis, data were cleaned and checked in order to ascertain that all assumptions had been met for the chosen statistical test. Where necessary, adjustments in analysis (specifically: using non-parametric, Spearman's rank correlation, analysis equivalents for testing associations when normality is violated) were made accordingly. The *p*-values were estimated using two-sided tests. Data transformations were performed for conducting multiple linear regression when necessary. When the outcome was positively skewed, square-root transformation was used while for negatively skewed outcome, $\log_{10}$ [max(variable+1)-variable] transformation was used.

Further examination, after transformation, did not appear to indicate that data further violated the required assumptions. To find the regression results for the original untransformed variables, the estimates for regression coefficients and 95% CIs were back-transformed while to find the SEs the delta method was used. As indicated in the aims, data analysis was largely exploratory in nature, requiring systematic progression of the analytical techniques used, which began by examining change in defence-style over time, followed by examining the associations between variables, and finally analysing the predictors of psychological distress, PHQoL, MHQoL and overall eating pathology, and of the three defence-styles.

To determine the overall (mean) change over time of defence-styles, paired samples *t*-tests were conducted for each defence-style DSQ score (mature, neurotic, and immature; with normal distribution) differences over time (T2–T1). In these analyses all variables followed normal distribution. The corresponding Cohen's d statistic for a paired t-statistic was calculated to measure effect size for the change over time. It was then classified based on magnitude (Cohen, 1988). Associations were examined overtime between each of the defence-styles (mature, neurotic, and immature) and eating pathology (including subscales and global score), psychological distress, and M/PHRQoL Spearman rho (r_s) analyses were used, due to non-normal distribution of some variables (including T1 psychological distress, and T1 and T2 PHRQoL). A series of multiple linear regressions (MLR) were conducted to examine the T1 predictors of psychological distress, PHQoL, MHQoL and overall eating pathology measured at T2 while controlling for demographic features at T1. A series of MLRs were also conducted to examine the T1 predictors of the three defence-style variables measured at T2, while controlling for demographic features, at T1. Using MLR allowed examination of between subject differences in defence-styles, and allowed for the assessment of each predictor's influence to the overall variance in DSQ subscale scores between each of the two time points. We also fitted MLRs with the dependent variable score at T1 as a covariate in the model plus the sociodemographic variables and psychological variables as predictors. The dependent variable (DV) for these models is mature defence style, immature defence style, neurotic defence style and overall eating pathology, respectively. Year 4 age was the only demographic variable entered in the models because it was found to be a confounder (operational) for most of the predictors included in the models. It was not found to be a significant predictor of the DVs in some of the models. An operational confounder does not require to be a significant predictor of the DV to be included in the model. Note that the operational definition of confounding provides a stronger adjustment of confounding than the classical definition (Mamdani et al., 2005). Because year 4 age is a confounder it was entered as a control variable in each model and hence the regression results of this variable are not reported. All missing data at baseline (year 4) were multiply imputed using multivariate normal imputation. There were 25 imputations performed. There were two auxiliary variables used in the imputation models: year 4 BMI and year 4 age. The results for multiple imputation were pooled using Rubin's method (Rubin, 1987). Multicollinearity for all regression analyses was tested using variance inflation factor (VIF) and tolerance values. No multicollinearity was detected for any of the predictors as none of the VIF values were above 10 or none of the tolerance values were above 0.1.

Reported effect sizes (Cohen's *d*) are based on cut-off criteria as specified by Cohen (1988). Effects have been classified in terms of magnitude with a cut-off of $d = 0.2$ considered a 'small' effect size; a cut-off of $d = 0.5$ considered a "medium"; and a cut-off of $d = 0.8$ considered a 'large' effect size (Cohen, 1988).

RESULTS

Cross-Sectional Associations Between Defence-Styles, HRQoL, Psychological Distress, and Eating Pathology

At T1, there was a significant positive association between an immature defence-style and overall eating pathology, $r_s = 0.89$, $p < 0.001$, and a weak significant association between overall eating pathology and mature defence-style $r_s = -0.13$, $p < 0.005$. There were no significant associations between mature or neurotic defence-style and overall eating pathology. All other within T1 associations are presented in **Supplementary Table 3**.

Defence-Style Changes Over Time

Results of a paired samples *t*-tests between T2 immature defence styles ($Mean = 3.46$, $S.E = 0.04$) and T1 immature defence-style ($Mean = 3.44$, $S.E = 0.94$) indicated a non-significant reduction in scores over time between scores; $t_{(606)} = -1.36$, $p = 0.173$. The effect size for change in immature defence style over time is −0.039 indicating weak (Cohen, 1988) negative effect. Neither neurotic defence styles ($Mean = 4.58$, $S.E = 0.05$; T2) nor mature defence-styles ($Mean = 5.37$, $S.E = 0.05$; T2) indicated significant changes over time [$t_{(606)} = -1.48$, $p = 0.140$; $Mean_{yr4} = 4.58$; $S.E_{yr4} = 0.062$; neurotic T1] [$t_{(606)} = -0.87$, $p = 0.382$; $Mean_{yr4} = 0.082$; $S.E_{yr4} = 0.132$; mature defences T1]. Cohen's d for these changes are −0.0425 and −0.025, respectively. Both these effects are small (Mitchison et al., 2013).

Supplementary Table 4 presents between all T1-and-T2 associations among defence-styles and other assessed psychometric measures.

TABLE 2A | Overall F test and fit statistics of the models with eating pathology subscales, quality of life & demographic factors predicting defence-styles.

Dependent variable	Model df	Error df	F-value	*p*-value	R^2	Adj-R^2
Immature defence-style	8	598	3.38	<0.001	0.043	0.032
Mature defence-style	8	598	2.99	<0.010	0.039	0.028
Neurotic defence-style	8	598	4.55	<0.0001	0.057	0.046
Overall eating pathology	8	598	4.55	<0.0001	0.403	0.396

Impacts of T1 Eating Pathology, Weight, Eating, and Shape Concerns, Restraint, HRQoL & Psychological Distress on T2 Defence-Styles

MLRs were fitted to predict each of the T2 defence-styles based on T1 eating pathology (weight concern, eating concern, shape concern, restraint and overall), MHQoL, PHQoL, and psychological distress. Overall F test was statistically significant in all models (**Table 2A**). The R^2 values ranged from 0.039 to 0.403 and adjusted R^2 ranged from 0.028 to 0.396, for these models (**Table 2A**).

Partial regression coefficients (B), and squared partial correlations (sr^2) for each predictor used in the regression models are reported in **Table 2A** while overall R^2 values are reported in **Table 2B**. These results are discussed below for each model.

Mature defence-style. In combination, T1 psychological distress, weight concern, eating concern, shape concern, restraint, MHQoL, PHQoL, overall eating pathology and age accounted for 8.6% of the variance in T2 mature defence-style ($R^2 = 0.086$), however except for PHQoL which had a negative significant effect ($p < 0.001$), none of these factors were individually significantly associated with mature-style.

Neurotic defence-style. In combination, T1 psychological distress, weight concern, eating concern, shape concern, restraint, MHQoL, PHQoL, overall eating pathology and age accounted for 5.0% of the variance in T2 neurotic defence style, with three of these factors, psychological distress, PHQoL and weight concern individually significantly associated with neurotic defence-style. T1 PHQoL and weight concern increased T2 neurotic defence style while MHQoL decreased it.

Immature defence-style. In combination, T1 psychological distress, MHQoL, PHQoL, restraint, overall eating pathology, weight concern, eating concern, shape concern and age accounted for 8.0% ($R^2 = 0.08$) of the total variance observed in the model. A significant regression coefficient ($p < 0.05$) was noted for T1 MHQoL and PHQoL but not for T1 psychological distress restraint, eating pathology, weight concer, eating concern and shape concern. T1 PHQoL increased T2 immature defence style while T1 MHQoL decreased it.

Eating pathology. In combination, T1 immaturity, psychological distress, MHQoL, PHQoL, restraint, weight concern, eating concern, shape concern and age accounted for 40.3% ($R^2 = 0.403$) of the total variance observed in the model. A significant regression coefficient ($p < 0.05$) was noted for T1 MHQoL, PHQoL, eating concern and restraint but not for T1 psychological distress, weight concern and shape concern. T1 MHQoL and PHQoL reduced T2 overall eating pathology while T1 eating concern and restraint increased it.

Supplementary Table 5 presents regression results for all three defence-styles and overall eating pathology and T1 predictors.

Impact of T1 Defence-Styles on T2 Psychological Distress, PHQoL, MHQoL, and Overall Eating Pathology

Multiple linear regressions were fitted to predict T2 psychological distress, PHQoL, MHQoL, and overall eating pathology based on T1 defence-styles. Overall F test was statistically significant for all models (**Table 3A**).

Partial regression coefficients (B), and squared partial correlations (sr^2) for each predictor used in the regression models are reported in **Table 3A** while overall R^2 values are reported in **Table 3B**. These results are discussed below for each model.

Psychological distress. In combination, T1 immature, mature and neurotic defence style variables and age accounted for 17.8% ($R^2 = 0.178$) of the total variance observed in the model. T1 immature-defence style significantly ($p < 0.001$) decreased psychological distress at T2 accounting for 6.8% variance (see **Table 3B**). Neurotic defence style also significantly ($p < 0.05$) increased psychological distress score but T1 mature defence style was not a significant predictor of psychological distress.

Mental health related quality of life. In combination, T1 immature, mature and neurotic defence style variables and age accounted for 13.1% ($R^2 = 0.131$) of the total variance observed in the model. T1 immature and mature-defence styles significantly decreased and increased MHQoL, accounting for 6.4 and 2.9% variance, respectively. Neurotic defence style was not a significant predictor of MHQoL.

Physical health related quality of life. In combination, T1 immature, mature and neurotic defence style variables and age accounted for 6% ($R^2 = 0.06$) of the total variance observed in the model. Neither T1 mature nor immature defence style nor neurotic defence style was a significant predictor of PHQoL.

Overall eating pathology. In combination, T1 immature, mature and neurotic defence style variables and age accounted for 5.9% ($R^2 = 0.059$) of the total variance observed in the model. Neither T1 mature defence style nor neurotic defence style was a significant predictor of overall eating pathology. T1 immature-defence style significantly ($p < 0.05$) increased overall eating pathology.

TABLE 2B | Influence of psychological distress, HRQoL, and eating pathology at T1 on defence-styles at T2.

Variables (T1)	B	SE	95% CI	sr^2	*P-value*
Dependent variable is mature at T2					
Psychological distress	−0.010	0.008	−0.025, 0.005	0.015	0.21179
PHQoL**	0.022	0.006	0.009, 0.034	0.020	0.00027
MHQoL	0.003	0.005	−0.006, −0.001	0.010	0.54873
Weight concern	−0.008	0.057	−0.120, 0.105	0.001	0.88843
Eating concern	0.003	0.057	−0.110, 0.116	0.000	0.95804
Shape concern	−0.018	0.057	−0.131, 0.095	0.000	0.75227
Restraint	−0.016	0.040	−0.095, 0.062	0.000	0.68930
Dependent variable is immature at T2					
Psychological distress	−0.001	0.006	−0.013, 0.010	0.001	0.86769
PHQoL*	0.013	0.005	0.004, 0.023	0.010	0.00955
MHQoL*	−0.008	0.004	−0.015, 0.008	0.003	0.04595
Weight concern	0.039	0.044	−0.047, 0.124	0.008	0.37578
Eating concern	−0.006	0.044	−0.092, 0.080	0.000	0.89158
Shape concern	0.066	0.044	−0.020, 0.152	0.003	0.13414
Restraint	−0.053	0.081	−0.113, 0.006	0.005	0.51316
Dependent variable is neurotic at T2					
Psychological distress*	−0.014*	0.007	−0.028, −0.000	0.001	0.04595
PHQoL*	0.018*	0.006	0.006, 0.030	0.020	0.00281
MHQoL	−0.010	0.009	−0.018, 0.001	0.012	0.26697
Weight concern*	0.135*	0.054	0.030, 0.241	0.027	0.01269
Eating concern	−0.044	0.054	−0.151, 0.062	0.001	0.41550
Shape concern	0.041	0.054	−0.065, 0.148	0.001	0.44800
Restraint	−0.021	0.038	−0.095, 0.053	0.000	0.58072
Dependent variable is overall eating pathology at T2					
Psychological distress	−0.001	0.013	−0.04, 0.02	0.116	0.93871
PHQoL**	−0.031**	0.007	−0.05, −0.02	0.028	0.00011
MHQoL**	−0.040**	0.006	−0.05, −0.03	0.106	<0.00001
Weight concern	0.140	0.094	−0.046, 0.325	0.131	0.13692
Eating concern*	0.173*	0.081	0.013, 0.332	0.031	0.03310
Shape concern	0.094	0.094	−0.092, 0.281	0.380	0.31771
Restraint**	0.186**	0.055	0.082, 0.291	0.005	0.00077
Immaturity	0.085	0.111	−0.139, 0.309	0.003	0.44412

**Significant to $p < 0.05$; **significant to $p < 0.001$. All models controlled for year 4 age.*

DISCUSSION

The first finding of the current study was a significant positive association between an immature defence-style and overall eating pathology, and a weak significant association between overall eating pathology and mature defence-style. No associations were found between eating pathology and neurotic defence-styles. This is consistent with Bond and Perry's (2004) conclusions that variations in defence-styles are to be expected among different patient groups with varying psychopathologies. Second, no defence-style changed significantly overtime; potentially indicating that defence-styles as a whole may be relatively immutable. However, immature defence-styles showed a non-significant decrease over time with a weak negative effect. When examined together, T1 psychological distress, weight concern, eating concern, shape concern, restraint, MHQoL, PHQoL, overall eating pathology and age accounted for only 8.6 and 5.0% of the change in mature and neurotic defence-style, respecitively, at T2. This would suggest that other factors may influence how much defence-styles (specifically mature and neurotic defence-styles) may change overtime. As highlighted further below, and as highlighted in Bond and Perry's study (Bond and Perry, 2004), the presence of therapy may influence the variance seen overtime between defence-styles and a range of psychopathologies.

Further to the above, defence-styles were relatively stable between T1 and T2 (year-9), except for mature defence-styles scores, which increased on average by 5.29 (M_{diff} = 0.08–5.37). However, no differences reached statistical significance. Outside of the eating disorder context significant changes in defence-style overtime (particularly in mature and immature defence-styles) have been reported in the presence of therapy or treatment (Akkerman et al., 1999; Mullen et al., 1999; Cramer,

TABLE 3A | Overall F test and fit statistics of the models with defence style and demographic factors predicting psychological distress, PHQoL, MHQoL, and overall eating pathology.

Dependent variable	Model df	Error df	F Value	*p*-value	R^2	Adj R^2
Psychological distress	4	602	32.65	<0.0001	0.178	0.173
PHQoL	4	602	9.60	<0.0001	0.060	0.054
MHQoL	4	602	22.74	<0.0001	0.131	0.125
Overall eating pathology	4	602	75.64	<0.0001	0.059	0.053

2007; Schauenburg et al., 2007; Hill et al., 2015). In the absence of intervention for particular psychological disorders, it has been found that neurotic and immature defence-styles reduced significantly while mature defences remained relatively stable, or increased marginally, over a 5–10 years period in late adolescents to early adulthood (Tuulio-Henriksson et al., 1997). The mean age of participants in the current study was 33 years old, and it is possible that in this older age group the defence style may be less likely to change.

Additionally, the findings of this study corroborate the findings by Hay and colleagues (Hay et al., 2010) and by Hay and Williams (Hay and Williams, 2013) who found that from baseline, immature defence-styles were associated with increased eating pathology, at year-2 and year-5 follow–ups, respectively. Moreover, the findings indicated that initial or early (T1) defence-style may predict to some extent, changes in overall eating pathology and MHQoL overtime, however these factors alone did not seem to significantly predict how mature-defence style would change over time. The findings therefore suggest that additional factors may contribute to the change in defence-styles over time. Such factors may include life experiences, environmental, and other physiological elements, which future studies should aim to address.

TABLE 3B | Influence of defence-style factors at T1 on T2 psychological distress, PHQoL, MHQoL, and overall eating pathology.

Variable	B	SE	95% CI	sr^2	*P-value*
Psychological distress T2					
Immature T1**	2.860	0.488	1.881, 3.835	0.068	<0.00001
Mature T1	−0.109	0.348	−1.911, 0.529	0.009	0.75422
Neurotic T1*	0.856	0.385	0.261, 1.270	0.009	0.02656
PHQoL T2					
Immature T1	−0.916	0.552	−2.013, 0.181	0.008	0.09395
Mature T1	0.014	0.365	−0.828, 0.610	0.003	0.96942
Neurotic T1	−0.236	0.476	−1.183, 0.711	0.005	0.62022
MHQoLT2					
Immature T1**	−2.520**	0.564	−0.363, −1.412	0.064	<0.00001
Mature T1**	1.785**	0.506	0.783, 2.787	0.029	0.00045
Neurotic T1	−1.125*	0.571	−2.258, −0.008	0.011	0.04927
Overall eating pathology T2					
Immature T1*	0.254	0.090	0.072, 0.436	0.048	0.00493
Mature T1	−0.127	0.075	−0.276, 0.022	0.004	0.09091
Neurotic T1	−0.076	0.080	−0.083, 0.235	0.004	0.34249

**Significant to $p < 0.05$; **significant to $p < 0.001$, All models controlled for year 4 age.*

Contextualisation of the Findings

Mental disorders, as a whole, can impede adaptive defence-styles. The more complex in nature the disorder, the more maladaptive defence-styles may present. Perhaps one of the most complex mental disorders, due to associated comorbidities, is eating disorders (Baucom et al., 2017). As previously alluded to in the introduction, psychodynamic theory relates eating disorders to inherent deficits in defence style including interpersonal functioning and self-regulation, and contends that abnormal eating pathology may attempt to reconcile tension regulation, an individual's sense of control, and the expression of interpersonal conflicts (Steiger and Houle, 1991).

Steiger and Houle (1991) found individuals with symptomatic eating disorder behaviours were more likely to exhibit maladaptive defence-styles. Moreover, the same study suggested that deficits in interpersonal and adaptive functioning may be antecedents to (as opposed to consequences of) the development of eating disorders (Steiger and Houle, 1991). Both Akkerman et al. (1999) and Bond and Perry (2004) assert that with psychodynamic therapy, long-term (>5 years) improvements in coping strategies and defence-styles can improve outcomes, particularly in individuals with depression—so far, no such study has been identified in the field of eating disorders. However, given the comorbidities often associated with eating disorders (depression, anxiety, obsessive compulsive tendencies, and trauma) (Hudson et al., 2007; Mond et al., 2009; Pini et al., 2013), defence-styles may improve more readily over an extended period of time in the presence of targeted ED-defence-style focused therapy.

Strengths and Limitations

Strengths of the study include examining multiple facets of eating pathology and use of non-clinical cohorts allowed the current study to go beyond previous studies examining similar variables, which relied on clinical samples. Having a more representative sample, allows for results to potentially be more representative from the population they were drawn and allows for more widely applicable inferences to be made (Mitchison et al., 2013).

Limitations include the use of convenience sampling for one cohort through select educational institutions and those who had registered for prior research may have influenced outcomes, limiting generalisability. A further limitation relates to the measure used, where the internal consistency of the DSQ neurotic subscale ($\alpha = 0.61$) was lower than both

the mature ($\alpha = 0.70$) and immature ($\alpha = 0.83$) DSQ subscales. According to Clark and Watson (1995), the average recommended inter-item correlation should be between 0.15 and 0.50, but can vary based on the construct being measured. However, in the interest of transparency, the wider gap between subscale scores may indicate that an alpha score of 0.61, may be comparatively low to the other subscales, which may have potentially influenced results (Clark and Watson, 1995). Additionally, attrition (necessitating data imputation) and non-inclusions of males, who are severely underrepresented especially in eating disorder research (Striegel et al., 2012; Murray et al., 2017), may have further influenced findings. Lastly, culture and ethnicity were not examined in the sample which previous studies have indicated may influence ED and mental health outcomes, as well as defence-style development over time (Watson and Sinha, 1998; Walker and Lim, 2010; Foroughi et al., 2019). Future examinations of eating disorders and defence-styles should account and control for cultural and ethnic differences in participants.

Clinical Significance

The current study is the first to examine longitudinal association of eating pathology and defence-styles in a community cohort. While this area of study still requires considerable research, the current study may offer academics and clinicians a starting point to consider treatments that may help increase adaptive defence-styles in order to reduce eating pathology over time, with treatments potentially focusing on transitioning individuals from using maladaptive defence-styles to adaptive styles, potentially lending itself to quicker recovery from an eating disorder. Specifically, treatments may focus on strengthening defence-styles by reducing immature defences and increasing mature defence-styles through therapy. Some efficacy for Cognitive Behavioural Therapy (CBT) has been found to influence defence-styles over time (Muris and Merckelbach, 1996; Coleman and Casey, 2007; Campbell et al., 2009). The findings of the current study suggest that more focus should be dedicated to investigating effective ways to instigate and maintain defence-style changes in individuals with eating disorder symptoms. This may be especially important in women with eating disorders, as previous studies (Evans et al., 2011; Hart et al., 2011) have shown that immature or maladaptive defence-styles may be a barrier to help-seeking in this population. There is some evidence to suggest that by increasing mature defence-styles individuals may begin to acknowledge, or accept, that they require professional help and may therefore be more likely to seek out treatment (Meyer, 2005).

Future Directions

Future studies should focus on investigation of treatments that are best suited to influence defence-style change over time in eating disorder symptomatic individuals. Further, strengthening defence styles appears important, as mature defence-styles were associated with more positive eating disorder outcomes, compared to immature and neurotic defence-styles which were associated with more negative outcomes. Finally, research into which defence-styles are able to be targeted earlier rather than later, would be valuable to understanding if there is potential to improve patient outcomes from a younger age.

CONCLUSION

The current study provides insight into the impact of increased eating pathology on shifts in defence-styles over-time. Overall, the study found that in adult women there was little change in defence style over time. Furthermore, the study highlights that therapeutic approaches that target shifting defence-styles in order to reduce eating pathology may be an avenue for treatment and research focus.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Human Research Ethics Committee Western Sydney University. The patients/participants provided their written informed consent to participate in this study.

AUTHOR'S NOTE

Part of the current research formed part of a thesis project conducted by PA–therefore some of the text utilised may be the same or similar to unpublished, published, or examined works written by PA.

AUTHOR CONTRIBUTIONS

PA conducted the literature review, data curation and data analysis, compiled the first draft, and undertook subsequent edits. PH undertook a supervisory role, data curation and data analysis, contributed to the first draft, and assisted with subsequent edits. NF conducted data curation and data analysis, contributed to the first draft, and assisted with subsequent edits. SC undertook a supervisory role, contributed to the first draft, and assisted with subsequent edits. HM conducted higher level data curation and data analysis, contributed to the first draft, assisted with subsequent edits, and took on an overall supervisory role/ senior academic. All authors contributed to the article and approved the submitted version.

SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2021.671652/full#supplementary-material

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The Mediator Effect of Personality on the Relationship Between Symptomatic Impairment and Treatment Outcome in Eating Disorders

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Features of personality disorders (PDs) have been found to explain meaningful variance in the onset, maintenance, and symptomatic presentation of eating disorders (EDs), and a co-occurent personality pathology is commonly associated with poorer response to ED treatment. The "pathoplasty model" of the relationship between personality and EDs implies that, once both conditions are established, they are likely to interact in ways that modify therapy outcome; however, to date, no studies have explored overall personality functioning, and especially PD clusters, as a mediator of treatment outcome. The present study aimed at conjointly exploring the associations between personality functioning and PDs, respectively, with pre-treatment ED symptomatic impairment and therapy outcome; and the mediating role of personality variables. At treatment onset, a sample of 107 women with ED problems were evaluated using both the Structured Clinical Interview for DSM-5 (SCID-5-CV) and the Shedler-Westen Assessment Procedure-200 (SWAP-200)—a clinician-rated procedure to dimensionally assess personality. Participants were also asked to complete self-report questionnaires on overall ED symptomatology, symptoms of binge eating and purging behaviors, and therapy outcome. The findings showed that, over and above the categorical ED diagnosis, the SWAP-200 healthy personality functioning score mediated the relationship between baseline ED symptom severity and therapy outcome, as well as the association between baseline bulimic symptoms and treatment outcome; furthermore, SWAP-200 Cluster B PD scores mediated the link between baseline binge eating and purging symptoms and therapy outcome, whereas scores in Clusters A and C showed no significant effects. The findings suggest that personality-based outcome research may improve treatment effectiveness in this difficult-to-treat population.

Keywords: personality, eating disorders, symptom severity, comorbidity, therapy outcome

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INTRODUCTION

Eating disorders (EDs), including anorexia nervosa (AN), and bulimia nervosa (BN), are commonly ranked amongst the most complex and pernicious of all psychiatric illnesses to treat. Often, they have a chronic course, and in some cases, they are fatal. A significant

therapeutic challenge is that, in patients with a severe ED, psychiatric comorbidities are the rule, rather than the exception (e.g., Keski-Rahkonen and Mustelin, 2016; Halmi, 2018). Several studies and systematic reviews have suggested that the lifetime prevalence of an additional psychiatric disorder is between 55–80% for AN and 85–95% for BN (Hudson et al., 2007; Van Alsten and Duncan, 2020). With estimated comorbidity rates of 27–93% (with higher rates registered by inpatients and those receiving intensive treatment), personality disorders (PDs) are among the most prevalent co-occurring conditions (Cassin and Von Ranson, 2005).

"Personality" describes a set of relatively stable ways of thinking, feeling, behaving, and relating to others, resulting from the convergence of constitutional factors, development, and social and cultural experiences (Lingiardi and McWilliams, 2017; McWilliams et al., 2018). This variable has been found to influence a wide range of psychiatric disorders, as well as patients' motivation, compliance, and response to treatment (Ramos-Grille et al., 2013; Steinert et al., 2015; Bagby et al., 2016; Huber et al., 2017). The relationship between personality, personality traits or disorders, and EDs has received considerable empirical testing, with linkages found between personality and ED etiology, symptomatic expression, and maintenance (Farstad et al., 2016; Martinussen et al., 2017). Lilenfeld et al. (2006) outlined that personality and EDs may interact in a variety of ways, and proposed several conceptual models to describe potential causal or correlational relationships between them. Of note, the so-called *pathoplasty model* implies that, once personality traits or disorders and EDs are established, they may influence each other in ways that modify the presentation and course of each condition, including ED symptomatic impairment and treatment outcome. This model is in line with the perspective that patients' personality is a relevant "context" (Westen et al., 2006) in which ED symptoms serve different functions and provide alternative meanings.

Although research on personality as a predictor of ED outcome is sparse, some relevant studies, drawing on the pathoplasty model, have found that PDs are commonly associated with poorer response to treatment (Steinhausen, 2002, 2009; Thompson-Brenner and Westen, 2005; Wildes et al., 2011; Muzi et al., 2020, 2021). Further research has suggested that high attrition, low compliance, dropout, symptom chronicity, low recovery rates, and low efficacy of therapeutic interventions relate to the personality characteristics of individual patients (Pham-Scottez et al., 2012; Martinez and Craighead, 2015; Levallius et al., 2016). ED patients with comorbid personality pathology have been found to present more severe overall psychopathology (according to anxiety, depression, somatization, psychoticism, and global severity scales) (e.g., Wonderlich et al., 1994) and higher levels of ED symptoms (Westen and Harnden-Fischer, 2001; Hopwood et al., 2010). More specifically, some outcome studies have found borderline personality disorder comorbidity and other Cluster B personality traits to predict negative therapy outcomes (Fahy et al., 1993; Rossiter et al., 1993; Voderholzer et al., 2021). Furthermore, follow-up studies with mixed ED samples have shown that baseline borderline symptoms relate to lower overall functioning, higher levels of ED symptoms, and lower rates of therapeutic change and life satisfaction (Sansone and Fine, 1992; Wonderlich et al., 1994). On the other hand, patients with a borderline personality disorder and a comorbid ED have been found to have a greater risk of recurrent suicide attempts, an increased risk of recurrent non-suicidal self-injury, and lower rates of remission (Zanarini et al., 2006; Chen et al., 2009). Interestingly, a follow-up study found that borderline personality disorder predicted a more negative ED outcome when measured dimensionally, but not when measured categorically (Wonderlich et al., 1994).

Research has also found that perfectionism is a core feature of severe EDs (Martinez and Craighead, 2015), and potentially predictive of the onset of eating pathology (Fairburn et al., 1999; Halmi et al., 2005). More general obsessive-compulsive personality traits have been shown to be a negative prognostic feature among ED patients (Steinhausen, 2002; Lilenfeld et al., 2006) that tend to persist after ED recovery (von Ranson et al., 1999; Sutandar-Pinnock et al., 2003). A systematic review also suggested that this variable may moderate or mediate the outcome of ED treatment, especially in patients with AN (Crane et al., 2007). Despite these findings, there is very scarce evidence with respect to other PDs, within Clusters A, B, or C. However, some authors have argued that the presence of suspiciousness, paranoid features, and interpersonal distrust or detachment may interacted with other patient variables to predict ED symptoms over the long term (Dingemans et al., 2016), and a recent study also found that paranoid and schizoid personality traits may predict therapy outcome in residential treatment for ED patients (Muzi et al., 2020). Moreover, avoidant-insecure personality features and a diagnosis of avoidant personality disorder have been found to be associated with more severe symptomatic impairment, lower ED symptom improvement, and higher treatment utilization (Thompson-Brenner et al., 2008a; Vrabel et al., 2010).

Some limitations of these contributions should be noted. First, none of the aforementioned studies with ED samples examined overall personality functioning—or PD cluster—as a mediator or moderator of treatment outcome (Linardon et al., 2017), despite some preliminary findings showing the mediating role of personality in the relationship between patients' attachment styles and ED symptomatic presentation (Eggert et al., 2007; Münch et al., 2016). Furthermore, research into the role of personality traits or disorders and their link to EDs is necessarily complicated by the ongoing debate over whether PDs are best conceptualized categorically or dimensionally, with increasing support for the latter hypothesis (e.g., Widiger, 2007). In this vein, some authors have outlined that the investigation of personality within the categorical

boundaries of ED diagnoses, as proposed by the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5; American Psychiatric Association, 2013), could be limited by the high rates of residual diagnoses (Fairweather-Schmidt and Wade, 2014), the common "diagnostic cross-over" between the main ED diagnoses, the low temporal stability of the main ED diagnoses, and their lack of discriminant validity in terms of severity of symptomatic impairment (Eddy et al., 2008). More specifically, with respect to treatment outcomes, some studies have found that categorical DSM-5 ED diagnoses do not predict patients' responses to therapeutic interventions or future clinical courses (Westen and Harnden-Fischer, 2001; Raykos et al., 2018; Muzi et al., 2021), and that DSM-5 severity specifiers are not related to ED psychopathology, overall impairment, health status, comorbid conditions (e.g., depressive symptoms), or therapy outcomes (Gianini et al., 2017; Machado et al., 2017; Dalle Grave et al., 2018). Conversely, studies employing more dimensional and empirically derived approaches, such as the Shedler-Westen Assessment Procedure-200 (SWAP-200; Westen and Shedler, 1999a,b), have shown promising results in the identification of personality constellations in ED patients (Westen and Harnden-Fischer, 2001; Thompson-Brenner and Westen, 2005; Gazzillo et al., 2013), including healthy personality features and psychological resources (e.g., Muzi et al., 2020), as well as their predictive value in determining therapeutic outcomes (Thompson-Brenner et al., 2008a,b).

Drawing on the literature, the present study aimed at conjointly exploring the associations between personality functioning and PD features, respectively, with pre-treatment ED symptomatic impairment and therapy outcome; and the mediating role of personality features. More specifically, we tested the following hypotheses:

(a) There would be significant positive associations of moderate magnitude (Cohen, 1988) between PDs in Clusters A, B, and C, more severe pre-treatment ED symptomatic impairment, and worse therapy outcome (e.g., Farstad et al., 2016), as well as a significant association between healthy personality functioning (see the SWAP-200 description in the "Measures" section), lower severity of ED symptoms at treatment intake, and better therapy outcome;
(b) There would be no significant differences between the main DSM-5 ED diagnoses (AN and BN) in terms of baseline ED symptomatic impairment and therapy outcome, in line with studies supporting the overall lack of discriminant validity of ED categorical diagnoses (e.g., Westen and Harnden-Fischer, 2001; Raykos et al., 2018); and
(c) Overall healthy personality functioning and PD clusters would mediate the association between the severity of ED symptomatic impairment at baseline and therapy outcome, in line with previous theoretical contributions (e.g., Lilenfeld et al., 2006) and empirical evidence showing that personality may influence both the severity or pattern of symptomatology and the course of the illness (e.g., Thompson-Brenner and Westen, 2005; Muzi et al., 2020).

MATERIALS AND METHODS

Participants

Participants were patients who had been consecutively admitted to a specialized, intensive, and psychodynamic-oriented residential treatment center for ED in Bologna (Italy) between September 2017 and April 2020. The inclusion criteria were: (a) at least 18 years of age; (b) a diagnosis of DSM-5 AN or BN, established at intake by the consensus of a licensed staff psychiatrist and a clinical psychologist, based on the Structured Clinical Interview for DSM-5 (SCID-5-CV; First et al., 2016); (c) cisgender women; and (d) no organic syndrome, psychotic disorder, or syndrome with psychotic symptoms that could complicate the assessment of any study variable.

An initial sample of $N = 144$ met these criteria. Twenty-one patients (14.6%) were excluded due to premature discharge or dropout and 16 patients (11.1%) were not considered due to missing data at intake or discharge. Out of the final study sample of $N = 107$ patients who completed all assessment measures at treatment intake and discharge, 62 (57.9%) were diagnosed with AN, with an average baseline BMI of 16.12 kg/m^2; and 45 (42.1%) fulfilled the diagnostic criteria for BN, with an average BMI of 21.95 kg/m^2. Participants' mean age was 24.06 years ($SD = 8.32$), and all were White. Most patients were single or separated ($N = 103$, 96.2%) and had no previous instance of hospitalization in a psychiatry unit ($N = 82$, 76.2%). At treatment intake, 86 patients (80.4%) reported the presence of dietary restrictions in the previous week, 51 patients (47.6%) reported compensatory behaviors, and 44 patients (41.1%) reported the presence of binge episodes. Their mean age of ED onset was 16.08 ($SD = 3.64$). The majority of patients ($N = 74$, 69.1%) also showed at least one comorbid PD, as assessed by the SCID-5-CV. More specifically, 35 patients fulfilled the diagnostic criteria for borderline personality disorder (32.7%), 21 for obsessive-compulsive personality disorder (19.6%), 10 for avoidant personality disorder (9.3%), 3 for schizoid personality disorder (2.8%), 2 for paranoid personality disorder (1.9%), 1 for antisocial personality disorder (0.9%), 1 for narcissistic personality disorder (0.9%), and 1 for dependent personality disorder (0.9%). Additionally, 6 patients (5.6%) received an "other specified" or "unspecified" personality disorder diagnoses. Furthermore, 18 patients (16.8%) received a concurrent diagnosis of major depressive disorder, 16 (14.9%) an anxiety disorder, 14 (13.1%) obsessive-compulsive disorder, 6 (5.6%) a persistent depressive disorder (dysthymia), 3 (2.8%) an "other specified" or "unspecified" depressive disorder, and 2 (1.8%) a somatic symptoms disorder. Eight patients (7.5%) also reported an alcohol use disorder, and 5 (4.7%) reported another substance-related disorder.

Seven therapists (all cisgender women) participated in the study as raters of patients' personality functioning and disorders. Their mean age was 42.7 (SD = 3.76; range = 37–49). The main self-reported clinical orientations were psychodynamic (N = 6, 85.7%) and cognitive behavioral (N = 1, 14.3%); all were clinical psychologists. The average length of clinical psychotherapy practice was 10.1 years (SD = 3.07; range = 7–15) and the average time spent per week practicing psychotherapy was 22.7 h (SD = 5.14; range = 15–35). All of the present study data were added to those of the patients and clinicians who participated in previous investigations using the same assessment tools (Muzi et al., 2020, 2021).

Measures

Sociodemographic and baseline clinical characteristics (e.g., age, marital status, length of stay in residential treatment, age of ED onset, dietary restrictions, etc.) were available from each patient's clinical chart.

Structured Clinical Interview for DSM-5, Clinical Version (SCID-5-CV)

The SCID-5-CV (First et al., 2016) is a semi-structured interview that was designed to categorically assess psychopathology according to the DSM-5. It is typically administered by a clinician who is familiar with the DSM-5 diagnostic criteria. Interview questions are provided alongside each DSM-5 criterion to aid users in rating each criterion as either present or absent. The previous version of the interview (SCID-IV) showed good interrater and test–retest reliability (Lobbestael et al., 2011).

Shedler–Westen Assessment Procedure-200 (SWAP-200)

The SWAP-200 (Westen and Shedler, 1999a,b; Shedler et al., 2014) is a well-established psychometric procedure that was designed to provide a comprehensive assessment of patient personality pathology and overall personality functioning. Unlike most personality assessment instruments, the SWAP-200 is designed for use by clinicians and mental health professionals in the context of a thorough examination of a patient in treatment. This Q-sort instrument consists of a set of 200 personality-descriptive statements, written in straightforward, jargon-free language, to be used by clinicians with varying theoretical orientations and levels of experience. Clinicians are asked to rank-order items for their degree of applicability to the patient at hand, and they must assign each rank or score a specified number of times (e.g., limiting the highest-ranking scale points [5, 6, or 7] defined as most descriptive of the patient to a smaller number of items, while assigning lower scores to a higher number of items). The SWAP-200 assessment provides: (a) a personality diagnosis that matches the patient assessment with 10 PD Scales that are prototypical descriptions of DSM–5 PDs and (b) a personality diagnosis based on the correlation/matching of the patient's SWAP-200 description with 11 empirically derived Q-factors/styles of personality. A "healthy personality functioning" score, which reflects experts' consensual understanding of adaptive personality functioning, is also provided (Westen and Shedler, 1999a). The measure yields both categorical and dimensional diagnoses. When a categorical diagnosis is desired, $T > 60$ indicate that a diagnosis applies and $T > 55$ indicate the presence of clinically significant "features." If more than one scale has a T-score above 60 and the healthy personality functioning scale has a $T < 60$, the highest score provides the primary personality diagnosis. However, in line with the research aims and the growing consensus on the limitations of contemporary categorical conceptualizations of personality, the present study used only the dimensional scores of the PD scales and healthy personality functioning. The SWAP-200 has been shown to have very good validity and reliability, both with raters who have not been trained in using the instrument (Shedler and Westen, 2004; Blagov et al., 2012) and with those who have received instrumental training (Bradley et al., 2007). In the present study, Cronbach's alphas for each SWAP-200 scale ranged from 0.72 to 0.85.

Eating Disorder Inventory-3 (EDI-3)

The EDI-3 (Garner, 2004; Giannini et al., 2008) is a self-report questionnaire that is widely used in both research and clinical settings to assess the core components of eating psychopathology. It consists of 91 items organized into 12 primary scales, consisting of 3 ED-specific scales and 9 general psychological scales that are highly relevant to EDs. It also yields six composite scores: one that is ED-specific and five that refer to general integrative psychological constructs. In this study, we considered the Global Psychological Maladjustment composite (GPMC) score as an index of overall ED symptomatic impairment. The EDI-3 was found to yield adequate convergent and discriminant validity (Clausen et al., 2011). In the present sample, Cronbach's alphas for EDI-3 scores ranged from 0.70 to 0.94.

Bulimic Investigatory Test, Edinburgh (BITE)

The BITE (Henderson and Freeman, 1987; Orlandi et al., 2005) is a 33-item, binary yes/no response self-report questionnaire aimed at assessing and identifying bulimic symptoms and behaviors. The instrument has been previously used for the early detection of bulimic symptoms in the general population, to assess the intensity of the pathology, and to register responses to treatment. It consists of two subscales: the Symptom Scale (30 items) (used in the present study), which measures the degree of symptomatic impairment; and the Severity Scale (3 items), which provides an index of the frequency of binge eating and purging behaviors. In the present sample, Cronbach's alpha for the BITE Symptom Scale was 0.79.

Outcome Questionnaire-45.2 (OQ-45.2)

The OQ-45.2 (Chiappelli et al., 2008; Lambert et al., 2010) is a 45-item self-report instrument that was designed to measure important areas of functioning (i.e., symptoms, interpersonal problems, social role) that are of central interest to mental health. Each item is rated on a 5-point Likert scale ranging from 0 (*never*) to 4 (*almost always*). The sum of item scores (after reverse coding selected items) provides a total score,

which was used in the present study as the outcome index. In prior studies, the measure has been found to demonstrate good internal consistency and test–retest reliability (Doerfler et al., 2002). In the present study, Cronbach's alpha for the OQ-45.2 total score was 0.90.

Procedures

Patients were attending an intense, multimodal, residential treatment program with a main psychodynamic orientation, which included both group and individual psychotherapy. Average treatment length was 6.08 months (*SD* = 2.15, range = 3–13). According to the most widespread practice guidelines for ED treatment, a team approach and a patient-tailored perspective were the cornerstones of the therapeutic program (Yager et al., 2006). Thus, a multidisciplinary team of specialized professionals (i.e., psychiatrists, psychologists, social workers, nutritionists, physicians, nurses) was involved. Each patient received individual psychotherapy once or twice a week on the basis of a comprehensive examination of his or her psychological development, psychodynamic issues, cognitive style, comorbid psychopathology, and family situation.

During the first week of treatment, all patients were evaluated with the SCID-5-CV by a licensed staff psychiatrist and a clinical psychologist, to ensure fulfillment of the inclusion criteria. Additionally, height and weight were measured during a full medical examination, to calculate BMI. Moreover, at the same time point and during the last week before discharge, all patients who agreed to participate were asked to complete self-report measures to assess ED-specific symptoms and therapy outcome, evaluated in terms of overall psychopathological impairment. To minimize the effect of acute starvation and acute ED symptoms on personality, the SWAP-200 assessment was provided by treating clinicians within the first 2 weeks after admission. Psychotherapists were trained to use the SWAP-200 in a 16-h workshop led by the first and last authors of this article. In their baseline evaluations of personality functioning and disorders, treating clinicians were blind to patients' SCID-5-CV assessments (administered by other staff members) and all other study variables, except for participants' ED symptoms. All study subjects participated voluntarily and provided written informed consent prior to the assessments, following the review and approval of the study protocol by the local research ethics committee.

STATISTICAL ANALYSES

All analyses were performed using SPSS Version 25 for Windows and the *jAMM* package of the statistical software Jamovi, based on R (R Development Core Team, 2018). To test the first hypothesis, bivariate correlations (Pearson's *r*, two-tailed) were calculated to study the relationship between PDs and healthy personality functioning (assessed by the SWAP-200), baseline overall ED symptomatic impairment (evaluated by the EDI-3 GPMC score), and bulimic symptoms (assessed by the BITE). Partial correlations were then carried out to explore the relationships between personality variables and therapy outcome, controlling for baseline values (using the OQ-45.2 total score). Due to the high rates of PD comorbidity, data were analyzed at the cluster level (Clusters A, B, and C). More specifically, for each patient, average scores of the SWAP-200 PD scales comprising each cluster were computed (i.e., Cluster A: paranoid, schizoid, and schizotypal PD scales; Cluster B: antisocial, borderline, histrionic, and narcissistic PD scales; Cluster C: avoidant, dependent, and obsessive-compulsive PD scales). To test the second hypothesis, group differences (in terms of the DSM-5 main diagnostic categories, AN and BN) on baseline ED symptomatic impairment and therapy outcome were analyzed using a multivariate analysis of covariance, controlling for age and BMI (MANCOVA). Finally, separate mediation models of the relationship between pre-treatment symptomatic impairment (EDI-3 and BITE overall scores) and therapy outcome (OQ-45.2) were tested to identify the mediation effects of overall personality functioning and PD clusters on these relationships. Because therapeutic change was the outcome variable of interest, a residualized change score was calculated for the OQ-45.2 total score by running a linear regression with the discharge values as the outcome and the baseline scores as the predictor. The standardized residual values were then saved and used in subsequent analyses. According to contemporary contributions on mediation analyses (Hayes, 2009; Hayes and Rockwood, 2017), the *indirect effect* of a predictor variable X on the outcome variable Y through a mediator M quantifies the estimated difference in Y resulting from a one-unit change in X through a sequence of causal steps in which X affects M, which in turn affects Y. In the present study, the bias-corrected 95% confidence intervals (CIs) were evaluated using the bootstrap percentiles method (N = 1,000). Effects were considered significant if the resulting CI did not contain 0. All continuous variables were grand mean centered to reduce collinearity. As mentioned in the "Procedure" section, any patient missing an ED symptoms assessment at treatment intake or a therapy outcome measure at discharge was not included in the analyses. Due to the software's fixed distribution requirement, no SWAP-200 data were missing.

RESULTS

Relationships Between PDs and Healthy Personality Functioning, Pre-treatment Symptomatic Impairment, and Therapy Outcome

The results showed that Clusters A and B of the SWAP-200 PD scales were positively associated with higher levels of overall ED symptomatic impairment at treatment intake and worse therapy outcome, with Cluster B showing an additional association with more severe baseline bulimic symptoms (see **Table 1**). Furthermore, SWAP-200 healthy personality functioning was negatively associated with more severe baseline ED and bulimic symptoms, as well as to worse therapy outcome. Contrary to expectations, Cluster C of the SWAP-200 PD scales was not

significantly related to pre-treatment ED symptoms or therapy outcome, but showed only a negative association with baseline severity of bulimic symptoms.

Comparisons Between AN and BN Patients in Pre-treatment ED Symptomatic Impairment and Therapy Outcome

To assess differences between AN and BN patient groups in pre-treatment overall ED and bulimic symptoms and therapy outcome, after controlling for patients' age and BMI as covariates, a MANCOVA was performed. The results revealed no significant effects for patients' age [Wilks' lambda = 0.93; $F(1, 105) = 1.91$; $p = 0.13$, $\eta_p^2 = 0.06$] or BMI [Wilks' lambda = 0.97; $F(1, 105) = 0.67$; $p = 0.57$, $\eta_p^2 = 0.02$]. Furthermore, there were no significant differences between AN and BN participants in EDI-3 overall symptomatic impairment at treatment intake [$F(1, 105) = 2.46$; $p = 0.07$, $\eta_p^2 = 0.07$)] or OQ-45.2 total score at discharge [$F(1, 105) = 0.87$; $p = 0.46$, $\eta_p^2 = 0.03$)]. However, patient groups significantly differed in terms of the baseline BITE severity of bulimic symptoms [$F(1, 105) = 6.75$; $p < 0.001$, $\eta_p^2 = 0.19$)]. More specifically, BN patients showed higher average levels of baseline bulimic symptomatology ($M_{BITE} = 19.97$, $SD = 6.38$) than AN patients ($M_{BITE} = 13.40$, $SD = 5.52$).

Personality, Pre-treatment ED Symptoms, and Therapy Outcome: A Mediation Analysis

The first two mediational models included the SWAP-200 healthy personality functioning as a mediator in the relationship between baseline symptomatic impairment and therapy outcome (see **Figure 1**). The results of the first mediation analysis showed that the total effect (path "*c*") of the baseline EDI-3 overall score on therapy outcome was significant ($\beta = 0.21$, $p < 0.05$). Significant coefficients of path "*a*" (EDI-3 overall score on healthy personality functioning; $\beta = -0.33$, $p = 0.002$) and path "*b*" (healthy personality functioning on therapy outcome; $\beta = -0.51$, $p < 0.001$) were also found. The point estimate of the indirect effect between pre-treatment EDI-3 and therapy outcome through healthy personality functioning (path "*a*b*") was.033 ($SE = 0.01$, $\beta = 0.17$, $p = 0.012$), and the bootstrapped 95% CIs did not include 0 (0.001 −0.006), indicating that the indirect effect of healthy personality functioning was significant. In addition, the direct effect of baseline EDI-3 score on therapy outcome (path "*c*'") was not significant after controlling for the mediator ($\beta = 0.03$, $p = 0.73$). **Figure 1** also shows that, in the second mediation model, healthy personality functioning mediated the relationship between baseline BITE score and therapy outcome (path "*a*b*") ($\beta = 0.15$, $p = 0.002$), as the resulting bootstrapped CIs did not contain 0 (0.006–0.033). The inclusion of SWAP-200 healthy personality functioning as a mediator implied a considerable reduction in the effect of baseline bulimic symptoms on therapy outcome, making it no longer significant ($\beta = 0.06$, $p = 0.48$).

Contrary to expectations, our findings shows that the mediated indirect effect (path "*a*b*") of Cluster A of the SWAP-200 PD scales in the relationship between baseline EDI-3 score and therapy outcome was not significant ($\beta = 0.05$, $p = 0.28$). However, in the fourth mediation model, Cluster B of the SWAP-200 PD scales was found to mediate the link between baseline BITE score and therapy outcome (see **Figure 2**). The findings indicated that the total effect (path "*c*") was significant ($\beta = 0.20$, $p = 0.044$), involving significant coefficients for both path "*a*" ($\beta = 0.59$, $p < 0.001$) and path "*b*" ($\beta = 0.27$, $p = 0.036$). The point estimate of the indirect effect between pre-treatment BITE and therapy outcome through the Cluster B score (path "*a*b*") was.022 ($SE = 0.01$, $p = 0.038$), and the bootstrapped 95% CI did not include 0 (0.001–0.044), indicating that the mediated indirect effect was significant. The direct effect of baseline BITE score on therapy outcome (path "*c*'") was no longer significant ($\beta = 0.03$, $p = 0.75$). Finally, Cluster C of the SWAP-200 PD scales did not show any mediator effect (path "*a*b*") in the relationship between pre-treatment EDI-3 overall score or BITE total score and therapy outcome ($\beta = 0.02$, $p = 0.37$ and $\beta = -0.006$, $p = 0.79$, respectively).

DISCUSSION

The main aim of the present study was to investigate whether overall healthy personality functioning and features of clusters of PDs, assessed dimensionally by the SWAP-200, could mediate the relationship between baseline ED and bulimic symptomatic impairment and therapy outcome at discharge from an ED residential treatment program. Despite preliminary findings of the mediator role of personality with respect to other patient variables in ED samples (Eggert et al., 2007; Münch et al., 2016) and other clinical populations (e.g., Verona et al., 2005; Okubo et al., 2017), the indirect effects of PDs on treatment response in ED patients remains under-researched.

The present study found that: (a) features of PDs in Clusters A and B, but not Cluster C, related to more severe baseline symptomatic presentation and worse therapy outcome, whereas healthy personality functioning showed the inverse associations; (b) the DSM-5 derived categorical ED diagnoses of AN and BN did not significantly differ in terms of ED symptomatic impairment at treatment intake and therapy outcome at discharge, except with respect to higher levels of binge eating and purging behaviors in BN patients; and (c) healthy personality functioning mediated the relationship between baseline symptom severity and therapy outcome, and the association between baseline bulimic symptoms and treatment outcome; furthermore, Cluster B PDs mediated the link between baseline binge eating and purging behaviors and therapy outcome, whereas PDs in Clusters A and C did not show any significant mediating effects.

The identification of significant mediators in ED treatment may help us to identify which intervention will work best for each patient, and under what conditions (Roth and Fonagy, 2005). Findings of a mediator effect of Cluster B symptoms on therapy outcome, over and above the direct effect of the severity of bulimic symptoms, suggest that

TABLE 1 | Means, standard deviations, and correlations between clusters of SWAP-200 PD scales, healthy personality functioning, baseline eating symptoms, and therapy outcome (*N* = 107).

SWAP-200[a] PD scales	*M* (*SD*)	BITE intake[b] 16.07 (6.04)	EDI-3[c] intake 5.19 (0.72)	OQ-45.2[d] termination 72.22 (27.07)
Cluster A	46.82 (6.54)	−0.014	0.243*	0.287**
Cluster B	45.47 (4.69)	0.384***	0.210*	0.224*
Cluster C	49.34 (6.46)	−0.387**	−0.057	0.165
Healthy personality functioning	50.87 (6.56)	−0.222*	−0.213*	−0.522***

[a]*Shedler-Westen Assessment Procedure-200 (SWAP-200; Westen and Shedler, 1999a,b);* [b]*Bulimic Investigatory Test, Edinburgh (BITE; Orlandi et al., 2005);* [c]*Eating Disorder Inventory-3 (Garner, 2004);* [d]*Outcome Questionnaire-45.2 total score (Lambert et al., 2010).*
*$p \leq 0.05$; **$p \leq 0.01$; *** $p \leq 0.001$.

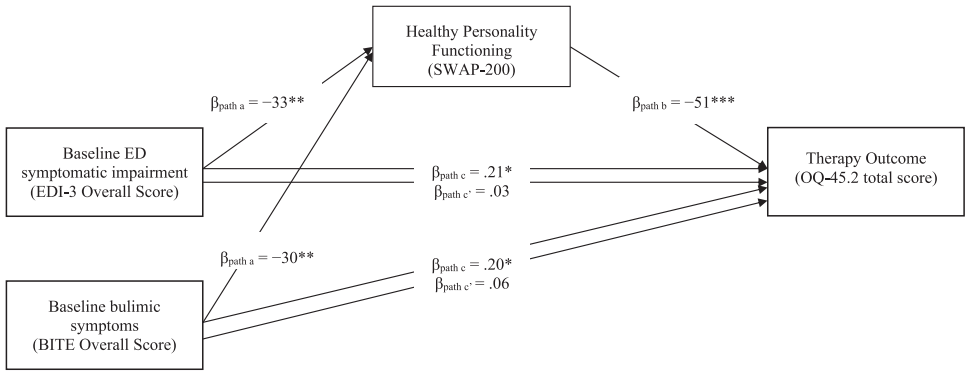

FIGURE 1 | Mediation Model with SWAP-200 Healthy Personality Functioning as a Mediator of the Effect of Bulimic and Overall Eating Symptoms at Intake on Therapy Outcome (*N* = 107). EDI-3 = Eating Disorder Inventory-3 (Garner, 2004); SWAP-200 = Shedler-Westen Assessment Procedure-200 Healthy Personality Functioning Scale (Westen and Shedler, 1999a,b); BITE = Bulimic Investigatory Test, Edinburgh (BITE; Orlandi et al., 2005); OQ-45.2 = Outcome Questionnaire-45.2 total score (Lambert et al., 2010). Confidence intervals computed using bootstrap percentiles.

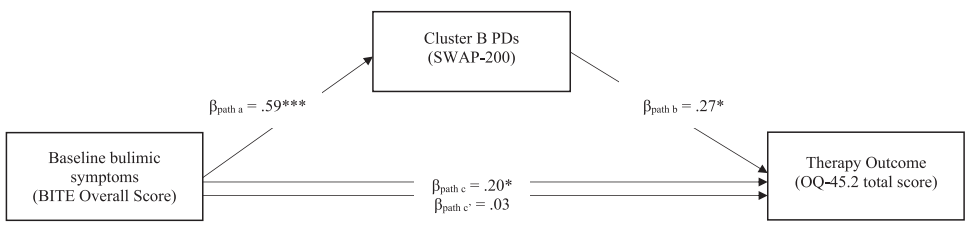

FIGURE 2 | Mediation Model with Cluster B of the SWAP-200 PD Scales as a Mediator of the Effect of Overall Bulimic Symptoms at Intake on Therapy Outcome (*N* = 107). SWAP-200 = Shedler-Westen Assessment Procedure-200 (Westen and Shedler, 1999a,b); BITE = Bulimic Investigatory Test, Edinburgh (BITE; Orlandi et al., 2005); OQ-45.2 = Outcome Questionnaire-45.2 total score (Lambert et al., 2010). Confidence intervals computed using bootstrap percentiles.

interpersonal difficulties, unstable self-image and self-esteem, marked impulsivity, dysfunctional defense mechanisms, and emotion dysregulation might play a relevant role in determining response to ED treatment (Martinussen et al., 2017; Voderholzer et al., 2021). In line with previous empirical evidence, co-occurring Cluster B symptoms in an ED patient may mark greater severity, and thus potentially predict a poorer outcome and less symptomatic change (Steiger et al., 1993; Hessler et al., 2019). Cluster B personality characteristics have also been related to other therapeutic variables, such as a history of psychiatric hospitalization for an ED or other condition (Westen and Harnden-Fischer, 2001) and a greater risk of discharge against medical advice and re-admission following intensive ED treatment (Wildes et al., 2011). These observations seem particularly relevant to intensive treatment settings, such as residential programs, in which these features may lead to a tendency to break rules and thereby limit patients' adjustment to the structured treatment protocol (Friedman et al., 2016; Muzi et al., 2019, 2020).

On the other hand, the SWAP-200 healthy personality functioning score, which measures psychological strengths such as mature defense mechanisms (e.g., humor), empathic abilities, responsiveness, capacities for relationship and intimacy, nurturance, affective regulation, insight, and reflective capacities (Westen and Shedler, 1999a,b), was found to significantly interact with and reduce the effect of baseline symptomatic

impairment in determining therapy outcome. Despite the need to replicate these findings on larger ED samples, it might be possible to hypothesize that targeting these protective factors related to psychological resources and well-being may increase the effectiveness of prevention and intervention programs for this clinical population (e.g., Tomba et al., 2014, 2017). However, contrary to expectations, the present findings did not show any significant mediating effect of PDs in Clusters A and C. This is surprising, due to the literature linking obsessive-compulsive personality traits and perfectionism with negative outcomes in ED patients, particularly those with mainly anorectic/restricting symptoms (Lilenfeld et al., 2006; Crane et al., 2007; Farstad et al., 2016). A possible explanation for this is that the SWAP-200 obsessive-compulsive personality and overall Cluster C PDs slightly differ from the corresponding DSM descriptions, showing some psychological strengths and the highest correlations with the Global Assessment of Functioning Scale (see Westen and Shedler, 1999b). Another potential reason is that the present study explored the mediating role of PD features only at a cluster level, due to the well-known high rates of PD comorbidity (e.g., Lenzenweger et al., 2007; Zimmerman, 2012), which may have masked some relevant findings at the individual PD level. Future research with larger sample sizes should explore the mediating effects of each PD score, especially when measured dimensionally, in line with the growing consensus on the limitations of contemporary categorical conceptualizations of personality (e.g., Widiger, 2007; Westen et al., 2012).

In this vein, another interesting result is that DSM-5 categorical diagnostic categories for EDs did not show adequate discriminant validity in terms of baseline variables, ED-specific symptoms (with the exception of binge eating and purging behaviors), and therapy outcome, in line with the literature (Westen and Harnden-Fischer, 2001; Raykos et al., 2018). Other studies have found that DSM-5 subtypes and their severity specifiers are not reliable indicators of the concurrent severity of ED symptomatic impairment (Smith et al., 2017). Taken together, these findings corroborate the hypothesis that more dimensional, individualized, and personality-based outcome studies may helpfully supplement the categorical framework in which EDs have been traditionally conceptualized. As outlined by Martinez and Craighead (2015), rather than classifying individuals based on the presence or absence of disordered eating behaviors, employing these alternative approaches might lead to improved knowledge of more generalized dysfunctions in psychological processes across several areas of individual functioning, which tend to be stable over time and across situations. These individual characteristics might include impaired mentalizing capacities (e.g., Rothschild-Yakar et al., 2010); difficulties in emotion regulation (Harrison et al., 2010); diminished interpersonal abilities (McAdams et al., 2015); and impaired self-directedness, self-awareness, and self-understanding (Marco et al., 2019). This strategy could be extremely useful for the development of targeted and patient-tailored treatment options to maximize successful outcomes (Norcross and Lambert, 2018).

Several shortcomings and methodological issues of the present study should be noted. First, the data derived from a single multimodal and residential ED program with a predominantly White population of cisgender women, which may limit the generalizability of the findings to other ED treatment settings or populations, especially those with baseline EDs other than AN or BN (e.g., binge eating disorder). Future studies should explore the mediating effects of personality functioning and disorders including a more heterogeneous ED patient sample and less intensive treatment settings (e.g., outpatient and day treatment programs). Second, although the present study adopted a multi-informant perspective, no data are available on the interrater reliability of either the DSM-5 diagnoses or the SWAP-200 evaluations. Future investigations should employ at least two independent raters for the personality assessments, to acquire more reliable data for analysis. With respect to the latter point, future studies should evaluate more comprehensive and reliable outcome indices. Such investigations might explore changes in personality functioning, as well as the potential indirect effects of the therapeutic alliance or therapist effects on ED treatment outcome (e.g., Colli et al., 2016; Lingiardi et al., 2018; Tanzilli et al., 2018; Groth et al., 2020). Lastly, some authors (e.g., Lilenfeld et al., 2006) have noted that it is difficult to differentiate the pathoplasty model from the so-called *predispositional model*. It is likely that if a particular personality trait has served as a predispositional risk factor for an ED, it will continue to operate as a pathoplastic factor over time. The present findings cannot establish any causal relationship between personality, ED symptoms, and therapy outcome; however, it will be important to further explore, via accurate longitudinal data, whether some features of PDs have proper causal significance in severe eating pathologies.

Despite these limitations, the present findings suggest that personality functioning and disorders may predict baseline symptomatic expression and treatment outcome in EDs, and that a deeper understanding of patient-related moderators and mediators of outcome should be enhanced to improve treatment effectiveness (Linardon et al., 2017). Most ED treatment guidelines share the view that patients' individual differences, with respect to symptom severity, treatment history, and comorbid psychopathology, should be clearly acknowledged to guide the selection of adequate psychosocial interventions within a stepped-care therapeutic approach (NICE, 2004; American Psychiatric Association, 2006). Thus, future research is needed to clarify the optimal integration of personality variables into ED treatment. Only then will we be able to say if shifting from a "one-size-fits-all" to a "person(ality)-centered" approach may represent a relevant advancement over the *status quo*.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the first author, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Research Ethics Committee of the

Department of Dynamic and Clinical Psychology, Sapienza University of Rome, Italy (Reference number: 0000398). The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

LM and VL conceived the study hypotheses, drafted the first version of the present manuscript, and contributed to the data analysis. LT, AF, and MR contributed to data collection and assessment and extensively revised the manuscript. All authors critically revised the manuscript and approved the final version to be published.

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ORIGINAL RESEARCH
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Coping With Adolescents Affected by Anorexia Nervosa: The Role of Parental Personality Traits

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Introduction: Anorexia nervosa (AN) promotes psychological distress in caregivers who adopt different coping strategies. Dysfunctional caregiving styles exacerbate further distress in the patient promoting the maintenance of the illness. We aimed to assess the possible contribution of personality traits of caregivers to the adoption of different coping strategies to deal with the affected relative.

Methods: About 87 adolescents with AN were recruited. Their parents completed the Family Coping Questionnaire for Eating Disorders (FCQ-EDs) and the Temperament and Character Inventory-Revised (TCI-R). Differences between mothers and fathers were assessed through the independent sample *t*-test. Multivariate regression analyses were run to assess if personality traits, the occurrence of psychiatry conditions in the parents, the marital status, and the duration of the illness predicted parental coping strategies.

Results: The group of mothers showed higher levels of avoidance and seeking for information coping strategies than the sample of fathers. Lower illness duration predicted higher collusion with the illness in both parents. Harm avoidance, cooperativeness, and self-directedness positively predicted parental coercion, collusion, and seeking for information strategies with some differences between mothers and fathers.

Discussion: Illness duration and personality traits of parents affect the type of parental coping strategies developed to face AN in adolescents. These variables should be considered in the assessment of families of adolescents with AN and may be addressed to promote more fine-tuned clinical interventions for caregivers.

Keywords: anorexia nervosa, caregiving, personality, coercion, collusion, illness duration

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INTRODUCTION

Anorexia nervosa (AN) is a complex psychiatric illness with a severe impact on physical and social domains (Monteleone et al., 2019; Treasure et al., 2020). Social functioning is reduced both before and after illness onset (Cardi et al., 2018a): people with AN describe their illness with the word "isolation" (McKnight and Boughton, 2009) and show the low quality of relationships with peers

before symptoms develop (Cardi et al., 2018b), while a wide range of alterations in social cognitive processes has been found in the acute phase of the illness (Monteleone et al., 2018, 2020) and partially after recovery (Oldershaw et al., 2011).

The social aspects of the illness also include the family network. The family relationships may either contribute to the AN development/maintenance (Schmidt and Treasure, 2006; Treasure and Schmidt, 2013) or are seriously affected by the AN onset (Treasure and Nazar, 2016). Indeed, AN typically starts in adolescence (Volpe et al., 2016) and people with AN often remain dependent upon their families during their lifetime (Hjern et al., 2006). Parents are involved in providing meal support, emotional, and financial help and may be essential to bridge isolation of their affective relative, especially in adolescents (Murray et al., 2015).

However, the parents also experience a wide range of emotional and behavioral reactions to the onset of AN symptoms in their relative and this may have a negative impact on the illness course (Treasure and Nazar, 2016). Dysfunctional parental coping strategies range from critical, hostile, and overcontrolling behaviors to accommodation to the eating disorder (ED) rules and avoidance of the illness (Treasure et al., 2020). According to a recent study (Parks et al., 2018), the mothers of adolescents with EDs adopt self-sufficient problem-focused strategies more than mothers of healthy adolescents and this may result in hostility and overinvolvement. Although further research is a need in this field, some differences in the reactions of parents have been detected between mothers and fathers, the former being more emotional overinvolved, less critical (Anastasiadou et al., 2016), and more prone to search for social support (Parks et al., 2018) than the fathers.

The adoption of maladaptive coping strategies may either be due to Anastasiadou et al. (2014) or contribute to Coomber and King (2012) the high levels of emotional and psychological distress occurring in caregivers of people with EDs. Treasure and Nazar (2016) hypothesized that several factors may promote specific caregiver coping strategies and their burden in the presence of the anorexic symptoms. These factors are clustered together in three domains: illness-related variables (i.e., the illness stage or the severity of symptoms), societal reactions to the illness (i.e., the stigma or the social support perceived by the family), and the variables of caregivers (which refer to their skillful aspects). In this line, Sepúlveda et al. (2012) found that the social isolation of parents, their educational levels, and their fear of the dangers related to physical health predicted their emotional well-being. However, the factors related to caregivers need to be further explored. Indeed, personality characteristics can affect emotional regulation and communication skills and, thus, the use of different behavioral strategies to cope with stressful events. Although clusters of personality traits of parents have been identified as associated with the psychopathology features of some daughters (Fassino et al., 2009; Amianto et al., 2013, 2015), no study has assessed the possible contribution of the personality of parents to the assumption of different coping strategies. This study aims to address this literature gap in adolescents with AN. We also explored differences in coping strategies between mothers and fathers, which have been not sufficiently assessed (Anastasiadou et al., 2014). Given the lack of previous studies, we had no prior hypothesis on the specific association between personality traits and the behaviors of caregivers.

MATERIALS AND METHODS

Participants

Participants in this study were recruited from patients consecutively admitted and hospitalized for their ED to the Child and Adolescent Neuropsychiatry Unit of the Clinical and Research Hospital "Bambino Gesù" of Rome, Italy, and the Child and Adolescent Psychiatry Unit, A. Meyer Children's Hospital, Florence, Italy, if they met the following inclusion criteria: (a) age $\leq$ 18 years; (b) current diagnosis of AN or atypical AN according to the DSM-5 criteria and confirmed by the Schedule for Affective Disorders and Schizophrenia for School-Age Children-Present and Lifetime Version (K-SADS-PL) (Kaufman et al., 2016); (c) absence of current and/or lifetime comorbid psychiatric disorders such as substance abuse disorder, schizophrenia, and bipolar disorder; and (d) living with both parents or with one of two if divorced. The diagnostic assessment was made by expert psychiatrists (VZ and AM), who made the diagnosis first through a face-to-face clinical interview and then employing the K-SADS-PL to confirm the AN diagnosis and psychiatric comorbidity. For each patient, the two parents were invited to participate in the study if they were actively involved in the care of the patient. Demographic characteristics (age, marital/living status, and presence of a first degree relative with a current or previous diagnosis of ED) and the presence of psychiatric disorders in the parents of the recruited patients were assessed employing the Structured Clinical Interview for DSM-5 Disorders–Research Version (SCID-RV) (First, 2016). The duration of the illness was evaluated considering the time elapsed between the onset of the symptoms and the moment of hospital care: this data was collected through the diagnostic interview KSADS-PL, administered to both parents and the child.

The final study sample included 87 patients (60 with AN restricting type, 7 with AN binge-purging type, and 20 with atypical AN), 87 mothers, and 87 fathers.

Procedure and Measures

The study was approved by the Institutional Board of the Child and Adolescent Neuropsychiatry Unit of the Clinical and Research Hospital "Bambino Gesù" of Rome (number: 2288_OPBG_2020) and was carried out in accordance with the Declaration of Helsinki for experiments involving humans. All the participants and their parents gave their written consent after being fully informed of the nature and procedures of the study.

The parents were asked to fill in the following questionnaires before patients entering specific treatment programs: the Italian version of the Family Coping Questionnaire for Eating Disorders (FCQ-EDs) (Fiorillo et al., 2015) and the Temperament and Character Inventory-Revised (TCI-R) (Fossati et al., 2007).

The FCQ-ED questionnaire (Fiorillo et al., 2015) assessed the coping strategies of parents to face the illness of patients. The questionnaire consists of 32-items exploring six domains: collusion with the behaviors of the patient (i.e., not saying

anything regarding dysfunctional eating symptoms of the patient); coercion (i.e., angry reactions of parents to behaviors of the patient); avoidance (i.e., parents avoid situations that remind the illness of patient); positive communication with the patient (i.e., calming and reassuring reactions of parents); seeking for information on the illness of patient (i.e., trying to get information on the illness); and seeking for spiritual help (single item). In the original version of the questionnaire (Fiorillo et al., 2015), coercion, collusion, and avoidance subscales clustered in a unique factor describing the emotional coping strategies of parents, while positive communication with the patient and seeking for information on the illness of patient subscales clustered in a factor pointing to problem-solving strategies. For this reason and in accordance with literature evidence (Treasure and Nazar, 2016), we did not include the seeking for spiritual help item in the analyses. Cronbach's values of each FCQ-ED subscore ranged between 0.65 and 0.87 in the group of fathers and between 0.69 and 0.88 in the group of mothers.

The TCI-R (Fossati et al., 2007) investigates personality characteristics. It is a 5-point Likert-type scale questionnaire grouped in seven subscales assessing four temperament dimensions (i.e., novelty seeking, harm avoidance, reward dependence, and persistence) and three character dimensions (i.e., self-directedness, cooperativeness, and self-transcendence). Temperamental features are considered inheritable and appearing in the first years of life, while character dimensions are developed during life resulting from social experiences (Cloninger et al., 1993). Cronbach's values of each TCI subscore ranged between 0.68 and 0.81 in the group of fathers and between 0.67 and 0.87 in the group of mothers.

Statistical Analyses

Differences between mothers and fathers in coping strategies and personality characteristics were investigated by means of the independent sample *t*-test through JASP software JASP Team (2020). Bonferroni corrections for multiple testing were applied dividing 0.05 by the overall number (12) of questionnaire comparisons. The level of significance was set at 0.004.

Multivariate regression analyses were conducted using the lavaan package (Rosseel, 2012) in R, Version 3.6.1 (R core Team, Vienna, Austria). The temperament and character scores of parents, illness duration (less than 6 months, between 6 and 12 months and above 12 months), the marital status (joined or divorced), and the occurrence of psychiatric disorders in the parents were included as predictors and the coping strategies of the parent as dependent variables. The simultaneous effect of each predictor on each dependent variable was evaluated, taking into account the covariance among variables.

These analyses were performed separately for each parent.

RESULTS

Patients Characteristics

The age of patients ranged between 11.1 and 18 years (mean: 15.4; SD: 1.5). The mean BMI was 16.5 ± 2.1. No comorbid psychiatric disorder was detected in 40 (45.9%) patients, while a comorbid depressive disorder was revealed in 27 (31%) patients, a comorbid anxiety disorder was diagnosed in 27 (31%) patients, and both anxiety and depressive disorder were observed in nine (10.3%) patients. Four (4.6%) patients were diagnosed with a comorbid obsessive-compulsive disorder. At referral, 22 (25.2%) patients were receiving antidepressant drugs, 22 (25.2%) patients were receiving antipsychotic drugs, and nine (10.3%) patients were receiving benzodiazepine. Illness duration was less than 6 months in 29 (33.3%) patients, ranged from 6 to 12 months in 32 (36.8%) patients, and was longer than 12 months in 26 (29.9%) patients.

Parents Characteristics

Demographic and clinical characteristics of the group of mothers and fathers are reported in **Table 1**. About 16 (18.4%) patients had a first-degree relative with a current or previous diagnosis of ED. The parents of 17 patients (19.5%) were divorced. Sixteen (18.4%) mothers and six (6.9%) fathers were diagnosed with a current depressive disorder; 12 (13.8%) mothers and eight (9.2%) fathers were diagnosed with a current anxiety disorder.

The *t*-test (**Table 1**) showed that mothers scored higher than fathers on seeking information and avoidance subscales. These differences did not persist after Bonferroni corrections. No differences were detected for the others FCQ-ED subscales between the parents. The *t*-test for the TCI-R subscales displayed that harm avoidance, reward dependence, and cooperativeness were significantly higher in mothers than in fathers, although only differences related to reward dependence persisted after Bonferroni corrections (**Table 1**).

Regression Analyses

Results of the multivariate regression analyses in fathers are reported in **Figure 1**. Coercion was significantly and positively predicted by harm avoidance. Collusion was positively predicted by cooperativeness and negatively predicted by the marital status and by illness duration, indicating that joined families and shorter illness duration predict higher levels of collusion. Avoidance was not significantly predicted by the TCI-R subscores. Positive communication with the patient was positively predicted by novelty seeking and negatively predicted by illness duration. Seeking information on the illness of patient was positively predicted by harm avoidance and self-directedness.

Results of the multivariate regression analyses in mothers are reported in **Figure 2**. Harm avoidance and self-directedness were positive predictors of coercion. Collusion was positively predicted by harm avoidance, while it was negatively predicted by the marital status and by illness duration, indicating that joined families and shorter illness duration predict higher levels of collusion. Avoidance and positive communication with the patient were not significantly predicted by the TCI-R subscores. Seeking information on the illness of patient was positively predicted by harm avoidance and persistence.

In both parents, coercion and collusion scores were positively associated with each other and with positive communication. Finally, avoidance was positively associated with seeking information and negatively associated with positive communication in fathers and mothers, respectively.

TABLE 1 | Demographic and clinical characteristics of the group of mothers and fathers.

	Mother	Father	*t*	*p*	Cohen's *d*
Age	48.24 ± 4.46	51.38 ± 5.38	4.17	<0.001*	0.64
TCI-R					
Novelty seeking	98.53 ± 14.20	97.75 ± 15.07	0.35	0.72	0.05
Harm avoidance	96.67 ± 19.20	90.88 ± 16.02	2.22	0.03	0.32
Reward dependence	107.37 ± 16.10	98.13 ± 14.62	5.04	<0.001*	0.60
Persistence	112.16 ± 18.27	112.68 ± 18.70	0.18	0.85	0.02
Self-directedness	149.15 ± 20.79	146.41 ± 25.41	0.77	0.43	0.11
Cooperativeness	138.95 ± 17.48	133.15 ± 17.28	2.20	0.02	0.33
Self-transcendence	70.54 ± 15.59	67.63 ± 14.05	1.29	0.19	0.19
FCQ-ED					
Avoidance	3.26 ± 2.47	2.30 ± 2.39	2.55	0.01	0.39
Coercion	28.33 ± 6.48	26.48 ± 9.55	1.47	0.14	0.22
Collusion	17.64 ± 5.04	18.22 ± 5.71	0.88	0.37	0.13
Information	5.31 ± 1.34	4.87 ± 1.39	2.06	0.04	0.31
Positive communication	29.85 ± 4.64	29.12 ± 7.22	0.79	0.43	0.12

TCI-R, Temperament and Character Inventory-Revised; FCQ-ED, Family Coping Questionnaire for Eating Disorders.
**Significant after Bonferroni correction.*

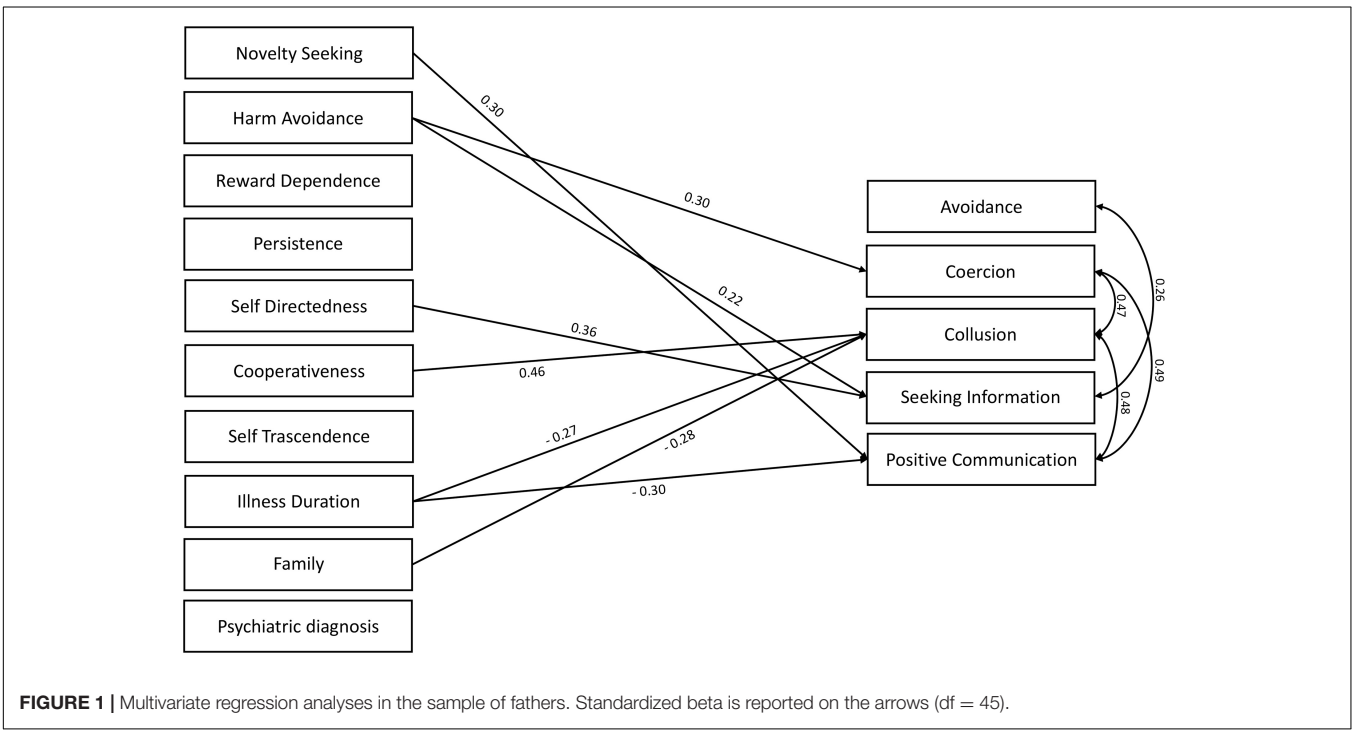

FIGURE 1 | Multivariate regression analyses in the sample of fathers. Standardized beta is reported on the arrows (df = 45).

DISCUSSION

This study investigated caregiving differences between mothers and fathers and personality-related factors of parents possibly promoting different coping strategies to face AN in adolescents. The group of mothers showed higher levels of seeking information and avoidance strategies than the sample of fathers. In both parents, the collusion was negatively associated with the illness duration and was higher when the parents were joined, while the occurrence of psychiatry disorders in the parents did not affect the adoption of parental coping strategies. The personality traits of parents were significant predictors of their caregiving style: harm avoidance was positively associated with coercion and seeking for information in both parents as well as with collusion in mothers. Some differences were detected between mothers and fathers, given that in the group of fathers, collusion was positively predicted by cooperativeness, while positive communication with the patient was higher at illness onset and positively predicted by novelty seeking; in the group of mothers, instead, coercion was predicted by self-directedness.

The first interesting aspect of this study is the investigation of parental coping strategies in adolescents with a diagnosis of

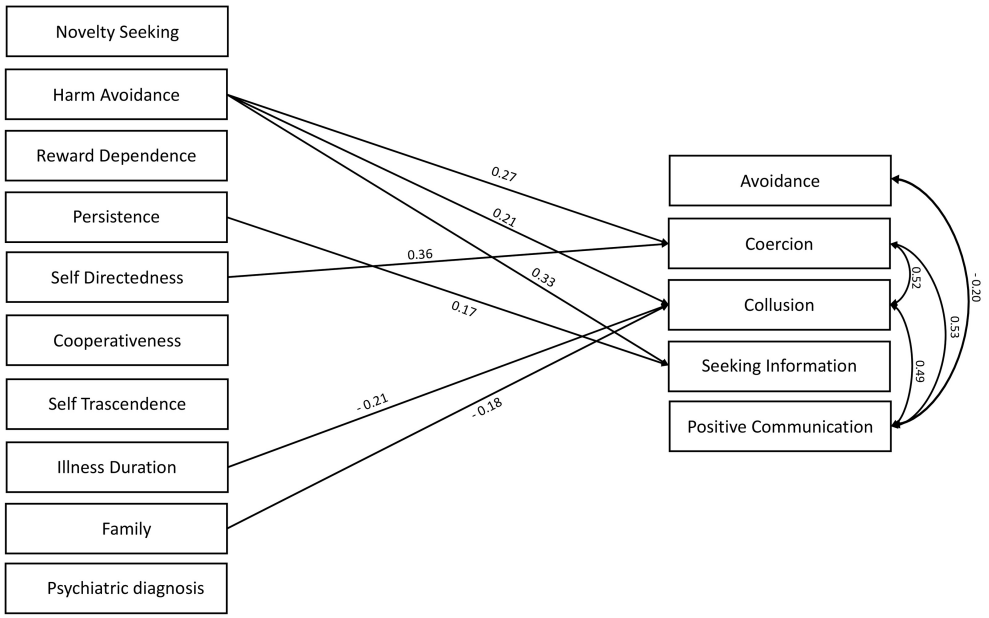

FIGURE 2 | Multivariate regression analyses in the sample of mothers. Standardized beta is reported on the arrows (df = 45).

AN. Adolescence is the lifetime period when usually AN starts (Volpe et al., 2016); thus, it is ideal to assess the parental reactions to the illness before further psychosocial impairment occurs (Treasure et al., 2020). Remarkably, family-based treatments are highly recommended in the first phase of the illness (Lock, 2015), highlighting the importance of studying how parents cope with the illness of patients in adolescence. In accordance with this background, we found that illness duration was a significant negative predictor of the collusion of mothers and fathers and a negative predictor of positive communication of fathers with the patients. These findings suggest that at illness onset, both parents tend to accommodate the illness (i.e., by organizing the family around the ED rules) and that fathers have more calming and reassuring reactions than in later stages of the illness. This is consistent with Rhind et al. (2016), who showed high levels of accommodation with the illness in mothers of adolescents with AN, and it adds to the positive association between the avoidance of relatives and illness duration of the patients found in caregivers of adults with AN (Fiorillo et al., 2017). In this line, the age of parents negatively predicted the use of avoidant coping strategies in caregivers of adolescents with EDs (Parks et al., 2018). Although differences between the illness stages (i.e., a comparison between adolescents vs. adults) have not been thoroughly explored in this study, these results support the staging model of AN (Treasure et al., 2015b) highlighting the possibility that also coping mechanisms of parents may differ throughout AN.

To the best of our knowledge, only two studies (Rhind et al., 2016; Parks et al., 2018) assessed gender differences related to the parental coping strategies in adolescents with AN displaying that mothers exhibit higher levels of overprotective and accommodating behaviors (Rhind et al., 2016), search more social support to cope with the illness and detect more positive and negative aspects of their caregiving (Parks et al., 2018) than fathers. Furthermore, the mother's avoidance was positively predicted by a more severe perception of the illness (Parks et al., 2018). The present study revealed higher avoidance and seeking for information in mothers than in fathers, although these differences did not persist after Bonferroni corrections. Despite different instruments were employed in these studies, the findings are not at odds with the previous ones given that avoidance is a component of the accommodating construct measured in the Rhind et al. (2016) study. Moreover, the emotional expression assessed by Rhind et al. (2016) pointed to criticism and overinvolvement and the lack of difference between the parents found in that study is in line with the lack of difference in terms of coercion shown in this study. In accordance with adult studies pointing to less maladaptive coping strategies in mothers (Fiorillo et al., 2017), we found higher seeking for information (which is an adaptive strategy) also in mothers of adolescents. However, the present findings are in contrast with studies displaying higher maternal emotional involvement and higher paternal criticism in parents of adult people with AN (Kyriacou et al., 2008; Whitney et al., 2012): differences in illness duration among the study samples are likely responsible for such a discrepancy. These results highlight the importance to consider illness duration when assessing gender differences between parents, even in adolescents in the first years of their illness.

A second innovative aspect of the study is that it is the first one showing that the caregiving style of parents to cope with AN is influenced by personality traits and characteristics. Harm avoidance was a positive predictor of coercion and of seeking for information on the illness of patient in both parents. In mothers, harm avoidance also predicted collusion. Harm avoidance

implies a predisposition to depressive, anxious, and stressful reactions to stressful events with low tolerance of uncertainty (Cloninger et al., 1993). Harm avoidance is high in fathers of restricting women with AN (Fassino et al., 2009), it was included in the most suffering personality clusters of mothers and fathers of people with EDs (Amianto et al., 2013), and is a transdiagnostic personality trait of people with EDs (Krug et al., 2011). The present findings show that higher harm avoidance predicts less adaptive emotional behaviors (coercion in both the parents and collusion in the mothers), and suggest that harm avoidance may be an important personality factor to handle the emotional burden triggered by the illness. However, in this analysis, harm avoidance resulted associated also with seeking information about the illness and, thus, it may simultaneously promote different coping strategies. Differences in the association between personality traits and coping strategies between mothers and fathers also emerged. Indeed, across dysfunctional coping strategies, collusion was predicted by cooperativeness in fathers, while coercion was predicted by self-directedness in mothers. These relationships may be comprehensible, given that more tolerant, supportive, and empathic characteristics of people with high cooperativeness (Cloninger et al., 1993) may be associated with higher collusion of fathers with ED behaviors and the ability to orient behaviors according to the goals of an individual (the self-directedness) may promote angry reactions of mothers to the behaviors of the patient. It is worth noting that the presence of psychiatric disorders in the parents had no significant effect on the assessed coping strategies; thus, emotional and behavioral skills connected to personality traits, beyond the occurrence of any psychiatry disorder, may orient their caregiving strategies.

The main strengths of this study are the investigation of parental coping strategies in a sample of adolescents with AN in their first years of the illness and the evaluation of differences between parents. Moreover, no study has previously assessed the contribution of personality traits to orient caregiving strategies in parents of adolescents with AN.

Limitations of the study also need to be acknowledged. First, societal aspects (i.e., social support) that may affect parental caregiving have been not assessed. Second, the family functioning dynamics in terms of the influence of personality traits of each parent or coping strategy on the counterpart have not been included as a possible predicting factor. Third, the size of the sample of patients with atypical AN is not adequate to investigate differences with adolescents with full AN diagnosis.

CONCLUSION

The ability of mothers to cope with AN in adolescence seems to be characterized by a trend toward higher avoidance strategies and seeking information with respect to the fathers. In both parents, collusion with the illness is higher at the beginning of the illness. Harm avoidance, self-directedness, and cooperativeness are the personality traits and characteristics that predict maladaptive emotional coping strategies (coercion and collusion) in the parents, with some differences between mothers and fathers. According to literature data (Treasure et al., 2009), distress of parents and the caregiving strategies may promote further distress in the adolescents with AN, constituting a vicious circle. In this line, the "New Maudsley Collaborative Care Approach" showed that caregiving behaviors are associated with the illness outcome (Treasure et al., 2015a). Thus, identifying and addressing the possible determinants of maladaptive parental coping strategies may be essential to improve clinical interventions recently developed to help families with prolonged illness (Cardi et al., 2017) or with adolescents patients with AN (i.e., an adaptation of the acceptance and commitment therapy) (Timko et al., 2015). According to the findings of the present study, clinicians are advised to consider that the reactions of parents to the illness of children may be associated with their emotional and interpersonal skills, as highlighted by their personality traits, and illness duration. Taking into account these personality traits may allow clinicians to provide a fine-tuned and grained approach to the families of adolescents with AN.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Institutional Board of the Child and Adolescent Neuropsychiatry Unit of the Clinical and Research Hospital "Bambino Gesù" of Rome. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

AUTHOR CONTRIBUTIONS

AMM and VZ: conceptualization. MC, CM, MG, MP, and AM: data curation and investigation. GC: formal analysis. AMM, AM, VZ, and GC: methodology. VZ, TP, and SV: project administration. AMM: roles/writing the original draft. AMM, AM, and VZ: writing the review and editing. All authors contributed to the article and approved the submitted version.

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Emotion and Psychophysiological Responses During Emotion–Eliciting Film Clips in an Eating Disorders Sample

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Background: Greater vulnerability to negative emotions appears associated with the development and maintenance of eating disorders (EDs). A systematic review of psychophysiological studies using emotion-eliciting film clips reveals that there are no studies examining the effect of standardized validated film clips on psychophysiological response across a range of EDs.

Methods: Using standardized validated film clips without ED-specific content, the present study examined self-reported emotions and psychophysiological responses of women with Binge-Eating Disorder (BED; $n = 57$), Anorexia Nervosa (AN; $n = 16$), Bulimia Nervosa (BN; $n = 34$), and Healthy Controls (HCs; $n = 26$) at Baseline, during Neutral, Sad, Happy, and Fear-inducing film clips, and at Recovery.

Results: Throughout the protocol, the ED groups reported significantly greater sadness and anxiety than HCs. Additionally, the AN group reported more fear, the BED group more frustration, and the BED and BN groups more tension than HCs. Compared to HCs, the BED group reported stronger urges to binge throughout the protocol, whereas BN group reported stronger urges to binge relative to the HC group only at Baseline and Recovery. The BN and BED groups experienced decreased urges to binge during all film clips compared to Baseline. Respiratory Sinus Arrhythmia levels were significantly lower in the BED group compared to HCs and the BN group throughout the protocol.

Discussion: Standardized validated film clips can be used to elicit expected self-reported emotion and skin conductance responses in ED groups, although individuals with EDs compared HCs report greater negative emotions. Interestingly, film clips appeared to reduce urges to binge in binge-eating groups.

Keywords: emotion, affect, binge eating, bulimia, anorexia nervosa, respiratory sinus arrhythmia, galvanic skin response, eating disorders

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INTRODUCTION

Multiple theories have pointed to negative affect as a trigger for engagement in disordered eating. In response to negative affect, models suggest that eating disorder behaviors, such as binge-eating or restriction, may serve as maladaptive emotion regulation strategies (Heatherton and Baumeister, 1991; Polivy et al., 1994; Hohlstein et al., 1998; Corstorphine, 2006; Haedt-Matt and Keel, 2011; Gross and Jazaieri, 2014).

However, there are limitations in the research regarding our understanding of emotional processing in eating disorder (ED) samples. Most studies do not induce emotions in a way that has been is both experimentally manipulated and has high ecological validity. Past methods of inducing affect include the use of slides (e.g., Lazarus et al., 1962), hypnosis (e.g., Bower et al., 1983), interactions with confederates (e.g., Ax, 1953), and music (e.g., Sutherland et al., 1982). In order to address the limitations of past research methods, Gross and Levenson (1995) and other research teams (Schaefer et al., 2010) validated films clips designed to elicit discrete emotions in a time-efficient, dynamic, and ecologically valid manner.

Studies measuring facial expressions and self-reported emotions after film mood inductions show individuals with Anorexia Nervosa (AN) tend to have an inhibited emotional facial expression of both positive and negative emotions (Davies et al., 2016), despite reporting similar or more intense emotions (Davies et al., 2011, 2013; Rhind et al., 2014; Dapelo et al., 2015; Lang et al., 2016). Some evidence shows individuals with Bulimia Nervosa (BN) may experience blunted affect (Claes et al., 2012), whereas other studies found BN samples had similar emotional response to Healthy Controls (HCs; Dapelo et al., 2015). For individuals with Binge-eating Disorder (BED), there is evidence that negative emotions precede binges; however, there is lack of causal data to support binge-eating as a function of negative affect (Dingemans et al., 2017).

Emotions have a psychophysiological component (Barrett et al., 2007) and measures of heart rate indices and skin conductance (SC) can provide insight into this aspect of emotional response. Respiratory sinus arrhythmia (RSA), a measure of heart rate variability throughout the respiration cycle, is associated parasympathetic function, while skin conductance is related to sympathetic activity (Boucsein, 1992; Beauchaine and Thayer, 2015).

We conducted a systematic review of film mood induction studies that also assessed RSA and/or SC in samples with disordered eating, which yielded only three relevant studies. One study using a body-related clip mood induction found an increase in negative affect (i.e., sadness and anxiety), desire to binge, and SC fluctuations in a BED group but found no changes in the HC group (Svaldi et al., 2009). Another study showed abnormalities in parasympathetic activity in an AN group (restricting type) compared to HCs at baseline and in response to a negative film mood induction (Rommel et al., 2015). Finally, another study found individuals with BN experienced more negative emotions than restrained eaters or HCs after a negative film mood induction (Tuschen-Caffier and Vogele, 1999). Although restrained eaters showed greater skin conductance levels (SCL) than the BN and HC groups, these results were not replicated for other sympathetic measures, such as heart rate. See https://osf.io/8vxen/?view_only=73da0b3db29c47558f74133e8112f3a3 for systematic review details. To our knowledge, there is no study that measures self-reported and psychophysiological data using multiple film mood inductions (e.g., fear, sadness, or happiness) across ED groups in a single study.

The present study measures RSA, SC, and self-reported emotions at baseline, and after film clips validated to elicit either a neutral, sad, happy, or fearful emotional state, and a recovery period in women with AN, BED, and BN as well as HCs. We hypothesized when compared to HCs, (1) women with AN, BED, and BN would have more reported negative emotions, fewer positive emotions, and greater urges to binge (particularly the BED and BN groups) throughout the protocol, and especially after the sad and fear film clips. Understanding the specific emotions that trigger disordered eating behaviors may inform treatment. In addition, by measuring urges to binge, we can investigate the underexplored question on the causal relationship between urges to binge and emotion. In terms of psychophysiological findings, we predicted that (2) women with EDs would have lower average RSA compared to HCs. Finally, we expected to see (3) more skin conductance responses (SCRs) and greater tonic SCLs after each emotion-inducing film clips compared to the neutral film clip.

MATERIALS AND METHODS

Participants

The sample consisted of 57 women who met criteria for BED, 16 for AN, and 34 for BN and 26 HCs. Participants with EDs were recruited from EDs treatment studies at a university hospital, and HCs were recruited from the community using flyers and online postings. Prior to starting the study, all measures and procedures were approved by the Institutional Review Board, and participants provided informed consent. In an initial session, a Masters-level clinician administered the Eating Disorders Examination-16 (Fairburn et al., 2008) and the Structured Clinical Interview for Diagnostic and Statistical Manual of Mental Disorders–IV-Text Revision [DSM-IV-TR; (American Psychiatric Association, 2000; First et al., 2002)]. The second session consisted of the experimental procedure. See **Supplementary Material 1** for full Inclusion and Exclusion criteria.

Procedure

Participants were assessed prior to any treatment (see **Table 1** for the procedure). At Baseline, self-reported emotions were first collected, followed by a 5-min "true" baseline, where participants were asked to "relax without focusing on anything in particular" while recording RSA and SC. Then, the four film clips were presented in random order across subjects. RSA and SC were assessed during each of the film clips. After each film clip, self-reported emotions were assessed, followed by psychophysiological recordings during a "Active" baseline where participants are asked to count the number of times a given color appears on the computer screen (called "Vanilla baseline" in Jennings et al., 1992). This task was designed to reduce return emotions to a neutral state in order to reduce carry-over effects from viewing previous film clip stimuli. During the Recovery period, self-reported emotions are assessed a final time, following by recordings at "active" baseline.

TABLE 1 | Study procedure timeline.

Study procedure timeline	
Baseline	
VAS of emotions assessment	1 min
"True" baseline	5 min
Sad clip (The Champ)	
Film clip shown†	3 min
VAS of emotions assessment	1 min
"Active" baseline	3 min
Happy clip (When Harry Met Sally)	
Film clip shown†	3 min
VAS of emotions assessment	1 min
"Active" baseline	3 min
Fear clip (Silence of the Lambs)	
Film clip shown†	3 min
VAS of emotions assessment	1 min
"Active" baseline	3 min
Neutral clip (Denali documentary)	
Film clip shown†	3 min
VAS of emotions assessment	1 min
"Active" baseline	3 min
Recovery period (after last clip)	
"Active" baseline	5 min
VAS emotions assessment	1 min

† *Film clips were presented in a random order per subject. "True" baseline and "Active" baseline involved assessment of respiratory sinus arrhythmia and skin conductance. Min, minute; VAS, visual analog scale.*

Film Clip Stimuli

Participants viewed four 3-min film clips on a computer screen in a randomized order to elicit either a positive emotion—happiness ("When Harry Met Sally"), sadness ("The Champ"), fear ("The Silence of the Lambs"), or a neutral mood ("Denali"). Clips were previously validated (Gross and Levenson, 1995). The film stimuli did not have an ED-specific content, such as topics related to food or body image.

Measures

The Eating Disorders Examination (EDE) Version 16.0 is a standardized semi-structured interview, measuring the frequency and severity of ED psychopathology (Fairburn et al., 2008). It has high internal consistency, inter-rater reliability, and test-retest reliability (Rizvi et al., 2000).

The Structured Clinical Interview for DSM–IV–TR (SCID) is a standardized semi-structured clinical interview used to assess psychological disorders with adequate inter-rater reliability (American Psychiatric Association, 2000; First et al., 2002).

Participants reported their current emotional states using a Visual Analog Scale [VAS; (Haines et al., 1995)] at: (1) Baseline, and after the (2) neutral film clip (termed Neutral clip), the (3) sadness-inducing film clip (Sad clip), (4) happiness-inducing film clip (Happy clip), and (5) fear-inducing film clip (Fear clip), and (6) completion of the task (i.e., Recovery). The VAS ranged from 0 to 100 and assessed frustration, anxiety, happiness, tension, fear, sadness, and "urges to binge," with higher VAS scores indicating greater emotional intensity.

Psychophysiological Measures

We collected electrocardiogram data utilizing a modified Lead II configuration. We derived RSA by using a band pass filter on the electrocardiogram signal and spectral analysis to extract the high-frequency component (>0.15 Hz) of heart rate variability. We measured SC by using two electrodes placed on the palm of the non-dominant hand. Tonic SCL refers to level SC collected over each period, whereas SCRs refer to the number of responses per period.

Statistical Treatment

Preliminary analyses included an assessment of group differences in demographic and clinical characteristic variables performed using ANOVAs or Chi-square (χ^2) for continuous and non-continuous variables, respectively. *Post-hoc* tests were conducted using simple contrasts for ANOVAs or adjusted residuals for Chi-square tests when significant group differences were found.

Repeated measures ANOVAs during six Conditions: Baseline, Neutral clip, Sad clip, Happy clip, Fear clip, and during Recovery, by four Group variables: BN, BED, AN, and HC were conducted. ANOVAs examined separately for self-reported anxiety, fear, frustration, sadness, tension, happiness, and urges to binge, as well as RSA, SCR, and SCL, resulting in 10 separate ANOVAs. A result was considered statistically significant if $p < 0.05$. SPSS Statistics 26 (IBM Corp. Released 2019. IBM SPSS Statistics for Windows, Version 26.0. Armonk, NY: IBM Corp) was used. *Post-hoc* comparisons were corrected using a Bonferroni adjustment. The output of the results may be found in https://osf.io/8vxen/?view_only=73da0b3db29c47558f74133e8112f3a3.

RESULTS

Sample Description

There were no significant group differences on marital status or full-time employment/student status. The AN group relative to the other groups had more individuals who identified as mixed-race ($p = 0.042$). Individuals with BED were older than individuals with BN and HCs (p's < 0.001). The AN group and HCs were more likely to be low-income (i.e., annual income below $25,000; p's < 0.03) while the BED group was less likely to be low-income ($p < 0.001$). Older age and higher income were correlated (r=0.343; $p < 0.001$). **Table 2** reports the sociodemographic group characteristics. **Supplementary Table 2** shows a correlation matrix with the demographic variables.

Overall, group differences in clinical characteristics aligned with diagnosis status (see **Table 2**). As expected, the BED group had the highest BMI, followed by the HC and the BN groups, while the AN group had the lowest BMI. All group differences for BMI were significant (p's < 0.001) except for the BN and HC group comparison. ED groups had greater ED psychopathology, as measured by the EDE subscales (p's < 0.001). Additionally, the BN group also scored higher than the BED group on the dietary restraint EDE subscale ($p = 0.003$). Mood disorders, anxiety disorders, medical comorbidities, and use of medical services

TABLE 2 | Sociodemographic and clinical characteristics of the sample.

	Anorexia nervosa *n* = 16	Binge eating disorder *n* = 57	Bulimia nervosa *n* = 34	Healthy controls *n* = 26		
	M (SD)	**M (SD)**	**M (SD)**	**M (SD)**	**F(df)**	***p*-value**
Age in years	35.75 (11.17)	41.00 (10.18)	29.47 (8.24)	28.65 (10.63)	14.00 (3,129)	<0.001
BMI (kg/m^2)†	18.66 (3.45)	36.72 (10.76)	25.00 (5.31)	26.38 (4.48)	30.77 (3,129)	<0.001
EDE-EC†,‡	3.10 (1.99)	2.72 (1.36)	2.78 (1.17)	0.02 (0.07)	32.24 (3,128)	<0.001
EDE-DR†,‡	3.29 (2.02)	2.18 (1.24)	3.06 (1.37)	0.44 (0.88)	22.70 (3,128)	<0.001
EDE-WC†,‡	2.61 (1.89)	3.61 (1.08)	3.40 (1.40)	0.53 (0.77)	38.52 (3,128)	<0.001
EDE-SC†,‡	3.27 (1.81)	3.81 (1.22)	3.65 (1.36)	0.50 (0.77)	42.79 (3,128)	<0.001
Objective binge episodes§	1.22 (2.38)	4.26 (3.99)	6.42 (6.24)	0.00 (0.00)	13.73 (3,129)	<0.001
Vomit episodes§	2.22 (3.94)	0.13 (0.93)	7.60 (8.34)	0.00 (0.00)	22.74 (3,129)	<0.001
	***N* (%)**	***N* (%)**	***N* (%)**	***N* (%)**	**x^2**	***p*-value**
Caucasian	13 (81.25)	39 (68.42)	24 (70.59)	15 (57.69)	21.48 Δ (3,129)	0.044
Black	0 (0.00)	8 (14.04)	3 (8.82)	5 (19.23)		
Asian	0 (0.00)	2 (3.51)	2 (5.88)	3 (11.54)		
Mixed	3 (18.75)	6 (10.53)	0 (0.00)	0 (0.00)		
Hispanic	0 (0.00)	2 (3.51)	5 (14.71)	3 (11.54)		
American Indian/Alaska Native	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)		
Native hawaiian or other pacific islander	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)		
Marital status: single‡	9 (75.00)	25 (44.64)	20 (60.61)	17 (68.00)	6.44 (3,122)	0.092
Employment status‡,‖	14 (87.50)	54 (94.74)	30 (90.91)	25 (96.15)	4.60 (3,128)	0.596
Income status‡,¶	12 (75.00)	16 (28.07)	18 (54.55)	18 (72.00)	20.02 (3,127)	<0.001
Mood disorders	7 (43.75)	35 (61.40)	25 (73.53)	1 (3.85)	32.85 (3,129)	<0.001
Anxiety disorders	10 (62.50)	20 (35.09)	10 (29.41)	0 (0.00)	19.87 (3,129)	<0.001
Medical comorbidities‡	8 (61.54)	25 (47.17)	21 (75.00)	4 (23.53)	12.43 (3,107)	0.006
Medication use	6 (37.50)	29 (50.88)	16 (47.06)	2 (7.69)	14.88 (3,129)	0.002

†*BMI, Body Mass Index, EDE, Eating Disorder Examination; EC, Eating Concerns; DR, Dietary Restraint; WC, Weight Concerns; SC, Shape Concerns.*
‡*Missing participants' responses for: EDE scales (1 HC); Marital status (4 AN, 1 BED, 1 BN, 1 HC); Employment status (1 BN); Income status: (1 BN, 1 HC); and Medical comorbidity (3 AN, 4 BED, 6 BN, 9 HC).*
§*Within the previous three months.*
‖*Employment status = Employment/Full-time student status.*
¶*Income status = low income status i.e., household income is < $25 000.*
Δ*Values for racial group differences.*

were less frequently reported by the HC group (p's < 0.001). The BED and BN groups reported more mood disorders ($p = 0.040$ and 0.002, respectively); the AN group reported more anxiety disorders ($p < 0.001$). The BED group reported a higher rate of medication use ($p = 0.024$), while the BN group had more medical problems, such as high blood pressure and cholesterol ($p = 0.005$). Consistent with clinical presentation, the BED and BN groups higher rates of binging than the AN and HC groups (p's < 0.001). Finally, individuals with BN reported the highest frequency of vomiting episodes compared to all other groups (p's < 0.004), and individuals with AN reported more vomiting episodes than HCs ($p = 0.040$).

Main Analyses

Negative Self-Reported Emotions

See **Table 3** for means and standard deviations of the negative emotion variables. There were significant main effects of Condition for anxiety [$F_{(5,97)} = 37.52$, $p < 0.001$, $\eta^2 = 0.279$], fear [$F_{(5,97)} = 52.90$, $p < 0.001$, $\eta^2 = 0.353$], frustration [$F_{(5,97)} = 14.76$, $p < 0.001$, $\eta^2 = 0.132$], sadness [$F_{(5,97)} = 68.06$, $p < 0.001$, $\eta^2 = 0.412$], and tension [$F_{(5,97)} = 46.78$, $p < 0.001$, $\eta^2 = 0.0.325$]. Anxiety, fear, and tension were higher after the Fear clip, compared to all other clips (p's < 0.05). Sadness was rated the highest after the Sad clip compared to all other clips (p's < 0.001).

For self-reported anxiety [$F_{(3,97)} = 5.18$, $p = 0.002$, $\eta^2 = 0.138$], fear [$F_{(3,97)} = 3.46$, $p = 0.019$, $\eta^2 = 0.097$], frustration [$F_{(3,97)} = 3.33$, $p = 0.023$, $\eta^2 = 0.093$], sadness [$F_{(3,97)} = 4.46$, $p = 0.006$, $\eta^2 = 0.121$], and tension [$F_{(3,97)} = 3.61$, $p = 0.016$, $\eta^2 = 0.101$], there was also a main effect of Group. ED groups reported anxiety and sadness as more intense than HCs (p's < 0.05). Additionally, compared to HCs, the AN group reported more fear ($p = 0.023$), the BED group more frustration ($p = 0.013$), and the BED and BN groups more tension than HCs (p's < 0.05). There were no significant interaction effects.

Positive Emotion

For happiness, there was an effect of Condition [$F_{(5,97)} = 80.82$, $p < 0.001$, $\eta^2 = 0.455$], where happiness had the highest ratings after the Happy clip compared to all conditions except the neutral clip (p's < 0.001). There was not a significant effect of Group

TABLE 3 | Self-reported emotions, urge to binge, respiratory sinus arrhythmia, and skin conductance measures for groups at baseline, after each film clip, and during recovery.

	Baseline	Neutral clip	Sad clip	Happy clip	Fear clip	Recovery
	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)
Anxious emotion						
AN ($n = 10$)	56.73 (22.14)	10.30 (18.51)	46.65 (25.81)	25.02 (27.00)	60.17 (11.31)	37.92 (29.82)
BED ($n = 47$)	41.30 (29.13)	11.95 (17.06)	40.51 (29.26)	13.26 (19.95)	56.65 (29.18)	34.28 (27.68)
BN ($n = 27$)	47.99 (28.96)	9.85 (18.57)	32.25 (31.06)	17.83 (27.43)	54.51 (33.02)	25.83 (27.20)
HCs ($n = 17$)	12.25 (22.07)	4.42 (12.14)	27.31 (27.24)	9.92 (18.47)	40.13 (30.31)	13.71 (20.64)
Fear emotion						
AN ($n = 10$)	42.42 (29.20)	0.95 (1.93)	28.42 (26.88)	20.88 (27.08)	59.92 (21.19)	22.47 (29.58)
BED ($n = 47$)	25.41 (25.44)	10.30 (16.01)	27.74 (29.83)	5.50 (11.15)	51.40 (28.47)	11.88 (20.26)
BN ($n = 27$)	30.65 (27.39)	5.91 (12.55)	30.44 (32.31)	8.55 (18.93)	54.84 (35.91)	8.64 (15.06)
HCs ($n = 17$)	4.27 (10.47)	1.72 (4.71)	22.03 (27.60)	3.01 (6.35)	36.41 (29.42)	6.41 (14.32)
Frustration emotion						
AN ($n = 10$)	39.35 (31.20)	7.87 (14.44)	29.25 (30.25)	14.20 (21.97)	24.85 (25.13)	35.38 (33.79)
BED ($n = 47$)	35.10 (29.45)	15.73 (21.78)	30.99 (29.52)	11.50 (18.69)	38.66 (32.02)	38.91 (31.24)
BN ($n = 27$)	32.27 (26.84)	12.44 (21.08)	25.44 (27.59)	9.74 (16.26)	27.84 (28.39)	36.06 (27.91)
HCs ($n = 17$)	7.30 (13.05)	4.51 (11.14)	22.49 (26.07)	8.35 (15.20)	24.45 (26.89)	13.92 (21.32)
Sadness emotion						
AN ($n = 10$)	42.75 (20.95)	14.80 (22.89)	71.12 (12.11)	16.68 (22.02)	22.38 (22.25)	19.85 (19.66)
BED ($n = 47$)	36.48 (28.66)	14.74 (21.26)	66.92 (30.62)	8.87 (14.35)	27.50 (26.64)	21.63 (23.50)
BN ($n = 27$)	37.22 (29.89)	14.19 (25.38)	67.14 (29.92)	6.00 (13.96)	28.09 (30.51)	22.27 (29.92)
HCs ($n = 17$)	5.65 (11.79)	4.73 (14.17)	51.32 (32.33)	2.13 (4.83)	16.19 (22.43)	10.53 (18.79)
Tension emotion						
AN ($n = 10$)	52.95 (27.55)	8.90 (15.64)	47.88 (27.76)	23.20 (23.94)	64.05 (11.18)	43.95 (29.65)
BED ($n = 47$)	48.72 (27.06)	15.76 (20.00)	49.98 (30.08)	15.35 (19.13)	60.94 (28.91)	39.34 (29.28)
BN ($n = 27$)	51.97 (29.32)	11.64 (23.05)	43.66 (34.82)	25.20 (29.97)	60.63 (35.57)	34.18 (32.42)
HCs ($n = 17$)	18.40 (19.63)	6.60 (15.16)	31.25 (31.55)	13.28 (21.49)	48.49 (32.28)	16.60 (23.58)
Happiness						
AN ($n = 10$)	40.70 (23.84)	46.83 (19.86)	5.92 (9.10)	57.58 (27.61)	15.70 (23.73)	29.75 (21.57)
BED ($n = 47$)	41.45 (17.60)	56.09 (25.91)	11.40 (17.16)	66.33 (20.91)	18.20 (21.26)	35.95 (22.19)
BN ($n = 27$)	43.48 (17.61)	47.90 (24.96)	8.83 (14.78)	58.01 (27.43)	15.84 (23.61)	32.15 (24.62)
HCs ($n = 17$)	59.89 (20.43)	55.89 (28.48)	13.88 (16.95)	61.32 (25.13)	23.32 (24.14)	52.61 (22.55)
Urge to binge						
AN ($n = 10$)	25.55 (28.80)	5.40 (15.69)	8.90 (22.94)	15.15 (24.05)	12.38 (26.20)	20.13 (28.97)
BED ($n = 47$)	42.30 (27.39)	20.15 (23.92)	29.36 (29.89)	23.63 (27.12)	25.75 (29.80)	35.43 (30.43)
BN ($n = 27$)	36.06 (29.26)	9.75 (19.42)	12.57 (23.01)	11.07 (20.69)	13.12 (24.03)	23.83 (25.97)
HCs ($n = 17$)	0.86 (2.07)	0.45 (1.15)	0.63 (2.05)	0.64 (1.58)	0.54 (1.48)	0.71 (1.91)
Respiratory sinus arrhythmia						
AN ($n = 16$)	5.91 (1.17)	5.78 (1.20)	5.66 (1.36)	5.66 (1.13)	5.76 (1.13)	6.03 (1.36)
BED ($n = 57$)	5.29 (1.58)	5.24 (1.35)	5.10 (1.65)	5.26 (1.53)	5.17 (1.34)	5.25 (1.36)
BN ($n = 34$)	6.38 (1.10)	6.24 (0.96)	6.01 (1.23)	6.11 (1.03)	6.09 (1.12)	6.46 (1.00)
HCs ($n = 26$)	6.23 (1.41)	6.38 (1.26)	6.36 (1.27)	6.30 (1.21)	6.18 (1.45)	6.32 (1.21)
Skin conductance response						
AN ($n = 12$)	2.40 (2.81)	2.54 (1.92)	3.78 (5.23)	3.47 (3.47)	3.29 (2.78)	3.28 (3.10)
BED ($n = 44$)	2.75 (2.31)	2.16 (1.89)	2.70 (2.57)	3.95 (2.84)	3.52 (2.33)	3.18 (2.17)
BN ($n = 24$)	1.59 (1.89)	2.29 (2.68)	2.32 (2.28)	3.78 (3.98)	2.53 (2.28)	3.65 (4.03)
HCs ($n = 21$)	1.86 (1.71)	1.48 (1.33)	2.37 (2.58)	2.46 (2.22)	2.13 (2.76)	2.99 (2.91)
Skin conductance level						
AN ($n = 11$)	3.14 (2.78)	3.64 (3.53)	5.66 (7.09)	4.54 (4.33)	4.77 (4.31)	4.91 (4.61)
BED ($n = 43$)	3.61 (2.74)	3.88 (3.02)	4.03 (3.42)	4.05 (3.15)	4.35 (2.87)	4.11 (3.10)
BN ($n = 24$)	3.00 (4.16)	4.28 (5.47)	4.84 (6.38)	4.90 (5.17)	3.93 (4.43)	4.94 (5.55)
HCs ($n = 21$)	2.32 (3.12)	2.95 (3.25)	5.35 (9.10)	4.44 (5.54)	3.97 (5.56)	4.96 (6.75)

Data was excluded from 32 participants in emotion self-report variables and skin conductance response and 34 participants for skin conductance level due to missing data during at least one condition.

AN, Anorexia Nervosa; BED, Binge-Eating Disorder; BN, Bulimia Nervosa; HCs, Healthy Controls.

or a Group by Condition interaction. See **Table 3** for means and standard deviations for the happiness rating.

Urge to Binge

For urge to binge, there was a main effect of Condition [$F_{(5,97)} = 11.25$, $p < 0.001$, $\eta^2 = 0.104$] and a main effect of Group [$F_{(3,97)} = 9.89$, $p < 0.001$, $\eta^2 = 0.234$]; however, Group and Condition effects were qualified by an interaction between Group and Condition [$F_{(15,97)} = 1.72$, $p = 0.043$, $\eta^2 = 0.051$]. Simple effects were significant for all Conditions between Groups (p's < 0.006). The BED group reported stronger urges to binge compared to: (1) the HC group during all of the Conditions (p's < 0.02) and (2) the BN group after the Sad film clip (p's $= 0.037$). *Post-hoc* tests showed that the BN group reported greater urges to binge than the HC group only at Baseline and Recovery but not after the film clips (p's < 0.04).

Simple effects examined for all Groups between Conditions showed that there were significant differences for the BN and BED groups (p's < 0.001). BN and BED groups experienced stronger urges to binge at Baseline compared to all film conditions (p's < 0.005). In the BED group, urges to binge were stronger (1) during Recovery than after the Neutral and Happy clips (p's < 0.03) and (2) after the Sad film clip compared to the Neutral film clip ($p = 0.013$). No simple effect differences in response to Conditions were observed for the AN and HC groups. See **Table 3** for means and standard deviations of the Urge to binge variable.

Respiratory Sinus Arrhythmia

There was a main effect of Condition [$F_{(5,129)} = 4.40$, $p = 0.001$, $\eta^2 = 0.033$], where average RSA was lower during the Fear and Sad clips compared to the during Recovery (p's < 0.03). There was also a significant main effect of Group [$F_{(3,129)} = 6.62$, $p < 0.001$, $\eta^2 = 0.133$], such that individuals with BED exhibited significantly lower average RSA levels than individuals with BN and HCs (p's < 0.003) at all conditions. There was no interaction between Condition and Group. See **Table 3** for means and standard deviations of RSA.

Skin Conductance

There was a significant main effect of Condition for average number of SCRs [$F_{(5,97)} = 6.08$, $p < 0.001$, $\eta^2 = 0.059$] and average tonic SCL [$F_{(5,96)} = 6.41$, $p < 0.001$, $\eta^2 = 0.063$]. After the Neutral clip, average SCRs and SCLs was reduced compared to during Recovery (p's < 0.005). In addition, after the Neutral clip there were fewer average SCRs compared to after the Happy and Fear clips (p's < 0.02). There were fewer average SCRs and lowered average SCLs during Baseline than after the Happy clip and during Recovery (p's < 0.03). Additionally, there was also reduced average SCLs during Baseline than after the Sad and Fear clips (p's < 0.02). There were no effects of Group or interaction effects for either average SCRs or tonic SCLs. See **Table 3**.

DISCUSSION

Standardized validated film clips, presented in a random order, specifically elicited intended emotions and average SCL and SCR responses across all groups. We found that individuals with EDs exhibited more negative emotions than HCs throughout the protocol. Interestingly, both the BN and BED groups had higher urges to binge at Baseline compared to the film clip conditions. Our psychophysiological findings show that the BED group had lower average RSA levels than HCs or the BN group.

Self-Reported Emotions

Taken together, our findings indicated individuals with EDs exhibit stronger negative emotions, especially sadness and anxiety, compared to HCs. There was no interaction between Group and Condition, supporting the idea that EDs have consistently higher negative emotional state, but not necessarily greater emotional reactivity to negative emotion-eliciting stimuli, at least when the stimuli is not ED-specific. This is consistent with some studies that showed ED groups report negative baseline emotion responses, but were *not* more reactive to emotion-eliciting stimuli using sad film clips than HCs (Danner et al., 2013, 2016; Naumann et al., 2016). Together with these recent studies, our findings challenge the theoretical hypothesis that general negative affect and increased emotional reactivity contribute to the maintenance of disordered eating, where disordered eating becomes a maladaptive emotion regulation strategy (Polivy et al., 1994; Haedt-Matt and Keel, 2011; Haynos and Fruzzetti, 2011). In contrast, ED samples may experience more negative emotion reactivity to disorder-specific stimuli, such as food (Ferrer-Garcia and Gutiérrez Maldonado, 2005; Christensen et al., 2020).

Urge to Binge

Our results add to the literature in examining urges to binge after the presentation of validated, emotion-eliciting film clips in women with different EDs relative to HCs. The pattern of urges to binge for the different groups did not fit the pattern of self-reported negative emotions. The BED group had stronger urges to binge compared to the HCs throughout the protocol, and the BN group had stronger urges to binge compared to HCs at Baseline and Recovery. Interesting, for both the BED and BN groups, urges to binge were *higher* during Baseline than after both positive and negative emotion-eliciting film clips. This is contrary to other studies using ecological momentary assessment (EMA) that have shown that urges to binge are preceded by negative emotions, although there has been limited experimental evidence showing a causal relationship between negative affect and urges to binge (see Dingemans et al., 2017 for a review). EMA studies are observational and not experimental but are conducted in real-life settings rather than laboratory settings. These differences between EMA and experimental studies may have contributed to the discrepancy between our findings and studies using EMA. Svaldi et al. (2010) found women with BED had an increased desire to binge after watching a sad film without instructions,

however, it is unclear whether standardized validated film clips were used in this study. Another study in a sample with obesity and binge-eating problems found no effect on film type on "urge to eat" (Chua et al., 2004). A recent meta-analysis found no effect between negative affect using mood induction procedures and food consumption for individuals with eating disorders, however, it is important to note that none of the studies included validated film clips as the mood induction procedure (Evers et al., 2018). Choice of the word "binge" instead of "hunger" or "eat" on the VAS scale assessing "urge to binge" may have increased the likelihood of stronger responses by the BED and BN group than HC groups and further studies are needed to explore this. Further exploration of the mechanism as to why individuals with BED and BN had stronger urges to binge prior to and after emotion-inducing films and why urges to binge in these groups were lower after the emotion-inducing film clips is needed.

Discrepancies Between Psychophysiological Results and Self-Reported Emotions

Although individuals with BED had lower average RSA levels throughout the protocol, there were no interaction effects or any other significant group differences among our psychophysiological findings. Lower resting RSA levels have been associated with a greater number of psychological problems, including dysregulated emotions and greater negative affect (Carney et al., 2001; Crowell et al., 2017; Sloan et al., 2017), but patterns have been less consistent when looking at emotional reactivity. Previous psychophysiological experiments using individuals with BED also reported a decreased parasympathetic response, after a negative film mood induction (Svaldi et al., 2010) or a stress inducing procedure (Friederich et al., 2006), while other studies did not show differences (Hilbert et al., 2011). Future research should look at moderating, transdiagnostic factors, such as impulsivity, alexithymia, and emotion dysregulation that may explain mixed findings in the literature (Westwood et al., 2017; Hasking, 2019).

Average number of SCR and SCL levels increased for all participants, but there were no differences between groups or interaction effects. Skin conductance has generally been thought to be a measure of arousal that increases during positive and negative emotions (Alpers et al., 2011). Therefore, it would be expected—as found in this study—that increased emotional reactivity would lead to increased average number of SCR and average SCL levels. Similar to our findings, there have been studies with participants with EDs that failed to show differences in SCL levels compared to HCs after negative mood induction or exposure to stress (Tuschen-Caffier and Vogele, 1999; Svaldi et al., 2010; Hilbert et al., 2011).

Strengths, Limitations, and Conclusions

High BMI and associated medical conditions may cause blunted cardiovascular responses (Masi et al., 2007; Carroll et al., 2012), which may have lowered RSA levels in the BED group. While our sample size was larger than most studies published to date using ED samples with similar measures, the overall sample size was relatively small. Some participants may have been familiar with the film stimuli, which may have allowed them to predict what would happen next and lead potentially to blunted psychophysiological responses. Memories of the context in which these movies were viewed in (e.g., to avoid the sound of family conflict) may have introduced noise in the collection of the psychophysiological data. Finally, since our study only included women, our results may not generalize to men.

Our study also possesses certain strengths. To our knowledge there is currently no other study that has used a mixed sample across EDs to record psychophysiological responses to a variety of standardized validated film clip types. Standardized validated film clips elicited expected affective responses and skin conductance responses in both ED and HC groups.

ED groups relative to individuals without EDs report more negative emotions generally, but were not more emotionally reactive to our film stimuli, which lacked ED-specific content. This has important treatment implications, as targeting non-ED specific cues may not be as effective at reducing ED pathology as reducing ED-specific cues. Throughout the protocol BED group had lower Respiratory Sinus Arrhythmia levels than the BN and HC groups. Respiratory Sinus Arrhythmia responses on this measure did not map onto the pattern of self-reported responses to the emotion-eliciting films presented, suggesting the importance of considering weight and cardiovascular problems in the use of this measure when assessing emotional response. The pattern of urges to binge for the different groups also did not match the pattern of self-reported emotional responses to the film clips. BN and BED groups experienced decreased urges to binge during all film clips compared to Baseline, suggesting that non-ED specific emotion-eliciting stimuli may at least temporarily decrease urges to binge, even while inducing negative affect. Future research is needed to understand the role of emotion-eliciting stimuli in reducing urges to binge in binge-eating groups.

DATA AVAILABILITY STATEMENT

The datasets presented in this article are not readily available because they contain protected health information. Requests to access the datasets should be directed to the corresponding author, EY Chen. The output of the results may be found in https://osf.io/8vxen/?view_only=73da0b3db29c47558f74133e8112f3a3.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by University of Chicago Institutional Review Board and Temple University of The Commonwealth Institutional Review Board. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

MNF: writing—original draft and revising (lead), formal analysis (lead), and conceptualization (equal). EYC: study design, original research idea, and methodology (lead), conceptualization (equal), mentoring and supervision (lead), writing—review and editing (equal), and formal analysis (supporting). All authors contributed to the article and approved the submitted version.

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SUPPLEMENTARY MATERIAL

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Childhood Memories in Eating Disorders: An Explorative Study Using Diagnostic Imagery

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Together with socio-cultural components, the family environment and early parent–child interactions play a role in the development of eating disorders. The aim of this study was to explore the nature of early parent–daughter relationships in a sample of 49 female inpatients with an eating disorder. To acquire a detailed image description of the childhood experiences of the patient, we used diagnostic imagery, a schema therapy-derived experiential technique. This procedure allows exploring specific contents within the childhood memory (i.e., emotions and unmet core needs), bypassing rational control, commonly active during direct verbal questioning. Additionally, patients completed self-report measures to assess for eating disorder severity, general psychopathology, and individual and parental schemas pervasiveness. Finally, we explored possible differences in the diagnostic imagery content and self-report measures in two subgroups of patients with anorexia nervosa and bulimia nervosa. The results showed that the most frequently reported unmet needs within the childhood memories of patients were those of safety/protection, care/nurturance, and emotional expression, referred specifically to the maternal figure. Overall, mothers were described as more abandoning, but at the same time particularly enmeshed in the relationship with their daughters. Conversely, patients perceived their fathers as more emotionally inhibited and neglecting. Imagery-based techniques might represent a powerful tool to explore the nature of early life experiences in eating disorders, allowing a more detailed case conceptualization and addressing intervention on early-life vulnerability aspects in disorder treatment.

Keywords: diagnostic imagery, eating disorders, anorexia nervosa, bulimia nervosa, early maladaptive schemas, parental schemas, unmet core needs

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INTRODUCTION

The nature of the association between parenting difficulties and eating disorder psychopathology is unclear, and the findings of the studies are still inconclusive. Literature exploring the connection between eating disorders and early parent–child relations includes studies based on the attachment theory and the parental bonding construct (Ward et al., 2000; Zachrisson and Skårderud, 2010). Insecure attachment (dismissed or preoccupied types) has been reported among individuals with eating disorders (Zachrisson and Skårderud, 2010). In particular, patients with anorexia nervosa

restricting type display more often an avoidant attachment style, while individuals with bulimia nervosa more often report a preoccupied attachment (Zachrisson and Skårderud, 2010). Moreover, higher attachment anxiety has also been significantly related to greater eating disorder severity and poorer treatment outcomes (Illing et al., 2010). Other studies investigated parental bonding, specifically the two fundamental dimensions of care and protection. Overall, the results revealed that patients with eating disorders tend to report lower paternal care and perceived absent or weak bonding, with an overprotective mother style (for a review, see Tetley et al., 2014). However, the results were often conflicting due to the studied population (clinical or non-clinical groups), the eating disorder diagnostic subtype (Balottin et al., 2017), the treatment setting (i.e., hospitalization or outpatients treatment), and the severity of the disorder, which might be indicative of eventual comorbidities or specific personality features (Meneguzzo et al., 2021). Another branch of studies has shown the impact of traumatic experiences (i.e., physical, sexual, or emotional abuse) in the development and maintenance of an eating disorder (Dalle Grave et al., 1996; Backholm et al., 2013; Monteleone et al., 2020; Meneguzzo et al., 2021; Scharff et al., 2021), with higher levels of childhood trauma and a number of experienced traumatic episodes, being associated with more severe symptoms of eating disorders (Guillaume et al., 2016). Furthermore, early exposure to traumatic events might have an impact on the neurobiological development of the brain, specifically on the long-lasting neuroendocrine modifications that might account for a major risk of developing a future eating disorder (for a review, see Marciello et al., 2020).

Negative mental images characterize many psychological disorders (Brewin et al., 2010), and negative images about shape, weight, the self, and others play a role in the maintenance of eating disorders (Cooper, 2011). Within the schema therapy model (Young et al., 2003), emotional–experiential techniques based on imagery are used by the clinician to explore the content of the early childhood memories of patients and associate such contents with their early maladaptive schemas (henceforth called "schemas") and their parental (or other caregivers) interpersonal schemas. Schema therapy is an integrated approach (i.e., cognitive-behavioral therapy, Gestalt, attachment theory, and transactional analysis) that emphasizes the role of biographical aspects in the development of maladaptive psychological patterns, through traumatization in childhood and frustration of basic childhood needs. Treatment based on this model uses both the therapeutic relationship and emotional techniques to address such unmet core needs, in order to help the client to fulfill such needs in a more functional way. Change of unhealthy coping strategies, at the basis of dysfunctional behaviors, might help to promote more healthy patterns. Several studies have shown that treatment based on schema therapy is very effective for patients with personality disorders (Giesen-Bloo et al., 2006; Farrell et al., 2009; Nadort et al., 2009; Bamelis et al., 2014; Dickhaut and Arntz, 2014), and better results are also reported for chronic Axis I disorders (Cockram et al., 2010; Malogiannis et al., 2014; Renner et al., 2016; Thiel et al., 2016).

Imagery is a powerful technique that allows access to early memories, bypassing cognitive, and rational control, that are commonly active during direct verbal questioning (Hackman et al., 2011). Imagery exercises can be used for diagnostic purposes, to clarify the biographical origin of actual dysfunctional schemas and emotional problems, as well as related behavioral patterns. This exercise is known as diagnostic imagery, or imagery for assessment, and commonly starts from a current negative emotional situation. Another way to access significant early contents starts directly with the visualization of a past memory, with specific instructions on the emotional valence of the episode to be retrieved (i.e., positive, negative, or neutral). To our knowledge, no study has investigated early parent–child memories through diagnostic imagery in patients with eating disorders. Previous studies have applied Imagery Rescripting (IR, Arntz and Weertman, 1999) to early memories as a therapeutic tool in the treatment of clients with anorexia or bulimia nervosa (Ohanian, 2002; Cooper et al., 2007; Cooper, 2011; Deguè et al., 2019; Zhou and Wade, 2021) and binge-eating disorder (Deguè et al., 2019). IR aims to address and change the meaning of adverse childhood events and emotions within the past episode, principally by satisfying the emotional unmet needs of the child, through guided mental visualization. Two papers reported a single-case study (Ohanian, 2002; Cooper, 2011), while another study compared one single session of cognitive restructuring technique with IR, on an image of social rejection, in individuals with binge-eating disorder and bulimia nervosa. In another study (Cooper et al., 2007), authors used one session of IR to change the negative self-beliefs of patients with bulimia nervosa, through the early negative memories associated with these beliefs. Moreover, in a meta-analysis, rescripting general negative imagery was shown to decrease dysfunctional attitudes and core beliefs associated with eating disorders (Morina et al., 2017). One very recent study (Zhou and Wade, 2021) failed to find a higher effect of one IR exercise associated with treatment as usual (compared with TAU without imagery), in a sample of patients with anorexia nervosa or otherwise specified feeding and eating disorders. These results could be due to the small sample size, the timing of the imagery intervention, which may not have been appropriate for the selected patients, and a short 4-week follow-up measurement. Finally, another study investigated spontaneous images, associated with negative core beliefs, occurring immediately before having worries about eating, weight, or shape, in individuals with bulimia nervosa (Somerville and Cooper, 2007). The authors found that patients diagnosed with bulimia nervosa reported significantly more negative self-core beliefs (assessed through the downward arrow technique, starting from the negative image) than the "dieters" and "healthy non-dieting" control groups. Overall, these findings show some evidence on the feasibility of applying imagery exercises to individuals with eating disorders, proposing the use of IR as a therapeutic tool.

According to the above premises, the aims of this study were: (i) to explore the content of negative childhood episodes (i.e., emotions and unmet core needs) in a sample of inpatients with eating disorders, through diagnostic imagery exercises; (ii) to investigate whether specific unmet core needs reported in the memory were associated with the individual and parental schemas of patients, as assessed through schema therapy-related

self-report measures; and (iii) to explore the differences between anorexia nervosa and bulimia nervosa in individual and parental maladaptive schemas and the content of the childhood memories.

MATERIALS AND METHODS

Participants

Forty-nine patients (mean age 25.2 [8.2] years; age range 18–51 years; all Caucasian women) with eating disorders participated in the study. All were above 18 years of age and were consecutively admitted to the eating disorder inpatient unit of the Villa Garda Hospital of Northern Italy. The patients were referred from all over Italy by general practitioners or by eating disorder specialists of outpatients. Thirty-three patients were diagnosed with anorexia nervosa (mean age 25.2 [8.7] years, BMI = 15.1), and 16 patients were diagnosed with bulimia nervosa (mean age 25.5 [7.04] years, BMI = 21.7). DSM-5 diagnosis was performed by an expert in eating disorders (RDG) using the Eating Disorder Examination (EDE) interview (Italian version) (Calugi et al., 2016). All the patients did not improve with less intensive treatment (e.g., outpatient treatment) or had an eating disorder of clinical severity not manageable in an outpatient setting. Patients with active substance misuse or any psychotic symptoms were not included in the study. Psychotropic medications were not prescribed during the treatment, and the psychotropic drugs being taken by patients at admission were gradually phased out during the first 2 weeks of hospitalization, while patients were under the supervision of clinic staff. The research was reviewed and approved by the Guglielmo Marconi University in Rome (Italy), and all participants gave written informed consent.

Measures

The assessment took place on the first day of inpatient admission. Data collection included weight and height measurement, a face-to-face structured eating disorder diagnostic interview, and a package of questionnaires to evaluate eating disorder and general psychopathology. Patients were dressed in underwear without shoes. The body mass index (BMI) was derived by dividing the weight (in kilograms)/height squared (in meters).

The Eating Disorders Examination 17.OD (EDE Italian versions; Fairburn et al., 2009; Calugi et al., 2015) was used to evaluate the eating disorder psychopathology and to elicit the diagnosis of the eating disorder. A senior specialist in the field (RDG) completed the interview.

The Eating Disorders Examination Questionnaire (EDE-Q Italian version; Fairburn et al., 2009; Calugi et al., 2016) is a self-report version of the EDE. It is a 28-item self-report questionnaire that focuses on the patient report of symptom occurrence over the past 28 days and includes four subscales: "restraint concerns," "eating concerns," "weight concerns," and "shape concerns." The higher the score, the greater the eating disorder psychopathology reported by the patient. The Italian version showed good internal consistency and the test–retest reliability (Calugi et al., 2016).

The Brief Symptom Inventory (BSI; Derogatis and Melisaratos, 1983; De Leo et al., 1993) is the shortened version of the Symptom Checklist (SCL-90-R) assessing based on the response of an individual to 53 items (e.g., feeling fearful and mind going blank) using the five-point Likert scale (0 = not at all, 4 = extremely). In this study, we used the Global Severity Index (GSI), i.e., calculated as the mean of 53 items, and the BSI depression subscale, that is, calculated as the mean of 7 items, to evaluate the confounding role of depression in autobiographic memories (Dalgleish et al., 2003). The Italian version showed good internal consistency and the test–retest reliability (De Leo et al., 1993).

The Clinical Impairment Assessment Questionnaire (CIA Italian version; Bohn et al., 2008; Calugi et al., 2018) is a 16-item self-report measure of the severity of psychosocial impairment due to eating disorder features. It focuses on the past 28 days. The 16 items cover impairment in the domains of life that are typically affected by eating disorder psychopathology: mood and self-perception, cognitive functioning, interpersonal functioning, and work performance. The purpose of the CIA is to provide a simple single index of the severity of psychosocial impairment secondary to eating disorder features. The Italian validation showed good internal consistency and test–retest reliability (Calugi et al., 2018).

The Young Parenting Inventory (YPI Italian version; Young et al., 2003, 2007) is a self-report questionnaire assessing perceived parental experiences in youth (before the age of 11 years old). The YPI is designed to identify the parental origin of the schemas identified by Young et al. (2003). The questionnaire consists of 72 items, which break down into 17 parental schemas that are clustered into five domains. Respondents were asked to rate items about their experience of the attitude and behavior of their parents toward them on the six-point Likert scale (ranging from 1 = completely untrue to 6 = describes him/her perfectly). The final scoring of each schema was calculated in percentage (from 0% = schema is absent to 100% the schema is fully present). Two versions were administered: a version with statements about the mother and a version with statements about the father. The first domain, disconnection/rejection, refers to the expectation that parents should provide stability, security, and empathy and consists of the schemas abandonment/instability, mistrust/abuse, emotional deprivation, and defectiveness/shame. The second domain is related to impaired autonomy and performance and refers to the perception that parents are overprotective and undermining the confidence of the child. It includes the schemas dependence/incompetence, vulnerability to harm or illness, enmeshment/undeveloped self, and failure. The third domain, impaired limits, refers to permissiveness and lack of direction by the parents and consists of two schemas: entitlement/grandiosity and insufficient self-control/self-discipline. The fourth domain is other-directedness. It includes subjugation, self-sacrifice, and approval-seeking/recognition-seeking and refers to the perception that emotional needs of parents are valued more than the unique needs of the child. Finally, the inhibition domain concerns a demanding and punitive parenting style in which performance and perfectionism predominate over pleasure. This domain includes negativity/pessimism, emotional inhibition, unrelenting standards/hyper-criticalness, and punitiveness. The higher the score in the schema, the greater its pervasiveness reported by the patient.

The Young Schema Questionnaire—Short Form 3 (YSQ-S3 Italian version; Young et al., 2005; Aloi et al., 2020) is a 90-item questionnaire that assesses 18 individual early maladaptive schemas (see the previous paragraph where the YPI is described, for a complete overview of schemas and domains). Each schema is assessed according to five items (i.e., statements such as "I haven't had someone to nurture me, share him/herself with me, or care deeply about everything that happens to me") scoring on a 6-point scale ranging from 1 = completely untrue of me to 6 = describes me perfectly. Final scores for each schema range from 5 to 30. The higher the score in the schema, the greater its pervasiveness. The Italian validation of the YSQ-S3 showed good internal consistency and excellent test–retest reliability (Aloi et al., 2020).

Procedure

Two certified schema therapists (BB and CN) who did not know the patients collected the diagnostic imagery interviews between May 2018 and September 2020. Imagery interviews took place within the first 5 weeks of hospitalization of individuals. The experiential exercise started with women closing their eyes and imaging themselves in a safe place. Then, they were asked to leave the situation and enter a positive and safe situation (the "safe place imagery" exercise), such as being at a peaceful beach, or any other personal safe place. Later, the therapist asked the patient to wipe the image away and to recall a childhood memory where she had experienced a negative emotion with one or both parents. The therapists, then, asked the patient to describe the selected event in detail, speaking in the present tense and in the first person. Particular attention was paid to experienced emotions and associated bodily sensations. When the emotion was clear and intense enough, the patient was asked to express the needs associated with the childhood situation (e.g., a need for nurture, safety, acceptance, emotional expression, realistic limits, and autonomy). In the final phase, the woman was asked to return to the safe place, and when a positive emotional state was re-established, the imagery exercise was concluded. In a final debriefing phase, the therapist and the patient together discussed the content of the childhood memory, to detect whether there could be any link with symptoms of actual eating disorders. Patients were instructed to speak out loudly about their experience within the imagery exercise in order to record the interview for later decoding. Each interview took place in one single session and lasted between 15 and 30 min. A complete description of the imagery exercise (adapted from de Haan et al., 2017) is reported in the **Supplementary Material (Appendix A)**.

Data Analyses

Three independent judges (all well-experienced schema and CBT therapists, working at the Association of Cognitive Psychology and School of Cognitive Psychotherapy), who were blind to the aim of the study, separately classified the imagery exercises of patients, after training and initial supervision (held by BB). Judges classified the content of the episode according to a grid with specific categories (age of the patient within the memory, the parent/s involved in the episode, its content, emotions, and unmet core needs within the episode, as referred by the patient, de Haan et al., 2017). Categories with all observations were included in the final scoring system. Data were analyzed using the Statistical Package for the Social Sciences, version 20.0 (SPSS Inc., Chicago, IL, United States).

Descriptive statistics included means and SDs, frequencies, and percentages for continuous (age, BMI, and self-report measures) and categorical (contents of the memory) variables. Partial correlations, controlling for BMI and BSI depression subscale score, to assess for the association between self-reported parental and individual schemas, and psychopathology measures were run. Moreover, the chi-square test was used to explore the most frequently reported emotions and unmet core needs within the childhood memory and the caregiver involved in the episode. Finally, partial correlations, controlling for BMI and BSI depression subscale score, between unmet core needs within the memory, and parental and individual schemas were analyzed. As well, linear regression analysis was run to assess the extent to which unmet core needs in the past (IV) were associated with the current self-reported parental (DV) and individual schemas (DV).

TABLE 1 | Clinical data, eating disorder, and general psychopathology by eating disorder diagnosis.

	Total eating disorder sample $n = 49$ Mean (*SD*) [range]	Anorexia nervosa $n = 33$ Mean (*SD*) [range]	Bulimia nervosa $n = 16$ Mean (*SD*) [range]	*p*
Age in years	25.44 (8.22) [18–51]	25.28 (8.77) [18–51]	25.58 (7.04) [18–40]	0.464
BMI	17.07 (4) [9.7–29.4]	15.07 (3.96) [9.7–18.11]	21.74 (2.74) [18.8–29.3]	<0.001
Days of hospitalization	29.38 (16.08) [0–68]	30.55 (14.00) [0–61]	27.71 (20.74) [0–68]	0.282
Years of formal education	13.94 (2.41) [8–18]	14.25 (2.26) [12–18]	13.2 (2.65) [8–18]	0.381
Global score (EDE-Q)	4.3 (1.25) [0.79–5.95]	4.21 (1.18) [0.91–5.70]	4.5 (1.34) [0.79–5.95]	0.216
Restraint eating (EDE-Q)	3.94 (1.66) [0–6]	4.27 (1.51) [0–6]	3.55 (1.84) [1.20–6]	0.174
Eating concern (EDE-Q)	3.80 (1.47) [0.67–6]	3.71 (1.36) [0.67–6]	4.81 (1.52) [1.2–6]	0.053
Weight concern (EDE-Q)	4.28 (1.62) [0.8–6]	4.25 (1.55) [0.8–6]	4.9 (1.51) [1.2–6]	0.252
Shape Concern (EDE-Q)	4.66 (1.45) [0.5–6]	4.62 (1.37) [0.5–6]	5.01 (1.50) [0.75–6]	0.125
BSI	2.28 (0.76) [0.42–4.6]	2.29 (0.75) [0.62–3.47]	2.25 (0.82) [0.4–4.6]	0.466
Depression (BSI)	2.72 (0.91) [0.71–4]	2.62 (0.87) [0.71–4]	2.99 (1.00) [0.71–4]	0.242
CIA	37.73 (9.41) [8–48]	37.35 (9.15) [8–48]	38.6 (10.25) [17–48]	0.957

Data are presented as mean (SD).
BMI, body mass index; BN, bulimia nervosa; BSI, Brief Symptoms Inventory; CIA, Clinical Impairment Assessment; EDE-Q, Eating Disorders Examination Questionnaire; SD, standard deviation.

Differences between patients with anorexia nervosa and bulimia nervosa in the self-report measures (i.e., EDE-Q, CIA, BSI, YPI, and YSQ global and subscale scores) and the content of the imagery exercises (i.e., age within the memory, parent involved in the episode, emotions, and unmet core needs) were explored through Mann-Whitney *U*-test and chi-square test, respectively. To avoid type I errors, the *p*-value for comparison tests was set at 0.05/18 = 0.003. Logistic regression was performed to test the extent to which emotions (IV) and unmet core needs (IV) of childhood memory were associated with the belongingness of participants to the specific group of ED (AN or BN, DV).

RESULTS

Whole Sample Analysis

Demographical information, severity of the eating disorder, and general psychopathology levels are reported in **Table 1**. Means, SDs, and scoring ranges in parental (YPI) and individual (YSQ) schemas are shown in **Table 2**. Differences in parental schemas (YPI mother vs. YPI father version) were determined through two-tailed Wilcoxon tests (see **Table 2**, for statistical significances). Partial correlation analyses, controlling for BMI and levels of depression, showed some significant correlations between the parental (YPI) and individual (YSQ) schemas of patients (see **Table 3**).

Diagnostic Imagery Interview

According to the information collected through the imagery exercises, we analyzed the content of the past memories examining specific categories. The mean age of patients within the childhood episode was approximately 9.3 ($SD = 3.11$, range from 3 to 14) years, whereas the caregivers involved in the memory were the mother ($n = 21$, 43%), the father ($n = 11$, 22%), and both parents together ($n = 15$, 31%), with two (4%) patients reporting significant others to be involved. The most frequently reported emotions within the memory included (participants reported a maximum of three emotions within the episode), in order, sadness equally as often as fear/anxiety ($n = 24$, 27.2%), anger ($n = 13$, 14%), shame equally as often as guilt ($n = 9$, 10.2%), surprise ($n = 4$, 4.5%), emptiness and humiliation ($n = 2$, 2.2% each), and self-disgust ($n = 1$, 1%). The unmet core needs within the episode (in a range of 1–3 needs per episode) included safety and protection ($n = 27$, 29.5%); care, nurturance, and safe attachment ($n = 22$, 24%); emotional expression ($n = 13$, 14%), attention ($n = 11$, 12%), reassurance ($n = 6$, 6.5%), empathy and acceptance ($n = 5$, 5.5%), limit setting ($n = 1$, 1%), and play ($n = 1$, 1%). Due to the low number of cases in some categories, we will analyze only those classes including more than 10 cases. The negative emotions and unmet needs reported in the memory referred to contents such as physical or emotional abuse (i.e., parents fighting against each other or against the patient as a child), abandonment (i.e., parent leaving the child or threatening her about doing so), and inhibition of the feelings of patient (i.e., the child inhibits and hides her negative feelings to avoid the suffering of parent or his/her negative reaction).

Partial correlations (controlling for BMI and BSI depression subscale score) between emotions and unmet core needs within the memory, and core needs and parental and individual schemas were analyzed. The lack of safety and protection need was positively associated with emotions of fear and anxiety ($r = 0.45$, $p = 0.001$) and negatively correlated with feelings of sadness ($r = -0.31$, $p = 0.02$). Likewise, the need for care, nurturance, and attachment was inversely correlated with the emotions of sadness ($r = -0.36$, $p = 0.01$) and shame ($r = -0.33$, $p = 0.01$), whereas the unmet core need for attention was positively associated with feelings of sadness ($r = 0.43$, $p = 0.003$). When considering the associations between unmet core needs within the early memory and actual schemas, significant correlations were observed between the need for safety and protection, and emotional deprivation ($r = 0.31$, $p = 0.03$) and failure ($r = 0.33$, $p = 0.02$) schemas of patients, and maternal ($r = 0.43$, $p = 0.003$) and paternal ($r = 0.33$, $p = 0.02$) emotional deprivation and paternal emotional inhibition ($r = -0.33$, $p = 0.02$) schemas of patients. The need for care, nurturance, and attachment correlated with paternal pessimism/negativism ($r = 0.35$, $p = 0.01$) and dependency ($r = 0.29$, $p = 0.05$) schemas; whereas the need for emotional expression correlated with paternal ($r = -0.32$, $p = 0.03$) emotional deprivation schema.

Multiple linear regression analyses were run to assess the extent to which unmet core needs (IV) in the past memory were significantly associated with current self-reported parental (DV) and individual schemas (DV). The need for safety and protection was significantly associated with maternal [$R^2 = 0.17$, $F_{(1,46)} = 9.56$, $p = 0.003$, $\beta = 0.41$, $p < 0.005$] and emotional deprivation schema of patients [$R^2 = 0.08$, $F_{(2,48)} = 4.34$, $p = 0.04$; $\beta = 0.29$, $p < 0.05$]. The need for care, nurturance, and attachment was significantly associated with maternal vulnerability to harm and illness [$R^2 = 0.12$, $F_{(2,46)} = 3.21$, $p = 0.05$]. While entering personal schemas as a dependent variable, this unmet core need within the childhood memory was significantly associated with mistrust/abuse [$R^2 = 0.32$, $F_{(6,42)} = 4.42$, $p = 0.008$; $\beta = -0.68$, $p < 0.001$], inadequacy/shame ($\beta = 0.56$, $p < 0.05$), and failure ($\beta = -0.51$, $p < 0.05$) schemas. The need for emotional expression was significantly associated with maternal emotional deprivation [$R^2 = 0.10$, $F_{(1,46)} = 5.36$, $p = 0.025$; $\beta = -0.32$, $p < 0.05$] and with paternal schemas [$R^2 = 0.33$, $F_{(3,44)} = 7.32$, $p = 0.000$] of emotional deprivation ($\beta = -0.30$, $p < 0.05$), punishment ($\beta = -0.41$, $p < 0.005$), and search for approval and admiration ($\beta = 0.33$, $p < 0.05$). Finally, the need for attention was significantly associated with paternal schemas [$R^2 = 0.17$, $F_{(2,45)} = 4.62$, $p = 0.015$] of enmeshment/undeveloped self ($\beta = -0.33$, $p < 0.05$) and emotional deprivation ($\beta = 0.29$, $p < 0.05$).

Finally, we ran some partial correlations (controlling for BMI and BSI depression subscale score) between the severity of the eating disorder, general levels of psychopathology, psychosocial impairment, and individual and parental schemas. No significant associations were detected between clinical measures (i.e., EDE-Q, BSI, and CIA) and individual schemas. The EDE-Q total score significantly correlated with paternal vulnerability to harm schema ($r = 0.32$, $p = 0.03$). General psychopathological severity of symptoms (BSI) was positively associated with paternal vulnerability to harm ($r = 0.33$, $p =$

TABLE 2 | Means and SD in individual and parental schemas in eating disorders are reported.

Schemas in eating disorders	Individual Mean (*SD*) [range]	Mother Mean (*SD*) [range]	Father Mean (*SD*) [range]	Wilcoxon		Schemas in eating disorders	Individual Mean (*SD*) [range]	Mother Mean (*SD*) [range]	Father Mean (*SD*) [range]	Wilcoxon	
				Z	*P*					*Z*	*P*
Emotional deprivation	12.2 (5.1) [5–29]	12 (20.1) [0–100]	29.1 (36.1) [0–100]	−3.25	0.001	Self-sacrifice	19.6 (5.3) [6–30]	27.1 (18.4) [0–100]	18.2 (15.4) [0–75]	−2.77	0.006
Abandonment	18.7 (6.4) [6–30]	3.1 (8.3) [0–25]	2 (8.6) [0–25]	−3.07	0.002	Subjugation	16.2 (6.3) [6–29]	6.7 (17.6) [0–75]	4.1 (12.9) [0–50]	−1.15	0.24
Abuse/mistrust	16.8 (6.0) [5–29]	1.5 (7.9) [0–50]	0.5 (3.6) [0–25]	−0.81	0.41	Admiration and approval seeking	17.7 (6.3) [5–28]	10.4 (25.1) [0–100]	8.3 (18.8) [0–100]	−3.29	0.74
Defectiveness/shame	18.2 (8.0) [5–30]	5.7 (18.7) [0–100]	5.7 (17.2) [0–100]	0	1	Pessimism/negativism	17.6 (5.5) [6–29]	18.2 (24) [0–100]	14 (19.9) [0–75]	−1.03	0.30
Social isolation	18.4 (6.8) [5–30]	–	–	–	–	Emotional inhibition	14.9 (5.9) [5–30]	21.5 (27.1) [0–80]	38.7 (27.1) [0–100]	−3.45	0.001
Dependency/incompetency	14.1 (6.4) [5–26]	13.8 (27.3) [0–100]	8.3 (22.3) [0–100]	−1.22	0.21	Unrelenting standards	20.2 (4.5) [10–28]	13.8 (27.3) [0–100]	23.8 (29) [0–100]	−0.62	0.52
Vulnerability to harm and illness	12.2 (5.5) [4–24]	18.7 (25.5) [0–100]	9.3 (16.1) [0–50]	−2.81	0.005	Punitiveness	18.6 (6.4) [4–30]	13.5 (24.1) [0–75]	14 (27.2) [0–100]	−0.027	0.97
Enmeshment/undeveloped self	13.6 (5.5) [5–24]	25 (27.2) [0–75]	10.2 (14.8) [0–50]	−3.85	0.000	Insufficient self-control	16.7 (5.4) [5–28]	6.2 (15) [0–75]	6.7 (15.2) [0–75]	−3.78	0.70
Failure	17.8 (8.0) [6–30]	0.5 (3.6) [0–25]	1.5 (6.1) [0–25]	−1.41	0.15	Entitlement/grandiosity	14.6 (4.5) [7–26]	20.3 (23.4) [0–75]	16.1 (22.1) [0–75]	−1.88	0.06

Differences between parental schemas (YPI mother vs. father version) were calculated through the two-tailed Wilcoxon tests.

0.02) and defectiveness/shame ($r = 0.34$, $p = 0.02$) schemas. Psychosocial impairment (CIA) significantly correlated with maternal entitlement/grandiosity ($r = -0.35$, $p = 0.02$) and enmeshment ($r = -0.31$, $p = 0.04$) schemas, and paternal enmeshment ($r = -0.36$, $p = 0.01$) and emotional inhibition ($r = -0.41$, $p = 0.006$) schemas.

Within-Group Differences

Non-parametric analyses were executed to detect differences between patients with anorexia nervosa and bulimia nervosa (see **Table 1**). When considering group differences within parental schemas (YPI), only the insufficient self-control paternal schema resulted to be significantly more pervasive in patients with bulimia nervosa than in those with anorexia nervosa ($M = 2.27$, DS = 7.29 in AN; $M = 16.66$, DS = 22.49 in BN, $Z = -3.02$, $p = 0.003$). When considering the schemas of patients (YSQ), again, only the insufficient self-control schema was significantly more pervasive in patients with bulimia nervosa ($M = 20.13$, DS = 5.57) than in those with anorexia nervosa ($M = 15.32$, DS = 54.79; $Z = -2.97$, $p = 0.003$).

Diagnostic Imagery Interview

No significant differences were observed between the two eating disorder groups of patients when examining childhood age within the memory, caregiver, emotions, and unmet core need reported in the imagery exercises. We ran a logistic regression analysis to detect whether specific core needs within the childhood memory would be associated with the belongingness to the eating disorders diagnosis. The overall logistic regression model (Nagelkerke $R^2 = 0.23$, $p < 0.05$) revealed that the unmet need of care, nurturance, and attachment was expressively coupled with the diagnosis of bulimia nervosa [$B = 2.03$, SE = 0.73, Wald = 7.63, $p < 0.05$, Exp(B) = 7.66, 95% CI = 1.08, 32.51] and not with the diagnosis of anorexia nervosa.

DISCUSSION

In this study, we used diagnostic imagery, an emotional experiential technique derived from the schema therapy model (Young et al., 2003), to investigate the content of negative early childhood memories involving parental figures in a sample of female inpatients with eating disorders. We focused

TABLE 3 | Partial correlations measuring the association between parental and individuals schemas, controlling for BMI and depression, are reported.

	M (*SD*)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Maternal emotional deprivation	12.1 (20.1)	–															
2. Maternal abandonment schema	3.1 (8.3%)	0.20	–														
3. Maternal enmeshment/undeveloped self-schema	25 (27.2)	**−0.28°**	0.16	–													
4. Maternal subjugation schema	6.7 (17.6)	0.08	−0.06	**0.38°°**	–												
5. Maternal punishment schema	13.5 (24.1)	0.17	**0.30°**	**0.48****	**0.67****	–											
6. Maternal unrelenting standards schema	26.7 (30.1)	0.18	0.10	**0.36***	**0.64****	**0.62****	–										
7. Paternal submission schema	4.1 (12.9)	**0.35***	−0.14	0.07	**0.57****	**0.50****	**0.29°**	–									
8. Paternal dependency/incompetency schema	8.3 (22.3)	0.04	0.02	−0.09	0.25	0.23	0.17	**0.31°**	–								
9. Individual emotional deprivation schema	12.1 (5.1)	**0.41°°**	**0.29°**	−0.07	0.05	0.15	0.19	0.09	−0.16	–							
10. Individual abandonment schema	18.5 (6.4)	**0.34°**	0.06	−0.03	−0.15	−0.16	−0.28	−0.08	−0.15	**0.29°**	–						
11. Individual abuse/mistrust schema	16.6 (6)	**0.30°**	0.04	−0.26	−0.25	−0.20	−0.13	−0.02	−0.17	**0.38°°**	**0.56****	–					
12. Individual social isolation schema	18.3 (6.8)	**0.29°**	−0.02	−0.08	−0.17	−0.07	0.07	0.03	−0.13	**0.55****	**0.53****	**0.45****	–				
13. Individual dependency/incompetency schema	14 (6.4)	**0.29°**	0.13	0.01	0.08	0.20	0.24	0.27	0.15	**0.47****	**0.47****	**0.26**	**0.60****	–			
14. Individual subjugation schema	16 (6.2)	**0.36***	0.13	0.16	**0.31°**	0.25	0.26	**0.37***	0.17	**0.36***	**0.54****	**0.41°°**	**0.42°°**	**0.68****	–		
15. Individual enmeshment/undeveloped self-schema	13.4 (5.4)	−0.11	0.08	**0.62****	**0.44****	**0.43°°**	**0.33°**	**0.30°**	0.06	0.19	−0.01	−0.09	0.10	**0.33°**	**0.49****	–	
16. Individual insufficient self-control schema	16.7 (5.5)	**0.31°**	**0.34***	−0.04	−0.07	0.04	**0.28°**	−0.05	**−0.31°**	**0.33°**	**0.41°°**	0.27	**0.43°°**	**0.56****	**0.29°**	−0.05	–
17. Individual unrelenting standards schema	20.1 (4.5)	0.24	−0.16	0.13	0.19	0.10	0.23	**0.36***	0.25	0.18	0.09	0.18	**0.31°**	0.16	**0.41°°**	0.25	−0.08

BMI, body mass index. Statistically significant associations are reported in bold.
*°p < 0.05, °°p < 0.005, *p < 0.01, and **p < 0.001.*

specifically on the negative emotions and the related unmet core needs within the past memory. Furthermore, we investigated the pervasiveness of individual and parental schemas of patients and their possible association with the unmet core needs in the childhood episode. Finally, differences between individuals diagnosed with anorexia nervosa and bulimia nervosa were explored.

When exploring the content of the negative early episodes, we found that the reported overall mean age of the child was around 9 years old and that the mother was the most frequently reported parental figure being involved in the negative childhood memory. The most recurrently reported emotions were fear and anxiety, which were congruently related to the unmet core need of safety and protection. The typical contents associated with this need were related to physical abuse toward the patient as a child or parents fighting against each other in the presence of their daughter. This need is typically frustrated when physical, sexual, or emotional abuse takes place and seems specifically associated with the mistrust/abuse schema (Young et al., 2003). Within our sample, the early unmet need for safety and protection was positively associated with emotional deprivation and paternal emotional inhibition schemas of both parents and with emotional deprivation and failure schemas of patients. The second most frequent unmet core need within the memory was lack of care, nurturance, and safe attachment. These needs were more often reported in those episodes where one or both parents were unable to take care of the child, abandoning her or simply being unable to cope with the negative situation. It covers the need of the child for support and care by caregivers and is commonly fulfilled through the presence of a stable and predictable emotional attachment figure, which reassures, guides, and takes care of the child. Not meeting the need of the child might foretell the development of an abandonment and instability schema (Young et al., 2003). We found this need to be inversely correlated with feelings of sadness and shame within the childhood episode and with paternal pessimism/negativism and dependency schemas. The third most frequently reported unmet need within the childhood memory was emotional expression. This need is unmet when spontaneous manifestations are mocked, punished or ignored, and when needs or normative or social rules of others are considered more important than that of the child. According to schema therapy, not meeting the need of emotional expression might lead to the development of the emotional inhibition maladaptive schema (Young et al., 2003). Emotional expression inhibition within the early memory correlated with paternal emotional deprivation schema.

We also observed differences in reported the pervasiveness of parental schemas, where mothers were described as more enmeshed, abandoning, vulnerable to harm and illness, and more self-sacrificing than fathers. Instead, our patients described their fathers as being more neglecting and emotionally inhibiting than their mothers. Moreover, individual schema of enmeshment of patients correlated with maternal enmeshment, subjugation, and punishment schemas. These findings seem in contrast to the parental overprotection perceived by patients with an eating disorder described by other authors (Tetley et al., 2014). Enmeshment and vulnerability to harm might represent a dysfunctional way to feel protected, limiting the independence and autonomy of the child. In a previous study (Sheffield et al., 2009), maternal emotional inhibition was related to the body dissatisfaction of patients, with the mediation of a behavioral-somatic avoidance process. Also, both parental figures were equally described as higher in emotional deprivation, overprotection (i.e., inhibition of fostering the independency of the child), belittling behaviors, punitiveness, control, and emotional inhibition in patients, compared with a non-clinical healthy sample. Another recent similar study (Basile et al., 2020) observed a higher inhibition schema only in the paternal figure in individuals with an eating disorder compared with a non-clinical group.

We also considered the association between psychopathology severity and pervasiveness of schemas. Higher levels of eating disorders and general psychopathology significantly correlated with paternal vulnerability to harm schema, with higher levels of general dysfunction being also associated with paternal defectiveness/shame schemas. Further, higher severity of psychosocial impairment due to eating disorder was associated with more pervasive maternal entitlement/grandiosity and enmeshment schemas, and with paternal enmeshment and emotional inhibition schemas. Conversely, we did not detect any significant association between psychopathology and psychosocial impairment and schemas of patients.

When exploring for potential differences in the content of the childhood memories and self-reported schemas between the two eating disorder categories, we observed that patients with bulimia nervosa reported more pervasive individual and paternal insufficient self-control schemas than patients with anorexia nervosa. Indeed, binge-eating episodes are commonly characterized by a feeling of being out of control during the eating episode. According to an emotion regulation explanation, they are not only the effect of dietary restraint but also of an avoidant self-soother coping mode (Luck et al., 2006; Waller et al., 2007; Brown et al., 2016; Simpson and Smith, 2019). The lack of self-control correlated with maternal emotional deprivation, abandonment, and unrelenting standards/ hypercriticism schemas. A previous study detected specific schema profiles in populations with an eating disorder, being characterized by critical, punitive, and demanding parental schema modes (Simpson and Smith, 2019). These schema modes refer to the underlying unrelenting standards and hypercriticism schema that is characterized by high and unrealistic expectations of perfectionism, where severe criticism and punishment might follow potential mistakes or not-accomplished standards. Coherently, some studies have observed an association between parental expectations of perfectionism and achievement and an increased risk for eating disorders in their children (e.g., Woodside et al., 2002; Luca, 2010). No differences between subgroups were observed in the content of the childhood memories, although the early unmet need of care, nurturance, and safe attachment of patients was significantly associated with the diagnosis of bulimia nervosa, but not with the diagnosis of anorexia nervosa.

This study has several limitations. First, because of its qualitative nature, the content of the childhood memories might

be inaccurately retrieved as the original memory might have been modified during recall. Also, one single memory cannot be representative of the nature of the relationship between the caregivers and the child. Second, as we have also used self-report measures, patients might have distorted and not adequately represented the earlier parental style. In line with this, as it is a cross-sectional study, we cannot make any causal inference between the contents within the childhood memory and self-report measures. Longitudinal studies, like that of Zubatsky et al. (2015), should be considered to make these predictions. Third, the absence of different clinical and non-clinical control groups does not permit to assess if our findings are specific to patients with an eating disorder. Furthermore, the exploratory nature of the study with the inclusion of a convenience sample of patients suffering from severe eating disorder psychopathology and a small sample size of patients with bulimia nervosa compromises the generalizability of the findings. Finally, our data cannot be generalized to patients with other specified or unspecified feeding and eating disorder diagnoses.

In summary, our study suggests that individuals with an eating disorder undergoing diagnostic imagery recalled more often negative early memories involving the maternal figure, mainly reporting unmet needs related to safety and protection, care and nurturance, and emotional inhibition. Patients further described their mothers as more abandoning, but at the same time more enmeshed, in the relationship with them, than the fathers. Conversely, paternal figures were perceived as more emotionally inhibited and neglecting than mothers. Diagnostic imagery is a short and feasible technique that could be used in the early phases of treatment of eating disorders to identify specific parent–child interactions and the unmet core needs of patients within a relationship. These contents might be further explored during treatment to address specific maladaptive schemas and their association with dysfunctional coping strategies of patients (i.e., dietary restriction, hyper-control, and perfectionistic behaviors). Further, in a later phase of treatment, these early memories could be addressed through Imagery Rescripting technique, allowing such needs to be fulfilled through imagination. Future studies should assess whether specific individual or parental schemas, as considered by the schema therapy approach, could somehow predict treatment outcomes. If this were the case, imagery assessment might become a useful clinical tool to assess eating disorders psychopathology, to develop a case conceptualization, or to inform directions for treatment.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Università Guglielmo Marconi—Roma. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

BB and FM contributed equally to the conception and design of the study. BB and CN conducted the diagnostic imagery interviews and organized the database. RD conducted all the assessments. BB and SC performed the statistical analysis. BB wrote the first draft of the manuscript. All authors contributed to manuscript revision, read, and approved the submitted version.

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SUPPLEMENTARY MATERIAL

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Prevalence of Various Traumatic Events Including Sexual Trauma in a Clinical Sample of Patients With an Eating Disorder

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Objective: Eating disorder (ED) and trauma have often been associated, and there is evidence that early experiences of traumatic events are associated with subsequent ED. Research results point toward an increased prevalence of sexual trauma in individuals with ED, and it has been suggested that sexual trauma precedes and contributes to the development of ED. The aim of this study was to assess the prevalence of sexual trauma as well as other types of traumatic life events in a clinical sample of children, adolescents, and adults with ED.

Method: Patients ($N = 329$), median age 16.9 [Interquartile Range (IQR):4.5], diagnosed with various EDs in a specialized ED unit were included.

Results: The majority (67%) of patients with ED reported at least one traumatic life event at time of assessment such as bullying (32%), loss (24%), or accidents (11%). Nineteen per cent of the patients reported having been the victim of a sexual trauma or another sexual traumatic event distributed as follows in terms of severity: 13% had been the victim of a negative experience associated with sex; 57% reported having experienced sexual assault other than rape; and 30% had been the victim of severe forms of sexual assault. The median time between the sexual trauma and the ED diagnosis was 3.4 years (IQR: 6.6). The median time between the sexual trauma and the onset of ED symptoms was 0 years (IQR: 5). The study results imply that the sexual trauma could be experienced either prior to or after onset of ED symptoms.

Conclusions: Sixty-seven per cent of the patients with an ED reported traumatic life events at time of assessment, whereby 19% reporting negative sexual experiences or sexual abuse. However, sexual trauma does not necessarily play a causal role in the development of EDs.

Keywords: eating disorder, anorexia nerviosa, bulimia nervesa, trauma, sexual trauma

INTRODUCTION

Stressors are often believed to play a crucial role as risk factors in the onset of eating disorders (ED) (Smyth et al., 2008). Traumatic events (TEs) are one type of stressors associated with risk for an ED (Molendijk et al., 2017). Trauma are often categorized into various groups, including sexual abuse, physical abuse, and emotional abuse. TEs can include both single- and multiple incident(s) and may be highly invasive and/or interpersonal in nature. One example of severe TE could be multiple experiences of victimization in connection with extended childhood neglect disrupting the parent-child attachment system and/or abuse (Zlotnick et al., 1996; Ford and Kidd, 1998) including sexual trauma. Sexual trauma is defined as unwanted sexual contact and includes sexual touching, fondling, attempted rape, rape, and incest. In a systematic review, Chen et al. (2010) found a statistically significant association between sexual abuse and a lifetime diagnosis of anxiety disorder, depression, post-traumatic stress disorder, sleep disorders, suicide attempts as well as ED. The associations persisted regardless of the victim's sex or age when the abuse occurred (Chen et al., 2010). Likewise, studies including meta-analyses and reviews have concluded that a strong association between childhood maltreatment and ED exists (Smolak and Murnen, 2002; Stice, 2002; Madowitz et al., 2015; Caslini et al., 2016; Molendijk et al., 2017). The relationship between ED and trauma has been investigated in several studies. In a systematic review and meta-analysis focusing on the association between these distinct types of abuse during childhood and different ED subtypes, the authors concluded that while bulimia nervosa (BN) and binge eating disorder (BED) were associated with childhood abuse, anorexia nervosa (AN) showed mixed results (Caslini et al., 2016). In a recent study by Talmon and Widom (2021), it was found that childhood maltreatment was not a significant risk factor for AN or BN diagnoses or symptoms in adulthood. However, the study found that adults who retrospectively reported maltreatment, physical abuse, and sexual abuse reported significantly more symptoms of AN than those who did not. According to Brewerton (2007), childhood sexual abuse is a non-specific risk factor for ED. The spectrum of trauma linked to ED includes a variety of abuse and neglect. Trauma is more common in the bulimic ED subtypes compared to the non-bulimic ED subtypes and the findings linking EDs with trauma have been extended to children/adolescents and boys/men with EDs as well. Multiple episodes or forms of trauma are associated with EDs, and that trauma is not necessarily associated with greater severity of ED (Brewerton, 2007). However, only a few studies of TEs have been conducted in children and adolescents with ED, and they have primarily focused on females with an ED (Sanci et al., 2008; Jaite et al., 2012). Furthermore, most studies have focused on AN or BN, and therefore only a limited number of studies have included less specific categories of ED, including other specified feeding or eating disorders (OSFED), atypical AN, and atypical BN (Molendijk et al., 2017).

AIM OF THE STUDY

The aim of this cross-sectional study was to analyze the prevalence at time of assessment of various types of traumatic events (TEs) including sexual TE (STEs) in a clinical sample of children, adolescents and adults with ED. Another aim was to search for potential differences between children/adolescents and adults with ED regarding the nature of STE. Finally, the aim was to investigate whether the reported STEs happened before or after disease onset.

METHOD

Study Population

The study population consisted of all individuals referred to the Unit for Eating Disorders at Aalborg University Hospital, Denmark, between January 2009 and May 2014. The Unit for Eating Disorders is a specialized interdisciplinary ED unit providing in- as well as outpatient treatment for patients of all ages with an ED. The diagnostic categorization for this study was conducted retrospectively in accordance with DSM-5 criteria (American Psychiatric Association, 2013) based on the diagnostic interview conducted at the time of diagnosis. The assessment was carried out during the first hospital contact (repeated at re-referrals) at the ED unit. A total of 329 female and male patients, children, adolescents as well as adults, were included in this study. See flowchart in **Figure 1**.

Diagnostic Assessment of ED

All assessment tools were administered by highly trained staff with extended experience in working with ED.

All patients were assessed for an ED according to a standardized diagnostic assessment battery that included the Eating Disorder Examination, edition 16.0D (EDE-16) (Cooper et al., 1989). Fully trained clinical psychologists administered the EDE-16 (Fairburn et al., 2008) interview after having received formal training before conducting the diagnostic interview. On-going co-rating and supervision were also provided. The EDE-16 assesses the frequency and severity of ED symptoms and behaviors indicative of an eating disorder over a 28-day period. The EDE-16 is scored on a 7-point scale (0-6). Cut-off for meeting a given ED criterion in this study was set at 3. EDE-16 has good internal consistency, discriminant and concurrent validity, and inter-rater reliability (Cooper et al., 1989; Fairburn et al., 1993; Wilfley et al., 2000).

The assessment likewise included information regarding the onset and developmental history of the ED.

Assessment of Trauma

The assessment also included a semi-structured interview on various life experiences, including TEs. Thus, after conducting the EDE-16, the same clinical psychologist performed a semi-structured interview to obtain information on various life experiences, including crucial and/or traumatic life events such as sexual traumatic events, loss (including parental loss), bullying,

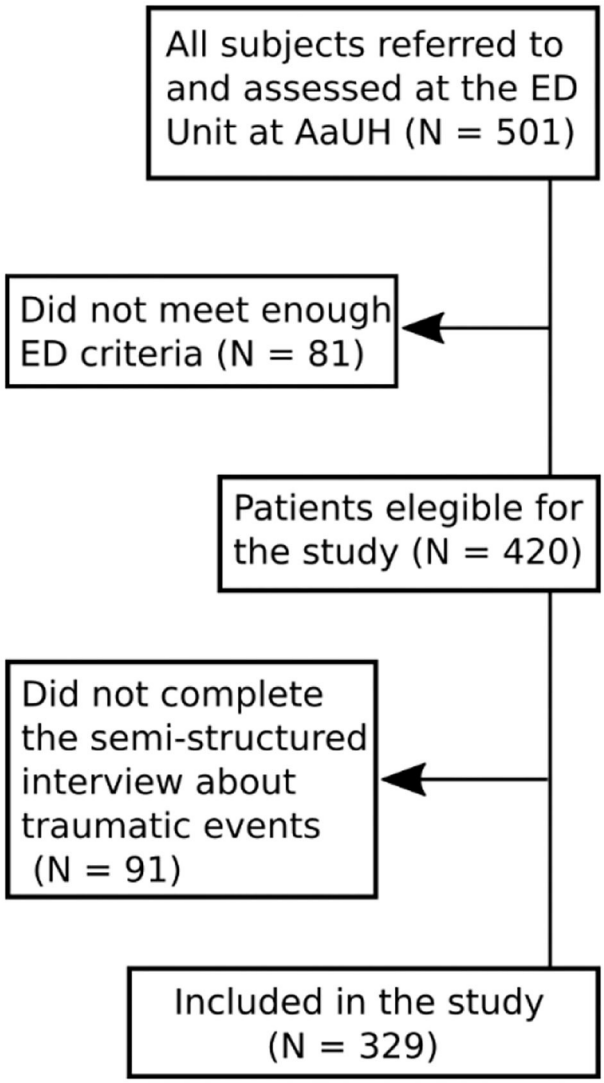

FIGURE 1 | Flow chart showing study inclusion.

or accidents. A text describing the nature, frequency and severity of the STE was also provided by the psychologist.

Further Assessment

The ED assessment battery further entailed a medical examination including structured collection of certain clinical observations and patient-reported symptoms according to generally recognized medical complications in ED. A parental interview to collect anamnestic data was conducted as well, however these data were not included in this study.

Definition of Variables

Age at assessment, which is also the time of inclusion in this study, was defined as age at time of diagnostic assessment with EDE-16. Patients were divided into two different age groups: children/adolescents when assessed before turning 18 and adults otherwise. Age at symptom onset for AN and atypical AN was defined as the onset of restrictive eating behavior and for BN and atypical BN as the onset of binge eating, purging and/or weight-controlling behavior. For AN binge-purge and other OSFED, onset of the first ED behavior among those mentioned above was chosen. BN behavior was determined as being present if the patient reported at least 12 episodes of BN binge and purging (or other compensatory behavior) in the 3 months prior to assessment. Compensatory behavior was a broad concept including vomiting, use of laxatives and/or diuretics, and extreme training (defined as exercise that exceeded several hours per day, caused distress if the individual was unable to exercise, exercise at inappropriate times and/or places, exercise that interfered with important activities, or exercise despite injury/illness/medical complication). The patient's BMI was calculated based on the height and weight measures obtained during the medical examination. If these measures were not available, patient-reported weight and height were used (collected with the EDE-16). As this study also includes children and adolescents, the WHO standards for weight-for-age and sex were used to compare the patient's BMI for diagnostic criteria. Duration of ED was defined as the difference between the patient's reported age at onset of ED symptoms (e.g., regulation in food intake, binge eating or purging behavior) and the date of the diagnostic interview.

Information from the interview was used to define the binary variables "bullying," "accident," "loss," "sexual," or "other," each of which contain TEs experienced or not by each patient. The variable "bullying" refers to all forms of bullying experienced by the patient, including being bullied by peers, juniors, older youths or adults; "accident" refers to accidents experienced by the patient, including being the victim of an accident, being a witness closely involved in an accident, or being involved in the aftermath of an accident; "loss" includes parental loss (one or both parents) as well as loss of other family members such as step-parents, grandparents, siblings or children, and of close friends; "sexual" covers a wide range of events including any unwanted sexual contact such as sexual touching, fondling, attempted rape, rape, and incest. Finally, "other" covers any TE that could not be classified under the previous categories at the time of the interview. A patient was determined to have experienced a TE if any of the above TEs was present (variable "any type of TE"). The number of different TE types experienced by each patient was recorded in the variable "number of different TEs" and classified as "None" (no TE), "One" (a single type of TE), "Two" (two different types of events), or "Three or more" (at least three TEs in three different categories). The severity of the sexual trauma and sexual traumatic events was rated independently by two of the authors (GKT and MRD) based on the accompanying text from the interview. The rating was categorized as follows: (1) Negative experiences associated with sex; (2) Sexual assault other than rape; (3) Sexual assault including rape, repeated rape, and incest. The categorizations were conducted separately (blinded) and subsequently consensus rated.

TABLE 1 | Characteristics of the study population.

	ED	AN-R	AN-BP	BN	OSFED AN-atypical	Other OSFED
Individuals	329	70 (21%)	42 (13%)	57 (17%)	69 (21%)	91 (28%)
Sex[a]						
Female	314 (95%)	66 (94%)	> 95%	> 95%	> 95%	84 (92%)
Male	15 (5%)	4 (6%)	< 5%	< 5%	< 5%	7 (8%)
Age at assessment[b]	16.9 [15.0; 19.5]	15.7 [14.4; 17.3]	18.0 [16.4; 21.9]	18.9 [16.4; 22.2]	16.8 [14.8; 19.4]	16.5 [15.0; 18.4]
Illness duration of ED[b]	1.7 [1.1; 3.3]	1.3 [0.9; 1.8]	3.1 [1.9; 5.5]	3.3 [1.7; 6.2]	1.6 [1.2; 2.8]	1.4 [1.0; 1.9]
BMI[c]	18.3 (3.6)	15.7 (1.5)	16.7 (1.3)	22.1 (3.0)	21.2 (3.5)	16.6 (2.0)
Binge eating[a]	84 (26%)	< 5%	22 (52%)	57 (100%)	< 5%	< 5%
Purging behavior[a]	246 (75%)	45 (64%)	40 (95%)	57 (100%)	48 (70%)	56 (62%)
Lanugo[a]	61 (26%)	24 (43%)	13 (39%)	5%	< 5%	20 (32%)
Peripheral cyanosis[a]	37 (15%)	18 (32%)	7 (21%)	0 (0%)	< 5%	10 (16%)

Overview of the diagnostic characteristics as well as patient characteristics of the study population. The number of patients in each specific diagnostic category as well as age at assessment (N = 329), sex (N = 329), duration of ED (N = 303), BMI (N = 318), and presence of binge eating (N = 329), purging behavior (N = 329), lanugo (N = 236), and peripheral cyanosis (N = 241) are presented. The percentages are computed based on the number of patients with non-missing information for each variable.

[a] *N (%).*

[b] *Years, median [Q1; Q3].*

[c] *Mean (sd).*

Statistical Analysis

All statistical analyses were performed in Stata14 (StataCorp, 2015). For categorical variables, the number of cases and percentages are reported, and for continuous variables the mean and standard deviation, except for highly skewed variables that are summarized using median, and first (Q1) and third (Q3) quartiles. No imputation of data was performed. Therefore, for variables where we do not have information on all patients, such as presence of lanugo, the percentage of lanugo is computed within the group of patients with available information. Chi-square tests for association or Fisher's exact tests were used to compare prevalence of TE between diagnostic groups or age groups. Continuous variables were compared between pairs of diagnostic categories using Wilcoxon rank-sum tests. The association between diagnostic category and number of different TE types was investigated using ordered logistic regression. For this analysis, the AN-R group was chosen as reference and odds ratios (OR) for the other groups compared to AN-R are reported. Results with p-values below 0.05 are considered statistically significant.

Ethical Aspects

The study was evaluated by the North Denmark Region Committee on Health Research Ethics for ethical approval. Due to the nature of the study design, no further approval was needed. The study was approved by the local Data Protection Agency (the North Denmark Region) and conducted in accordance with the Helsinki Declaration. To preserve patient privacy in general and due to the sensitive nature of the study aim, it was decided to follow the regulations set by the Danish Data Protection Agency. Thus, caution was taken for groups consisting of fewer than four patients, and data are not reported in exact numbers but rather shown as informative percentages.

RESULTS

As reported, a total of 329 patients were included in the study (95.4% females and 4.6% males). Most of the included patients were children and adolescents with 225 (68%) patients in the group aged between 10 and 17 years and 104 (32%) patients in the age group 18 or above. **Table 1** presents demographic and diagnostic characteristics of the study population divided by diagnostic categories. Median age at time of diagnosis was 16.9 years of age [15.0; 19.5] spanning between just over 11 years old and the early 30s, while median duration of illness at time of diagnosis was 1.7 years [1; 3.1], with some patients having had symptoms for a few months and others for over 20 years. In all diagnostic groups, over 90% of the patients were women. Patients with AN were younger than patients with BN ($p < 0.001$) at time of diagnosis and had had ED symptoms for a shorter duration of time ($p < 0.001$). BN and AN binge-purge were comparable, both in age at diagnosis and ED duration ($p = 0.6$ and 0.7, respectively), though BMI obviously differs. Compared to AN-R, patients with AN binge-purge were diagnosed at an older age ($p < 0.001$) and had been sick for a longer time ($p < 0.001$). Lanugo and peripheral cyanosis were mostly present in patients with AN restricting-type (AN-R) and AN binge-purge, but also in patients with other OSFED, whereas it was practically absent in patients with BN and atypical AN.

Sixty-seven per cent (95% CI [61%, 72%]) of the patients had experienced at least one TE (**Figure 2**), among which bullying was the most common (32%, 95% CI [27%, 38%]), followed by loss (24%, 95% CI [20%, 29%]) (including 5% (95% CI [3%, 8%]) parental loss), negative sexual experience/assault (19%, 95% CI [15%, 24%]), and accident(s) (11%, 95% CI [8%, 15%]). Thirty-nine per cent of the patients (95% CI [34%, 45%]) reported a TE that could not be included in any of these categories. The number and percentage of patients, divided by diagnostic ED categories,

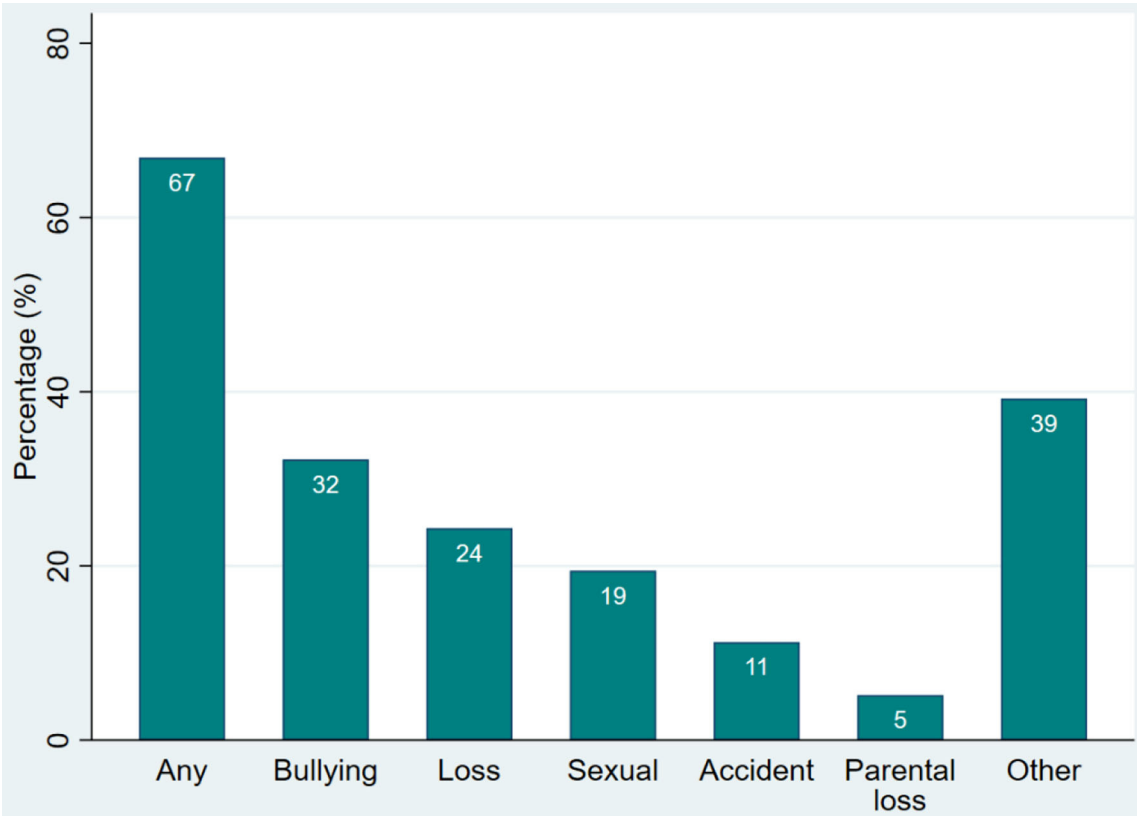

FIGURE 2 | Types of TE reported by the patients. Percentage of patients ($N = 329$) with ED who have experienced each type of TE.

TABLE 2 | Prevalence of different types of traumatic experiences by diagnostic category (number of patients and percentage per category).

	AN-R ($N = 70$)	AN-BP ($N = 42$)	BN ($N = 57$)	OSFED AN-atypical ($N = 69$)	Other OSFED ($N = 91$)	*P*-value
Any type	39 (56%)	30 (71%)	41 (72%)	47 (68%)	63 (69%)	0.3
Bullying	24 (34%)	13 (31%)	23 (40%)	20 (29%)	26 (29%)	0.6
Loss	10 (14%)	9 (21%)	19 (33%)	20 (29%)	22 (24%)	0.1
(Parental loss)	< 4%	< 4%	5 (9%)	3 (4%)	6 (7%)	0.5)
Sexual	10 (14%)	14 (33%)	14 (25%)	17 (25%)	9 (10%)	<0.01
Accident	6 (9%)	6 (14%)	5 (9%)	7 (10%)	13 (14%)	0.7
Other type of TE	18 (26%)	17 (40%)	25 (44%)	29 (42%)	40 (44%)	0.1

The number and percentage of patients, divided by diagnostic categories, who have experienced the various types of TE. P-values from chi-square tests for association between presence of each.

TABLE 3 | Total number of different TE types experienced by each patient in the whole group and per diagnostic category.

	ED ($N = 329$)	AN-R ($N = 70$)	AN-BP ($N = 42$)	BN ($N = 57$)	OSFED AN-atypical ($N = 69$)	Other OSFED ($N = 91$)
None	109 (33%)	31 (44%)	12 (29%)	16 (28%)	22 (32%)	28 (31%)
One	90 (27%)	21 (30%)	8 (19%)	13 (23%)	17 (25%)	31 (34%)
Two	80 (24%)	11 (16%)	16 (38%)	16 (28%)	17 (25%)	20 (22%)
Three or more	50 (15%)	7 (10%)	6 (14%)	12 (21%)	13 (19%)	12 (13%)

Number of different TE types experienced per patient divided by diagnostic category.

experiencing each type of TE are presented in **Table 2**. There were no statistically significant associations between diagnostic categories and the following variables: "Any TE," "Bullying," "Loss," "Accidents," "Parental loss," or "Other TE."

Table 3 presents the total number of different TE types experienced by each patient in the whole group and for each of the ED subtypes. It appeared that 109 patients (33.1%) had experienced no TE; 90 patients (27.4%) had experienced a single type of TE; 80 patients (24.3%) had experienced two different types of TEs; and 50 patients (15.2%) had experienced at least three different types of TEs. Nine (3%) patients reported experiencing more than three different types of TEs. The maximum reported number of different TEs is five, and no males reported more than three TEs. The association between the number of different TE types and the diagnostic category was statistically significant ($p = 0.049$). Specifically, the likelihood of having experienced more different TE types is significantly lower for the AN-R group than all other diagnostic subgroups except other OSFED. Indeed, the estimated OR compared to AN-R were highest for BN (OR = 2.4), followed by AN-BP (OR = 2.3), OSFED AN-atypical (OR = 2.0), and finally other OSFED

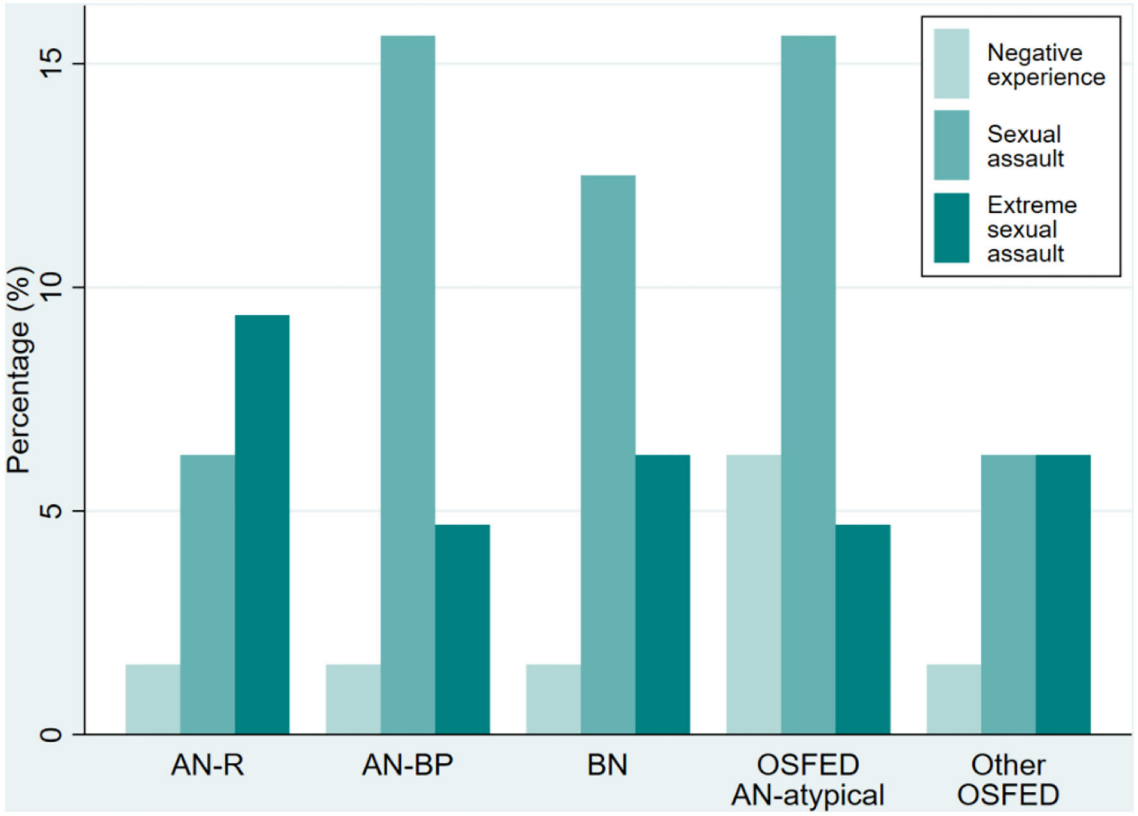

FIGURE 3 | Severity of STE by diagnostic category. Distribution of the severity of STE for each diagnostic category ($N = 329$). Note that since far from all patients reported STE, the sum of the percentages in the bars for each diagnostic category does not add up to 100%.

(OR = 1.6) (95% CIs [1.3, 4.6], [1.1, 4.6], [1.1, 3.6], and [0.9, 2.8], respectively).

Sixty-four females, corresponding to 19% (95% CI [15%, 24%]) of all patients, reported some type of STE while none of the 15 males reported STE. Among those reporting STE, the severity was distributed as follows: 13% of the patients reported a negative experience associated with sex; 57% reported having experienced a sexual assault other than rape; while 30% had experienced extreme forms of sexual assault including rape, repeated rape, and incest. The reported prevalence of sexual trauma was significantly associated with the diagnostic group ($p < 0.01$) with the lower prevalence in other OSFED (10%, 95% CI [5%, 18%]) and AN-R (14%, 95% CI [7%, 25%]) and somewhat higher in patients with AN binge-purge (33%, 95% CI [20%, 50%]), atypical AN (25%, 95% CI [15%, 36%]), and BN (25%, 95% CI [14%, 38%]), see **Table 2**.

Figure 3 displays the distribution of severity of STE by diagnostic category. Patients in the AN-R group experienced extreme sexual assault more often than any of the other ED groups, where sexual assault was the most commonly reported STE. Fifty-one of the patients suffering STE reported their age at the time the assault occurred. The median age at STE was 14 years [12; 16], with 6 (12%) patients aged 5 years or younger at the time of the STE and 7 (14%) having experienced the STE as adults.

Among the 64 patients that had experienced sexual traumatic events or sexual trauma, 35 (55%) were children/adolescents and 29 (45%) were 18 years or above. **Figure 4** presents a more detailed description of the severity of STE divided by group (children/adolescents vs. adults). As shown, the reported STE in adults was 12 percentage points higher than in children (16 vs. 28%, chi-square test, p-value for association < 0.001). A more profound difference between the two groups appeared when looking at the severity of STE; indeed, almost all of the adult-reported STEs were at least classified as sexual assault, and 48% were extreme sexual assault, compared to 17% among the STEs reported by the younger patients.

The median time between the STE and the ED diagnosis was 3.5 years [1; 8], with 12 (23%) of the patients reporting less than a year between the sexual trauma and the ED diagnosis, and 10 (19%) of the patients reporting that the STE happened more than 10 years before the diagnosis of ED. Forty-two patients reported both age at STE and age at onset of ED (see **Figure 5**). The median time elapsed between STE and onset of the ED was 0 years [−3; 2], with some patients reporting that the STE happened over 10 years before the onset of the ED while others reported that the STE happened over 5 years after the onset of the ED.

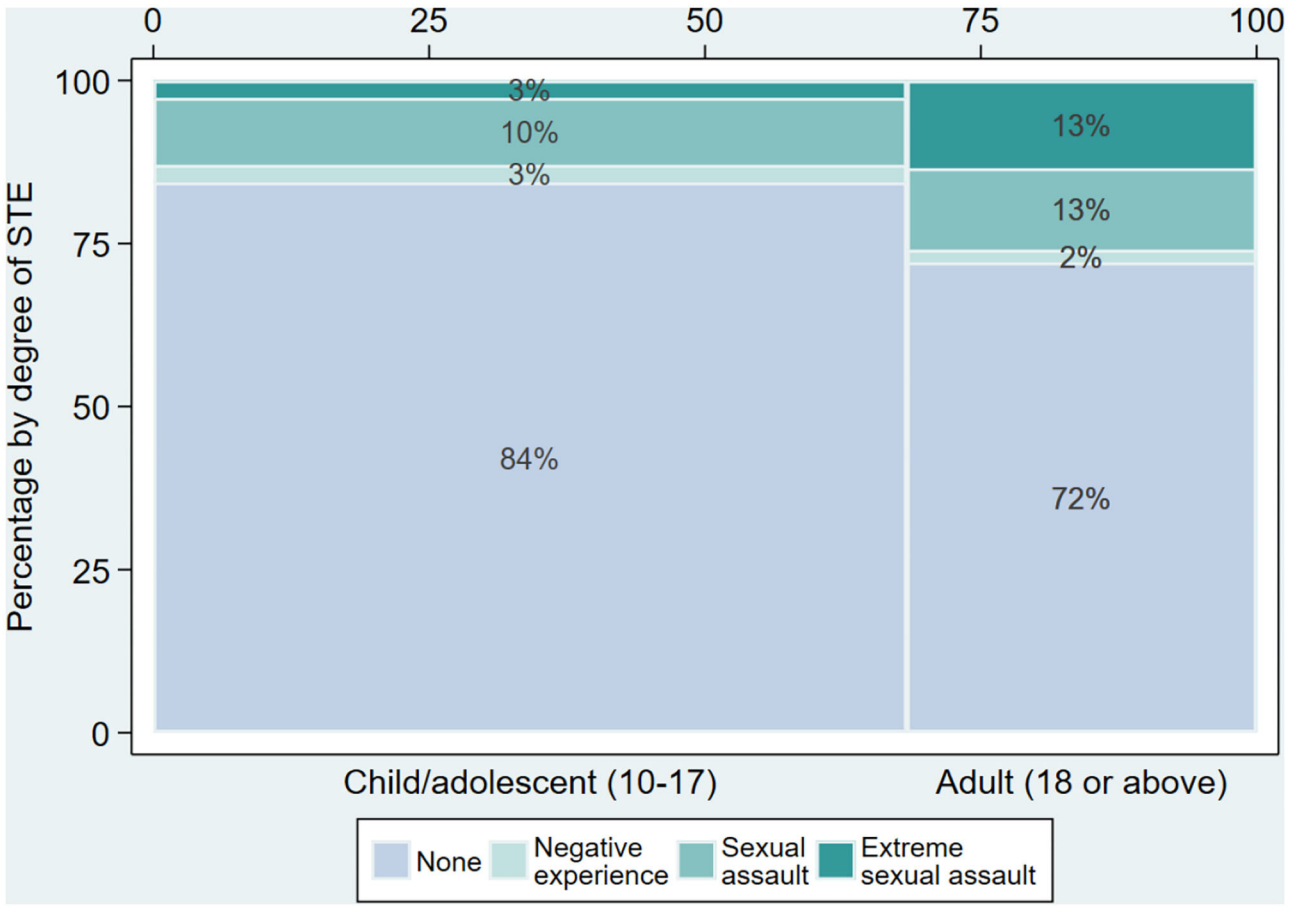

FIGURE 4 | Severity of STE for children/adolescents and adults. This figure displays the distribution of presence and severity of STE divided by age group [*N* = 329, for children/adolescents (*N* = 225) and adults (*N* = 104), respectively]. The percentages are within each age group. The thickness of the bar for each age group reflects the size of the group (see percentage bar at the top).

DISCUSSION

The aim of this study was to assess the prevalence of various sexual traumatic events including sexual trauma in a clinical sample of children, adolescents, and adults with ED at time of assessment. Three hundred and twenty-nine patients diagnosed with an ED in a specialized ED unit were included.

Sixty-seven percent (95% CI [61%, 72%]) of the patients in our sample had experienced at least one TE, which is in line with the results in a study by Mitchell et al. (2012) where the vast majority of adult women and men with ED reported a history of at least one interpersonal trauma (Mitchell et al., 2012). In a Swedish study it was found that about 20% of the ED patients had experienced a TE, and 4.5% of the total sample had been exposed to at least one additional trauma (Backholm et al., 2013), which is a much lower frequency than our findings. There may be several explanations for these differences. All patients in our sample were included regardless of age, and a significant proportion of the patients were under the age of 18, which contrasts with the study by Backholm et al. (2013) where all participants under the age of 18 were excluded. Another contributing explanation may also be the methodological differences in the data collection of the trauma history. Our sample was assessed with an interview comprising more TE options than the Swedish study as we included bullying. Further, traumatic events may have been defined differently between the two studies.

Evaluation of the percentage of patients with ED that had experienced TE and putting this percentage into perspective is, however, challenging. When comparing the prevalence of the TE loss of a parent between our ED sample and the background population from the Danish registers (data from Statistics Denmark), we found that, in the 10–19 years age group, 2.4% of the background population had suffered the loss of a parent while 5% (95% CI [3%, 8%]) of the ED population had lost at least one parent. Thus, the prevalence of parental loss was somewhat higher in the ED population than in the general population. Thirty-two per cent (95% CI [27%, 38%]) of our ED population reported that they had experienced bullying. In a report investigating bullying among Danish students aged from 9 to 15 (in the year 2009–2010) (Dansk Center for Undervisningsmiljø, 2010) it was found that 16% had experienced bullying from other students. Although we

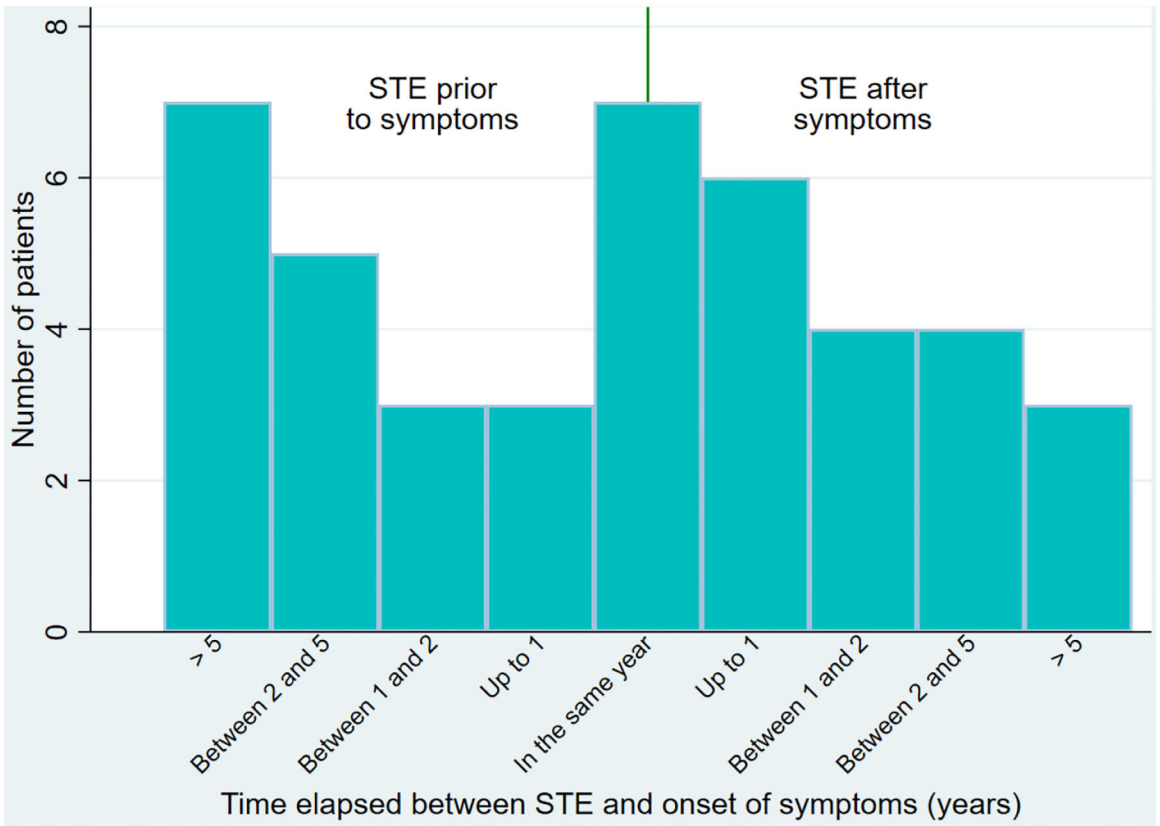

FIGURE 5 | Time elapsed between STE and symptoms of ED. Bar plot of the time elapsed between the STE and the onset of ED symptoms for patients reporting both ($N = 42$).

cannot tell whether the bullying in our ED population was prior or posterior to the ED onset, the presence of bullying is clearly much higher in our ED population than seen in the report. We should stress that our patients report bullying at any time point in their lives while the report only included recent bullying. Still, it seems as if bullying is significantly more common in the ED population than in the background population.

Sixty-four of the females, corresponding to 19% (95% CI [15%, 24%]) of the patients, had been the victim of a sexual trauma or another sexual traumatic event. Of them, 13% had been the victim of a negative experience associated with sex, 57% had experienced sexual assault other than rape, and 30% had been the victim of severe forms of sexual assault. Comparing the number of sexual assaults in the study population to the general Danish population is challenging due to the dark figures as large numbers of offenses are unreported to the police (Socialstyrelsen: https://vidensportal.dk/temaer/seksuelle-overgreb/omfang; http://web.archive.org/web/20210124083808/https://vidensportal.dk/temaer/seksuelle-overgreb/omfang). However, a Danish report from 2008 may provide insight into sexual assault and violence in children and young adolescents (https://www.sdu.dk/da/sif/rapporter/2009/unges_trivsel_aar_2008; http://web.archive.org/web/20170320155123/Http://Www.Si-Folkesundhed.Dk/Upload/Unges_trivsel_2008_samlet_1.Pdf). The report was based on questionnaires delivered to 4093 students (approximately equal number of males and females) aged 14–17. The questionnaire included questions about sexual experiences, sexual experiences with adults, sexual assault, as well as other problematic experiences. About 22% of the females and 5% of the males reported that they had been subject to some type of unwanted sexual experience or sexual violence. When asked if they felt they had been sexually assaulted, 9% of the females and 1% of the males replied affirmatively. In contrast, 19% (95% CI [15%, 24%]) of this clinical ED population reported having been subjected to a STE. It is important to keep in mind that the setting for reporting the STE differs significantly between the two data sets. While the report used self-reported screening data, the reporting on STEs in our ED population was obtained during an interview with a psychologist at the end of a longer ED interview session in the hospital ward, i.e., the patients with ED were in a setting where they may have felt it was safe to reveal or discuss traumatic sexual experiences. There seems to be a higher prevalence of STEs in our study population of patients with an ED. However, this is only applicable for the females of this study as none of the male patients with an ED reported having experienced an STE. STEs may be more prevalent in the ED population and this could easily lead to the assumption that STE is a risk factor for the development of the

ED. This would indeed be in accordance with the conclusion of a review on the relationship between ED and trauma, where it was concluded that childhood sexual abuse is a significant although non-specific risk factor for ED (Brewerton, 2007). However, as one in four of the patients who had experienced an STE in our ED sample reported having had ED symptoms before the time of the sexual trauma, the causality between the two is far from clear after all. As reported in *Results,* the prevalence of STE in adults with ED was 12 percentage points higher than in children with ED. Although this difference could be explained by time at risk, as adults have had a longer life and potentially thereby are at higher risk of being exposed to STE, the patients in the adult group reported having experienced STE at a young age. The prevalence of STE may vary depending on the severity and duration of the ED and it is therefore likely that the prevalence is higher in a subgroup of patients e.g., with severe and enduring ED.

There are both strengths and limitations to this cross-sectional study that should be mentioned. The study included a substantial number of patients assessed for an ED. Besides the sample size, another strength in the study is that all patients, regardless of age, gender and specific ED diagnoses, were included. As there is a limited number of studies of TE in children and adolescents with ED, this study does contribute with data in an area that is not well-documented but that is, nevertheless, highly relevant. However, some limitations should be mentioned. Although data relating to traumatic experiences were collected in a rigorous and uniform manner through interviews conducted by experienced clinical psychologists, this was carried out without the use of a recognized assessment instrument such as, e.g., Pennebaker and Susmans: Childhood Trauma Questionnaire (Pennebaker and Susman, 2013). The risk of recall bias when asked about traumatic experiences in the past may also be a considerable limitation for this study as well as for other studies of this topic. However, it is impossible to estimate the magnitude of this. The lack of a control group with a similar age and sex composition to our clinical sample poses a challenge when interpreting prevalence. Relevant references and publicly available data have been used to compensate for this absence. The age of the data set should be mentioned as a limitation. As the data set consists of clinical data subsequently released and approved for use in this research study there is a delay in publishing these results. As BED was not treated at the time of inclusion to the study, patients with BED could not be included.

CONCLUSION

In conclusion, the majority of patients with ED reported that they had experienced at least one traumatic life event, and about one in five reported that they had been the subject of a negative sexual experience or sexual abuse. Although most of the patients with an ED had not experienced any sexual traumatic event, sexual trauma seems to be prevalent to an extent that makes it clinically relevant to address when assessing and treating patients with an ED. The causality between having an ED and having experienced a traumatic event of a sexual nature is, however, not clear as one in four experiencing a sexual trauma in our sample reported having had ED symptoms before the time of the traumatic sexual event. While the AN-R group reported a somewhat lower prevalence of STE than AN-BP, BN, and atypical AN, they reported the highest percentage of extreme sexual trauma of all diagnostic subgroups. This could be relevant to investigate in future studies.

Increased knowledge regarding traumatic life events and any possible causality between the ED and traumatic events are relevant objects for future research.

DATA AVAILABILITY STATEMENT

The datasets presented in this article are not readily available because of the severity of the topic. We will be happy to provide raw and anonymized data if requested but no micro-data can be provided. Requests to access the datasets should be directed to Gry Kjaersdam Telléus, gdkt@rn.dk.

AUTHOR CONTRIBUTIONS

GKT has participated in all parts of the study, design of the study, data collection, data management, statistical analysis, writing, and editing of the manuscript. ML participated in the writing of the manuscript. MR-D has participated in data management, statistical analysis, writing, and editing of the manuscript. All authors contributed to the article and approved the submitted version.

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Narrative and Bodily Identity in Eating Disorders: Toward an Integrated Theoretical-Clinical Approach

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Eating disorders (EDs) can be viewed as "embodied acts" that help to cope with internal and external demands that are perceived as overwhelming. The maintenance of EDs affects the entire identity of the person; the lack of a defined; or valid sense of self is expressed in terms of both physical body and personal identity. According to attachment theory, primary relationships characterized by insecurity, traumatic experiences, poor mirroring, and emotional attunement lead to the development of dysfunctional regulatory strategies. Although the literature shows an association between attachment style or states of mind, trauma, behavioral strategies, and various EDs, the debate is still ongoing and the results are still conflicting. Therefore, we believe it is important to examine and treat EDs by understanding which narrative trajectory intercepts distress in relation to narrative and embodied self-concept. Drawing on clinical observation and a narrative review of the literature, we focus on the construction and organization of bodily and narrative identity. Because bodily representations are the primary tools for generating meaning, organizing experience, and shaping social identity from the earliest stages of life, we focus on the role that bodily interactions and sensorimotor and proprioceptive patterns have played in the development of EDs. We consider the role that lack of attunement, insecure attachment, and relational trauma play in mentalizing, affecting self-representation and emotion regulation strategies. The paper also considers a semantic mode of trauma in EDs that involves a top-down pathway through beliefs and narratives about oneself based on lack of amiability, on devaluation, and on humiliation memories. Finally, we would like to highlight the proposal of an integrated model with multiple access model to psychotherapy that takes into account the complexity of ED patients in whom aspects related to dysregulation, body image disintegration, and post-traumatic symptoms are associated with a suffering sense of self and a retraumatizing narrative.

Keywords: eating disorders, attachment, identity, somatic memory, narrative memory

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INTRODUCTION

Anorexia nervosa (AN), bulimia nervosa (BN), binge eating disorder (BED), and other eating disorders (EDs) are characterized by poor awareness and emotional regulation in the form of "embodied acts" used to cope with internal and external demands that are perceived as overwhelming and stressful (Cook-Cottone, 2006; Verschueren et al., 2021). In some cases, self-assessment is dependent on body shape and weight, leading to persistent dissatisfaction and concerns about one's worth and body image. The comparison between one's own body and the bodies of others, and the obsessive search for imperfections that need to be corrected in order to achieve unrealistic standards, increases the discrepancy between the real body and the ideal body in a vicious cycle, thus increasing dissatisfaction. In other patients with ED, over-control of the body is functional for coping with anxiety or post-traumatic symptoms, independent of problems related to bodily dissatisfaction.

The maintenance of EDs involves the entire identity of the person; the lack of a definite; or valid sense of self is expressed in terms of both physical body and personal identity. In fact, many unhealthy eating behaviors are functional to maintaining the sense of self and a coherence of the patient's belief system, to feeling special or to perceiving control and protection. Instead of evaluating themselves and building their own identity on the basis of different domains of life, people evaluate themselves mainly on the basis of the control they are able to exercise over their body and nutrition.

The individual builds his or her own bodily self during the pre-linguistic stage, in early interactions with the caregiver, and in the progressive differentiation between self and other through the encoding of sensory stimuli. Given the close relationship between somatosensory processing and the formation of the self-concept demonstrated in studies of embodied cognition (Meteyard et al., 2012) and in recent neuroimaging studies (Ronga et al., 2021), the purpose of this article is to examine the relationship between somatic and narrative memory from the perspective of identity construction early in life. Since bodily representations are the main tools for the generation of meaning, the organization of experiences, and the shaping of social identity, the first part of the article discusses the connection between somatic memory, narrative memory, identity construction, and eating disorders. In particular, we investigate the role of the first bodily interactions and the formation of sensorimotor and proprioceptive patterns in the development of EDs. The acquisition of language and of a more articulated ability to represent reality allow the individual to develop a narrative self that, as in individuals with an ED, often expresses the sufferance on some critical themes, such as a sense of low personal value and a lack of amiability (Veglia and Di Fini, 2017), accompanied by the feeling of never being adequate in relationships (and up to chronic shame). Thus, it is important to also consider the narrative function of the body and the relationship to one's body boundaries when examining EDs.

Given the role of early attachment relationships in the development of EDs, and based on an ongoing debate about the prevalence of attachment styles and states in individuals with ED, the second part of the article focuses on the dynamics communicated through the body and/or the eating behaviors in ED. The reflection we describe draws its main ideas from clinical observations, clinical practice, and the study of the theoretical and empirical literature. Specifically, we propose a possible functional model that considers the impact of early relational trauma on hetero-regulation and self-regulation skills and strategies, changing strategies for maintaining attachment relationships, and the parallel unfolding of EDs, even as they transition from one set of symptoms to another over time. In line with many studies (Palmisano et al., 2016; Pignatelli et al., 2017; Monteleone et al., 2020) the focus is also on the possible links between adverse childhood experiences and the development of EDs. Indeed, according to attachment theory (Bowlby, 1973), primary relationships characterized by insecurity, poor mirroring, and poor emotional attunement (Tronick, 1989) favor the development of dysfunctional regulatory strategies, which in turn may be a risk factor for ED development.

The literature has highlighted the high incidence of negative and traumatic experiences in the histories of people with EDs (Tasca et al., 2013) and reported a prevalence of emotional neglect (Pignatelli et al., 2017) that does not allow for optimal development of the ability to read and differentiate one's emotional states or integrate them with physical states. Thus, they remain separate and no longer represent a source of self-awareness. Given the role of early relational trauma as a vulnerability factor in the development of ED, as well as the fundamental importance of semantic self-representation in the maintenance of these disorders, the third section of the article proposes a typology of traumatization that incorporates a top-down approach involving the role of semantic and narrative memory in the formation of negative self-representations and beliefs. This part then moves the reflection on the level of the main intrapersonal dynamics that are communicated through the ED.

In terms of clinical implications, the fourth part of the article aims to highlight the proposal of an integrated model with multiple approaches to psychotherapy (Veglia et al., 2019) that takes into account the complexity of the patient with ED, his particular way of attributing meaning and his preferred ways (procedural, verbal-declarative, or affective-relational) of processing the experiences.

CONNECTION BETWEEN SOMATIC MEMORY, NARRATIVE MEMORY, IDENTITY CONSTRUCTION, AND EATING DISORDERS

The socio-emotional ontogenesis of the child develops in close relation to the maturation of its sensory systems. In particular, the first year of life is studded with somatosensory experiences that play an essential role in emotional and social development (Wright, 1991). Sensory channels, such as the visual pathway, function as an interpersonal communication channel that allows

for the transmission of reciprocal influences (Schore and Schore, 2008). The interaction between the child and his caregiver develops as a kind of speechless dialog (Spitz, 1958), characterized by mutual affective mirroring modulated by a continuous synchronization of affects in which the two members of the dyad engage each other through the coordination of affective responses.

It has been observed that the child looks away after a visual interaction characterized by a high affective level. This indicates the need to regulate the potentially disorganizing effect of an overly intense emotion, such as a look of joy or anger (Fogel, 1982). If the caregiver is well adjusted, he or she can understand what is happening and allows the child the necessary space to self-regulate by withdrawing and waiting for the signals that indicate the child's readiness for new involvement. Mirroring is characterized by interactions with continuous regulatory mechanisms (autonomous and relational); thus, emotional regulation develops within this synchronized mode of interaction (Schore and Schore, 2008).

The moments of mirroring trigger changes in the mental states of both the mother and the infant and, in the case of attunement, allow for the re-establishment of a mutually regulating activation system (Beebe and Lachmann, 1988). Therefore, attachment relationships characterized by intrusiveness or lack of affective involvement on the part of the caregiver impede the development of affect regulation skills. In the pre-linguistic stage, the child learns to recognize the boundary between self and other through information from the senses and the distinction between self-produced stimuli and those that come from outside (Blanke, 2012). This is made possible by a mechanism that provides for the attenuation of cortical sensory processing (Bays et al., 2006), by which the perception of self-produced stimuli is suppressed. Namely, the brain must predict the sensory feedback of its actions in order to suppress their perception and distinguish them from the perception of external stimuli. This mechanism has also been shown to affect the tactile domain (Boehme et al., 2019): the distinction between externally and self-generated touch forms the basis for the establishment of social bonds. Indeed, touch by others is associated with the activation of areas involved in social cognition, such as the insular cortex and the posterior superior temporal sulcus (Gordon et al., 2013), and it is processed differently depending on whether it is a light touch or a touch that signals affective content (for example, a caress). The latter contributes to the construction of the bodily self. Therefore, the link between somatosensory processing and the formation of the self-concept is evident (Boehme et al., 2019).

The ability to recognize one's own body and its boundaries as an entity distinct from the environment seems to develop within a few hours of birth (Ronga et al., 2021): by distinguishing whether an auditory or tactile stimulus comes from near or far from one's own body, the infant is able to develop defensive behaviors and relational mechanisms. Thus, it appears that newborns are already able to make multisensory responses by distinguishing body-related stimuli from stimuli from the environment and that this ability is modulated by the proximity of these stimuli to the body. The near-body space would be represented from the earliest stages of life, predisposing individuals to direct their actions toward a goal, interact with people, respond to threats, and build a coherent bodily representation of themselves (Ronga et al., 2021).

From these recent scientific acquisitions, it is even more evident how physical proximity and social interaction through contact in early attachment relationships, long before the development of language, play a fundamental role in the construction of the self. In fact, in the early stages of development, the search for proximity and the "exchange of safety signals" depends on the movements of the body regulated by the most primitive neural pathways. However, for the sake of completeness, the influence of the individual's innate/inherited characteristics on hyperreactivity or over-control dynamics must also be considered. In fact, there is considerable evidence that anxious features, emotional dysregulation and impulsivity associated to alterations of reward system also occur in ED (Harrison et al., 2010; Wierenga et al., 2014).

The authors of this article hypothesize that, from the first exchanges between caregiver and newborn already, as well as from the first action patterns and physical contacts, a basis can be created for a functioning that will lead to the development of an ED. We can think that an intrusive and controlling caregiver will use a different touch than a caregiver tuned to the needs of the child, repeatedly invading their proximity space, creating confusion in the coding of signals coming from near and far and compromising the child's ability to differentiate themselves from the other. If already in the first hours of life, the child is able to distinguish an affective touch from an accidental or non-affective touch, early interactions based on a contact aimed at almost exclusively accentuating the material care of the body could contribute to the construction of a bodily self-representation based on exteriority and esthetics above all as sources of one's personal value. During development, the body becomes the place where the individual realizes and manifests a personal failure or success. Moreover, the caregiver's obsessive attention to the child's body image through the evaluation of shape, weight, size, and musculature can disrupt these processes of delineation between self and others and lead to an overdifferentiation of one's body, which even becomes an object that can be manipulated. Legrand and Briend (2015) emphasize that in anorexia and the associated manipulation of eating behavior, the transformation of the body is functional to influence relationships with others in order to gain recognition. In this case, the person seeks autonomy but also the recognition of others by showing hunger for the other, not for who the other is as such.

As the theory of embodied cognition (Meteyard et al., 2012) explains, there is indeed a functional unity between the sensory-motor level and the cognitive/perceptual processes. Information processing may be influenced by, modified by, or completely dependent on bodily experiences. In EDs, the person's behaviors tending to focus on the external features of the body (such as height, weight, and muscles) become tools to communicate the internal state as well as the difficulties in the interactions with the environment.

Since body representations in the early stages of life are the most important tools for generating meaning, organizing experiences, and shaping social identity, we can ask what role bodily interactions and the formation of sensorimotor and proprioceptive patterns play in the development of EDs. Bonev and Matanova (2021) highlight how the lack of attunement and traumatic experiences later affect the ability to think symbolically. The reduction in the ability to know and see oneself as an independent agent can lead to the use of the body to express what cannot be represented.

According to some authors, EDs can be considered as the result of damage to the ability to update a negative representation of the body contained in autobiographical memory with sensorimotor data and current proprioceptive data (Riva, 2014; Fuchs, 2021). According to this view, in patients with ED the representation of the body ("objectified body" or "body-as-object") could be blocked, unable to contrast with egocentric representations and proprioceptive information. In anorexia, the emphasis on the sole dimension of the body-as-object, the body-for-others, to the detriment of the body-as-subject (in the awareness of the physical and emotional sensations experienced), leads to a reification of one's individuality with the consequent search for control and self-observation over the external image (Fuchs, 2021). The shame experiences present in autobiographical memory would influence beliefs about oneself and body image, causing a distortion of attention to one's body. The shame experiences are recalled from the perspective of an external observer, which is associated with an inhibition of insula activity and real-time processing of body experiences. Blocking an allocentric perspective of self and body and reducing the perspective of the embodied self may contribute to a lack of awareness of interoceptive cues (Riva, 2014).

Such non-integrated body states are perceived as a source of dissatisfaction and no longer represent a source of awareness of self. In the typical binge eating episodes of BED and BN, poor monitoring of mental states and a confused understanding of the body's signals leads to feelings of anxiety, shame, emptiness, and helplessness being misperceived as signals of hunger. On the other hand, a "false caress" exerted by a frightened/anxious caregiver is configured in a "neuroperception" that generates alarm and does not allow to deactivate the defense system in safe conditions or, on the contrary, to activate a defensive behavior in dangerous situations (Porges, 2011).

The repetitive patterns of interaction between caregiver and child, remembered through implicit and procedural memories, influence the formation of memories, and the development of representational processes; the narrative processes, emerging during the first years of life, help to give these representations a sense of continuity over time and to create generalizations, mental models of relationships and basic cognitive structures with which to interact with others (Siegel, 1999). High levels of affective attunement, maternal sensitivity, and responsiveness allow the child, from birth, both to maintain an optimal balance between closeness and exploration behaviors and to profit from mirroring games and conversations in order to formulate inferences about states their own and other people's mentalities as well as to attribute meanings to the resulting behaviors (Legerstee, 2005).

Thanks to the acquisition of a more articulated language and a more mature ability to represent reality, the child develops a self that integrates memories at a still semantic level; then, the narrative self emerges, through which the child is able to organize past and future experiences into a unitary life story. Specific episodes and social representations of one's own culture are then integrated (Nelson and Fivush, 2004).

The explicit processes of memory play an important role in contextualizing experiences in time and space; the use of language in communication patterns shapes one's conscious experience of oneself and the way one relates to others. This helps to determine the "Life themes" in the narratives (Di Fini et al., 2013; Veglia, 2013; Veglia and Di Fini, 2017; Di Fini and Veglia, 2019) around which the elements of implicit memory are integrated. This extends to the creation of narrative processes that allow us to imagine and recall experiences in the form of stories, creating a narrative memory (Siegel, 2014). By considering the connection between somatic memory and narrative memory as a site of identity construction, we can propose a reflection on the construction of the self by people with ED, in light of the narrative function of the body and how it relates to their own bodily boundaries. Food interactions are one such area of a person's daily life that renegotiates body image and thus influences body boundaries. Thus, food can constitute one of the communication channels of attachment relationships within food interactions (Johnson and Connors, 1987). Non-verbal exchange and interaction leave neurophysiological and representational traces that will serve as a model, organizing the child's subsequent experiences (Siegel, 2001).

ATTACHMENT AND EATING DISORDERS: FROM CONTROLLING OTHERS TO SELF-REGULATION

Studies that have examined the relationship between attachment relationships and EDs are numerous and do not always agree in their findings. Empirical studies report a high prevalence of attachment insecurity in samples with EDs, between 70 and 100% (Ramacciotti et al., 2001; Ringer and Crittenden, 2007; Lunn et al., 2012), compared to control groups, both by self-report and by the Adult Attachment Interview (AAI; George et al., 1996; Kuipers and Bekker, 2012; Caglar-Nazali et al., 2014). In several studies of patients diagnosed with AN, BN, and BED, a higher incidence of an avoidant attachment style compared to an anxious one was found (Ramacciotti et al., 2001; Latzer et al., 2002; Barone and Guiducci, 2009). However, there are not many studies that have investigated this prevalence by comparing the different attachment styles or states of mind (SoMs), and the results seem to be contradictory. While some authors report a prevalence of a dismissing SoM, others report a prevalence of a preoccupied SoM, especially when the disorder is accompanied by depression (DeKlyen and Greenberg, 2016). Candelori and Ciocca (1998)

found a prevalence of dismissing SoMs in patients with restrictive AN (58%), whereas preoccupied SoM were prevalent in patients with purging AN (50%) and BN (67%), indicating a relationship between dismissive attachment and food restriction versus food elimination and preoccupied attachment. However, the findings of Zachrisson and Kulbotten (2006) and Ward et al. (2001) did not show a specific relationship between the type of anorexia (restrictive vs. laxative) and SoMs. Instead, other authors found a prevalence of a preoccupied SoM (40%) in people diagnosed with AN, whereas in those diagnosed with BN (50%) and BED (70%) the predominant SoM was dismissing (Barone and Guiducci, 2009). Numerous studies have also highlighted the presence of a high incidence of negative and traumatic experiences with unresolved and unsafe SoM in the samples with EDs, underlining that early relational trauma is also a predictor in these psychopathological disorders (Fonagy et al., 1996; Ward et al., 2001; Ringer and Crittenden, 2007; Tasca et al., 2013).

Currently, research does not allow us to take a definitive position, and there is disagreement about the relative prevalence of each attachment style in the ED population (Tasca and Balfour, 2014), as well as the relationship between attachment style and specific ED diagnosis (Kuipers and Bekker, 2012; Tasca, 2019). Therefore, attachment insecurity appears to be a transdiagnostic risk factor that increases vulnerability to ED onset, but only partially explains it. In contrast, other, more specific factors would influence the specific nature of EDs (Kuipers and Bekker, 2012; Tasca, 2019). The change of these factors or the influence of negative, traumatic or relational experiences could lead to a switch between different diagnostic triggers (Rø et al., 2005; Vrabel et al., 2008).

Several authors have also sought to understand the role that attachment insecurity plays in the development and maintenance of EDs. It is well known that effective attunement by the attachment figure does not always occur, leading to crises or "breaks" in attachment. In secure attachment relationships, after the lack of attunement with the child, the parent is able to regulate the child's affective state in a psychobiologically attuned manner, focusing not only on the child's manifest behaviors but also on the child's internal states (Tronick, 1989; Beebe and Lachmann, 1994; Schore, 1994). In order to perform her own regulatory function and mirror the child's affective state, the caregiver monitors herself, separates herself from the child, and self-regulates by managing this tension so as not to be overwhelmed by it (Krystal, 1978; Fonagy et al., 1996). The parent supports the child in enduring the strongest emotional tensions by intervening just enough to comfort the child and thus modulate communication so that the emotions do not become unbearable and unmanageable. Thus, in the first stage of life, the experience of disturbing affect is externally regulated by an attachment figure who is attuned to and involved in a mechanism of reciprocal emotional communication (Stern, 1985; Beebe and Lachmann, 1988).

A parent who is able to reflect on the child's mental life, see the mind beyond behavior and respect the existence of their own internal subjective world is fundamental to the development of secure attachment (Slade et al., 2005). Within the attachment relationship, the infant's immature brain manages to coordinate its activities through the brain processes of the parent (Hofer, 2006). The ability to connect and relate to others is therefore crucial for the maturation of those neural circuits that mediate the capacity for self-regulation, mentalizing, and reflective functioning (Schore, 2001). Fonagy and Target (2001) use the concept of reflexive function to refer to the mother's mental capacity to think and mentally represent her child's mental states, to attach subjective and intersubjective meanings to them, and to enable them to internalize this function, which is useful for reading their internal experience. When the mother acknowledges the child's mental states, the child recognizes that she has the ability to influence reality herself and develops a sense of agency.

As Tronick et al. (1998) points out, isolated moments of nonattunement in the dyadic relationship are normal and do not in themselves have a negative impact on development as long as the individual can still experience repair and attunement. However, when frequent moments of resonance and affective attunement are absent during the first 3 years of a child's life, we may observe diminished development of emotional regulatory functions and impaired *reflective functioning* (Fonagy and Target, 2001). In these cases, the child's intentionality tends not to be reflected by the caregiver, leading to difficulties in the maturation of the right hemisphere areas involved in affect regulation. It is likely that high levels of arousal, prolonged, and unregulated, contribute to inhibiting the functioning of the frontal areas of the brain that normally underlie mentalization (Phelps and LeDoux, 2005). The chaotic and destabilizing emotional activation, combined with the loss of hope that one will receive reassurance and co-regulation from the other, results in the continuity of the self being undermined (Bromberg, 1998), with the result that metacognitive skills, such as mentalizing and emotion regulation break down.

In reports of parenting styles of people with EDs, fathers are most often described as dismissive and emotionally unavailable, while mothers often seem to be perfectionistic, controlling, intrusive, or overprotective. Parents tend to inhibit behaviors aimed at their children's autonomy and independence, resulting in the gradual development of feelings of rejection and inadequacy (Cole-Detke and Kobak, 1996). Often in the reconstruction of the history of patients with EDs, through episodes reported by caregivers or by the patients themselves, it is observed how the family context of growth was characterized by situations of confusion or ambiguity. In these contexts, food can be used as an instrument of regulation and comfort. For example, a worried and anxious caregiver, activated by their baby's crying, can use food to reduce their alarm. A caregiver who is not tuned with emotionality may interpret crying as a signal of a material and practical need of nourishment for hunger, thus not reflecting the emotional dysregulation underlying that signal, but diminishing it. From many narratives of obese patients or patients with a BED, memories related to the care and comfort offered by alternative attachment figures in accompaniment to or through food emerge. In these cases, the patients' narrative memory about safety, emotional regulation, and loving kindness seems to be associated with the somatic memory of comfort through a special food. However, the

perpetration of an uncontrolled mode of eating would seem to be connected to the lack of an emotional awareness about the meaning of that gesture and its compulsive search or to the underlying need for comfort and kindness (Verschueren et al., 2021).

In these scenarios, communication is strongly connected to the feeding. In the lack of attunement, the opportunity for the child to acquire the ability to recognize, disambiguate, and differentiate the connotation of their own needs, necessities, and discomforts underlying a moment of activation, such as crying, is lost. In addition, the constant violation of personal boundaries, common in ED families, by intrusive parents who tend not to delineate and substitute for their child, leads them to be confused about themselves, others, and self-definition (Selvini Palazzoli, 1988). These repeated failures are the basis for attachment insecurity and the resulting lack of emotion regulation (Liotti, 2001). In many cases, this insecurity takes the form of alexithymia, characterized by poor emotional awareness, with an inability to recognize the arousing effect on somatic elements and an operative cognitive style, a condition that often underlies the development of psychopathological situations with somatic implications (Taylor et al., 2006b). Alexithymia appears to play a mediating role between the presence of attachment insecurity and body dissatisfaction (Keating et al., 2013). The latter is an important factor in predisposing to EDs (Troisi et al., 2006; Abbate-Daga et al., 2010). It has also been associated with two aspects commonly found in patients with AN and BN, namely, the need for approval and the fear of rejection, both of which are relevant factors in attachment anxiety. Greater attachment anxiety is associated with greater symptom severity and poorer therapeutic outcomes (Illing et al., 2010), and it appears that it is emotional dysregulation that mediates the impact on ED symptoms.

These studies support the perspective that attachment insecurity, along with a lack of emotional regulation skills, plays a role in the development of and resistance to change in EDs. When the experiences of emotional neglect occur in the relationship with the caregiver, mental closeness becomes painful and the natural need for closeness tends to be expressed at the physical level, for example, through excessive attention to body-oriented material care and feeding. Indeed, there is a high prevalence of neglect, particularly emotional neglect, in the lived experience of people with ED compared to the general population (Pignatelli et al., 2017). Emotional neglect, included among the Adverse Childhood Experiences (ACE, Felitti et al., 1998; Van der Kolk, 2014), affects the physical unhappiness (Grenon et al., 2016) of people with ED, where emotions can be read and expressed primarily through the body, while mental abilities are impaired, which does not allow for adequate mental representational capacity. The inability to think through representations that may contain an experience means that they are experienced as concrete and tangible facts through the body (Skårderud, 2007). In EDs, symptoms are concrete (Buhl, 2002), physical, and described by body image, shape, and weight. The body triggers emotional experiences, just as actions trigger physical sensations; therefore, abstract meanings are absent in favor of concrete experience (Skårderud, 2007). This process can be explained by a deficient reflective function leading to immature functioning, such as "mental equivalence," where mental states are perceived as extracts of objective reality (which is certainly true) rather than mental representations (Bateman and Fonagy, 2004), indicating weakened development of symbolic ability (Enckell, 2002).

Research that has looked at mentalization has confirmed that people with EDs lack this competence (Kuipers and Bekker, 2012) and has found that this is a specific factor in the diagnosis of certain EDs, particularly AN (Fonagy et al., 1996; Rothschild-Yakar et al., 2010). At the same time, inadequately controlled affective regulation has been shown to be associated with eliminative eating behaviors (Candelori and Ciocca, 1998) and overly controlled with restrictive eating behaviors (Stice and Fairburn, 2003).

In addition to early attachment relationships and the development of emotion regulation skills, consideration must also be given to the role of personality and innate/inherited traits for which ED is a way of reenacting or communicating these issues. In fact, also considering personality traits allows for a better understanding of the heterogeneity of symptom profiles, the strong or critical points for treatment adherence, and the different treatment prognoses (Farstad et al., 2016). In patients with borderline personality traits, emotional dysregulation was found to be a negative predictor of treatment outcomes (Muzi et al., 2021). In addition to emotional dysregulation, impulsivity also plays an important role in patients with ED, especially in those with BED and BN. It contributes to greater levels of psychiatric and eating disorder symptoms (Favaro et al., 2004) and greater symptom residuals at the end of treatment (Martinez and Craighead, 2015). Other important personality traits in ED phenomenology include perfectionism and obsessive–compulsive traits. The former is associated with a longer clinical course of suffering, while high levels of obsessions about food, weight, and body shape are associated with higher severity of disordered eating behaviors and prognosis. Avoidance of experiences, characterized by aversion to internal states, is also prominent in patients diagnosed with eating disorders. In this case, eating symptoms would allow them to cope with the negative or too intense affects they are trying to avoid (Martinez and Craighead, 2015).

Another characteristic feature of EDs, and in particular of AN, is cognitive rigidity, which is important for the development and maintenance of the disorder (Tenconi et al., 2010).

Years of clinical observations in the field of ED have led the authors of this article to note a particular phenomenon in patients with ED and a history marked by adverse childhood experiences, which is simultaneously associated with regulatory strategies and symptoms. As found in the literature (Fairburn and Harrison, 2003), a change in ED symptomatology or a transition from one dysfunctional eating behavior to another was noted in many cases during the course of treatment. At the same time, a shift from one emotional regulation strategy to another was observed over time. In order to try to provide an explanation for these phenomena observed in clinical practice, the authors propose an explanation of the possible mechanism that takes into account the effects of traumatization, the changes

in behavioral strategies, and the transition to different dysfunctional behaviors of eating and EDs. The mechanism schematized in **Figure 1** considers cases of ED, in which the process of traumatization combined with a disorganized attachment following adverse relational experiences may have played a role in the development and maintenance of symptoms.

Starting from developmental trauma (for example, due to repeated experiences of emotional neglect in childhood, common in the narratives of patients with EDs; Pignatelli et al., 2017) and the resulting disorganization of the internal working model (IWM), the attachment system seems to reorganize around the sixth year of life. Strategies defined as "controlling" are developed (Lyons-Ruth and Jacobvitz, 1999; Liotti, 2004), which, in order to maintain closeness to the caregiver, activate the rank motivational system (punitive-dominant strategy) or the caregiving strategy instead of the attachment system. Furthermore, following the theories of Crittenden (1992), the authors of this article hypothesize that in EDs, the attachment style reconfigures and reorganizes itself in an insecure style with anxious-ambivalent or mixed tendencies, belonging to the A/C defended/coercive classification. This reorganization would include a relational modality that implies the control of the other and the management of power over the other, typical of the relational exchanges of EDs, in particular AN. Symptomatology gives the individual power and control over others since, thanks to this, the relational balance of the family is modified (Selvini Palazzoli, 1988). At a semantic and narrative level, power is a central theme in families whose members have EDs (Bruch, 1973; Castiglioni et al., 2013; Ugazio, 2013). The central emotions are those of pride if superiority is recognized to the conversational partner, and shame if, on the other hand, a defeat is perceived (Ugazio, 2013). The polarities on which these people move are winner-loser and strong-will surrender, which is subordinate to the former for a means-ends relationship, as the person is a winner if they are also strong-willed and is a loser if they are passive (Ugazio, 2013).

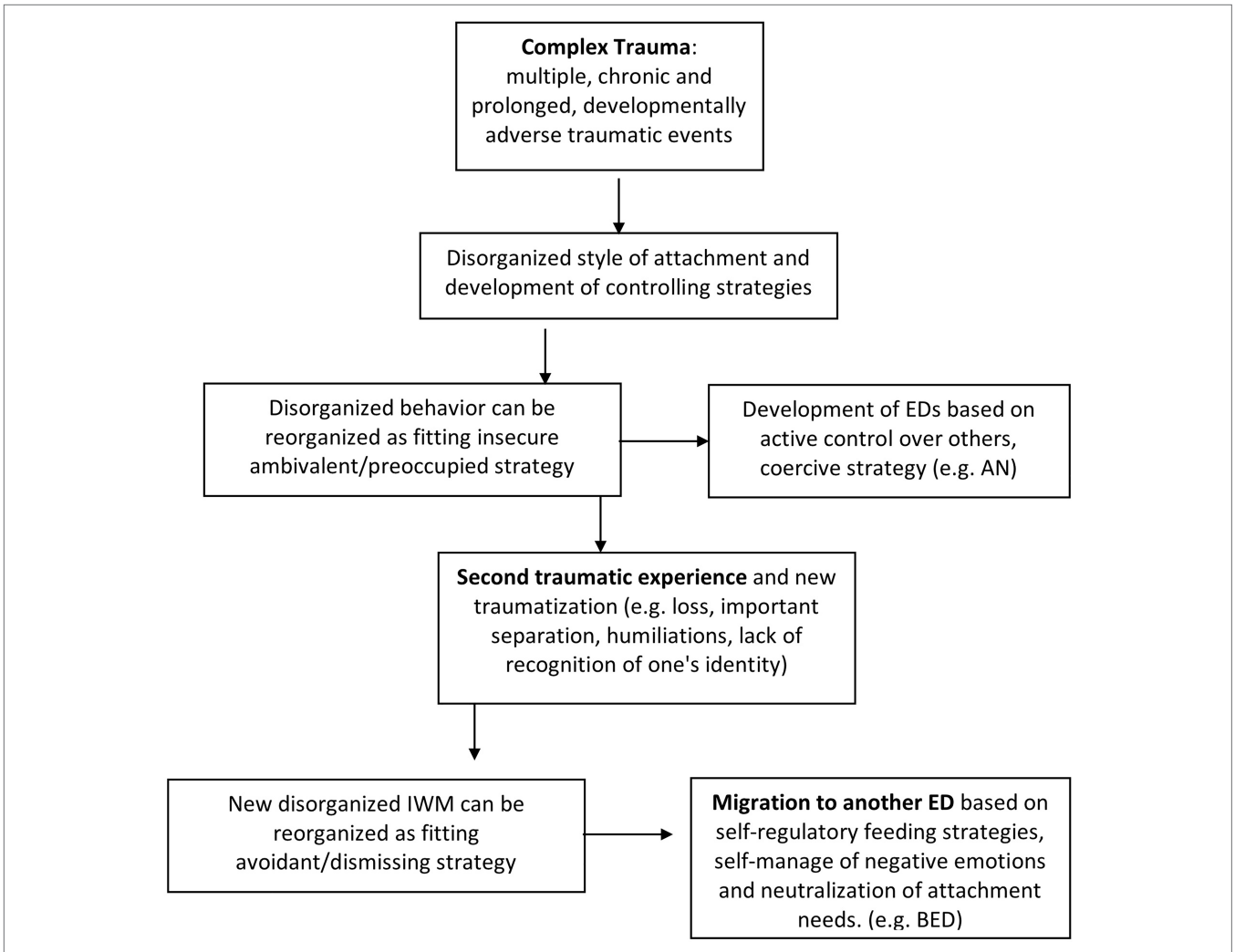

FIGURE 1 | The diagram summarizes the proposed hypotheses about the transition from one set of symptoms to another in the histories characterized by complex trauma, taking into account the effects of traumatization and the consequent reorganization of attachment and regulation strategies.

The content of this semantics is purely relational as the people who use it can define themselves as winners or losers only with respect to others. Perceiving oneself as a winner or a loser is not individual, but is only allowed in a relationship, after a comparison based on rank differences (Ugazio, 2013).

At the same time, the anxious-ambivalent attachment style in the caregiver is accompanied by a poor capacity for self-regulation in the eating behaviors of the child; this regulation seems to be mediated by a controlling and persuasive attitude by the caregiver. Practices linked to a restriction of certain foods, bans, and punishments or positive reinforcements through particular foods would lead the child to no longer respond to their own sense of hunger or satiety, but rather to react to the pressing requests of the caregiver in exchange for approval and comfort. The relationship with an inconstant, unpredictable and intrusive caregiver in their care behaviors leads the child to develop an unreliable sense of self in decoding internal states, with a consequent sense of personal vagueness and indefiniteness (Guidano, 1988; Anderson et al., 2012; De Campora et al., 2016). With adolescence, the food symptom signals troubles through the transformations of the body which, in an ambivalent way, requires attention and care on the one hand and rejects them on the other.

However, it is interesting to note that in clinical work the transition over time toward an avoidant-type style underlying EDs is increasingly observed. If the ambivalent attachment style involves the need to stay in a relationship by hyperactivating the attachment system, the avoidant style allows one to avoid the relationship that has not been regulative and to aim for self-regulation (Schore, 2003). A strategy based on "do-it-yourself," autonomy, and relational withdrawal as a way of regulating affect, rather than hetero-regulation (in which the individual uses others to regulate him- or herself) or co-regulation, is associated with some parent feeding styles (Hughes et al., 2011; De Campora et al., 2016).

The migration from a set of symptoms to another one could be explained by the arrival, at a certain point of life, of a second traumatizing factor (for example, a bereavement, a significant separation or the disavowal, and humiliation of one's identity by others). This would imply a new phase of disorganization of the system and a new fluidity of the IWM which would be followed by a second reorganization. In fact, the research reports how, in response to some vulnerability factors and particularly stressful life events, the SoM can change (security levels are subject to fluctuation; Mikulincer and Shaver, 2016). This phenomenon appears to be more likely for individuals who have had early traumatic experiences and who have developed more unstable and nuanced models of self and others (Davila and Cobb, 2003). The authors of this article therefore hypothesize that, in correspondence with a new opportunity for reorganization, the system may migrate toward an avoidant style and toward the development of a self-regulatory feeding strategy. This is in line with the promotion of deactivating and distancing strategies for managing distress (Powell et al., 2017). Where the controlling strategy collapsed, for example, a strategy of a punitive type, it would move to a strategy based on self-control, accompanied by a social withdrawal and a mode of nutrition aimed at self-consolation (typical of BED and obesity). Having been humiliated, or thinking oneself capable of being humiliated, leads to experiencing shame as a predominant emotion in the EDs. During binges, the sufferer tries to regulate the feeling of shame, but it is exacerbated by the binge itself and the inability to control one's eating. Sometimes the disorder then withdraws itself so as not to be disturbed in its self-regulation, rather than seeking it out, while neutralizing attachment needs.

By withdrawing and using avoidance strategies to reduce criticism from others, there are fewer opportunities to have sufficient communicative exchanges with the other, thus also reducing the possibility of reparative and corrective experiences. In adolescence, even with peers, inadequate interaction and a modality based on forced autonomy and withdrawal leads to the individual not developing the measure of their own acceptability/non-acceptability. Therefore, avoidance feeds the feeling of social inadequacy in a dysfunctional interpersonal circle (Carcione et al., 2016). According to the theoretical framework of attachment (Bowlby, 1973), the experience of inadequacy and the sense of loss of control, characteristic of EDs, emerge in the child when the caregiver, through the relationship, conveys to the child that the child lacks amiability and adequate ability to cope with life. In these cases, the development of an avoidant attachment style seems to be aimed at the possibility of diverting attention from the inner emotional distress. In an ED, such an attempt would find a way of realizing one's control oriented approach toward an external and tangible objective that is easier to manage (DeKlyen and Greenberg, 2016). In summary, if the ED and the body initially attract the attention of the family, signaling a struggle for self-esteem, autonomy and separation, and a hunger for recognition (Fuchs, 2021), they later become the place to self-manage one's negative emotions and neutralize attachment needs.

The underlying process thus hypothesized could therefore reconcile the conflicting results of the studies that in the samples of subjects with EDs. It could also highlight the presence of separation anxiety, fear of abandonment and control strategies over others in relationships typical of preoccupied SoM on the one hand (Barone and Guiducci, 2009) as well as a predominance of unsolved and dismissing SoM on the other (Zachrisson and Skårderud, 2010; Delvecchio et al., 2014). Therefore, from the perspective of the complexity of EDs, we can consider multiple functioning in different periods of life of the same individual, not just multiple diagnoses.

THE SEMANTIC RE-TRAUMATIZATION

Clinical experience in the field of psychotraumatology has led to the identification of another type of trauma that occurs when an individual's sense of self is threatened and develops in interpersonal relationships. In such cases, we can speak of semantic trauma (Veglia, 1999, 2013), since the traumatization process takes place through the path of attribution and exchange of meanings, primarily involving third-level motivational systems (epistemic motivational systems; Liotti and Monticelli, 2008)

and thus the neural networks of the neocortex (Panksepp, 2004). This type of trauma is associated with disintegration, fragmentation, and loss of the sense of self built in relationships on a semantic and narrative level. In the context of ED, the process of traumatization, which is primarily concerned with personal worth, the ability to be oneself, and the sense of kindness, as well as the memory of humiliations suffered during development, can be triggered not only by the words received, but also by extra-linguistic experiences in the form of looks, gestures, etc.

Starting from a bottom-up traumatization, a dysregulation of the memory-consciousness system develops and could recursively expose the subject to semantic re-traumatization. The feeling of dysregulation is not organizational from a neurovegetative point of view (dysregulation of the tolerance window) nor from an interpersonal point of view (Interpersonal Motivational Systems – IMS are activated in an incongruent way or, in the case of attachment trauma, through controlling strategies), thus developing a feeling of helplessness. After traumatic experiences, the left brain, with or without words, must inevitably make sense of what is happening (Gazzaniga, 2006, 2011) and is forced to form an image of itself as traumatized. We can say that the brain "tries again" in a cortical way to understand what happened: from this operation emerge the meanings and "negative" or "pathogenic" beliefs about oneself and the world. The negative beliefs thus stem from the reactivation of the cortex immediately after the trauma, which tries to reorganize itself to ensure that what happened is congruent with the other possible meanings it can form, and to translate "the extraordinary" into the canonical and intelligible (Bruner, 2000). For example, the threat of humiliation no longer comes from the outside, but from a constant self-deprecating attitude. This way of thinking about oneself becomes the source of re-traumatization (e.g., irrefutable memory of being bad and unworthy) as a consequence of post-traumatic "adaptation" (see the concept of "accommodation" in Piaget, 1952 and "self-deception" in Guidano, 1988).

Semantic memory and narrative memory are the result of reorganizing the meaning of an event that was originally meaningless. In trying to make sense of it, the person becomes retraumatized to the point where the mere activation of this negative belief about himself is enough to restart his alarm system. When the person is in a critical situation that triggers severe stress, he or she does not necessarily activate the original traumatic memory (e.g., direct humiliation in the past), but rather the self-representation available at that moment that was developed to explain the traumatic experience. This self-representation in EDs manifests primarily in beliefs, such as "You are fat," "You have no control," "You are not worth anything," and "You are incapable of not eating." These reactivate the alarm system in a dysregulated manner and cause the individual to re-trigger the action patterns developed during development for self-regulation, such as avoidance behaviors or fight-flight patterns.

According to Foa et al. (1991), what makes memories "traumatic" is a combination of the original experience of the trauma being stored as it actually happened and the subsequent visual reproduction and linguistic representation of the memory. The representations of the event change as they are experienced along with a variety of cognitive and affective associations that give meaning to the traumatic event in a continuous process. Eventually, the affective networks activated by the memory of the trauma may come to dominate the neural network when later memories of the event occur. Lanius et al. (2011) also consider the impact of psychological trauma on the sense of self and disturbances in self-referential processing, as they note that post-traumatic cognitions associated with a sense of shame would form following trauma.

Thus, this mode of functioning goes beyond the notion of traumatization as activation caused solely by triggers related to unresolved experiences, and envisions top-down traumatization through beliefs and narratives about oneself based on lack of kindness, devaluation, and an inaccessible truth regarding what others think of oneself in limited spaces.

According to the theories of Tronick et al. (1998), newborns, as open dynamic systems, need to constantly gather information to increase their complexity and coherence. They satisfy this need by converting non-verbal meaning into a "biopsychosocial state of consciousness" that shapes their ongoing engagement with the world. Psychological problems in children arise when the meanings ascribed to the situation selectively limit their subsequent relationship to the world and thus the long-term growth of their state of consciousness. When chronic and repeated, these altered meanings can impair development and increase vulnerability to pathological outcomes. This perspective views trauma as interrupting and distorting the creation and selection of meanings, in no way neglecting the dysregulatory, disorganizing, and dissociative effects of traumatic events. Trauma would thus limit the expansion of complexity in open dyadic systems by interfering with the processes of defining new meanings. Moreover, the toxic effects of early relational trauma on young children are amplified over time because these effects distort and exclude other typical meaning attribution processes that underlie positive developmental outcomes (Tronick and Beeghly, 2011).

In the stories of patients with ED, we often find experiences of constant confrontation with brothers/sisters, who were more valued and respected by caregivers, or external models (thin-ideal internalization), disqualifying, and disabling relational experiences, such as experiences of recognition that are mainly associated with achieving outstanding results or accomplishment (Taylor et al., 2006a; Setiadi and Risnawaty, 2021). When the parental figures do not allow the individual to be themselves, to express and build their sense of self, to realize their potential and freely make sense of their own existence, a painful and torn wound is created. In fact, in the development of the IWM, which, at the level of internal representations, is configured as a prerequisite for the construction of the self, the constraint of maintaining coherence and continuity in one's self may conflict with the constraint of maintaining closeness and relationship with the caregiver. When the sense of self enters a crisis in relation to critical narrative themes, there is a sense of not being adequate in interactions and having to give up an authentic part of oneself in order to maintain a sense of

security. This is followed by a threat to the narrative development of the themes of personal worth and likability (Veglia and Di Fini, 2017; Di Fini and Veglia, 2019). For example, if the relationship with the caregiver generates alarm, restrictive eating behaviors may be a way to maintain a sense of control over the relationship and a powerful sense of self; however, this creates disapproval from the outside. Conversely, the price of maintaining a positive external evaluation is a sense of helplessness in the relationship and a negative internal representation of oneself. At this point, the individual finds himself in the paradoxical situation of having to choose between losing a sense of security in the relationship while maintaining their sense of self, or, conversely, losing their sense of self while maintaining a stable attachment. This dilemma leads to a sense of helplessness because he/she cannot be both good and bad, lovable and despicable, and victim and guilty (top-down semantic traumatization). The failure of the narrative, the lack of meaning and the contradictory nature of the meanings create a new, protracted alarm and recursively retraumatize the individual (reactivation of the semantic traumatization cycle from bottom to top). The result is therefore a fragmentation of narrative coherence and continuity, leading to a dysregulation of IMS activation and arousal.

For example, if perfectionism, as a characteristic regulatory strategy of some EDs, aims, on the one hand, at obtaining affirmations from others in support of one's own worth, on the other hand, it constantly exposes the individual to an unbearable sense of shame and emergent unworthiness because he or she considers him- or herself inferior and uninteresting. In the disorganization of attachment that characterizes traumatic relational contexts, the state of fear without solution can lead to a deficit in the integrative functions of consciousness and a greater susceptibility to dissociative reactions and a fragmentation of the self in response to traumatic stressors during development. Problems with self-esteem, a deep sense of shame and inferiority, and diversity act as mediating factors that increase the likelihood of using food to cope with the disturbed self-image. Prolonged and repeated traumatic shame experiences tend to lead to fragmentation of the self, which is the extreme dissociative form. At a high level, chronic shame does not necessarily require the real presence of another person, but merely the internal image of how another person might judge one. Chronic shame, then, is fueled by humiliating internal images that may stem from past experiences without necessarily reflecting the current situation.

PROPOSAL FOR A MULTI-ACCESS MODEL OF PSYCHOTHERAPY

In recent decades, the methodological approach on which cognitive behavioral therapy is based has spawned several conceptual frameworks and numerous scientifically based intervention methods. However, these are often limited to the part of the brain or to the mental functions that each individual author or research group or school of thought has focused its attention on during a particular historical period. The goal of the various explanatory models of the mind or brain is to identify, describe, demonstrate, and formalize the mechanism that explains the physiology and pathology of mental functions and enables the creation of the most effective intervention plan possible. However, this very often conflicts with other explanatory models. These methods have been derived from reference theories of great epistemic consistency, such as evolutionism, constructivism, constructionism, developmental psychology, the metacognitive approach, and the bottom-up approach. Each of these areas can be studied as a pathway for activating/deactivating the brain/mind system or as a predominant processing center for the organism's internal and external signals or for regulating actions, mental states, and interpersonal positions.

Clinical observation and the results of neurobiological research, albeit preliminary, illustrate the ongoing reciprocal and overlapping influence of every activity in every area of the brain and in every domain of mental experience, both *via* interhemispheric conduction and *via* top-down/bottom-up pathways. The question of whether a strong and sudden threat signal stimulates flight rather than thought, or whether a persecutory ideology produces a strong sense of threat *via* the cortical pathway that causes one to fight or flight, is the result of conceptualization by opposites that fails to capture the complexity of the situation. Currently, cognitive and behavioral psychotherapy consider different approaches to orienting the patient in therapy, configured as predominantly declarative (based on cognitive, logical, linguistic, and narrative interventions), predominantly affective and relational (based on interpersonal, metacognitive, and emotionally motivational interventions), or predominantly procedural (based on behavioral, sensory, motor, and neuroregulatory interventions). Although the effectiveness of each of these approaches has been demonstrated, there is no conclusive evidence that one is more effective than the other. What distinguishes them from one another is their use in the creation, planning, implementation, and ongoing reformulation of the plan of care. Each approach is appropriate to functionally support parts of the treatment plan and to keep the links between reflection and clinical action consistent. Thus, the choice between different approaches, techniques, and content should depend on the patient's history and personal processing modalities of critical experiences (agency, mastery, and resilience) rather than on nosographic diagnosis or therapist preferences. It should relate to the gene expression of their DNA, which has been favored by the physical and relational context in which they have lived, to the way life has shaped their brain, to what they have learned from the experiences, and to their unique and unrepeatable way of consciously using these experiences and communicating them to themselves and others as an expression of their autobiographical consciousness.

The Multiple Access Psychotherapy (MAP; Veglia et al., 2019) model refers to the choice of method, starting from the self-referential way in which the individual tends to build the idea of themselves and themselves in the world. Some do this through verbal and linguistic narratives or through schemas of action, while others do so through schemas of

relationship. These are different modalities of semantic attribution that are probably biologically predetermined, as a request from the brain structure to work more easily in certain modalities. These are also the most likely access pathways for finding the specific locus of the patient's suffering. "Multi-access" refers to the indication for the clinician to go where the patient would pass in order to report their suffering, to successively uncover and explore other access routes, to enrich the work and increase the flexibility, integration and degrees of freedom of the system, and to offer more possibilities to the individual. The clinical work begins with the current suffering expressed according to the personal modalities of each patient. The clinician records it, reads it and describes it together with the patient in order to understand how it manifests in the form of cognitive, emotional, somatic, behavioral, and relational deficits or dysregulations. To work in this direction, the clinician uses the tools of critical sequence analysis as they relate to functional analysis.

Clarifying the experience of pain within the context of a therapeutic alliance reduces the sense of paralysis, disorientation, confusion, fragmentation, and anxiety associated with the inability to understand one's suffering, and therefore reduces the sense of helplessness that comes from trying to respond. Within the therapeutic session, the development of new emotion regulation skills also takes place through the construction and repair of the alliance, each time trying to maintain a cooperative interaction (Liotti and Monticelli, 2014). Often, some of the suffering remains incomprehensible because it does not seem to be associated with any known antecedents. It is the pain that is evoked by memory, often by unintegrated memories that can suddenly burst into the present, and it is activated by triggers that are difficult to identify. The study of life histories allows us to trace maladaptive learning, punctual traumatic events, or repeated and complex relational traumas with evocative tools capable of detecting the narrative scripts most likely to be associated with current suffering (Pellegrini and Veglia, 1999). The therapeutic relationship is necessarily involved and the body is not only a place of encounter with the other, but also an instrument of therapy. The most important signs of welcome, willingness to listen, acceptance, loving kindness, and empathic sharing are somatic rather than linguistic. If the clinician's arousal fluctuates within the tolerance window, the tone of voice, rate of breathing, and willingness to make eye contact are likely to activate the patient's ventral prosocial vagus system, which acts as a regulator of his own state of alarm more than any reasoning about his misconceptions (Porges, 2011).

On the other hand, the memory of many adverse childhood experiences is compromised by the prevailing brain stem and midbrain activation at the expense of the cortical integration areas activation and, in this case, the bottom-up approach offers a way to reactivate them in safety conditions. Thus, it helps individuals to integrate traumatic memories and finally express and make a cathartic gesture. For some patients, however, the main road to change is the construction of new knowledge, new skills, and alternative views on their problems.

Reducing negative thoughts, using multiple points of view, increasing positive mental representations, acquiring the ability to read interpersonal signals and automating the production of more adequate responses to complex social situations with exercise already offer a feeling of competence and security and improve self-image, arousal regulation, and mood. Reconstructing, rearranging, re-reading and narrating, listening, giving back and sharing are powerful evocative and transformative movements in narrative approaches to knowledge and change. The approach is only partially characterized by the use of the word, since the narrative is the product of the whole person and their story, of the characters they are and have been, of their memories and of the possible selves that they will be.

Thus, we have three words for three ways of accessing memory which show how much of the entire mind is involved in its body in the simple act of recalling an event (giving it a voice): remembrance (memory of the body and of the limbs); affective memory (memory of the heart); and reminiscence (cognitive memory of knowledge).

The literature has highlighted how essential it is to take into account the influence of attachment and the factors connected to it in the development and maintenance of EDs. Different styles have also been observed within the same diagnostic category (Wei et al., 2005), with the suggestion to consider the patient's specific attachment style in the clinical strategies to be used when planning interventions (Tasca, 2019). For example, it was observed that, for BED patients, the treatments in which an opportunity for experience and emotional expression was experienced promoted and increased the therapeutic alliance and the reflective functioning (Compare et al., 2018; Maxwell et al., 2018). Moreover, literature (Zaitsoff et al., 2015; Graves et al., 2017) shows that, especially in the early stages of therapy, the improvement and stabilization of symptoms is accompanied by an improvement in the quality of the therapeutic alliance, which in turn opens up the possibility of working more deeply. Therefore, a relational context characterized by attunement allows the experience of mirroring and co-regulation, acquiring an alternative way to regulate the arousal and improving metacognitive abilities and their consequent mastery (Fonagy et al., 2002; Schore, 2003). This is even more true in cases where ED symptoms are initially hidden from the patient. Working with the therapist to also recognize the adaptive significance of some eating behaviors will help increase the ability to self-reflect, develop a more integrated sense of self, and find new ways to cope with disturbing feelings (Barth, 2008).

The MAP further orients us to the subjective specificity of the patient. It is not the patient who adapts to the therapeutic model, but the treatment plan that must take shape around their relational modalities of meaning construction, alarm management, and expression, considering the factors related to the development history implied in the maintenance of the ED.

According to this perspective, EDs do not correspond to a diagnosis that involves the application of a specific intervention protocol: the patient is placed at the center

and teaches the clinician where to go from the beginning, according to their preferential access, to meet their suffering and to begin to understand it. Taking into account the mechanism schematized in **Figure 1**, MAP can more easily adapt to changes in regulatory strategies, to the shift to different dysfunctional eating behaviors, to the transition from one relational style to another sometimes observed in ED patients. By considering different accesses and different perspectives on the patient's suffering, we are able to understand its complexity and its processes over time. This tuning to the patient's preferences is also oriented according to their preferential access way, allowing a consolidation of the therapeutic alliance. This allows the patient to gain confidence in being accompanied in the exploration of other methods. If a patient were more oriented toward bodily concreteness, with a poor reading of their own internal states, we would avoid refuting with them in a declarative way in the first instance. For example, in the theme of control, if we were faced with a patient withdrawn relationally and oriented toward the acquisition of knowledge and the sharing of meanings, it would be more appropriate to use a more cognitive and narrative approach. Meanwhile, if the patient were oriented to action and to experience bodily, it would be advisable to seek relational engagement through the use of bodily actions and a procedural method.

From a clinical point of view, the authors of this article try to highlight the proposal of an integrated model with multiple access to therapy that takes into account the complexity of patients with ED in which the aspects related to dysregulation, non-integration of the perception of one's own body and post-traumatic symptoms are associated with a sense of suffering self and a self- retraumatizing narrative. Through a sensorimotor approach, able to assess the somatic capacities of the patient and therefore to elaborate a joint plan to observe the defensive reactions of the body, it is possible to structure alternative somatic regulation strategies instead of those related to nutrition. EDs, especially AN, often arise from an attempt to change the structures and balance of the person seeking change through the body (Skårderud, 2007). The body then becomes the incorporated site of synthesis of what the person is seeking. Therefore, the body in therapy can become a place of self-encounter, renegotiation of boundaries and exploration of what cannot be said or done with words. Awareness of one's own body through the scanning and self-observation of all somatic signals enables the patient with ED, to "stay with it" without avoiding feelings and without being overwhelmed by painful sensations. As the patient learns to notice his or her own habitual responses and relationship to the limits of his or her body, and learns to accept alternative somatic responses, a sense of greater control over arousal is facilitated. The sense of control and mastery therefore counteracts the feelings of vulnerability, helplessness, and shame characteristic of EDs. By working on the modalities of meaning attribution (based on control mechanisms, co-regulation, or semantic exchange of critical narrative themes), narrative integration, and access to mental and somatic states from which one had become alienated, we can help the patient reconstruct his or her own bodily and narrative identity. Thus, if the patient is able to tell his or her own story in different ways (somatically, interactively, or linguistically), this can lead to a deep integration between his or her brain, body, and connection to others.

CONCLUSION

Combining clinical observations with recent findings from the literature, this article proposes a reflection on the functioning of EDs that includes the impact of early relational trauma on emotion regulation strategies, the role of attachment relationships in the development and maintenance of these disorders, the narrative construction of the self and the symptom, and connections with somatic memories. Studies of early interactions and physical contact with attachment figures, as well as the literature on the role of mirroring and emotional attunement in self-construction, even before the emergence of language, may shed light on the mechanisms leading to the development of EDs and its associated body representations.

Studies that have examined attachment relationships in the context of EDs report conflicting data on the prevalence of attachment styles and states of mind in these disorders in general, as well as across EDs specific diagnoses. However, a complex and multicomponent perspective that considers the role of attachment insecurity, mirroring, emotional attunement within early mother–child interactions, the impact of traumatization, and semantic re-traumatization in attempting to maintain a coherent sense of self may offer new insights into the development, maintenance, and also the modifiability of eating disorder symptoms. In line with these considerations, the proposed model MAP focuses on the self-referential modalities through which the individual tends to build the representation of the self and of oneself in the world, adapting to one's preferred "access route" to cope with suffering.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/supplementary material, and further inquiries can be directed to the corresponding author/s.

AUTHOR CONTRIBUTIONS

FV and RAP contributed to the development of the ideas and hypotheses, provided the theoretical insights and clinical foundations, and contributed to drafting and revising the manuscript. GDF and SF contributed to the search of literature, drafted and revised the paper, and translated the paper in English Language. All authors contributed to the article and approved the submitted version.

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"Can A Ballerina Eat Ice Cream?": A Mixed-Method Study on Eating Attitudes and Body Image in Female Ballet Dancers

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Aim: We aimed to explore how a group of classical ballet dancers perceived their eating attitudes and their bodies, with special attention to the potential presence of eating disorders (EDs) symptoms and body image (dis)satisfaction.

Methods: A cross-sectional, mixed-method study was conducted on fourteen trained classical ballet dancers (18–30 years old). Their experiences, perceptions, and feelings regarding eating attitudes and body image concerning classical ballet were acquired through qualitative focus groups. The presence of EDs symptoms and perception and (dis)satisfaction with body image was analyzed quantitatively through self-report questionnaires.

Results: Participants reported concerning eating attitudes during the focus groups, such as the regular practice of several restrictive popular diets, constant restriction of foods considered "heavy" or "fatty," meal skipping and ignoring signs of hunger, presence of overeating episodes due to stress and anxiety, feeling guilty about breaking their usual diet, classifying foods as "good" and "bad" or "lean" and "fat," and excluding some of those foods from their usual diets. These reports were partially reflected in the questionnaires, with 50% of the ballerinas showing bulimic symptoms indicative of an unusual eating pattern (only two of them with a significant risk index), 7.1% showing symptoms of moderate binge eating, and 14.3% symptoms of EDs in general. Additionally, when considering their bodies in the context of everyday life, participants were satisfied; however, in the "classical ballet" context, they reported feeling dissatisfied with their shape. These findings were in line with results from the Stunkard's Scale, which revealed that 50% of the sample was dissatisfied with their current body shape and 57.1% indicated that their desired body shape was a leaner figure than one they considered healthy.

Conclusions: The constant practice of restrictive diets and other weight-loss strategies to achieve a leaner body were associated with symptoms of EDs and body dissatisfaction

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in this sample. Importantly, the questionnaires used seemed to underestimate the presence of a disordered eating pattern reported by the participants during focus groups. These data could help to inform psychological and nutritional strategies aimed at improving performance, physical and psychological well-being, and quality of life of ballet dancers.

Keywords: classical ballet, eating disoders, disordered eating, body image, restrictive dieting

INTRODUCTION

Eating disorders (EDs) are psychiatric disorders with multifactorial origins, which can cause major biopsychological damage and increased mortality (1). EDs affect mainly adolescents and young adults, particularly females (2). Moreover, a few subgroups of the population seem to be at an even higher risk of developing EDs, for instance, the prevalence of EDs in athletes is higher than in the general population and greater among female athletes (3, 4). Furthermore, the risk of developing EDs is also higher in sports modalities that have an aesthetic component or categorize athletes according to weight (5).

EDs in athletes may have major health and performance consequences, namely, premature muscle fatigue, impaired thermoregulation, impaired oxygen and nutrient transport, reduced aerobic capacity, bone loss, increased susceptibility to infections, anemia, gastrointestinal disorders, and dehydration (6), in addition to increased susceptibility to depression, anxiety, and low self-esteem (7).

Classical ballet is a physically demanding sport characterized as an intermittent exercise, which demands energy from different metabolic pathways (8). Moreover, it is an artistic expression in which the demand for a lean body is broadly accepted as necessary for dancers to succeed (9), considering the high demand in terms of uniform, such as leotard and tights, and the high number of movements which require lifting (10). This cultural "requirement" might potentially explain a prevalence rate of 16.4% of EDs in classical ballet dancers and a 78% higher risk of developing these disorders when compared with non-dancers (11).

Researchers have attributed the higher risk of developing EDs in classical ballet dancers to their characteristics such as perfectionism (12), low self-esteem (13), body image dissatisfaction, (13) and even genetic predisposition (12). Moreover, when compared with dancers from other genres, classical ballet dancers show a higher percentage of body mass index lower than 17.5 kg/m^2, combined with more pressure from choreographers to achieve a lean body (10, 14).

Previous qualitative research has also investigated specific risk factors which may make dancers more susceptible to the development of EDs. Thinness-Related Learning (TRL), which is the degree to which an individual is exposed to learning about thinness in a dance class, such as comments from teachers and peers about the benefits of dieting, social comparisons between peers and observational learning of dieting and restriction through a teacher or peer modeling, may play a role (15). Indeed, food restriction and the pressure to be thin are characteristics commonly reported by dancers in the classical ballet environment (16).

Despite these valuable findings, no study has investigated specific eating attitudes associated with EDs and body image in classical ballet dancers by combining both quantitative and qualitative approaches, which may allow for a more in-depth investigation into this relationship and help understand associated feelings and perceptions. Based on previous literature, we expected to better understand how the participants' rehearsal and championship routines, the relationship with their coaches and peers, and their career goals related to their eating attitudes, the relationship with their bodies, and the presence of EDs symptoms. This approach may also lead to new areas of investigation, in this case, new behaviors and attitudes potentially associated with EDs in this population. Thus, this study aimed to explore experiences, perceptions, and feelings regarding eating attitudes associated with EDs symptoms and body image (dis)satisfaction in classical ballet dancers using a mixed-method approach.

MATERIALS AND METHODS

Study Design

A cross-sectional, mixed-method study was conducted. Experiences, perceptions, and feelings regarding eating attitudes and body image in relation to the classical ballet were qualitatively explored through focus groups. Additionally, the presence of EDs symptoms and perception and (dis)satisfaction of body image was analyzed quantitatively through self-report questionnaires.

Participants

Four Ballet schools in the city of Campinas, São Paulo - Brazil, were contacted. Two schools declined to participate in the study. All dancers from the two schools who agreed to participate took part in the study.

The convenience sample consisted of 14 female ballet dancers, aged between 18 and 30 years (22 $\pm$ 4 years) with a BMI between 17.8 and 22.0 kg/m^2 (20.6 $\pm$ 2.1 kg/m^2) who regularly trained in ballet schools (more than 4 times a week). Participants had been practicing ballet for an average of 14 $\pm$ 7 years and 8 of the 14 participants were professional ballet dancers at the time of the study. The other participants of the study (6) were not professional dancers, although they still took regular ballet classes and competed in some local ballet competitions.

All participants signed the Informed Consent Form (CAAE: 95432818.5.0000.8142), approved by the Research Ethics

Committee of the State University of Campinas (UNICAMP) before entering the study.

Qualitative Methods

Aiming to explore the dancer's experiences, perceptions, and feelings regarding their eating attitudes and body image in relation to classical ballet, three focus groups were conducted (17), each composed of 3, 5, and 6 dancers. Focus groups were led by a moderator, who was an experienced researcher on qualitative methods, to provide a judgment-free atmosphere in which participants could feel comfortable expressing their opinions. The moderator used pre-defined, open-ended questions (**Supplementary File 1**), which aimed to guide the conversation and ensure that all necessary topics were covered. The questions were first created by two researchers who discussed the objectives of the study and raised aspects they considered relevant to be addressed. Thereafter, questions were either approved or vetted by three other researchers, two of whom were experts in EDs and one in sports science, leading to the final questions used in the study.

During focus groups, we asked participants to report experiences and thoughts about their rehearsal routine; features of their usual diets; changes in their usual diets when close to championships, presentations, or vacations; whether they compared their diets with non-dancers' diets; whether other people make comments about their eating patterns and how they felt regarding these opinions. We also asked if they had previously followed restricted diets and why; which foods they "cannot" eat during their usual diets and how they dealt with any potential desires to eat these foods; what they eat after championships or presentations; what was a pleasurable meal for them and how they felt when they ate it. Moreover, we raised questions about what they felt regarding their bodies in different contexts (i.e., in the context of classical ballet and in everyday life); whether they received comments from others about their bodies, and how they dealt with those. Finally, we asked questions about their careers, including their career goals, what they would do to achieve them, and what their diets would look like if they stopped dancing. Focus groups were not used to assess the frequency or the extent of disordered eating attitudes and behaviors. They took place at the dance schools, in a private room with no contact with the school's coaches or staff, lasted between 30 and 45 min, were recorded, and later transcribed verbatim to enable qualitative analysis.

Quantitative Methods

The presence of EDs symptoms was assessed quantitatively *via* three self-administered questionnaires, all translated into Portuguese and previously validated for the Brazilian population (18–21).

To assess eating attitudes and behaviors, we used the Eating Attitude Test (EAT-26) (22). This is a self-administered questionnaire composed of 26 questions across 3 categories: (1) Dieting: Reflects a pathological refusal to eat high-calorie foods and intense preoccupation with body image; (2) Bulimia: Refers to episodes of excessive food intake, followed by vomiting and other behaviors to prevent weight gain; (3) Food Preoccupation: Refers to self-control over food and recognized social forces in the environment that stimulate food intake. Each question has 6 answer options (always = 3, often = 2, sometimes = 1, few times = 0, almost never = 0, never = 0), and total score can range from 0 to 78. Scores $\geq$ 21 correspond to abnormal eating behavior and increased risk of ED.

The Bulimic Investigatory Test Edinburgh (BITE) aims to identify individuals with ED, specifically bulimia nervosa, and to evaluate control over eating behaviors (23). It consists of 33 questions divided into 2 parts, referring to symptoms and their severity. All questions relating to symptoms (all questions apart from 6, 7, and 27) are answered "yes" or "no," with corresponding scores of 1 or 0 points. Questions 6, 7, and 27 relate to the severity of the symptoms and are scored on scales ranging from 1 to 5 (Q.6) or 1 to 7 (Q.7 and 27). On the symptom scale, a score $>$ 10 is representative of atypical eating behaviors, while scores $>$ 20 indicate compulsive, restrictive, or purgative behaviors. On the severity scale, a score $\geq$ 5 indicates that symptoms may be clinically significant, while scores $\geq$ 10 indicate high severity.

To assess binge eating and the severity of symptoms, we used the Binge Eating Scale (BES) (24). BES is composed of 16 questions, each with 3 or 4 answer options scoring from 0 to 3 (0 = absence of symptom and 3 = severe symptom). The overall score can range from 0 to 46. Scores $\leq$ 17 indicate the absence of binge-eating behaviors; scores between 18 and 26 indicate moderate binge-eating behaviors and scores $\geq$ 27 indicate severe binge-eating behaviors.

Perception of body image was assessed using the Stunkard's Scale (25), which consists of nine female figures, numbered 1–9, ranging from a very thin figure (# 1) to a very obese figure (# 9). Participants should choose three figures, one they believe best represents their current body, one they believe represents a desirable body, and one they consider to be a healthy body. Scores were calculated by subtracting the current body choice by the desirable body and healthy body choice. Negative scores represent body dissatisfaction.

Data Analysis

Quantitative data are presented as mean $\pm$ standard deviation (range), unless stated otherwise. The qualitative data (focus groups) analysis approach involved classical and exploratory content analysis (26). The qualitative data analysis was conducted with the software MAXQDA. This is a world-leading software package for qualitative and mixed methods research. Its interface offers an experience very similar to that provided by Windows text editor, creating an easy-to-use, and user-friendly experience. The researchers were trained before its use by an experienced qualitative researcher. Classical content analysis used themes derived from the EDs literature and questionnaires (used in the quantitative analysis) and were defined *a priori* (i.e., presence of symptoms consistent with EDs and body image satisfaction). Further themes arose from the data by exploratory content analysis, totaling six themes which are described in **Table 1**. Initially, a first reading of the material was performed and the corpora of the work was defined. A codebook was developed for coding these themes, which included for each theme: short and detailed descriptions; inclusion and exclusion criteria; typical

TABLE 1 | Codes and kappa coefficients from focus groups.

Theme	Kappa
Usual eating	0.750 ± 0.079
Unusual eating	0.929 ± 0.025
Eating attitudes	0.894 ± 0.037
Body image	1.000 ± 0.000
External perceptions	1.000 ± 0.000
Reharsals and career goals	0.876 ± 0.046

Kappa results are interpreted as follows: 0.61 to 0.80 as "good agreement," and 0.81 to 1.00 as "very good agreement" (27).

TABLE 2 | Presence of ED symptoms.

Outcome	Mean ± SD	Range
Presence of eating disorders symptoms		
BES	7.9 ± 6.7	1–25
BITE (symptoms)	8.4 ± 4.6	2–15
BITE (severity)	2.1 ± 1.7	0–5
EAT	9.1 ± 9.7	1–36
Body image perception and dissatisfaction		
Body satisfaction score	−0.6 ± 0.6	−2–0
Stunkard's scale (current)	3.2 ± 0.9	2–5
Stunkard's scale (healthy)	3.3 ± 0.6	2–4
Stunkard's scale (desirable)	2.7 ± 0.6	2–4

BES, Binge Eating Scale; BITE, Bulimic Investigatory Test; EAT, Eating Attitude Test. Data presented as mean ± standard deviation.

and atypical quotes, and an exemplar classified as "close but no" (26, 28). Two researchers discussed the codebook and applied it independently to the corpora, using phrases as the unit of analysis. The "cutting and sorting" approach, a process that identifies important quotes and expressions and then arranges them according to similarities, was used to identify the themes (26). Kappa coefficients for inter-rater reliability were calculated using the GraphPad QuickCalcs, with values between 0.61 and 0.80 defined as "good" agreement and ≥0.80 as "very good" agreement (**Table 1**) (27). Speeches from participants are identified as "P."

RESULTS

Participants Characteristics

According to the EAT-26 questionnaire (**Table 2**), twelve dancers (85.7%) showed no restrictive-eating behaviors or symptoms consistent with the presence of EDs, while two dancers (14.3%)—both professionals—had scores higher than 21 points (22 and 36), which suggests the presence of EDs symptoms. Regarding BES, only one dancer (7.1%)—also a professional—presented symptoms of moderate binge eating (25 points), while thirteen dancers (92.8%) did not present binge-eating symptoms (**Table 2**).

From the symptom scale of the BITE questionnaire, 7 dancers (50.0%) showed bulimic symptoms, obtaining a score between 10 and 19 (medium score, suggesting unusual eating patterns), 6 of them being professionals. The other 7 dancers (50.0%) of the sample presented low scores. Moreover, on the severity scale, only two participants (14.3%), also professional ones, presented clinically significant scores whereas the remaining participants presented low scores (**Table 2**).

Regarding body image perception, 7 dancers (50.0%), 4 of them being professionals, wanted to have a thinner body than their perception of their current body shape, while 6 of them (42.9%), 4 of them being professionals, were satisfied with their current body shape according to the Stunkard's scale (**Figure 1**). More than half of the dancers (57.1%)—2 professionals—indicated that their desirable body shape was a leaner figure than the one they considered healthy, suggesting that they did not exactly perceive their desirable body shape to be healthy. Eight dancers (57.1%)—4 professionals—considered their current body to be healthy, while three of them (21.4%)—1 professional—believed that their current body shape was thinner than the one they considered to be healthy (**Figure 1**).

Experiences, Perceptions, and Feelings Regarding Eating Attitudes and Body Image in Relation to Classical Ballet

Usual Eating

When asked about their usual eating pattern, dancers agreed on the importance of having a dietary routine for performing as a dancer: *"Here (in the ballet school) we have a tight schedule, so we must have a healthy dietary routine in order to have energy and feel willing to take the dance classes and rehearsals" (P3).* They also emphasized the fact that they stick to a regular diet during the week, allowing for some exceptions on the weekend: *"I control myself during the week so I can eat an ice cream on the weekend" (P5)* or *"From Monday to Saturday I eat healthy foods, on Sundays I usually falter and have a milk shake, go to the mall, cinema, popcorn, all these things"(P7).* Participants talked about skipping meals, especially dinner, or cutting out specific foods such as sodas, fried foods, sweets, or even rice during weekdays either as a dietary strategy or due to rehearsal schedule issues: *"On weekdays I eat 'right': I don't drink soda, I eat lots of eggs, I don't eat dinner, these things" (P5), "When I have rehearsals at night, I don't have dinner, because when I get home late, I don't get hungry" (P11).* Another issue brought up by the dancers was that eating fatty foods or foods they considered as "heavy" lead to increased fatigue and decreased performance during classes and rehearsals: *"if you eat junk food on a day that you have rehearsals, like Saturday, it ruins it" (P4).*

Eating Attitudes

Importantly, dancers expressed concern during periods when they step out of their usual diet, leading to an "all or nothing" eating behavior ["*On weekends, I throw everything up in the air" (P1); "When I start a restrictive diet, I stay on focus until the end of it, but I know that, on the next day, I'll eat whatever I want" (P8)*]. Episodes of overeating were also brought up by some ballet dancers when it came to eating what they considered to be "pleasurable foods": *"One day I picked up a Nutella jar and I ate*

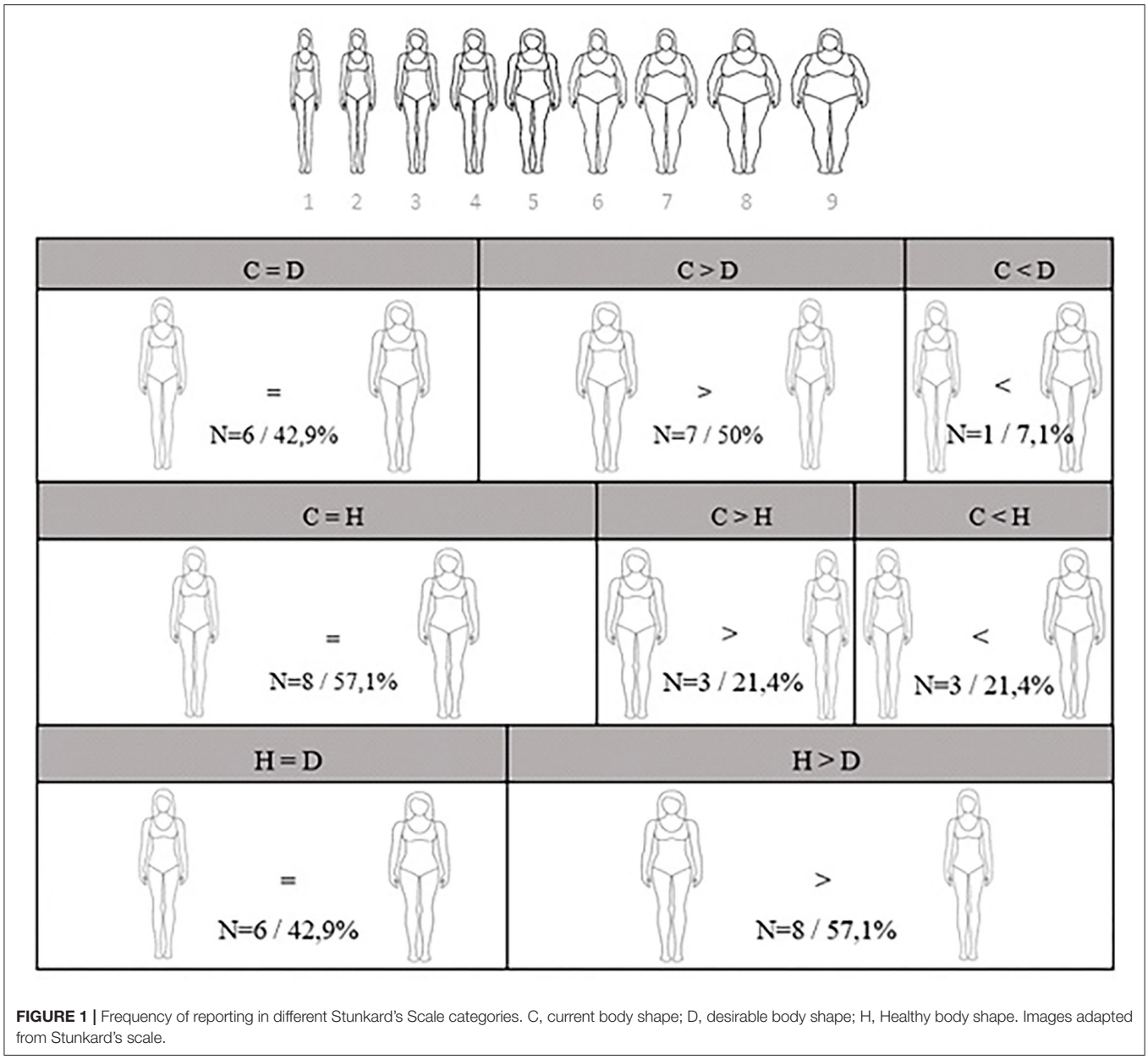

FIGURE 1 | Frequency of reporting in different Stunkard's Scale categories. C, current body shape; D, desirable body shape; H, Healthy body shape. Images adapted from Stunkard's scale.

it and cried later" (P1) "When I eat sweets, I feel heavy and I feel a little remorse" (P12). The dancers also mentioned strategies for not deviating from their diets and eating foods considered "bad" or "fatty": *"I drink a lot of water. Are you hungry? Drink some water!" (P4);* or *"At night, if I already had dinner, but I'm still hungry, I don't eat, I usually sleep" (P1).*

Unusual Eating

The role of dieting in a dancer's life was also discussed. All of them said that at some point, they tried to follow popular restrictive diets, such as "Detox," "Low-carb," and "Keto-diet." When asked about possible motives which had led them to undergo these types of diet, different explanations came up, such as *"Desire to see immediate results" (P5)*; "*I did it due to lack of maturity" (P6)*; *"To improve my performance! My body had to work harder and recover faster" (P2);* or *"Aesthetics, the dancer always has to be thin" (P7)*; or even the influence of social media [*"I always saw the nutritionists on Instagram saying that 'low-carb' is good for this and that" (P7)*].

When it came to pre-championships or pre-dance festivals, dancers agreed that they usually change their eating pattern during times of increased rehearsal hours, anxiety, and when feeling fat while dressing up: *"When it gets closer to a competition or dance festivals, we feel anxious and we eat a little more or a little less, it depends, but the emotional part counts a lot. Also, when we have a greater load of rehearsals, we end up skipping meals, otherwise we feel heavy" (P3); "If I want to eat some chocolate, I think 'I'm too close to the presentation, I won't eat it'" (P7).*

Dancers also debated types of food they eat after championships and dance festivals ["*Almost every time we compete, we have a burger or a pizza afterwards" (P9)*] and motives underlying these behaviors [*"It's kind of a reward, to celebrate" (P12)*].

When asked if they would change something in their usual diets if they stopped dancing, the dancers said they would not change much, just adapt to a new routine: "*Maybe a less restricted and worrying diet but always looking for a balance" (P8)*.

External Perceptions

The relationship of participants with external opinions such as family, friends and colleagues regarding their eating habits was also discussed: *"My dad is always watchful with the things that I eat, and he constantly says things like 'oh, you already ate that, you won't eat anymore', and I know he does that because of the ballet" (P13)*; *"When I'm with someone who's not a dancer and they see me eating an ice cream for example (...) they often say: 'Wow, can a ballerina eat ice cream?" (P7); "I am a vegetarian and I usually eat in healthy restaurants, so my friends constantly say that, because I am a ballerina, I am fussy about food and that I am 'fitness'" (P14)*. When dancers were asked about the consequences of these external opinions on their attitudes, the answers were mixed. Many said they do not care; some said they do not care anymore, but that at some point in their lives these comments caused some discomfort; and others said it bothers them: *"When I was younger, it bothered me a lot, I think it passed over time, about a year and a half ago I stopped caring about those comments" (P8)*; or *"From the moment a person looks at me and says thinks like 'Are you really going eat this?', I eat the whole thing thinking that I shouldn't eat it" (P1)*.

Body Image

Perceptions, attitudes, and concerns of ballet dancers toward their bodies were discussed during focus groups. Participants' perceptions toward their bodies varied when they put it into context: *"When I look in the mirror like a normal person, I feel good, but if I look in the mirror as a ballerina, I want to die" (P1)*; *"When it comes to ballet practice, I get more concerned about my body, since there is always someone correcting me, telling me to close my chest, or shrink my belly, so I get more uncomfortable" (P11)*.

Dancers also mentioned situations where they heard external opinions about their bodies: *"Once I heard from one (teacher): you are not fat, but you have wide knuckles" (P9); "Actually, I always heard people say that I am too skinny, and I suffered a lot with this" (P10); "There was a teacher one time that told me to lose butt fat" (P13)*. Interestingly, however, most of them said they did not care about these opinions regarding their bodies: *"If I cared I would go crazy" (P13)*.

Rehearsals and Career Goals

In addition, the participants agreed that there is a predefined stereotype assigned to the classical ballet dancers, and that it had a large influence on whether they wanted to become a professional: *"I don't have the ideal ballet dancer body type, I'm lucky that I wasn't born with that dream (...), I see myself more on the side of the contemporary dance, where my body fits better" (P2). / "To be professional, there is a pattern that 'they' want, and to say that I want it to be a professional, it's kind of a utopia, I would like that, but there is this stereotype factor" (P12).*

DISCUSSION

The aim of this study was to explore experiences, perceptions, and feelings regarding eating attitudes associated with EDs symptoms and body image (dis)satisfaction in a cohort of ballet dancers, using a mixed-method approach.

During focus groups, eating attitudes related to the regular practice of several restrictive popular diets, constant restriction of foods considered "heavy" or "fatty," meal skipping and ignoring signs of hunger were identified in our participants. Moreover, overeating episodes due to stress and anxiety, feeling guilty about breaking their usual diet (using expressions like "*I threw everything up in the air*" or "*I flinched*"), classifying foods as "good" and "bad" or "lean" and "fat," and excluding some of those foods from their usual diets were also reported by these ballet dancers. These reports of disordered eating were partially reflected in the questionnaires, with 50% of the ballerinas showing bulimic symptoms indicative of an unusual eating pattern (only two of them with a significant risk index), 7.1% showing symptoms of moderate binge eating, and 14.3% symptoms of EDs in general.

A strong association between the practice of weight-loss diets and the development of EDs has been extensively shown in the literature (29). A study that tracked 1,000 teenage girls for 1 year showed that the relative risk of a dieter developing EDs is eight times higher than a non-dieter, thus concluding that dieting is a strong risk factor for the development of EDs (30). Since many of the ballet dancers in the study reported the habit of regular dieting in addition to disordered eating symptoms on the questionnaires, it is more than possible that these symptoms may develop into clinical EDs. Ballet dancers and coaches should be made aware of these dangerous practices to reduce the risk of these athletes developing serious EDs, which may impact their overall health.

The participants also talked about applying certain strategies, such as drinking water or going to sleep when feeling hungry, to prevent themselves from eating "junk food" or foods that did not form part of their usual diets, particularly near competitions and dance festivals. This may explain the higher symptoms score on the BITE questionnaire compared to the BES and the EAT-26, since the symptoms part of BITE is composed of "yes" or "no" questions, while BES and EAT-26 are related to the frequency of behaviors. Thus, although only 7–15% of the sample reported a high frequency of these behaviors, they were present in 50% of the sample, probably around competitions.

It is noteworthy that the questionnaires used in the study seemed to underestimate the presence of a disordered eating pattern in the participants, with relatively low scores, particularly in the EAT-26 and BES. This apparent discrepancy between qualitative and quantitative findings is not necessarily uncommon and has been reported in the previous studies (31). The questionnaires aimed at tracing ED symptoms might have also introduced an artificial element to the way the participants assessed their "dysfunctional" eating patterns, leading them to

soften their understanding of dysfunctional eating behavior. The qualitative tools used in this study aimed to explore their experiences, perceptions, and feelings regarding their eating attitudes and body image. If we consider these topics as prompts to talk about their behaviors, it makes sense that the "dysfunctional eating" compartment was assessed in the participants with this approach. It is possible to assume that the mixing of study designs (i.e., qualitative and quantitative) used herein enabled us to find "blind spots" which would not have been assessed using the quantitative approach alone. Moreover, it may be that these questionnaires use more rigorous definitions of disordered eating behaviors, which may underestimate their incidence in the sample. Therefore, the use of qualitative approaches might be useful and complementary to questionnaires to assess the risk of developing EDs in this population.

These eating attitudes were potentially driven by the dancers' perception of their body image, as 50% of the ballet dancers showed some dissatisfaction with their current body shape. Although we cannot specifically say we found evidence of body dysmorphia, the fact that more than half of the participants (eight of them) considered a desirable body to be one thinner than a body they considered to be healthy is somewhat concerning. Previous research has demonstrated that dancers express more concerns about their physical appearance and body image, which, according to them, have an impact on how they control their dietary intake and eating habits continuously, to lose or maintain weight (32). Accordingly, Kulshreshtha et al. (33) showed a positive correlation between body dissatisfaction and disordered eating attitudes, concluding that dancers who are more concerned with body shape size were five times more likely to report disordered eating attitudes than their peers.

These data support the so-called "dancer's stereotype," mentioned by the participants themselves in the focus groups, which is characterized by a slim and light body (34). It is noteworthy that during focus groups, participants mentioned differences in body satisfaction when dancers compare how they see their bodies in and out of the classical ballet context. They pointed out that when they analyze their bodies in a more regular context (i.e., everyday life), they consider themselves satisfied; however, when analyzing themselves in the classical ballet context, they would prefer their bodies to be thinner, which may explain the fact that 50% of the sample showed body image dissatisfaction.

Literature shows that when compared with non-dancers, dancers have a higher risk of developing EDs, disordered eating attitudes, more dieting behaviors, and more binge-eating episodes (32, 33). Moreover, compared to other dance genres (contemporary, flamenco, and Spanish dance), ballet dancers are more likely to appoint their coaches as a key factor in their body dissatisfaction, and to report more pressure from choreographers (14, 35), an issue that has also been brought up by the dancers in the focus groups, when they talked about how common it was for coaches to talk about their bodies.

It is noteworthy that the majority of participants reporting the highest scores in the questionnaires were professionals, indicating that they are at the greatest risk of developing ED than the students. Body image is known to play a significant role in the process of "socialization" among classical ballet dancers (36). Alexias and Dimitropoulou (36) argue that "professional ballet dancers form an almost ascetic, abstinent attitude toward their bodies in order to have it work at the limits of its biological basis (overcoming even pain and serious injuries) and offer them profits (in a wider sense including financial remuneration as well as prestige and professional development and distinction)". This gives support to the association between body dissatisfaction and a higher risk of developing EDs, particularly in sports modalities with a strong aesthetic component such as classical ballet (16).

A study conducted in 2013, which evaluated 237 girls in Spain, showed that there is an indirect effect of using social media with body dissatisfaction, as current media can generate greater competitiveness and comparisons between people, which may lead to a negative body image (37). The influence of media was also raised in the focus groups and specified as a reason to begin dieting, especially "low-carb" diets. This factor exemplifies the dancers' lack of knowledge about nutrition, which is often exploited in social media by personalities who constantly promote "miraculous diets" with impressive results that lack scientific underpinning. Dancers, who often lack adequate professional and nutritional support, end up believing bogus claims and following radical suggestions. In this regard, it is worth mentioning that only a few participants underwent nutritional monitoring, suggesting a low participation of skilled professionals in classical ballet. Nutritional support could be extremely important in the prevention and treatment of EDs symptoms in dancers, as well as helping them to improve performance and quality of life.

The strengths of this study include the recruitment of some experienced and professional ballet dancers who have been engaged in this sport for a long time, allowing determination of chronic exposure to the "classical ballet environment" on body image and EDs. Moreover, the qualitative analysis allowed an in-depth investigation of behaviors related to body satisfaction and EDs. The limitations include the relatively small, convenience sample enrolled in the study, as participants were selected from two schools only, limiting the generalizability of findings. It is noteworthy, however, that although a sample size of 14 may be regarded as small for studies essentially composed by quantitative methods, it was the qualitative component that guided our findings, whereas the quantitative component was used to characterize the sample and to complement the qualitative data. Importantly, our data showed that the information that emerged from qualitative methods reached saturation, as themes surfaced in different focus groups were quite similar, indicating that the sample size was adequate for the main aim of the study. Additionally, although we made a strong effort to provide a welcoming and judgment-free environment, the ballet dancers might not have been completely open in the completion of questionnaires and during focus groups. It is worth mentioning, however, that focus groups were characterized by the expressive participation of the participants and the discussion of a wide variety of ideas, suggesting that participants did feel comfortable expressing their opinions. Finally, it is possible that other factors out of the scope of the present study, such as menstrual status,

may have influenced the results. Future research should address these factors.

IMPLICATIONS FOR RESEARCH AND PRACTICE

In conclusion, the constant practice of restrictive diets and other weight-loss strategies to achieve a body shape leaner than the one they considered healthy were associated with symptoms of EDs and body dissatisfaction in a sample of female ballet dancers. Of importance, body dissatisfaction was shown to be associated with the sport itself, as the dancers did not report any sign of dissatisfaction with their bodies in the context of "normal societal standards." Thus, health professionals should consider assessing a dancer's body image (dis)satisfaction both in the general context and in the context of classical ballet, and exercise caution when recommending restrictive diets to achieve a leaner body, as they may lead dancers to the development of EDs. Moreover, the questionnaires used in the study seemed to underestimate the presence of a disordered eating pattern reported during focus groups by the participants. Therefore, health professionals should acknowledge that classical ballet dancers, particularly the professional ones, may present disordered eating behaviors before the development of EDs. These data are of clinical relevance and could be used to inform psychological and nutritional strategies to improve the performance, well-being, and quality of life of these dancers.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Research Ethics Committee of the State University of Campinas (UNICAMP). The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

HS and FB conceived the study, analyzed and interpreted the data, and drafted the manuscript. AP, BM, FS, MU, and BG collected and analyzed the data. All authors revised and approved the final version of the manuscript and are, thus, accountable for its content.

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Exploring Correlates of Loss of Control Eating in a Nonclinical Sample

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Objective: Loss of control (LOC) eating has been directly related to the core aspects of the psychopathology of eating disorders and to different dimensions of emotion and behavior regulation and self-criticism. This study investigates a model representing the interplay between these dimensions to understand LOC eating among a nonclinical sample.

Methods: A total of 341 participants, recruited in a college campus (mean age 23.21, SD = 6.02), completed a set of self-report measures assessing LOC eating, weight suppression, psychopathology of eating disorders, depression, negative urgency, emotion regulation difficulties, and self-criticism. Path analysis modeling tested a hypothesized model with 3 paths for LOC eating as follows: (1) psychopathology of eating disorders; (2) emotion and behavior regulation; and (3) interplay between these paths.

Results: We found goodness-of-fit indexes to our data: χ^2 = 17.11, df = 10, Comparative Fit Index (CFI) = 0.99, Tucker-Lewis index (TLI) = 0.98, Root Mean Square Error Approximation (RMSEA) = 0.045, Standardized Root Mean Square Residual (SRMR) = 0.041, suggesting that: (1) participants with higher weight suppression showed higher degrees of the psychopathology of eating disorders, which was linked to higher levels of LOC eating; (2) self-criticism was a mediator between emotion regulation and depression/negative urgency; (3) self-criticism was a mediator between emotion regulation and disorder eating, which was significantly associated with LOC eating *via* increased negative urgency.

Conclusion: Our model shows that LOC eating occurs for individuals with the psychopathology of higher eating disorders who experience depressive symptoms and act rashly under distress for their inability to cope adequately with negative feelings of self-devaluation. These findings point to the importance of negative self-evaluations and feelings of inadequacy or worthlessness to understand LOC eating among college students.

Keywords: self-criticism, loss of control eating, non-clinical sample, eating disorders psychopathology, emotion regulation

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INTRODUCTION

Loss of control (LOC) eating is described as the subjective perception of being compelled to eat or unable to resist or stop eating. LOC eating has been considered a core symptom of several eating disorders, including binge-eating disorder, bulimia nervosa, and anorexia nervosa-binge/purge subtype (American Psychiatric Association [APA], 2013). The experience of LOC eating and the consumption of an unambiguously large quantity of food in a discrete period of time are considered the two hallmark features in the definition of binge eating of the DSM-5 (American Psychiatric Association [APA], 2013). However, cumulative evidence suggests that the experience of LOC eating, rather than episode size, is the most salient indicator of the psychopathology of eating disorders and psychological distress in clinical and nonclinical samples of both in the youths (Schlüter et al., 2016; Byrne et al., 2019) and adults (Mond et al., 2010; Fitzsimmons-Craft et al., 2014; Goldschmidt, 2017). Current research also suggests that the degree of LOC eating is associated with the degree of eating-related psychopathology and psychological distress in bariatric surgery samples (Conceição E. M. et al., 2018), adults (Latner et al., 2014), and adolescents (Vannucci and Ohannessian, 2018), in a way that the greater the degree of LOC eating experienced, regardless of the amount of food eaten, the more severe are eating-related symptoms and distress. Although LOC eating is conceptualized as directly related to the core aspects of the psychopathology of eating disorders, particularly the importance and concerns over eating and body weight/shape (Fairburn et al., 2003), other variables have been investigated to explain the relationship between core psychopathology of eating disorders and LOC eating behavior.

Psychological and Weight-Related Variables Associated With Loss of Control Over Eating

Weight suppression represents the difference between the highest lifetime weight and current weight and is considered a transdiagnostic factor in eating disorders (Lowe et al., 2018). Weight suppression has been associated with more shape and weight concerns, higher restraint, and eating disorders severity in individuals with eating disorders (Lowe et al., 2018) and nonclinical undergraduates (Burnette et al., 2018). In the community sample, weight suppression was found to be a predictor of binge-eating behavior and more frequent LOC eating (Van Son et al., 2013).

Overvaluation over eating, body weight, and body shape are considered the core-psychopathology of eating disorders, and self-evaluation is overdependent on the control exerted over these dimensions (Fairburn et al., 2003). In the context of eating disorders, self-evaluation is also dependent on the achievement of demanding and self-imposed standards in the control of these dimensions (Shafran et al., 2002; Fairburn et al., 2003). Failure to meet those standards results in self-critical thoughts toward oneself and strengthens the concerns over body shape, weight, and eating (Shafran et al., 2002).

Consistent with this perspective, *self-criticism* has been suggested as a strong predictor of the psychopathology of eating disorders (Fennig et al., 2008) in patients with binge eating disorders (Dunkley and Grilo, 2007) and college students (Porter et al., 2018). Self-criticism also seems to have significant longitudinal relations with fasting, purging, and excessive exercise (Zelkowitz and Cole, 2020). It involves negative self-evaluations and feelings of inadequacy or worthlessness (Gilbert et al., 2004). The relationship between these self-critical feelings and psychopathology of eating disorders may be partially mediated by *depressive symptoms* and low self-esteem (Dunkley and Grilo, 2007), which are reinforced by pursuing and failing to meet high standards on the dimensions of eating, weight, and shape control. Consistently, Feinson and Hornik-Lurie (2016) suggested that binge eating may be a self-soothe strategy from the negative effect triggered by self-critical thoughts that result from failing to meet the self-imposed high/demanding standards (Feinson and Hornik-Lurie, 2016).

Along these lines, a growing body of research suggests that *emotion regulation* also seems to play a role in the link between self-criticism and binge eating/LOC eating. Different studies showed that poor emotion regulation skills are prospectively and concurrently associated with binge eating and LOC eating in adolescents (Goldschmidt et al., 2017), college students (Markey and Vander Wal, 2007), and adults (Bodell et al., 2019), even after controlling for negative affect (Markey and Vander Wal, 2007). Moreover, negative affect seems to increase prior and decreases after binge eating (Berg et al., 2015; Schaefer et al., 2020), and there is evidence that the learned expectancy that eating will alleviate distress seems to increase the risk for binge eating (Fischer et al., 2013). These findings are consistent with the affect regulation model of binge eating (Haedt-Matt and Keel, 2011; Leehr et al., 2015) arguing that binge eating may serve as an emotion regulation process in individuals lacking adaptive strategies and show that this relationship may not be exclusive to individuals with eating disorders.

Finally, the tendency to act impulsively under situations of negative emotionality (*negative urgency*) may provide additional insight on the behavioral relation between emotion regulation difficulties and LOC eating. Negative urgency is considered the facet of impulsivity mostly associated with binge eating (Kelly et al., 2014) and seems to be significantly associated with both LOC eating and the ingestion of large amounts of food (Racine et al., 2015). Research has consistently shown that higher negative urgency scores are prospectively (Emery et al., 2013; Fischer et al., 2013) and cross-sectionally (Kelly et al., 2014; Aloi et al., 2020) associated with binge-eating severity in clinical or community samples. Additionally, greater negative urgency combined with greater negative emotionality is associated with the psychopathology of eating disorders in women with and without bulimic disorders (Conceição E. et al., 2018; Magel and von Ranson, 2021). Considering this research, individuals with poorer emotion regulation strategies, particularly those who tend to act rashly when experiencing negative emotions, would tend to engage more in LOC eating.

The Interplay Between Weight-Related and Psychological Aspects to Understand Loss of Control Over Eating

Despite the extensive body of literature regarding each of these factors (weight suppression, psychopathology of eating disorders, self-criticism, depressive symptoms, and negative urgency), to the best of our knowledge, no study investigated how these aspects interact with each other to explain LOC eating. This research is particularly scarce in nonclinical samples despite the growing evidence that LOC eating in this population is highly prevalent and associated with the psychopathology of eating disorders, psychological distress, and body mass index (BMI) (Mustelin et al., 2017). This research can have important implications for identifying the mechanisms that link psychopathology of eating disorders and emotion regulation under distress, and to inform our understanding of LOC eating in nonclinical conditions.

Taking into consideration the data previously described, we proposed the model of LOC eating presented in **Figure 1**. In this model, we hypothesized three paths to understand LOC eating in a nonclinical sample:

Path 1 –Psychopathology of eating disorders and LOC eating: increased weight suppression (greater variations in the weight of individuals) would be associated with eating disorders (eating and weight/shape concerns), which would be positively and significantly associated with higher LOC eating;

Path 2 – Emotion and behavior regulation under distress: emotion regulation difficulties would be associated with greater self-criticism (thoughts of self-inadequacy and self-failure), leading to more depressive symptoms, which would increase LOC eating directly or *via* greater levels of negative urgency.

Path 3 – Interplay between Path 1 and Path 2: self-criticism (feelings of failure/negative self-evaluation) and emotion regulation difficulties (to deal with such negative experiences of the self) would be associated with LOC eating *via* increased psychopathology of eating disorders. Psychopathology of eating disorders would be associated with LOC eating *via* increased levels of negative urgency.

MATERIALS AND METHODS

Participants and Procedure

Recruitment was conducted in a university campus in the north of Portugal from January to April 2018. All students from the university institution received an invitation to participate in this study in their institutional email. Survey invitation letters provided a link to the questionnaires *via Google Docs* software. Advertising on Facebook was also used to disseminate the invitation. Participants not fluent in written Portuguese were excluded. All participants were informed about the aims, as well as the voluntary and confidential nature of the study. Participants agreed on an informed consent form and filled out a set of questionnaires that took approximately 20 min. To enhance the response rate, a raffle draw of a €20 voucher to use in a main retail chain store following survey completion was run with accepting participants. The institutional review board from the university involved approved this study.

Measures

Sociodemographic and anthropometric questionnaire: a measure that included items self-reported about sociodemographic (age, gender, educational level, and professional status) and anthropometric information (height, current, highest, and lowest weight in adulthood). Weight suppression relative to current weight was computed as [current weight suppression = highest weight - current weight]; weight suppression relative to lowest weight was computed as [lifetime weight suppression = highest weight - lowest weight].

The Loss of Control over Eating Scale (LOCES) (Latner et al., 2014): A 24-item self-report measure intended to measure the degree of LOC eating. Responses ranged from 1 ("never") to 5 ("always") focuses in the past 28 days, which were averaged to generate a total score. The items are organized into three factors: (1) the behavioral aspects of LOC eating (e.g., "I kept eating although I was no longer hungry"), (2) the cognitive/dissociative aspects of LOC eating (e.g., "I could not concentrate on anything other than eating"), and (3) the positive/euphoric aspects of LOC eating (e.g., "While eating, I felt a sense of relief or release"). Higher results indicate higher LOC eating. The Cronbach's α obtained in the present investigation was 0.95 for the total score. Validation of the Portuguese version of this measure is currently ongoing and being prepared for publication. Translation and back-translation and a pilot test with the target audience were conducted and followed by larger recruitment with clinical and community samples.

Eating Disorder-15 (ED-15) (Tatham et al., 2015; Rodrigues et al., 2019): This measure includes a 10-item measure answered in a 7-point Likert scale from 0 ("Not at all") to 6 ("All the time") that assesses behaviors, attitudes, and feelings associated with eating disorders. This questionnaire generates two subscale scores (weight and body shape concern, and eating concern) and a combined global severity score. Higher scores indicate psychopathology of greater eating disorders. In this study, only the total score was used (α = 0.94 for our sample).

Depression, Anxiety and Stress Scales (DASS-21) (Lovibond and Lovibond, 1995; Pais-Ribeiro et al., 2004): A self-report measure that assesses the magnitude of the following three negative emotional states: depression, anxiety, and stress. For this study, only the depression scale of this questionnaire was used. The corresponding 7 items are answered in a 4-point Likert scale from 0 ("Did not apply to me at all") to 3 ("Applied to me very much or most of the time") during the previous week. Higher scores express greater distress. Cronbach's α for our sample was 0.96 for the depression subscale.

Urgency, Premeditation, Perseverance, and Sensation Seeking Scales – Negative urgency (UPPS-NU) (Whiteside et al., 2005; Conceição et al., 2020): The subscale of negative urgency of the UPPS was used. Negative urgency is the tendency of an individual to act rashly under situations of negative emotions. The 12-item scale is answered on a 4-point Likert scale from 1 ("Completely agree") to 4 ("Completely disagree") assess. Higher scores indicate

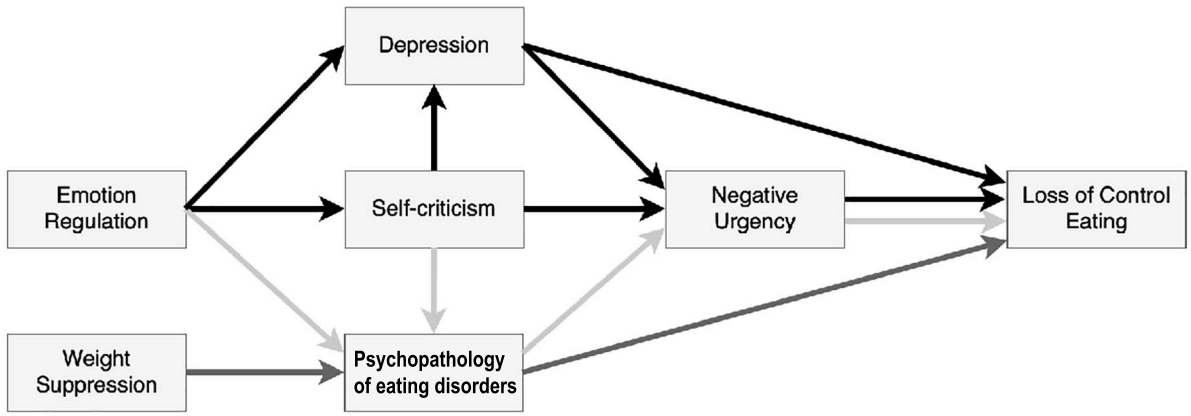

FIGURE 1 | Hypothesized model depicting the interplay between disordered eating-related variables and other psychological variables to explain loss of control (LOC) eating. ▬ Path 1 – Psychopathology of eating disorders and LOC eating; ▬ Path 2 – emotion and behavior regulation under distress; and ▬ Path 3 – interplay between Path 1 and Path 2.

greater negative urgency. Cronbach's α for our sample was 0.91 for the total score.

Difficulties in Emotion Regulation Scale (DERS) (Gratz and Roemer, 2004; Veloso et al., 2011): A 36-item self-report measure that assesses clinically relevant difficulties in emotion regulation through a total score and six dimensions. For this study, only the total score of this questionnaire was used. Responses ranged from 1 ("Almost never") to 5 ("Almost always"). Higher scores indicate increased difficulties with emotion regulation. Cronbach's α for our sample was 0.95 for the total score.

Forms of Self-Criticizing and Reassuring Scale (FSCRS) (Gilbert et al., 2004; Castilho and Gouveia, 2011): A 22-item self-report measure that assesses how people tend to self-criticize and self-reassure themselves, toward failure and error situations. Items are rated on a five-point Likert scale from 0 ("Anything like me") to 4 ("Extremely like me") and generate three subscales. For this study, only the self-criticism subscales were used as a single variable corresponding to the sum of the inadequate self and hated self-subscales. Higher scores indicate greater self-criticism feelings/thoughts. Cronbach's α for our sample was 0.94 for the computed total score.

Statistical Analyses

Spearman's rho coefficients were conducted to investigate the correlation between LOC eating and the other variables under study. This analysis was conducted using the IBM® SPSS® Statistics 25.0 (SPSS Inc., Chicago, IL, United States) for windows.

The path analyses were conducted using the R statistical environment (RStudio, version 3.6.2, R Development Core Team, 2018), through the package "lavaan" (Rosseel, 2012). The significance level was set at $\alpha = 0.05$. Structural equation modeling (SEM) tools were used to assess the validity of the path model by fitting it to the observed data. Several fit indices were used to assess the model fit: chi-square statistic, degrees of freedom (df), the Comparative Fit Index (CFI), the Tucker-Lewis index (TLI), the Root Mean Square Error Approximation (RMSEA), and the Standardized Root Mean Square Residual (SRMR). Goodness-of-fit model is indicated by a nonsignificant chi-square test, TLI and CFI greater than 0.95, RMSEA smaller than 0.06, and SRMR smaller than 0.08 (Hu and Bentler, 1999). The bootstrapping method was selected to compute SEs of the parameter estimates. All continuous variables were standardized and centered. The full information maximum likelihood (FIML) method was selected to deal with missing data. The hypothesized model was tested and the nonsignificant paths between variables were dropped to improve the model until we reached the final model.

RESULTS

A total of 341 participants aged between 18 and 59 years (M = 23.21, SD = 6.02) responded to our survey. Participants included 246 (72.1%) women and 95 (27.9%) men. Within the sample, 58 (17%) participants attended their 1st year of college, 78 (22.9%) attended their final (5th) year, 173 (50.7%) spread through the 2nd and 4th year, and 32 (9.4%) were doctoral or postgraduate students. The majority of participants, 285 (83.6%), were students, 45 (13.2%) were student-workers, and 11 (3.2%) identified as other. Mean current, highest, and lowest BMI was 22.91 (SD = 4.40), 24.47 (SD = 4.98), and 20.75 (SD = 3.61) kg/m^2, respectively. Mean current weight suppression and mean lifetime weight suppression was 4.33 (SD = 4.33) and 10.28 (SD = 7.95), respectively.

Table 1 presents the correlations between LOC eating and the other psychological variable under study. Although correlations between the variables under study were all statistically significant, LOC eating showed particularly strong correlations (> 0.4) with the psychopathology of eating disorders (ED-15), and negative urgency (UPPS-NU). Interestingly, psychopathology of eating disorders was strongly (> 0.4) correlated only with self-criticism (FSCRS). Of note, lifetime weight suppression was more strongly associated with psychopathology of eating disorders and LOC eating than weight suppression relative to current weight.

TABLE 1 | Correlation between variables under study.

		1	2	3	4	5	6	7	8
1	Loss of control eating (LOCES)	–							
2	Eating disorder psychopathology (ED-15)	**0.52*****	–						
3	Current weight suppression	0.01	0.12*	–					
4	Life-time weight suppression	0.21***	0.28***	**0.53*****	–				
5	Self-criticism (FSCRS)	0.36***	**0.54*****	−0.02	0.14*	–			
6	Negative urgency (UPPS-NU)	**0.41*****	0.32***	0.01	0.19**	**0.45*****	–		
7	Depression (DASS)	0.37***	0.35***	−0.08	0.07	**0.58*****	**0.40*****	–	
8	Emotion regulation (DERS)	0.25***	0.34***	−0.04	0.11	**0.55*****	0.32***	0.35***	–

LOCES – The Loss of Control over Eating Scale; ED-15 – Eating Disorder-15; Depression, FSCRS – Forms of Self-Criticizing and Reassuring Scale, sum of the inadequate-self and hated self; UPPS-NU – Urgency, Premeditation, Perseverance, and Sensation Seeking scales; DASS – Depression, Anxiety and Stress Scales; DERS – Difficulties in Emotion Regulation Scale.

** $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Strong correlations (> 0.4) are highlighted in bold.*

Self-criticism was further strongly correlated with difficulties in emotion regulation, negative urgency, and depression.

Figure 2 depicts the final model that reached goodness-of-fit indexes and depicts the complex web of interactions between the variables under study. The main parameter estimates are summarized in **Table 2**, and the mediation estimates are presented as Supplementary Material (**Supplementary Table 1**). The relationships between the main variables in this study were specified based on theoretical findings (hypothesized model in **Figure 1**) and on the correlation matrix presented in **Table 1**. The model depicted in **Figure 2** exhibited very goodness-of-fit indexes to the data with the following goodness-of-fit measures: chi-square = 17.11, df = 10, *p*-value = 0.72, CFI = 0.99, TLI = 0.98, RMSEA = 0.045 with 90% CI = [0.000, 0.082], and SRMR = 0.041.

This model brings support to the hypothesized paths to understand LOC eating. *Path 1 – Psychopathology of eating disorders and LOC eating,* entailing the psychopathology of eating disorders in which participants with higher weight suppression had higher levels of eating disordered disorders psychopathology, which was strongly associated with LOC eating. *Path 2 – Emotion and behavior regulation under distress,* entailing mechanisms of emotion and behavior regulation in relation to depressive symptoms and feelings of self-criticism. Emotion regulation was only indirectly associated with LOC eating through the mediation of self-criticism, which, in turn, associates with LOC eating through the mediation of depressive symptoms and negative urgency. The hypothesized direct paths between emotion regulation and depression/negative urgency were not significant and thus were removed from the final model. Additionally, negative urgency also mediated the relationship between depression and LOC eating. The hypothesized direct path between depression and LOC eating was also significant. Finally, we hypothesized *Path 3 – Interplay between Path 1 and Path 2,* entailing the interplay between the psychopathology of eating disorders (*Path 1*) and the emotion and behavior regulation (*Path 2*). We found that emotion regulation (*Path 2*) was only indirectly associated with LOC eating through the mediation of self-criticism (*Path 2*), which, in turn, is associated with LOC eating through the mediation of psychopathology of eating disorders (*Path 1*). The hypothesized direct paths between emotion regulation and psychopathology of eating disorders were tested but found to be nonsignificant in the model. Additionally, the relationship between psychopathology of eating disorders (*Path 1*) and LOC eating was also partially mediated by negative urgency (*Path 2*).

DISCUSSION

This study sought to investigate how weight suppression, psychopathology of eating disorders, self-criticism, depression, and emotion and behavior regulation deficits interact to understand LOC eating among a nonclinical sample of college students.

Overall, our model shows that emotion dysregulation is associated with self-criticism, which, in turn, associates with LOC eating through the mediation of psychopathology of eating disorders, negative urgency, and depression. Moreover, weight suppression is associated with the psychopathology of eating disorders, which, in turn, is associated with LOC eating directly and indirectly *via* the mediation of negative urgency.

Specifically, we found support for the hypothesized paths and most of the associations between the variables under study. Regarding *Path 1 – Psychopathology of eating disorders and LOC eating*, our data suggest that LOC eating tends to occur in individuals who score higher on levels of weight/shape and eating concerns. Psychopathology of eating disorders was the variable most strongly associated with LOC eating, which sets the context for this eating disordered behavior. In line with past research, weight suppression was associated with LOC eating (Van Son et al., 2013), but only through the mediation effect of the psychopathology of eating disorders.

Interestingly, our data show that lifetime weight suppression and not current weight suppression had a role in our model. This may suggest that the past experience of weight variation might be a stronger trigger for the development of psychopathology of eating disorders (specifically, weight, shape, and eating concerns), than current weight suppression. Contrary to our findings, other research with clinical samples showed that current weight suppression (Lowe et al., 2018) was strongly associated with eating disorder-related psychopathology and behaviors. In fact, a higher weight suppression may be associated with a stronger bio-behavioral vulnerability (Lowe, 2011), which can contribute to the maintenance of eating and shape concerns, fear of weight gain, and ED behaviors (Bodell and Keel, 2016; Lowe et al., 2018). A possible explanation may rely on disruption in physiological processes in weight-suppressed individuals (e.g., reduced leptin or increased ghrelin levels), which may increase the drive for food consumption and vulnerability to bulimic episodes

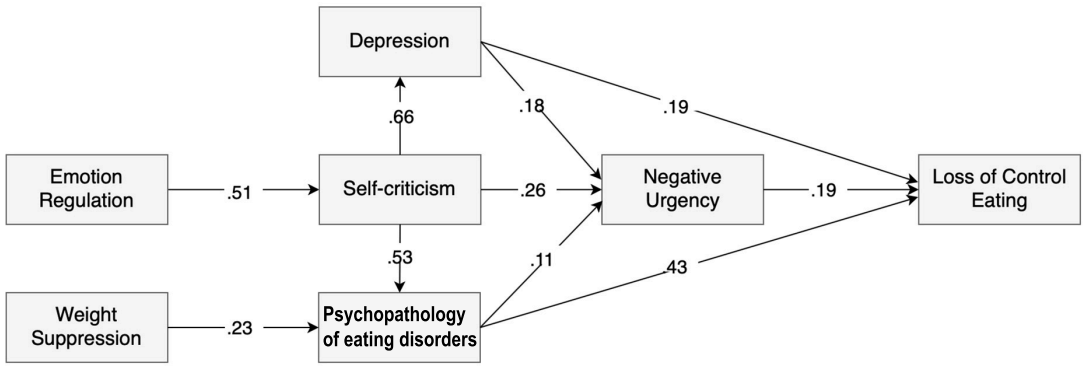

FIGURE 2 | LOC over eating: structural equation model depicting the interplay between disordered eating-related variables and other psychological variables. All paths represented between each variable are significant with $p < 0.05$. Path 1 – Weight suppression → Psychopathology of eating disorders → Loss of control eating. Path 2 – Emotion regulation → Self-criticism → Depression → Negative urgency → Loss of control eating. Path 3 – Self-criticism → Psychopathology of eating disorders → Negative urgency → Loss of control eating.

(Keel et al., 2019). It is possible that the apparently conflicting results reported with our findings are due to the nonclinical nature of our sample and that in this sample, current weight suppression is not clinically severe to induce this biological effect on eating.

TABLE 2 | Parameter estimation of the final model outlined in **Figure 2**.

Parameters	Estimate	SE	*p*-value	95% bootstrap CI
Paths (regressions)				
Emotional regulation → Self-criticism	0.51	0.065	< 0.001	[0.384, 0.634]
Self-criticism → Depression	0.66	0.041	< 0.001	[0.581, 0.744]
Self-criticism → Negative urgency	0.26	0.072	< 0.001	[0.114, 0.396]
Depression → Negative urgency	0.18	0.070	0.011	[0.049, 0.317]
Disordered eating → Negative urgency	0.11	0.057	0.048	[0.010, 0.226]
Weight suppression → Disordered eating	0.23	0.050	< 0.001	[0.138, 0.336]
Self-criticism → Disordered eating	0.53	0.051	< 0.001	[0.425, 0.631]
Depression → Loss of control eating	0.19	0.070	0.008	[0.045, 0.312]
Negative urgency →Loss of control eating	0.19	0.054	0.001	[0.085, 0.305]
Disordered eating → Loss of control eating	0.43	0.057	< 0.001	[0.324, 0.546]
Covariances				
Emotional regulation ∼∼ Weight suppression	0.09	0.000	NA	NA
Variances				
Self-criticism	0.74	0.090	< 0.001	[0.580, 0.928]
Depression	0.56	0.049	< 0.001	[0.458, 0.654]
Negative urgency	0.78	0.071	< 0.001	[0.641, 0.916]
Disordered eating	0.64	0.054	< 0.001	[0.538, 0.752]
Loss of control eating	0.60	0.052	< 0.001	[0.491, 0.695]
Emotional regulation	1.00	0.000	NA	NA
Weight suppression	1.00	0.000	NA	NA

Concerning the hypothesized *Path 2 – Emotion and behavior regulation under distress*, our model highlighted the central role of self-criticism as a strong mediator between emotion regulation difficulties and depression/negative urgency, which, in turn, are related to LOC eating. These findings suggest that difficulties dealing with feelings of self-inadequacy or depressive symptoms lead to LOC eating *via* a higher tendency to act rashly under these negative situations. The lack of appropriate emotion regulation skills to deal with thoughts of self-inadequacy and self-failure (self-criticism) results in increased depressive symptoms, which, in turn, lead to LOC eating partially *via* negative urgency. Consistent with past studies, these findings suggest that LOC eating occurs in individuals with greater emotion regulation difficulties (Leehr et al., 2015) who tend to be highly critical about themselves (Feinson and Hornik-Lurie, 2016), feeling more depressed (Dunkley and Grilo, 2007), or acting rashly under negative emotions.

More important to understand LOC eating is *Path 3 – Interaction between Path 1 and Path 2*. Our data show evidence for an interplay between the variables associated with the psychopathology of eating disorders (Path 1) and difficulties in emotion and behavior regulation under negative emotions. Specifically, self-criticism showed to be highly correlated with the psychopathology of eating disorders and to be a strong mediator between emotion regulation and psychopathology of eating disorders, which is associated with LOC eating. These findings highlight the central role of feelings of self-inadequacy and self-failure in the psychopathology of eating disorders and LOC eating. Interestingly, the hypothesized direct paths between emotion regulation and psychopathology of eating disorders, emotion regulation and depression, and emotion regulation and negative urgency were not significant. These data support the argument that, in the context of the psychopathology of eating disorders leading to LOC eating, appropriate emotion regulation skills are needed to specifically deal with self-critic feelings regarding eating, weight, and body shape. Supporting these findings, past research suggests that

self-criticism is related to eating disorder symptoms beyond and independently of depression or self-esteem (Dunkley and Grilo, 2007; Porter et al., 2018), probably through a cognitive-personality vulnerability that maintains the eating disorder core-psychopathology (Dunkley and Grilo, 2007). Feinson and Hornik-Lurie (2016) investigated self-criticism, depression, and anxiety and found self-criticism to be the only significant contributor to binge eating severity (Feinson and Hornik-Lurie, 2016). Negative feelings regarding the self may lead to engaging in maladaptive eating (e.g., LOC eating) or weight control behaviors to compensate for the perceived inadequacies or to lessen the negative effect generated from such feelings (Fairburn et al., 2003; Porter et al., 2018). Consistent with the emotion regulation model of binge eating (Leehr et al., 2015), individuals lacking adaptive strategies to cope with negative emotions and feelings of inadequacy resulting from their critical appraisal of the self (triggers) may engage in problematic eating behaviors such as LOC eating (maladaptive emotion regulation behavior) to downregulate such negative states.

Finally, negative urgency served as a partial mediator between psychopathology of eating disorders and LOC eating. This suggests that part of the link between the psychopathology of eating disorders and LOC eating is explained by the tendency to act rashly under negative emotions. Our data provide further evidence for the argument that negative urgency was associated with binge eating above and beyond the influence of attitudes of eating disorders and depressive symptoms (Kelly et al., 2014).

These findings should be read in light of the cross-sectional design of this study. We cannot conclude about causality between these variables neither we can extrapolate these findings for what happens momentarily before or after a LOC eating episode. For instance, recent research with individuals with binge-eating disorder using Ecological Momentary Assessment (EMA) showed that levels of negative affect increase prior to and decreased after binge-eating episodes, suggesting that binge eating may function to alleviate unpleasant emotional experiences (Schaefer et al., 2020). Our data do not allow for such a conclusion but our model fits these EMA findings by depicting a close association between depressive symptom/negative urgency and LOC eating. Future research using EMA technologies to investigate the real-time associations between these variables would certainly expand our knowledge on the cross talk between these measures and how they operate to understand LOC eating.

Future studies should also test this model in clinical samples across the eating disorders and weight spectrum. Although we provided evidence for the interplay between these variables in a nonclinical sample, these conclusions should not be generalized to other samples. For instance, within individuals with eating disorders, emotion regulation difficulties could play a more central role with a more direct link with negative urgency, depression, and eating disorders psychopathology. In eating disorders, emotion regulation difficulties have been shown to improve with eating-disorders treatment (Mallorquí-Bagué et al., 2018), and differentially associated with more restrictive/compulsive eating symptomatology (Monell et al., 2018). Moreover, recent research using an EMA design shows that self-criticism is a potent momentary predictor of cognitions and behaviors of eating disorders in individuals with eating disorders (Mason et al., 2021). In contrast, self-criticism and the hypothesized *Path 1* might not be as salient in the population with overweight/obesity without eating disorders. Current research shows that the experience of LOC eating can appear in association with disordered eating behaviors that are not strongly linked to eating disorders psychopathology (Conceição et al., 2015; Conceição E. M. et al., 2018). Individuals with overweight/obesity may resort to food when under negative emotions or when feeling depressed for its immediate rewarding properties (Lee and Dixon, 2017). Therefore, emotion regulation, depressive symptoms, and negative urgency might place a more central role in explaining LOC eating than self-criticism and eating disorders' psychopathology among this population.

Finally, our data were collected using self-report measures assessing the perceived experience of LOC eating. Self-report measures are known to overreport LOC eating behaviors (Everett et al., 2021). Although we are not assessing LOC behaviors *per se*, but rather the subjective perception of LOC while eating, it is unclear whether similar findings would apply to LOC eating as assessed by a clinical interview.

Overall, our model shows that LOC eating occurs for individuals with higher eating disorders psychopathology who experience depressive symptoms and act rashly under distress for their inability to cope adequately with negative feelings of self-devaluation. Our results also highlight the central role of self-criticism as a mediator between emotion regulation and psychopathology of eating disorders, depression, and negative urgency in eating. These findings point to the importance of the negative self-evaluations and feelings of inadequacy or worthlessness among college students to understand LOC eating.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Ethics Committee for Research in Social and Human Sciences (CEICSH). The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

EC contributed to the planning and design of the study, data analysis and interpretation, took primary responsibility for the manuscript, including reviewing relevant literature, and drafting the manuscript for publication. CM was responsible for data analysis and reporting and interpretation of the results. ML and SR were responsible for data collection, participant recruiting, and contributed to its analysis and interpretation. AV contributed to the design and planning of the study and to its analysis and interpretation. All authors assisted with the literature review

and editing of the manuscript and read and approved the final manuscript.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2021.787558/full#supplementary-material

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Psychological Correlates of Excessive Healthy and Orthorexic Eating: Emotion Regulation, Attachment, and Anxious-Depressive-Stress Symptomatology

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Orthorexia nervosa, the pathological obsession with eating healthy, shares risks and significant comorbidity with other mental disorders. Based on a behavioral conceptualization of the overlap, emotion regulation, attachment style, and anxious-depressive-stress symptomatology are prominent but insufficiently researched endophenotypes for orthorexia nervosa. This study aimed at identifying ways in which difficulties in emotion regulation and attachment-related anxiety and avoidance become apparent in orthorexia nervosa and healthy orthorexia. Additionally, the moderating role of anxious, depressive, and stress symptoms was explored. A convenience sample of 399 adults (266 women) completed questionnaires to measure orthorexia nervosa and healthy orthorexia, difficulties in emotion regulation, partnership-related bond, and anxious-depressive-stress symptomatology. The healthy orthorexia subscale was negatively associated with lack of emotional awareness but no other subscale of difficulties in emotion regulation or attachment-related anxiety and avoidance. Orthorexia nervosa scores were positively linked to difficulties in emotion regulation as well as attachment-related anxiety and avoidance. Multiple linear regression indicated non-acceptance of emotional responses and impulse control difficulties to be the strongest predictors for orthorexia nervosa. Both subscales also mediated the effects of attachment style on orthorexia nervosa with anxious-depressive-stress symptomatology moderating some of these effects. Individuals with higher orthorexia nervosa tendencies showed difficulties in emotion regulation, a common feature also of affective and eating disorders. Improvement in understanding the psychological features of orthorexia nervosa can enable a better differentiation from other disorders, advances in the development of treatment approaches and treatment planning, and outlines directions for future research on mechanisms.

Keywords: healthful eating, orthorexia nervosa, emotion regulation, attachment, affective psychopathology, stress

INTRODUCTION

Orthorexia nervosa (OrNe) describes the pathological obsession with healthy eating. Although not officially recognized as a mental disorder, obsession over nutrition, severely restricting types of food one eats, and trying to achieve the "perfect" diet can result in severe malnutrition, weight loss, emotional distress and other health issues (1). Up to date, however, the pathological relevance of this behavior is still hotly debated (2). It has been suggested that OrNe should be distinguished from healthy orthorexia (HeOr), defined as a healthy interest in diet and nutrition, and as having a healthy eating identity (3). This proposed two-factor structure has been replicated in follow-up studies showing opposite associations of OrNe and HeOr with disordered eating attitudes, food choices and affective measures (4). In line, orthorexic eating is often accompanied by other disorders, such as eating disorders, obsessive-compulsive as well as affective psychopathology (5–7). These comorbidities substantiate the debate whether OrNe is actually a diagnostic entity that is distinct from established mental disorders (8). At present, this question cannot be readily answered. Some studies clearly identify individuals with symptoms of orthorexia nervosa as a specific group distinct from individuals with eating disorder symptoms or obsessive-compulsive symptoms (9). However, based on commonalities in risk factors, psychological profiles, and clinical symptoms classification of OrNe within the eating disorder spectrum is most popular (10).

According to theoretical models, potentially harmful behaviors share characteristics that facilitate their co-occurrence [e.g., the Problem-Behavior Theory; (11)]. In that regard, difficulties in emotion regulation or the use of maladaptive emotion regulation is a central concept in many mental disorders (12). Emotion regulation encompasses deliberate and automatic processes responsible for monitoring, evaluating, and modifying emotional reactions (13, 14) influencing the quality and intensity of emotions individuals have, and when and how they experience them (15). Thus, difficulties in emotion regulation are related to various disorders' etiology and maintenance (16). Emotion dysregulation is even suggested to constitute a common transdiagnostic factor in mental disorders (17). Emotional dysregulation is also characterized by the inability to tolerate intense, unpleasant emotional states increasing the probability of developing severe mental health problems often associated with problems in impulse control [e.g., self-harm, suicidal ideation; (18)]. In that sense, emotion dysregulation is closely related to eating disorder pathologies. Eating disorder patients often report difficulties in emotion regulation (19, 20) and alexithymia (21). Specifically, two subscales of the difficulties in emotion regulation questionnaire (DERS), the lack of emotional awareness and clarity and low acceptance of emotions show high positive effect sizes in their associations with eating disorders. Moreover, the adaptive emotion regulation strategies re-appraisal and problem-solving show negative associations (22). Two previous studies suggest that emotion regulation might also be one of the factors explaining differences in orthorexic eating tendencies. Vuillier et al. (23) recruited a mainly female UK sample and were the first to relate orthorexic eating tendencies to difficulties in emotion regulations as measured with the Difficulty in Emotion Regulation Scale (DERS). However, after including disordered eating attitudes as a predictor, emotion dysregulation no longer contributed as a statistical predictor of orthorexic eating tendencies. Data from Lebanon confirmed these findings (24). In this study, difficulties in emotion regulation were positively associated with orthorexic tendencies but provided only little additional explained variance beyond current levels of disordered eating. Conclusions from both studies are limited, however, as they both included a version of ORTO-15, a tool criticized for its limited psychometric properties and for not measuring the pathological form of OrNe (25). Still, OrNe is phenomenologically characterized by the expectancy of obtaining positive affective states or mitigating aversive emotional states through eating only healthy food. Hence, negative affective states may predispose to orthorexic eating. Difficulties in emotion regulation may than aggravate the situation and trigger a vicious circle. It could be possible that orthorexic eating is a form of emotion regulation which is used when other strategies do not work or when one does not belief to be capable of using emotion regulation strategies when needed. Orthorexic eating is then used to gain feelings of security by focusing on healthy eating. However, these are only assumptions and need to be tested in (micro-)longitudinal studies. Current diagnostic criteria have partially followed this idea (1, 26) by suggesting emotional consequences of non-adherence to self-imposed nutritional rules as one of three main criteria. Again, this still has to be empirically proven.

Another non-specific vulnerability factor related to emotion regulation and suggested to explain a higher risk for OrNe is insecure attachment. Negative emotions that exceed or challenge the individual emotion regulation competence activate the attachment system (27, 28). In case of secure attachment, individuals seek the physical or psychological closeness of the attachment figures. However, based on relationship experiences of rejection or unpredictable support, already children develop either an insecure-avoidant or an insecure-ambivalent attachment pattern (29). Attachment research in adults distinguishes between insecure-avoidant and insecure-anxious attachment styles. Individuals with an insecure-avoidant attachment style have difficulties to trust their partner, prefer not to depend on them, and avoid being too close. Individuals with an insecure–anxious attachment style feel that their need for closeness in a partnership is not satisfied and fear of being abandoned (30, 31). Attachment theorists assume that attachment avoidance is associated with a deactivating emotion regulation pattern in which the access to negative emotions and the expression and interpersonal regulation is minimized (29, 31). In contrast, the ineffective emotion regulation of individuals with an anxious attachment style is described as hyperactivating and maximizing emotional expression and as inability to change negative emotions. However, empirical evidence also shows that both insecure attachment patterns may only differ in their hierarchy of emotion regulation styles (32). Many models of eating disorders follow the idea that insecure attachment, both anxious or avoidant attachment style, and preoccupied and dismissing representation in close

relationships, have important implications in the disorders' development and maintenance (33–35). Insecure attachment patterns in childhood are predictive of emotional eating in adolescence mediated by expressive suppression as emotion regulation strategy (36). Insecure attachment styles have been related to eating disorders accompanied by anxiety, depression, and low self-esteem. Maladaptive emotion regulation is a major mediator between insecure attachment style and symptoms of eating disorders (37). Especially high levels of anxious attachment style predicted eating disorder group membership (38, 39). However, up to date, only one study investigated the contribution of insecure attachment styles to OrNe. Here, both fearful and dismissing attachment styles correlated with higher interest in healthy eating (ORTO-15) but there was no significant additional contribution to explained variance in healthy eating orientation when overweight preoccupation, appearance orientation, and the presence of an eating disorder history were also considered (40).

As noted, OrNe is associated with the experience of increased negative emotions and arousal and even with the increased presence of anxious and depressive symptomatology [for a summary see (2)]. Negative emotional states activate the attachment behavior system and in case of insecure attachment consequently lead to an increased use of maladaptive emotion regulation strategies (29, 32). However, if negative emotions are not elicited, attachment differences in emotion regulation may not be obvious (41). Negative emotional states can also result in an excessive need of self-control but simultaneously in failures in self-regulation and in showing rather impulsive behaviors (e.g., emotional eating) depending on one's fixed mind regarding effective emotion regulation (42). Difficulties in emotion regulation are mediators between insecure attachment style and emotional eating (43). As mentioned above, anxious or avoidant attachment styles are linked to disordered eating behaviors mediated by maladaptive responses to emotions and emotional distress (44). This may especially be the case when experiencing negative emotions like stress, anxiety, or depressive feelings as they activate the attachment system and increase the use of maladaptive emotion regulation. Maladaptive emotion regulation may thus mediate the relationship between attachment style and disordered eating behaviors, including OrNe, with affective symptoms increasing this association. A study looking at this hypothesis in OrNe does not exist yet.

Therefore, this study aimed at investigating two primary goals. First, we aimed to analyze the association of insecure attachment styles with the presence of pathological orthorexic eating (OrNe) separated from the mere interest in healthy eating (HeOr). Second, we explored the mediating role of difficulties in emotion regulation for the association between insecure attachment and OrNe. In these analyses, affective psychopathology is considered to be a moderator expecting that higher affective symptoms reinforce the links. To account for possible gender differences with regard to emotion regulation, attachment, affective psychopathology, and orthorexic behaviors (1, 45), exploratory analyses will quantify the assumed associations separately for men and for women.

METHODS

Participants

For this study, we used convenience sampling via university mailing lists, social media, posters displayed within the campus, and advertisements in newspapers. Participants had to be aged 16 years and older, and had to clearly assign themselves to the male or female gender. Initially, 434 individuals at least read through the study information (survey page 1). On survey page 2 (consent form), $n = 3$ wanted to stop the survey at this point and $n = 22$ did not give an answer but closed the browser window. No further participant dropped out after providing informed consent. From initially 409 complete data sets, ten sets had to be excluded due to extreme stress levels (open question about major stressor within the last 2 weeks, $n = 1$) and unrealistically fast completion of the survey (i.e., a relative speed index >2, $n = 9$). The final sample consisted of 399 individuals (266 women) aged between 16 and 82 years (median age = 25.00 years).

Measures

Orthorexic Eating

Orthorexic eating was measured by means of the German version of the Teruel Orthorexia Scale [TOS; (3, 46)]. This 17-item tool considers both pathological and healthy aspects of orthorexic eating. Pathological orthorexic eating tendencies are captured through the orthorexia nervosa subscale (TOS-OrNe subscale, eight items, e.g., "I feel guilty when I eat foods that I do not consider healthy") while the healthy, non-pathological interest in healthy eating is captured through the healthy orthorexia dimension (TOS-HeOr subscale, nine items, e.g. "I feel good when I eat healthy."). Items are rated on 4-point scales from *0* = "completely disagree" to *3* = "completely agree" with reference to the individual's "general eating behavior". Internal consistencies were good for both subscales in the present study (*Cronbach's* α TOS-HeOr = 0.84, TOS-OrNe = 0.85).

Emotion Regulation

The 36-item Difficulties in Emotion Regulation Scale (47) was employed to analyze different deficits related to suboptimal emotion regulation. We used a German version of the DERS (translation by the authors) for which, like the English-language original, a 6-factor solution was proposed: *non-acceptance of emotional responses* (i.e., non-acceptance of reactions to own distresses, or negative secondary emotional reactions to one's own negative emotions), *difficulties engaging in goal-directed behavior* (i.e., difficulty concentrating and completing tasks in the face of negative emotions), *impulse control difficulties* (i.e., difficulty maintaining control over one's behavior when experiencing negative emotions and the belief that there is little one can do to effectively regulate emotions once upset), *limited access to emotion regulation strategies* (i.e., problems to access strategies for feeling better when distressed), *lack of emotional clarity* (i.e., the extent to which the individual is clear about the emotions they experience), and *lack of emotional awareness* (i.e., tendency to pay only little attention to and to not acknowledge emotions). Answers are given on a 5-point scale with the endpoints "Almost never/0–10% of the time" and "Almost always/90–100% of the

time." Sum scores are created for each subscale. Present good reliability scores confirm previous validation studies (*Cronbach's* α non-acceptance = 0.87, goals = 0.85, impulse = 0.81, strategies = 0.90, clarity = 0.86, awareness = 0.82).

Attachment Styles

Attachment style was assessed using a German translation of the Experiences in Close Relationships-Revised [ECR-R; (48, 49)]. This tool allows for the assessment of individual differences in attachment anxiety (i.e., feeling secure or insecure about the availability and responsiveness of romantic partners) and attachment avoidance (i.e., feeling uncomfortable being close to others or depending on others). Items are answered on a 7-point scale where *1* = "strongly disagree" and *7* = "strongly agree". Mean scores are created. Continuous scores of attachment avoidance and attachment anxiety are used for analyses in concordance with attachment research using this instrument. Internal consistency of both dimensions was good to excellent in the present sample (*Cronbach's* α anxiety = 0.87, avoidance = 0.93).

Affective Psychopathology

The Depression-Anxiety-Stress Scales (DASS-21) were used to measure affective symptoms and distress levels (50). Using the 21-item short form, seven items make up each subscale and each item is rated on a 4-point scale from *0* = "Did not apply to me at all" and *3* = "Applied very strongly to me or most of the time." Answers should be referenced to the last week. Internal consistencies of all subscales were acceptable to good in the present sample (*Cronbach's* α depression = 0.89, anxiety = 0.78, stress = 0.88).

Sociodemographics

Besides gender, data on age (years), body mass index (BMI, kg/m^2), partnerships status (yes/no), current employment (student, employed, other), and regular eating style (vegan, vegetarian, flexitarian, omnivorous) were collected to describe the sample.

Procedures

Interested individuals were provided with a link to the online survey (platform Soscisurvey). The link was accessible from May to June 2019. Questions were asked in fixed order. Study participation was voluntary, informed consent was attained electronically by clicking the respective statement for approval, and the study was approved by the local ethics committee (University of Wuppertal, reference: MS/BBL 190718). University students received course credit for their participation. All participants completing the questionnaires could additionally participate in a lottery for 5 × 20€ vouchers.

Statistics

Analyses of this concurrent study were conducted in SPSS v.23 for Mac OS. We standardized all scales using *Z*-scoring. First, zero-order correlations between the orthorexia scales (TOS) and affective psychopathology (DASS-21), emotion regulation difficulties (DERS), attachment styles (ECR-R) were calculated (see **Table 1**). According to Cohen's criterion, coefficients below 0.29 are considered small, values between 0.30 and 0.49 are interpreted as medium correlation, and values above 0.50 represent strong correlations. Coefficients below 0.20 were considered negligible and are thus not interpreted. We additionally explored the possible confounding effects of age. First, we correlated age with variables under study. Except one meaningful negative correlation with insecure-anxious attachment, there were no significant correlations. Second, we computed partial correlations controlling for age. In addition, we repeated all analyses excluding participants aged >60 years. Coefficients hardly changed indicating negligible influence of this factor (**Supplementary Material**). Moreover, differences in these associations between women and men were examined in gender-separate analyses complementing the total sample analyses. For the comparison of the two correlations Fisher's *z* transformation was used (**Supplementary Material**). Overall gender differences could not be verified. Following analyses were therefore conducted without both variables. Second, stepwise multiple regressions evaluated the predictive role of emotion regulation and attachment relative to depressive-anxious-stress symptomatology and healthy/pathological orthorexic eating. Third, a moderated mediation analysis was conducted using the PROCESS macro (version 3.5) to analyze how the independent variables (insecure-anxious attachment, insecure-avoidant attachment) affect the dependent variable (pathological orthorexic eating) through multiple mediators (emotion regulation) and moderators (symptoms of depression, anxiety, stress). Thus, the effects of the predictors (ECR-R subscales) on the mediator variables (DERS subscales) and the effects of mediator variables on the dependent variable (TOS-OrNe) were examined while considering the moderating effects of affective symptoms (DASS-21 subscales). The direct (c') and conditional indirect effects were estimated for each predictor and moderator in an independent model (model 58). Indirect effects of mediators were examined by bootstrapping (5,000 bootstraps). In case of full mediation, c' = 0. Results for the conditional indirect effects are reported as 95% confidence intervals with intervals that do not contain zero were considered significant (51). A heteroscedasticity consistent standard error and covariance matrix estimator was used because the existence of heteroskedasticity could not be excluded from the scatterplot of residuals. *P*-values < 0.05 were considered significant. Controlling for multiple testing, Bonferroni correction was applied with $p_{corrected} < 0.05/8$ and 0.05/6 for the regression (six DERS and two ECR-R subscales) and mediation (two ECR-R and three DASS-21 subscales) models, respectively.

RESULTS

Participants were between 16 and 82 years of age, with a mean age of 30.53 ± 12.90 years, and with $n = 16$ (4.0 %) individuals being older than 60 years. The BMI ranged between 16.20 and 40.56 kg/m^2, with a mean of 22.89 ± 3.64 kg/m^2. Four individuals had a BMI < 17 kg/m^2 (three women, one men) and $n = 19$ were overweight (BMI > 30 kg/m^2, 11 women, eight men). About 2/3 of the sample reported to be in a solid partnership (n =

TABLE 1 | Pearson correlations of variables under study for the total group.

Variable	*M*	*SD*	Correlation											
			(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1) TOS HeOr	12.10	5.09												
(2) TOS OrNe	3.34	3.77	0.472***											
(3) DASS-21 Depression	3.07	3.77	−0.027	0.341***										
(4) DASS-21 Anxiety	1.76	2.59	0.041	0.319***	0.672***									
(5) DASS-21 Stress	4.46	4.11	0.039	0.358***	0.757***	0.676***								
(6) DERS Non-acceptance	11.11	4.81	0.089	0.479***	0.495***	0.431***	0.546***							
(7) DERS Goals	12.31	4.25	−0.014	0.278***	0.445***	0.407***	0.524***	0.523***						
(8) DERS Impulse	10.86	3.91	0.069	0.444***	0.481***	0.401***	0.609***	0.672***	0.617***					
(9) DERS Strategies	15.82	6.39	−0.007	0.406***	0.674***	0.564***	0.636***	0.725***	0.682***	0.730***				
(10) DERS Clarity	9.58	3.70	−0.128*	0.280***	0.434***	0.341***	0.396***	0.500***	0.328***	0.466***	0.542***			
(11) DERS Awareness	15.00	4.52	−0.208***	0.121*	0.245***	0.163**	0.190***	0.287***	0.115*	0.292***	0.315***	0.618***		
(12) ECR-R Anxiety	2.83	0.98	−0.108*	0.220***	0.393***	0.373***	0.388***	0.369***	0.378***	0.334***	0.467***	0.361***	0.188***	
(13) ECR-R Avoidance	2.65	1.12	−0.087	0.181***	0.330***	0.239***	0.218***	0.278***	0.137**	0.263***	0.309**	0.394***	0.422***	0.435***

*TOS, Teruel Orthorexia Scale; HeOr, healthy orthorexia; OrNe, Orthorexia nervosa; DASS-21, Depression-Anxiety-Stress Scales; DERS, Difficulties in Emotion Regulation Scale; ECR-R, Experiences in Close Relationships – Revised. ***p < 0.001, **p < 0.01, *p < 0.05. r > 0.2.*

256, 64.2%). About half of the sample were students ($n = 212$, 53.1%) and one third were employed ($n = 141$, 35.3%). Some kind of restriction in their regular diet was reported by 42.6% of the sample (5.3% vegan, 17.5% vegetarian, 19.8% flexitarian, 57.4% omnivore).

Pearson correlations of all variables are reported in **Table 1**. All emotion regulation subscales of the DERS correlated positively with TOS-OrNe (orthorexia nervosa), though with small to moderate effects. Only the subscale "lack of emotional awareness" correlated below r = 0.20. Attachment anxiety was significantly positively associated with TOS-OrNe, but attachment avoidance was not. In contrast, the TOS-HeOr subscale for healthy orthorexia was uncorrelated to all DERS and ECR-R subscales except with the DERS scale "lack of emotional awareness" which showed a small negative association. Gender differences were hardly shown. Only the associations of DASS depression and attachment anxiety with TOS-HeOr (stronger negative correlation in men), and of DASS stress and DERS lack of emotional awareness with TOS-OrNe (stronger positive correlation in women) were significantly different between men and women. As already noted above, variables were uncorrelated to age (except insecure-anxious attachment).

Table 2 shows results from the multiple regression analyses examining the statistical prediction of psychopathological symptoms assessed in the DASS and symptoms of orthorexia from insecure attachment styles (ECR-R) and emotion regulation difficulties (DERS). The model explained 47% of depressive symptoms assessed in the DASS, R^2 adjusted = 0.47, $F_{(2,396)} = 176.4$, $p < 0.001$, with limited access to strategies and attachment avoidance being significant predictors. Individuals with more limited access to emotion regulation strategies and scoring higher in avoidant attachment were more likely to report higher scores in depressive symptoms. The same predictors significantly explained for symptoms of anxiety assessed in the DASS (explained variance 33%, R^2 adjusted = 0.33, $F_{(2,396)} = 99.1$, $p < 0.001$). For stress, the model explained 46% variance, R^2 adjusted = 0.46, $F_{(3,395)} = 112.2$, $p < 0.001$. Here, the DERS subscales limited access to strategies and impulse control difficulties as well as attachment anxiety were significant predictors. In the TOS-HeOr model, predictors explained 8% variance, R^2 adjusted = 0.08, $F_{(3,395)} = 12.1$, $p < 0.001$. The DERS subscales lack of emotional awareness and non-acceptance and also attachment anxiety were significant predictors. Individuals with less impaired awareness of their feelings, higher scores in non-acceptance of emotions and low scores in attachment anxiety reported higher healthy orthorexic eating behaviors. Finally, the model explained 26% of variance in TOS-OrNe, R^2 adjusted = 0.25, $F_{(2,396)} = 68.3$, $p <$

TABLE 2 | Linear multiple regressions of difficulties in emotion regulation and attachment style on symptoms of depression, anxiety, stress, and orthorexic eating.

	β	*t*	*p*
Depression ($R = 0.69$, $R^2 = 0.47$, adjusted $R^2 = 0.47$, $p < 0.001$)			
DERS Limited strategies	0.633	16.47	<0.001
ECR-R Avoidance	0.134	3.50	0.001
Anxiety ($R = 0.58$, $R^2 = 0.33$, adjusted $R^2 = 0.33$, $p < 0.001$)			
DERS Limited strategies	0.499	10.75	<0.001
ECR-R Avoidance	0.140	3.02	0.003
Stress ($R = 0.68$, $R^2 = 0.46$, adjusted $R^2 = 0.46$, $p < 0.001$)			
DERS Limited strategies	0.353	6.13	<0.001
DERS Impulse control difficulties	0.311	5.75	<0.001
ECR-R Anxiety	0.119	2.84	0.005
Healthy orthorexia ($R = 0.29$, $R^2 = 0.08$, adjusted $R^2 = 0.08$, $p < 0.001$)			
DERS Lack of awareness	−0.242	−4.80	<0.001
DERS Non-acceptance	0.210	3.94	<0.001
ECR-R Anxiety	−0.140	−2.70	0.007[#]
Orthorexia nervosa ($R = 0.51$, $R^2 = 0.26$, adjusted $R^2 = 0.25$, $p < 0.001$)			
DERS Non-acceptance	0.329	5.62	<0.001
DERS Impulse control difficulties	0.223	3.82	<0.001

DERS, Difficulties in Emotion Regulation Scale; ECR-R, Experiences in Close Relationships – Revised.
[#]*Not significant after multiple testing correction.*

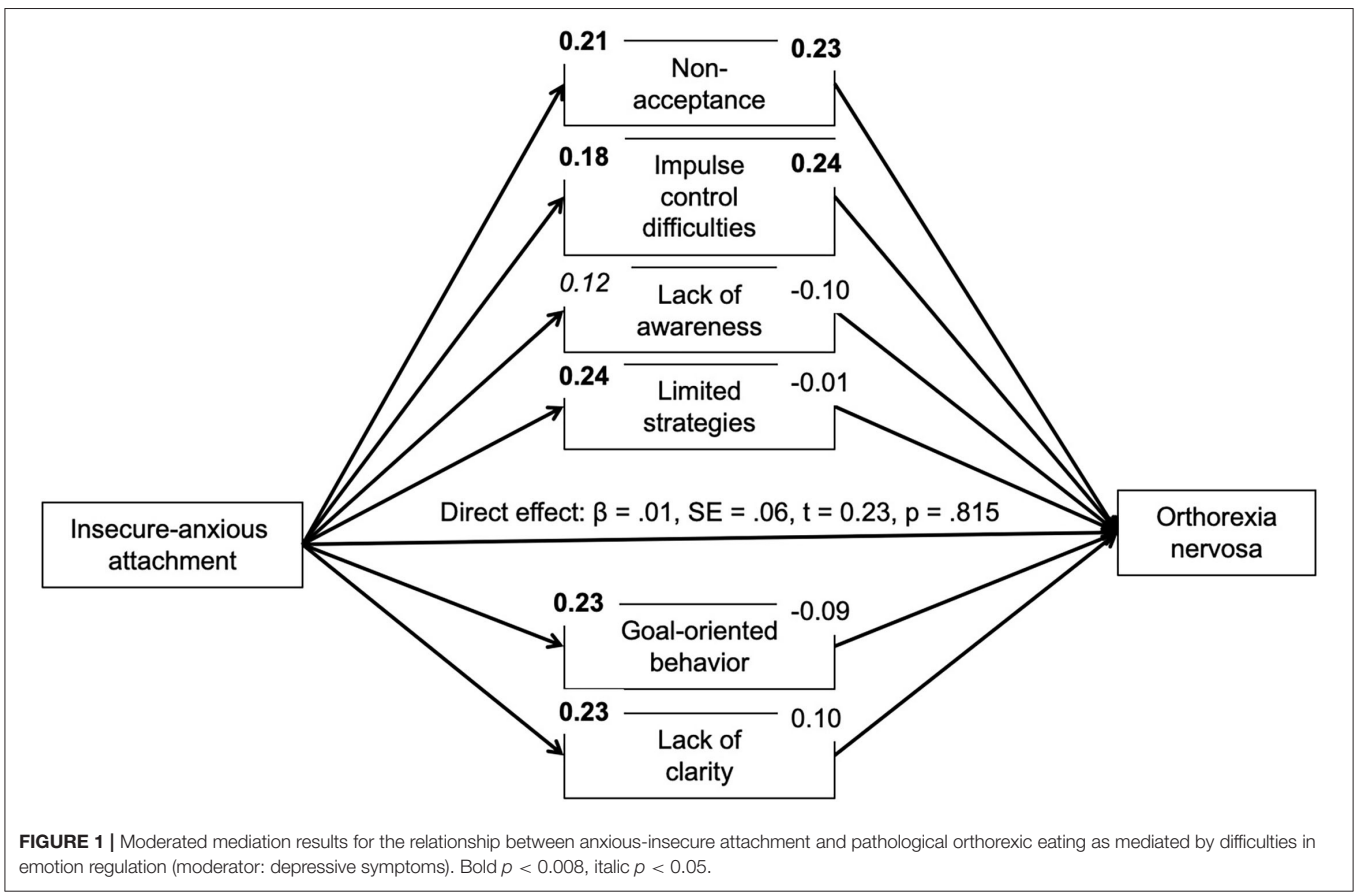

FIGURE 1 | Moderated mediation results for the relationship between anxious-insecure attachment and pathological orthorexic eating as mediated by difficulties in emotion regulation (moderator: depressive symptoms). Bold $p < 0.008$, italic $p < 0.05$.

0.001. The DERS subscales non-acceptance and impulse control difficulties were significant predictors. Higher pathological orthorexic eating was reported by individuals scoring higher on both scales.

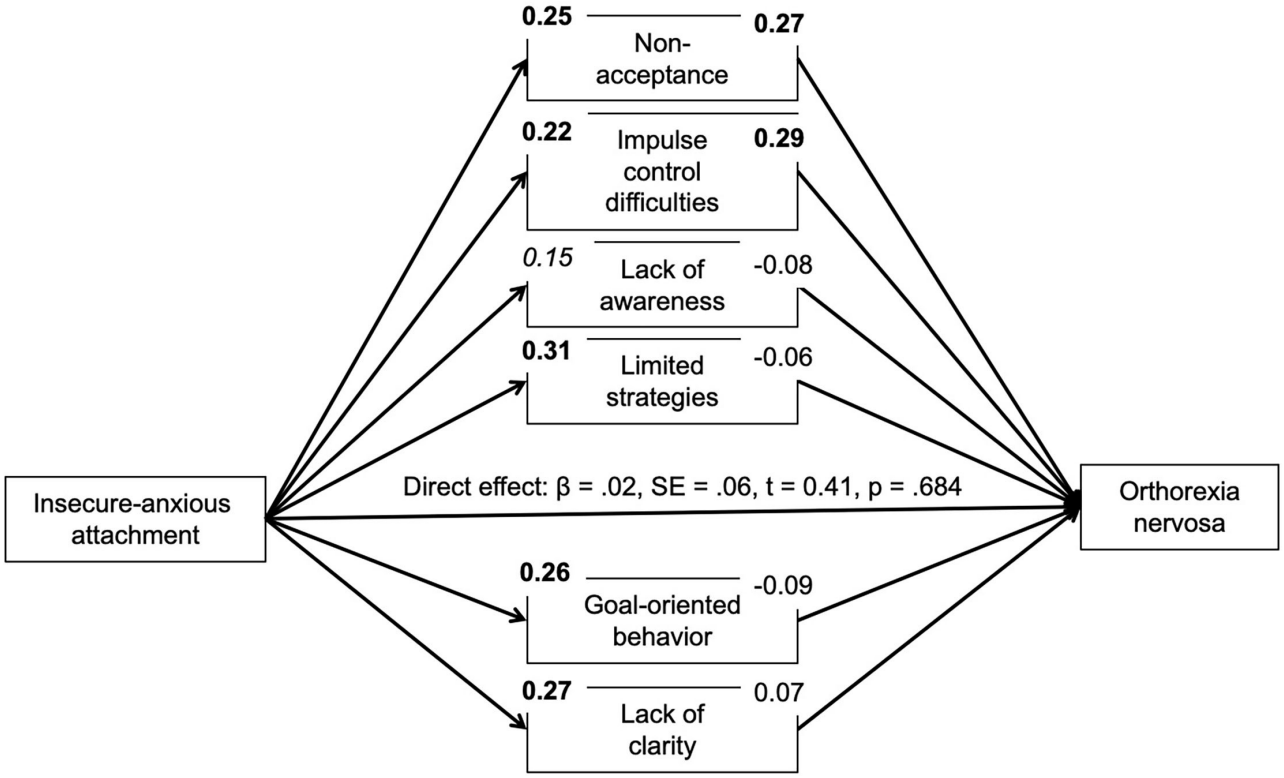

FIGURE 2 | Moderated mediation results for the relationship between anxious-insecure attachment and pathological orthorexic eating as mediated by difficulties in emotion regulation (moderator: anxiety symptoms). Bold $p < 0.008$, italic $p < 0.05$.

Based on correlational analyses, the proposed mediating role of difficulties in emotion regulation for the association between insecure attachment and pathological orthorexic eating moderated by affective psychopathology was examined using a moderated mediation model, controlling for the effects of gender, age, and BMI. In regard to insecure-anxious attachment, the a-path (predictor on mediator effect) was always significant or nearly significant. The b-path was only significant for a few mediators. Namely, an indirect effect of non-acceptance and impulse control difficulties was found. The conditional indirect effect of non-acceptance appeared stronger at mean [$b = 0.04$, 95% *BC CI* (0.01–0.09)] and high levels {+SD, [$b = 0.07$, 95% *BC CI* (0.02–0.13)]} of depressive symptoms compared to low (–SD) levels. The conditional indirect effect of impulse control difficulties appeared stronger at low {–SD, [$b = 0.05$, 95% *BC CI* (0.01–0.12)]} and mean levels [$b = 0.04$, 95% *BC CI* (0.01–0.09)] of depressive symptoms compared to high (+SD) levels. While there was no moderating effect of anxiety symptoms, the conditional indirect effect of non-acceptance appeared stronger at high levels of stress {+SD, [$b = 0.07$, 95% *BC CI* (0.02–0.13)]} compared to low (–SD) and mean levels. In regard to attachment avoidance, the model including depressive symptoms as moderator showed no indirect effects. By contrast, the model including anxiety symptoms showed indirect effects of non-acceptance and impulse control difficulties on symptoms of orthorexia nervosa. The indirect effect of non-acceptance was not moderated by anxiety symptoms. The conditional indirect effect of impulse control difficulties, however, appeared stronger at low {–*SD*, [$b = 0.06$, 95% *BC CI* (0.01–0.12)]} and mean levels [$b = 0.06$, 95% *BC CI* (0.01–0.11)] of anxious symptoms compared to high (+*SD*) levels. The model including the moderator stress showed an indirect effect of non-acceptance which appeared stronger at high levels of stress {+*SD*, [$b = 0.07$, 95% *BC CI* (0.02–0.13)]} compared to low (–*SD*) and mean levels (see **Figures 1**–**6**).

DISCUSSION

The aim of the study was to examine the associations of emotion regulation difficulties and insecure attachment styles with signs of healthy and pathological orthorexic behaviors. The findings of this study with a convenience sample showed that specific dimensions of emotion regulation difficulties correlated with pathological orthorexic behaviors while there was no relation to the healthy aspects of orthorexic eating. Overall, gender differences in these associations were rare. Attachment style played a role for women, less so for men. Mediation models implicated that non-acceptance of emotions and impulse control difficulties fully mediated the relationship between attachment style and pathological orthorexic behaviors. Current affective symptoms partially moderated this association.

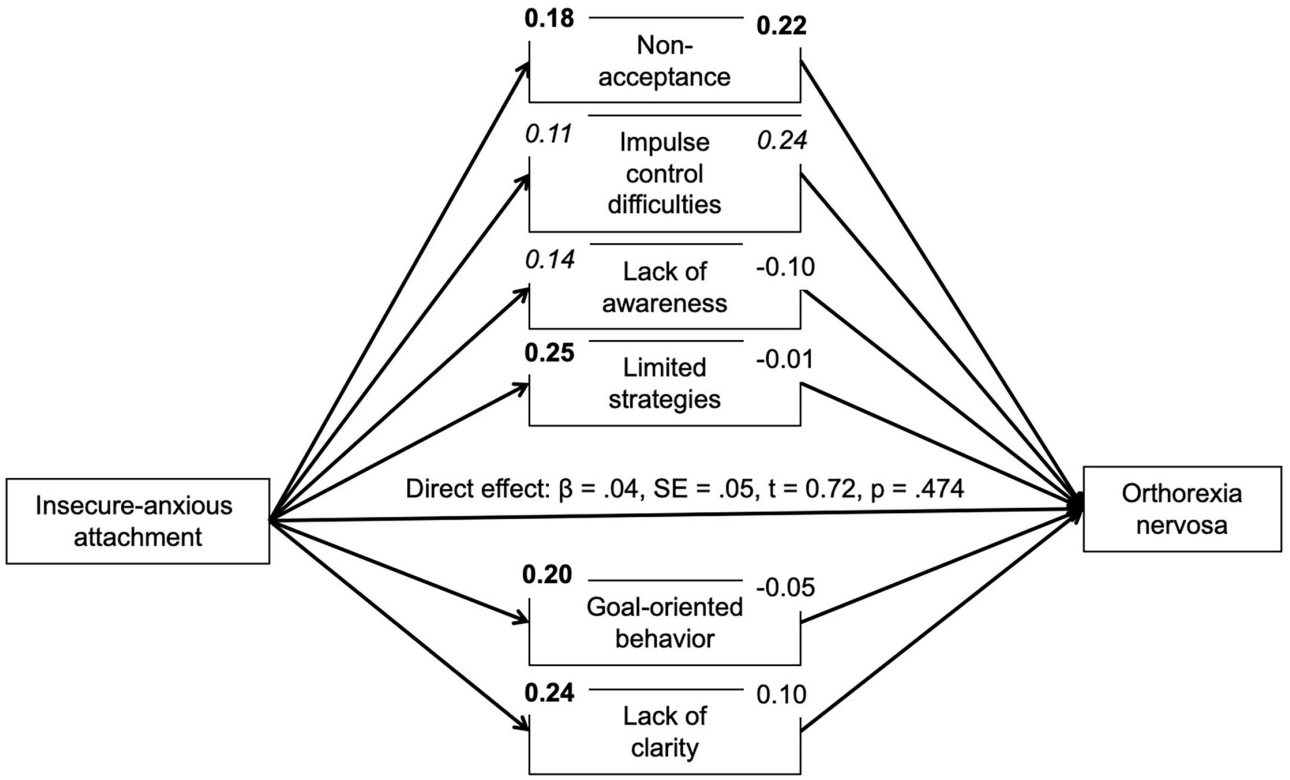

FIGURE 3 | Moderated mediation results for the relationship between anxious-insecure attachment and pathological orthorexic eating as mediated by difficulties in emotion regulation (moderator: stress symptoms). Bold $p < 0.008$, italic $p < 0.05$.

Emotion Dysregulation and Orthorexia Nervosa

In case of emotion regulation, the positive associations between all domains of difficulties in emotion regulation and symptoms of orthorexia nervosa were in accordance with similar results obtained from eating disordered populations who also score higher on emotion regulation difficulties or show maladaptive emotion regulation (19, 20). Previous studies of anorexia and bulimia nervosa have found lower distress tolerance, more impulsive behaviors when distressed, deficits in the flexible use of adaptive and situationally appropriate strategies as well as deficits in emotion understanding (52–54). The present study did only find a small association between OrNe and the subscale of the DERS assessing emotional self-awareness deficits. This is in contrast to numerous studies on alexithymia in Anorexia nervosa and Bulimia nervosa (55). Importantly, the effect sizes were only small (for problems with goal-directed behavior and lack of emotional clarity) to medium (for non-acceptance of emotions, impulse control difficulties and limited access to emotion regulation strategies). This, however, is comparable to previous studies on pathological healthful eating. One study showed DERS problems with clarity of emotions to be unrelated to preoccupation with healthy food, whereas the difficulties in impulse control and access to emotion regulation strategies dimension of the DERS correlated to a moderate degree (23). The data from the second study in this area did not show stronger associations [all $r < 0.3$; (24)]. This may suggest that there are small linear effects of difficulties in emotion regulation, when studying a sample with few participants showing orthorexic behaviors. Regression analyses showed that emotion dysregulation predicted orthorexic behaviors and affective symptomatology, limited access to strategies and impulse control difficulties in particular. This supports previous theories that consider emotion dysregulation a transdiagnostic factor playing a key role in various psychiatric disorders (17). On the other hand, previous theories that consider pathological eating behaviors and OrNe as a way of distracting from negative affect and a consequence of self-control failures also fit the results (1, 26). Two dimensions that stood out in the mediation analyses were non-acceptance and impulse control difficulties. Both of them mediated the predictive effects of insecure attachment styles on OrNe. Non-acceptance measures negative secondary emotional reactions to one's own negative emotions, individuals react to their emotions with discomfort or shame. Failures to keep control over one's feelings and behaviors define the impulse dimension. Both facets are defining characteristics of other impulse control disorders and addictive behaviors (42). Whether orthorexic eating may serve as a way of alleviating depressive, anxious and stress symptoms or whether affective symptoms aggravate orthorexic eating leaving

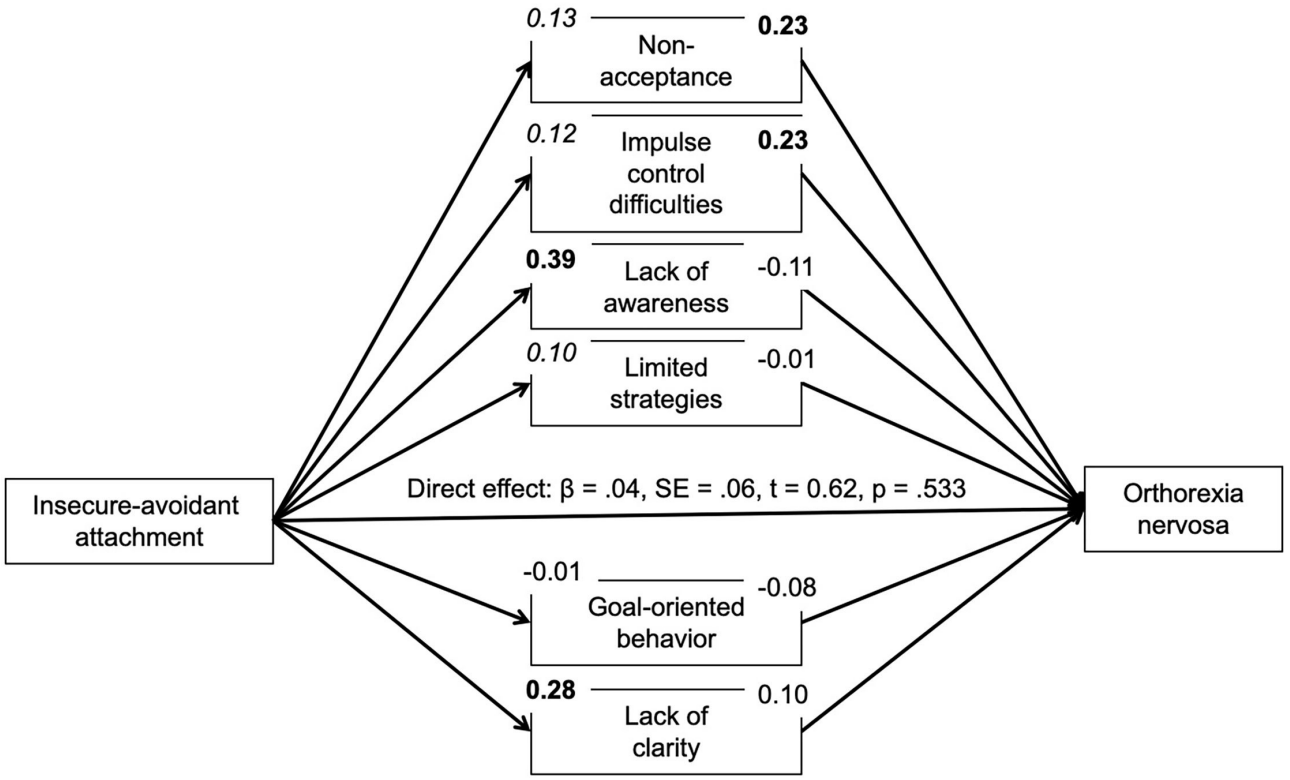

FIGURE 4 | Moderated mediation results for the relationship between avoidant attachment and pathological orthorexic eating as mediated by difficulties in emotion regulation (moderator: depressive symptoms). Bold $p < 0.008$, italic $p < 0.05$.

individuals in a vicious cycle has neither been examined using experimental nor naturalistic study designs. In regard to the latter, ecological momentary assessment studies would allow to examine the bi-directional link between negative affect and OrNe. Studies in eating disorders indicate that negative affect precedes binge and purging episodes but challenge reductions in negative affect after these compensatory behaviors (56, 57). Initial experimental studies showing weaknesses in emotional control, cognitive inflexibility and attentional bias toward healthy food (58, 59) support this alleviation assumption in OrNe. Studies using mood induction in relation to food cue reactivity are still missing, additional research is thus needed. Overall, even if the correlations are not as strong as in the case of already established clinical diagnoses of eating disorders, the findings are consistent. Emotion dysregulation appeared as a common predictor of orthorexic eating and affective psychopathology. Exploring whether the treatment of emotion regulation difficulties may be beneficial for reducing this behavior and comorbid symptoms seems a fruitful future endeavor.

Attachment and Orthorexia Nervosa

The results showed that anxious attachment was linked to orthorexic eating, but there was only a small association with attachment avoidance in this sample. Importantly, this positive association was driven mainly by the female sample. These results corroborate results of the only other study examining associations of attachment with pathological healthful eating. In this previous report, the extent of healthful eating was weakly associated with both fearful and dismissing/avoidant attachment style (40). However, history of eating disorders and appearance related aspects reduced the significant association. The association's direction is thus consistent with observed links in eating disorders (38, 47, 60). Especially patients with anorexia nervosa show problems reflecting on their behavior in relationships. Moreover, insecure attachment style negatively affects the therapeutic process and the treatment success (61). Mediation analyses showed that attachment did play a role in explaining OrNe scores through maladaptive emotion regulation. The development of secure attachment is an important developmental task (41, 62), subsequent expression of emotion regulation strategies may than confer the risk for maladjustment, specifically developing problematic eating (35). Present results support this assumption, in particular for non-acceptance of emotional responses and impulse control difficulties when distressed. Moderated mediated regressions showed the assumed reinforcing effects of depressive and stress symptoms for the mediating effects of non-acceptance for insecure-anxious attachment style. Results are different for insecure-avoidant attachment style. For the indirect path from avoidant attachment to symptoms of orthorexia nervosa

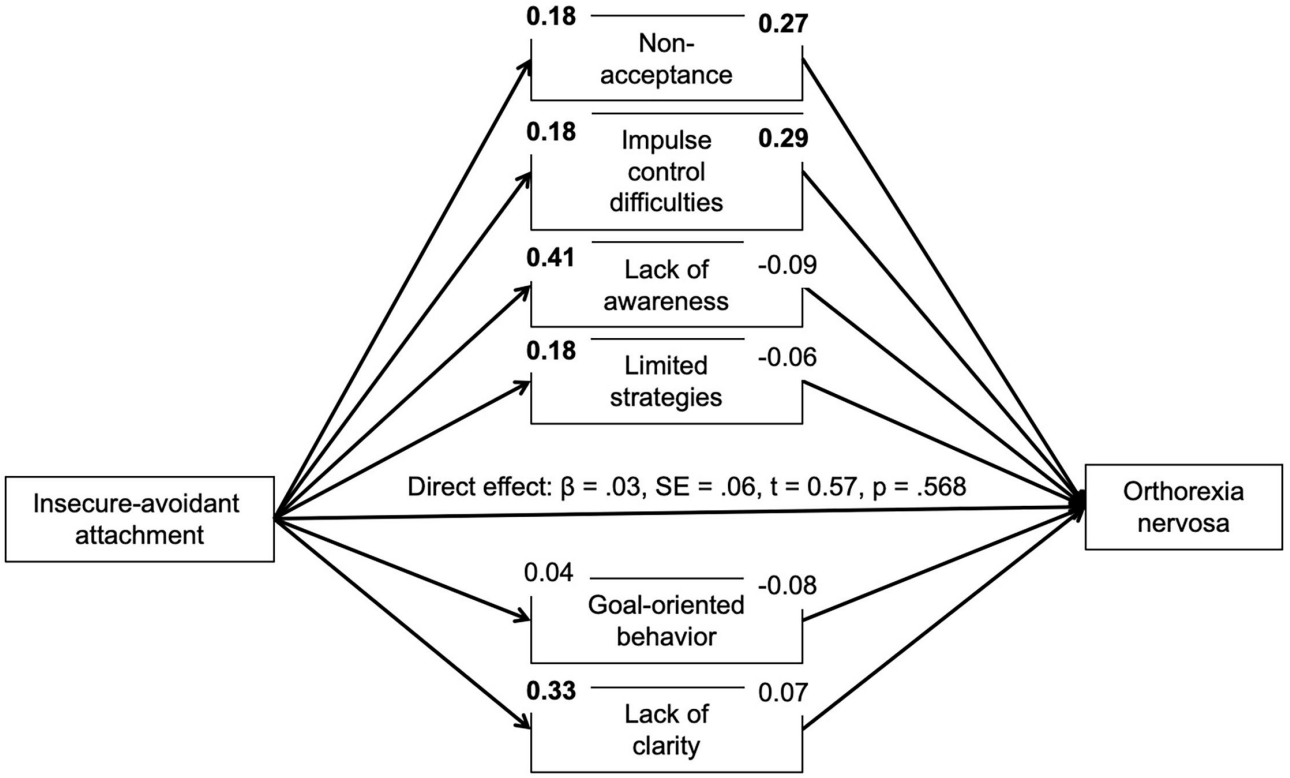

FIGURE 5 | Moderated mediation results for the relationship between avoidant attachment and pathological orthorexic eating as mediated by difficulties in emotion regulation (moderator: anxiety symptoms). Bold $p < 0.008$, italic $p < 0.05$.

mediated by impulse control difficulties, the results indicated a more pronounced mediation at low and mean depressive and anxious symptoms. Avoidant attachment style is characterized by an increased tendency to control and deactivate feeling and expressing negative emotions or needs, especially in social contexts (29, 32). Difficulties in controlling own impulses and feeling out of control as assessed in this DERS scale counteract this avoidance tendency. Thus, already low to moderate anxiety symptoms may activate the pathological orthorexic symptoms of feeling guilty when losing control and eating unhealthy food. High intensity of anxiety symptoms may no longer increase this link. However, this is the first study examining such a moderated mediation. Other studies mainly examined either whether negative affect is a reinforcer of emotional or pathological eating (63) or whether insecurely attached individuals have an increased risk for developing symptoms of eating disorder (63, 64). However, the associations between attachment avoidance and eating disorder symptoms associated with impulse control (e.g., binge eating, emotional eating) are clearly lower than the associations with insecure anxious attachment (64). One additional perspective might be that in the case of above-average depression/anxiety levels, there is simply a lack of resources to pursue a healthy lifestyle. Since the mean values of affective symptoms were comparably low in our rather healthy sample, the results must not be overinterpreted. Micro-longitudinal study approaches are warranted to investigate this further.

Differentiating Healthy Orthorexia Behavior From Orthorexia Nervosa

We found differential effects for healthy orthorexic behaviors. Here, the TOS-HeOr subscale was unrelated to all dimensions of attachment and emotion dysregulation except lack of emotional awareness. Individuals who pay only little attention to and do not acknowledge emotions showed lower healthy orthorexic behaviors. Regression analysis confirmed this and showed anxious attachment to be also negatively related to HeOr. Additionally, non-acceptance was a relevant predictor but in contrast to our expectations with a positive coefficient. This is surprising given the missing correlation between this dimension and HeOr in the bivariate analysis. Furthermore, this contradicts previous studies showing healthy dietary patterns, e.g., Mediterranean diet, to be associated with fewer difficulties in emotion regulation (65). In general, individuals with better emotion regulation capabilities are more likely to engage in healthy behaviors (66). It may be possible that other important variables may moderate the association between emotion dysregulation and HeOr. In particular, motivation and consciousness of individual goals may be relevant. For instance, non-accepting individuals who show achievement-oriented goals (e.g., health and fitness) rather than emotion-oriented goals may display a higher interest in healthy eating in the sense of compensatory behavior. Such moderating relationships have to be explored in future studies.

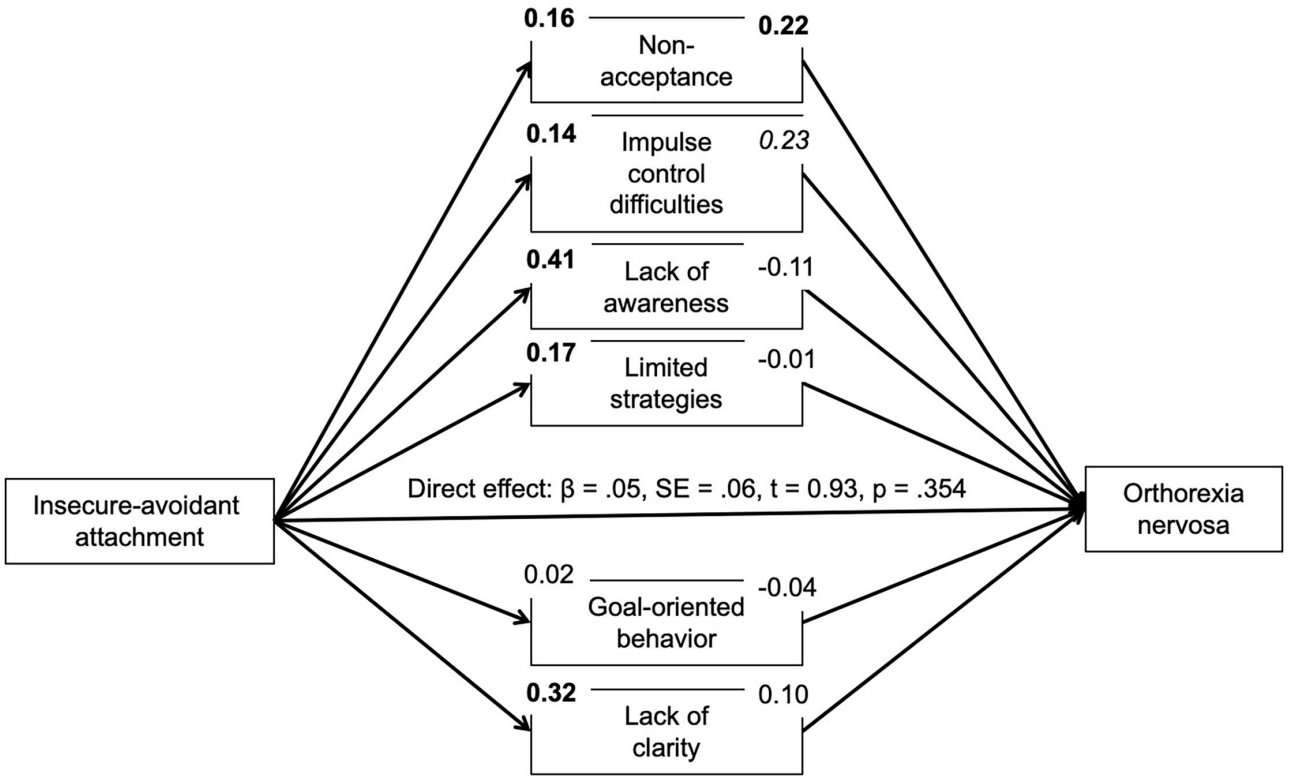

FIGURE 6 | Moderated mediation results for the relationship between avoidant attachment and pathological orthorexic eating as mediated by difficulties in emotion regulation (moderator: stress symptoms). Bold $p < 0.008$, italic $p < 0.05$.

Gender Effects

Examining gender differences was not a main aim of this study. However, given our previous knowledge of gender differences in orthorexic eating and underlying developmental mechanisms (1), gender-separate correlation analyses were conducted. In fact, significant gender differences were only shown for anxious attachment style with HeOr (only significant in men) and lack of emotional awareness with OrNe (only significant in women). Anxious attachment style is quite prominent in females compared to males and the associated trend to a more hyperactivating emotion regulation style (29, 31). This might be due to the diverse functions that healthy and orthorexic eating may serve differentially between genders. Whether these diverging associations also suggest differential developmental mechanisms of orthorexic eating in men and women is difficult to conclude from the present data and the sample studied here. Unequal groups sizes and potential selection bias may undermine generalizability of findings and thus require replication.

Limitations

Findings should be interpreted in light of a number of limitations. First, the age range of our sample was rather wide which could generate important variability and bias due age-specific influences on attitudes or symptoms regarding healthy eating, depending on changing health status. Additional analyses neither indicated meaningful correlations between age and study variables (except a negative correlation with insecure-anxious attachment style) nor did results change when excluding older participants. Findings thus appear to be robust and do not meaningfully covary with age. However, age differences and associated health status need to be considered more closely. As already noted, the sample included a high percentage of female participants and convenience sampling was applied leaving generalizability unclear. In addition, the study did not specifically control for eating disorders. Thus, this study cannot address pathological eating as a possible contributor to the findings and what orthorexic eating contributes beyond eating disorder attitudes. Finally, the study design only allows the analysis of concurrent associations. The examined mediational processes need to be replicated longitudinally controlling for current eating disorder problems in order to examine more causal mechanisms.

CONCLUSION

In conclusion, the results of the present study suggest that individuals with higher pathological orthorexic eating have increased difficulties in regulating their emotions implying that this may serve as a risk factor for Orthorexia nervosa. In addition, they also showed a more insecure attachment pattern. Therefore, our findings show parallels to findings for several affective and eating disorders (35).

Accordingly, the relationship between insecure attachment and pathological orthorexic eating tendencies was mediated by emotion dysregulation. Moreover, symptoms of affective psychopathology partly moderated these mediations. The non-pathological interest in healthy dieting was not related to emotion dysregulation and insecure attachment, thus confirming assumptions of a bi-dimensional structure of orthorexic tendencies.

Findings imply that emotion dysregulation and attachment style are important determinants of mental health in Orthorexia nervosa. Whether both factors should be considered as potential vulnerability factors or diagnostic criteria, how they fit into models of development, and whether their consideration would advance approaches to treatment and counseling for orthorexic eating behavior are important future questions. The differentiated findings regarding pathological and healthy orthorexic eating can also be helpful for the diagnosis of Orthorexia nervosa, for example, when clarifying whether the behavior is pathological and clinically relevant or merely a healthy interest in nutrition.

For future studies and to solidify the results, in addition to the use of self-report measurements, the use of other diagnostic tools such as clinical interviews would be desirable. Concerning the acquisition of emotion dysregulation, the use of the ecological momentary assessment (EMA) method in future studies will enrich our understanding of emotion regulation processes in healthy and pathological orthorexic behaviors.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by University of Wuppertal, reference: MS/BBL 190718. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

JS and PZ conceived and designed the study. JS collected the data and performed the analyses. JS and SN wrote the first article draft. HW and PZ revised the article. All authors discussed the results and contributed to the final manuscript and have approved the final article.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fnut.2022.817047/full#supplementary-material

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Severe and Enduring' Stage in Anorexia Nervosa: Comparing Eating Attitudes, Impairment and Associated Psychopathology

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This study aimed to assess differences in eating attitudes, impairment, and related psychopathology at treatment presentation for patients with "Non-severe and enduring Anorexia Nervosa" (illness duration of <7 years) and patients with "severe and enduring Anorexia Nervosa" (illness duration of 7 years or more). One hundred and thirty-nine patients diagnosed with Anorexia Nervosa participated in this study. Participants were interviewed with the Eating Disorder Examination (EDE) and asked to complete several questionnaires at the end of the first treatment appointment. We also explored differences at treatment presentation by considering alternative criteria to define groups, namely a composite of illness duration and clinical impairment (≥16 CIA total score). No differences were found when comparing participants based on illness duration**.** However, when participants were classified into a different classification scheme: "Non-severe and enduring Anorexia Nervosa" (illness duration <7 years and a CIA total score <16) vs. "severe and enduring Anorexia Nervosa" (illness duration ≥7 years and CIA total score ≥16), significant differences were found in terms of eating pathology, depressive symptomatology, psychological distress, and emotion dysregulation. Further research is needed to better understand the role of illness duration and clinical impairment in informing the course of AN.

Keywords: Anorexia Nervosa, duration of illness, clinical impairment, severe-enduring criteria, staging

INTRODUCTION

Anorexia Nervosa (AN) is a severe psychiatric illness associated with various medical complications that arise as a result of weight loss and malnutrition, as well as with increased mortality rates (1, 2). Even receiving treatment, many patients do not recover or remain symptomatic. Accordingly, a recent study (3) found recovery rates of 62.8% at 22-year follow-up with ∼40% remaining symptomatic.

In recent years, a staging model of Eating Disorders (ED) has been formulated to better understand the different stages of illness over time. This model categorizes ED psychopathology

into a set of severity stages (i.e., high risk, prodromal, full syndrome, and severe and enduring) associated with the development of a form of neuroprogression that results from malnutrition and abnormal eating patterns (4). In AN, the severe and enduring stage (SE-AN) has been receiving increasing attention in the literature; however, an accepted definition of this stage is still lacking (5). Common criteria used to define this final stage of the staging model include previously failed treatment attempts, underweight body mass (6), and an illness duration of at least 7 years (7), but a consensual, empirically-based definition of this stage is still an important research goal.

While some studies found significant differences in several clinical outcomes between patients with SE-AN and non-SE-AN (8), other studies found no difference when the only criterion for the distinction of the two categories is the temporal criterion (9, 10). These findings have contributed to controversy over the clinical utility of a SE-AN classification based solely on the criterion of illness duration.

Functional impairment has also been positively associated with severity in patients with EDs (11). Glasofer et al. (12) found that severity at discharge from an ED inpatient treatment was positively associated with clinical impairment at 5-year follow-up in patients with AN. Similarly, a recent study using network analysis (13) indicated that the centrality of symptoms in the network was associated with clinical impairment after treatment. Thus, clinical impairment should be investigated as a marker of the severity of Anorexia Nervosa in longer durations, since it may differentiate individuals with an important compromise secondary to ED psychopathology regarding personal, cognitive, and social dimensions that are important as therapeutic targets in severe and enduring states. The development of a consensual definition of the severe and enduring form of AN is critical, as it would facilitate the development of evidence-based treatment approaches for this population, guide the intervention, and determine which patients would benefit from treatments tailored for this population (5).

The present study aims to deepen the knowledge around the conceptualization of AN psychopathology across different severity stages, and to explore the utility of illness duration as a criterion to distinguish more severe and enduring courses. Specifically, we intend to assess differences in demographic and clinical characteristics, eating attitudes, clinical impairment, and related psychopathology at treatment presentation for patients categorized as being in the "non-SE-AN" stage vs. those in the SE-AN stage. For this purpose, a definition of <7 years and 7 years or more was adopted, respectively, since the cut-off of 7 years has been the most frequently used in previous research (6). We hypothesize that patients with longer illness duration will present greater ED psychopathology, clinical impairment, depressive symptomatology, emotion dysregulation, and psychological distress than the group with an illness duration of <7 years. We also intend to explore differences at treatment presentation considering an alternative classification scheme to define groups, namely a composite of illness duration and clinical impairment, since its established association with severity in ED patients (14).

MATERIALS AND METHODS

Participants

Participants were 139 patients (128 female, and 11 male) diagnosed with Anorexia Nervosa recruited from two hospital units specialized in treating eating disorders in the North and Center of Portugal, either inpatient or outpatient. All participants were referred to the study by their psychiatrist at the end of the first appointment of the current treatment and assessed that same day. Participants' age ranged from 13 to 53 years ($M = 23.83$, $SD = 8.70$). Mean BMI (kg/m^2) was 16.07 ($SD = 2.25$). One hundred and five participants were diagnosed with AN-Restricting subtype and 34 participants with AN-Binge Eating/Purging subtype. The majority (82.0%, $n = 114$) were single, 9.4% ($n = 13$) were married, 1.4% ($n = 2$) divorced, and 2.2% ($n = 3$) lived with a partner. About half of the sample were students ($n = 68$, 48.9%), 21.6% ($n = 30$) were employed, 7.9% ($n = 11$) unemployed, 2.9% ($n = 4$) had no occupation, 0.7% ($n = 1$) were retired, and 1.4% ($n = 2$) were on sick leave. The mean duration of AN was 62.00 months ($SD = 74.81$).

One hundred and six participants (76.3%) were classified as having an illness duration of <7 years, and 33 (23.7%) participants as having an illness duration of 7 years or more, according to a semi-structured clinical interview to address the first time participants met the criteria for the diagnosis of Anorexia Nervosa. Illness duration ranged between 3 and 84 months ($M = 28.66$, $SD = 21.80$) for the group with an illness duration of <7 years, and between 96 and 456 months ($M = 169.09$, $SD = 84.07$) for the group with an illness duration of 7 years or more.

Procedure

The present study is part of a larger naturalistic longitudinal study that focuses on treatment monitoring of ED patients in outpatient and inpatient treatment settings.

During the first treatment appointment, all participants were interviewed by a psychiatrist to obtain clinical history information and for diagnostic purposes. Those who met the criteria for the diagnosis of Anorexia Nervosa and agreed to participate in the study were interviewed by clinical psychologists trained in ED assessment and treatment, using the Eating Disorders Examination (15) and a clinical interview for demographic information and clinical ED-related history. Afterward, participants completed a series of self-report questionnaires to assess variables of interest.

Written informed consent was obtained from all participants or their parents if aged <18 years. The present study was approved by the ethical committees of all the institutions involved.

Definition of Illness Duration

Each participant was classified according to AN illness duration based on a semi-structured clinical interview to assess clinical history, namely weight history, dieting behavior and clinical related variables (15) conducted by clinical psychologists specialized in ED treatment and assessment. To obtain a more detailed description of each patient's clinical history, participants

were also interviewed with a complementary semi-structured interview (16), which allowed the collection of additional information about the history of the illness (e.g., the age of onset of the most significant ED behaviors), and that was then adapted for the definition of illness duration. This variable was defined as the time elapsed between the onset of AN (i.e., the first time participants presented symptoms clinically indicative of the presence of AN diagnosis) and the time of the study assessment.

The sample was divided into two groups: the group with "non-SE-AN" (i.e., illness duration of <7 years) and the group with SE-AN (i.e., illness duration of 7 years or more), to mirror the most accepted definitions in the literature.

Measures

Eating Disorders Examination (EDE) (15): is a semi-structured interview that aims to assess eating disorder related psychopathology and dysfunctional eating behaviors. Only the diagnostic items were used in the present study.

Eating Disorder Examination-Questionnaire (EDE-Q) (17): is a 28-item self-report measure used to assess eating disorder symptoms and associated psychopathology over the last 28 days. It comprises four subscales (restraint, eating concern, shape concern, and weight concern) and a total score. The Portuguese version of the EDE-Q has demonstrated good internal consistency, with Cronbach's alphas ranging from 0.83 to 0.96 (18). Cronbach's α for our sample was 0.93 for the global score.

Outcome Questionnaire-45 (OQ-45) (19): is a 45-item self-report measure designed to assess patients' progress in a therapeutic setting but can also be used as a measure of psychological distress. The OQ-45 includes three subscales: Symptom distress (SD), Interpersonal Relationships (IR), and Social Role Functioning (SR). It was used as a baseline measure of symptoms of psychological distress. The Portuguese version has demonstrated good internal consistency (Cronbach's $\alpha = 0.93$). Cronbach's α for our sample was 0.76 for the global score.

Beck Depression Inventory (BDI) (20): is a 21-item self-report measure developed to assess cognitive, affective, and somatic symptoms of depression over the last month. The Portuguese version has demonstrated excellent internal consistency (Cronbach's $\alpha = 0.92$) (21). Cronbach's α for our sample was 0.89.

Clinical Impairment Assessment (CIA) (22): is a 16-item self-report measure that assesses clinical impairment secondary to eating disorders in three domains (personal, social, and cognitive) over the last 28 days. The global score ranges from 0 to 48, and higher scores represent more impairment. The Portuguese version has demonstrated good internal consistency (Cronbach's $\alpha = 0.96$) (23). Cronbach's α for our sample was 0.95 for the global score.

Difficulties in Emotion Regulation Scale (DERS) (24): is a 36-item self-measure that assesses patients' response to negative emotional states. The global score ranges from 36 to 180, and higher scores represent greater difficulties in emotion regulation. The Portuguese version has demonstrated excellent internal consistency (Cronbach's $\alpha = 0.93$) (25). Cronbach's α for our sample was 0.90 for the global score.

Statistical Analysis

All statistical analyses were conducted using the IBM SPSS Statistics software (version 27.0).

For the characterization of the sample, descriptive statistics were performed. Differences between groups with non-SE-AN (i.e., <7 years duration) and SE-AN (i.e., ≥7 years duration) were estimated with Mann-Whitney tests for age, body mass index, weight suppression (i.e., the difference between highest and current weight), and the number of hospitalizations. Chi-square tests were used for categorical data (previous treatments, overweight history, AN severity, AN subtype, previous eating disorder treatment, and treatment setting).

Analysis of Covariance (ANCOVA) was conducted to analyze differences between groups regarding eating attitudes and related psychopathology (EDE-Q, OQ-45, BDI, CIA, and DERS score). Age was introduced as a co-variable in all analyses. The same analysis was performed for groups with clinical impairment <16 and clinical impairment ≥16.

Differences between inpatient and outpatient groups regarding variables under study were tested using Univariate Analysis of Variance (ANOVA), and no differences were found.

We also explored differences at treatment presentation by considering an alternative SE-AN classification scheme, namely a combination of illness duration and clinical impairment (CIA Total score). For this purpose, ANCOVA models were conducted with the group (illness duration <7 and clinical impairment <16; illness duration <7 and clinical impairment ≥16; and illness duration ≥7 and clinical impairment ≥16) as the independent variable (IV), the variables under study as dependent variables (DV), and age as a covariate. The group "illness duration ≥7 and clinical impairment <16" was not included in the analysis, since the small number of participants included in this group ($n = 3$). *Post hoc* Bonferroni tests were conducted for significant ANCOVAs. Exploratory analysis was also performed by considering a combination of illness duration and depressive symptomatology (BDI Total score ≥13), and no statistically significant differences were found.

RESULTS

Differences in clinical and demographic characteristics between "non-SE-AN" and SE-AN groups are summarized in **Table 1**.

Findings revealed a significant difference in the number of hospitalizations between the groups, with higher values for the SE-AN group. There was also a significant difference in age between groups, as expected.

Differences in eating attitudes and related psychopathology across "non-SE-AN" and "SE-AN" groups are summarized in **Table 2**. The percentage of participants with a CIA total score ≥16 was 75.2% in the group with an illness duration of <7 years, and 90% in the group with an illness duration of 7 years or more. No statistically significant differences were found between groups.

Exploratory analysis of the differences at treatment presentation when a composite of illness duration and clinical impairment was considered:

TABLE 1 | Group differences in clinical and demographic characteristics, comparing "Non-SE-AN" and "SE-AN" groups.

		Non-SE-AN (<7 years duration) (*n* = 106) M (SD)	SE-AN (≥7 years duration) (*n* = 33) M (SD)	Statistics	*p*
Age (years)	Range: 13–53	21.09 (6.61)	32.61 (8.88)	Z = −6.769	<0.001***
BMI	Range: 11.20–24.14	16.05 (2.24)	16.14 (2.30)	Z = −0.124	0.902
Weight suppression (kg)	Range: 0–45.10	15.08 (9.07)	17.64 (11.04)	Z = −1.014	0.311
Number of hospitalizations	Range: 0–15	0.32 (0.76)	1.73 (3.38)	Z = −2.789	0.005**
Previous Treatments	Yes	75 (96.2%)	20 (90.9%)	χ2 (1) = 0.994	0.319
	No	3 (3.8%)	2 (9.1%)		
Overweight history	Yes	20 (19.6%)	8 (28.6%)	χ2 (1) = 1.044	0.307
	No	82 (80.4%)	20 (70.1%)		
Severity	Mild	32 (30.2%)	9 (27.3%)	Cramer's V = 0.099	0.712
	Moderate	18 (17.0%)	5 (15.2%)		
	Severe	19 (17.9%)	9 (27.3%)	χ2 (3) = 1.373	
	Extreme	37 (34.9%)	10 (30.3%)		
Subtype	Restricting	84 (79.2%)	21 (63.6%)	χ2 (1) = 3.318	0.069
	Binge	22 (20.8%)	12 (36.4%)		
	Eating/Purging				
Previous ED Treatment	Psychologist	18 (23.1%)	1 (4.5%)	χ2 (5) = 9.157	0.103
	Psychiatrist	27 (34.6%)	6 (27.3%)		
	Both	22 (28.2%)	10 (45.5%)		
	Pedopsychiatry	1 (1.3%)	0 (0.0%)		
	Other	0 (0.0%)	1 (4.5%)		
	None	10 (12.8%)	4 (18.2%)		
Treatment setting	Inpatient	22 (20.8%)	10 (30.3%)	χ2 (1) = 1.295	0.255
	Outpatient	84 (79.2%)	23 (69.7%)		

N = 139.

M, Mean; SD, Standard deviation; BMI, Body Mass Index; ED, Eating Disorder. Severity was calculated according to the DSM-5 severity criterion based on body mass index cut-points.

***p < 0.01.*

****p < 0.001.*

TABLE 2 | Differences between "Non-SE-AN" and SE-AN groups regarding eating attitudes and related psychopathology.

	Non-SE-AN (<7 years duration) (*n* = 106) M (SD)	SE-AN (≥7 years duration) (*n* = 33) M (SD)	*Z*	*p*	*Partial η2*
EDE-Q Total Score	2.87 (1.65)	2.73 (1.69)	0.605	0.438	0.005
OQ-45 Total Score	75.18 (32.59)	82.05 (26.79)	0.558	0.457	0.005
BDI	21.50 (11.62)	20.89 (11.17)	0.000	0.995	0.000
CIA Total Score	23.74 (13.96)	27.20 (12.02)	0.939	0.335	0.009
DERS Total Score	98.01 (33.42)	93.96 (29.70)	0.183	0.670	0.002

N = 139.

EDE-Q, Eating Disorder Examination-Questionnaire; OQ-45, Outcome Questionnaire-45; BDI, Beck Depression Inventory; CIA, Clinical Impairment Assessment; DERS, Difficulties in Emotion Regulation Scale.

Several exploratory analyses of the differences at treatment presentation in eating attitudes and related psychopathology when a composite variable of illness duration and clinical impairment was considered were tested.

ANCOVAs revealed significant differences between the groups in terms of eating pathology, depressive symptomatology, psychological distress, and emotion dysregulation (**Table 3**). *Post hoc* tests showed that the group "illness duration ≥7 years and clinical impairment ≥16" presented significantly higher eating psychopathology ($p < 0.001$), depressive symptomatology ($p < 0.001$), psychological distress ($p < 0.001$), and emotion dysregulation ($p < 0.01$) than the "illness duration <7 and clinical impairment <16" group. The group "illness duration <7 and clinical impairment ≥16" presented significantly higher eating psychopathology ($p < 0.001$), depressive symptomatology ($p < 0.001$), psychological distress ($p < 0.001$), and emotion dysregulation ($p < 0.001$) than the "illness duration <7 years and clinical impairment <16" group. No significant differences

TABLE 3 | Differences between groups in terms of eating attitudes and related psychopathology when a composite of illness duration and clinical impairment was considered.

	Univariate results						*Post-hoc*		*Effect size*
	Group A (Illness duration <7 and clinical impairment <16) *n* = 26 M (SD)	**Group B (Illness duration <7 and clinical impairment ≥16) *n* = 79 M (SD)**	**Group C (Illness duration ≥7 and clinical impairment ≥16) *n* = 27 M (SD)**	***Z***	***p***	***Partial η2***	***≠ between groups***	***p* value**	***Cohen's d***
EDE-Q	1.12 (0.83)	3.53 (1.40)	3.24 (1.53)	33.564	<0.001***	0.371	Group A < Group B Group A < Group C	<0.001*** <0.001***	1.90 1.78
OQ-45	41.08 (19.51)	88.94 (26.16)	86.89 (26.31)	34.857	<0.001***	0.404	Group A < Group B Group A < Group C	<0.001*** <0.001***	1.96 2.04
BDI	10.46 (6.60)	25.54 (10.41)	22.45 (10.49)	22.541	<0.001***	0.258	Group A < Group B Group A < Group C	<0.001*** <0.001***	1.58 1.40
DERS	68.00 (24.25)	109.87 (29.17)	101.50 (28.07)	19.650	<0.001***	0.278	Group A < Group B Group A < Group C	<0.001*** 0.003**	1.50 1.29

N = 132.
EDE-Q, Eating Disorder Examination-Questionnaire; OQ-45, Outcome Questionnaire-45; BDI, Beck Depression Inventory; DERS, Difficulties in Emotion Regulation Scale.
**p < 0.01.
***p < 0.001.

were found between the "illness duration <7 and clinical impairment ≥16" and the "illness duration ≥7 years and clinical impairment ≥16" groups.

DISCUSSION

The present study aimed to explore the differences in treatment presentation between patients with non-SE-AN (defined as an illness duration of <7 years) and patients with SE-AN (defined as an illness duration of 7 years or more) regarding clinical characteristics, namely eating attitudes, clinical impairment, and related psychopathology.

Differences between groups were found in terms of the number of previous hospitalizations, which were higher for the SE-AN group. Accordingly, the number of hospitalizations has been previously considered an indicator of the enduring aspect of the SE-AN stage (26). In addition, a recent study from Hay and Touyz (27) proposed that unsuccessful treatments, namely the exposure to at least two evidence-based treatments, constitute a criterion for SE-AN definition. No differences were found between groups regarding eating attitudes and related psychopathology at clinical presentation. Time *per se* did not seem to differentiate patients with Anorexia Nervosa at treatment presentation. These results are in line with a recent study from Calugi et al. (9) which reported that patients with SE-AN (defined as the duration of illness of at least 7 years) and non-SE-AN displayed similar improvements in BMI, eating disorder symptoms, and general psychopathology following enhanced cognitive behavioral therapy (CBT-E), at Post-treatment and 12-month follow-up. Wildes et al. (10), using structural equation modeling, also reported that illness duration did not differentiate groups with higher and lower severity profiles in their sample, but eating disorders behaviors and quality of life did.

However, when we considered in the exploratory analysis both illness duration and clinical impairment as markers of severity and "enduringness", there were significant differences between groups in terms of eating psychopathology, depressive symptomatology, symptom distress, and emotion dysregulation, but only regarding the group with less illness duration and severity (i.e., illness duration of <7 years and a clinical impairment below the clinical cut-off). These findings did not allow to differentiate groups with similar functional impairment regardless of illness duration, reinforcing that illness duration *per se* may not provide sufficient information for differentiating severity profiles. However, in our sample 90% of those with a duration of illness >7 years were above the clinical impairment cut-off, suggesting that long duration of illness can be considered a proxy of severity. On the other hand, shorter duration of illness should not be associated with presumed lowest severity. Groups did not significantly differ regarding BMI. Accordingly, only the group with a shorter illness duration and less impaired differed significantly in eating and weight attitudes, psychological distress, depressive symptoms and emotion regulation difficulties at treatment presentation.

Interestingly, our study's results point out that both groups "illness duration ≥7 and CIA total score ≥16" and "illness

duration <7 and CIA total score ≥16" showed poorer scores on all measures as compared to the "illness duration <7 and CIA total score <16" group, suggesting that clinical impairment may have an important role as a marker of severity in AN. This is in line with previous studies on the association between clinical impairment and severity in patients with ED (11).

It is important to note that differences between groups with CIA total score <16 and CIA total score ≥16 were also explored, and statistically significant differences were found for all measures in study. Nevertheless, in the present study the proportion of patients with impairment above the clinical cut-off was higher for those with higher duration of illness, emphasizing the possible interrelation between severity and longer illness duration. This overlap is important to consider in future research, as well as the potential influence that a longer course of illness may itself have on severity. Future studies should consider longitudinal assessment and treatment outcomes in these subgroups of patients with AN.

This study's results do not support the study from Ambwani and colleagues (8) that found statistically significant differences at baseline regarding eating disorder symptomatology when considering a SE-AN classification based on both illness duration and emotional distress as a marker of severity, but different comparison groups were used (illness duration <3 years vs. illness duration ≥7 and Depression, Anxiety and Stress Scale (DASS) total ≥60). Our study uses different classification groups adding a classification based on less duration but equal impairment, which did not present differences regarding eating attitudes and associated psychopathology.

In conclusion, this study does not provide support for a SE-AN classification based solely on an illness duration of 7 years or more, and highlights the need to further explore the validity of a SE-AN conceptualization beyond the indicators of the "enduring" component (26). Accordingly, Hay and Touyz (27) recently proposed the exposure to at least two evidence-based treatments, a duration of AN >3 years, and a persistent state of restriction, low weight and over-evaluation of weight and shape with functional impairment as testable criteria for SE-AN. Also, a recent study found statistically significant differences regarding ED symptomatology when considering a SE-AN classification based on both illness duration and emotional distress as a marker of severity (8), which should also be further explored and considered in future research around the SE-AN classification.

Future studies should explore the characterization of the severe stage in long duration Anorexia Nervosa which can differentiate patients and individualized care. In fact, therapeutic outcomes in patients with severe and enduring courses are divergent and an important research goal. For example, a recent study (28) found that illness severity and duration did not predict treatment outcome in CBT-E. Similarly, another study that compared treatment outcomes in patients with illness duration shorter or >7 years indicated similar improvements after discharge and at 12 month (9). In opposition, in a study from Wild et al. (29), the authors found that illness duration was a negative predictor of treatment outcome.

Future research is needed to better understand the link between illness severity, clinical impairment, and illness duration in AN, namely in longitudinal studies with larger sample sizes. This study is cross-sectional and longitudinal data are needed to inform the predictive value of the duration of illness on illness severity and enduring stage. Also, in the present study, we did not include variables such as the presence of psychiatric comorbidity (e.g., personality disorders, mood, and anxiety disorders) or neurocognitive domains, like uncertainty intolerance traits, negative thought processes (e.g., rumination), and habit formation, which could differentiate groups and should be included in future studies. Longer illness duration stages have also been associated with neuroprogressive changes (4), which should be considered in future research. Several limitations should be considered when interpreting the present findings, namely the heterogeneity of the sample in terms of the gender and AN subtype, as they can make the results less generalizable. Moreover, the groups "non-SE-AN" and SE-AN, as well as the groups "illness duration <7 and clinical impairment <16", "illness duration <7 and clinical impairment ≥16" and "illness duration ≥7 and clinical impairment ≥16" are not balanced in terms of sample size, which should be considered when interpreting this study's results. Future studies should replicate these analyses with a more homogeneous number of participants in each group and with a larger sample size.

Despite these limitations, it is important to note that our sample consisted of patients with AN who were starting specialized ED treatment, which can be considered a strength of the study.

In conclusion, the present study is an important first step to explore the clinical utility of illness duration at presentation for treatment in AN, as well as to consider clinical impairment as a marker of severity. Our results highlight that patients with longer duration of illness and higher impairment secondary to ED may require more individualized and specific treatment. In addition, it highlights the need to ensure a close monitoring and fast access to treatment to these subgroups of patients since an early stage in order to prevent the development of an enduring course with associated functional impairment. Additionally, addressing impairment secondary to the ED can be used as an important clinical strategy to motivate patients to change. Further research is needed to understand illness's progress through different severity stages and the factors associated with the course of illness.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Ethics Committee for Research in Social and Human Sciences (CEICSH). Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

AUTHOR CONTRIBUTIONS

RR, AV, and PM took primary responsibility for the manuscript, including reviewing relevant literature, and drafting the paper for publication. AP-B and TR were responsible for data collection, participant recruiting, contributed to its analysis, and interpretation. EC contributed to its analysis and interpretation. IB and AN conducted the diagnostic interviews. All authors assisted with the literature review, editing of the manuscript, contributed to the planning, design of the study, read, and approved the final manuscript. All authors contributed to the article and approved the submitted version.

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BRIEF RESEARCH REPORT
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Mediational Effect of Fairburn's Transdiagnostic Mechanisms Between Attachment to the Mother and Eating Disorder Symptoms in a Clinical Sample

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Objective: Research has supported a link between insecure attachment and eating disorders (EDs); however, little is known about how this influence is exerted in young female EDs patients. This study tested, for the first time, a multiple mediational model, wherein the four Fairburn's transdiagnostic mechanisms mediated the relationship between attachment to the mother and ED symptoms.

Methods: A total of 101 female young EDs patients aged 15–24 were administered the Inventory of Parent and Peer Attachment, Eating Disorder Inventory-3 and Eating Attitudes Test-26 to assess attachment, the four transdiagnostic maintaining mechanisms and ED symptoms, respectively.

Results: Comparison analyses showed that there were no significant differences between the diagnostic groups in terms of attachment and the transdiagnostic variables. Multiple mediational analyses indicated that low self-esteem and clinical perfectionism were significant mediators between insecure attachment to the mother and ED symptoms, while controlling for depressive symptoms.

Conclusion: These findings suggest that the distal risk influence of insecure attachment to the mother in the development of ED symptoms might be explained by low self-esteem and high clinical perfectionism, controlling for depressive symptoms. Further investigation into the efficacy of cognitive-behavioral treatments targeting insecure attachment representations for young EDs patients is recommended.

Keywords: eating disorder, insecure attachment, transdiagnostic mechanisms, multiple mediation analysis, female patient

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INTRODUCTION

Eating disorders (EDs) are highly distinctive psychiatric disorders characterized by severe and persistent disturbance in eating behaviors (American Psychiatric Association, 2013). EDs are associated with a wide variety of psychiatric and physical problems, and present high rates of persistence and recurrence, predominantly among adolescent and young adult women of Western societies (Ágh et al., 2016; Schmidt et al., 2016). Given the detrimental clinical and social impact of EDs, it is crucial to identify the factors that may contribute to their development and maintenance.

Insecure attachment has been recognized as a risk factor for the development of psychopathology, particularly EDs (Skarderud and Fonagy, 2012; Tasca, 2018). Individuals with insecure attachment are characterized by having experienced insensitive or unreliable care which favors the basis of representations of the self as unworthy or unlovable and of others as untrustworthy or unloving (Bowlby, 1969). However, even though insecure attachment, especially to mother, is associated with ED symptoms, this relationship is usually conditioned by the concurrence of other variables that channel the risk of early attachment experiences (Tasca and Balfour, 2014; Faber et al., 2018). Consequently, contemporary researchers have tried to identify intermediate mechanisms through which insecure attachment might influence the development of EDs symptoms (Cortés-García et al., 2019).

The transdiagnostic theory of the maintenance of EDs of Fairburn et al. (2003) postulates that there are four maintaining mechanisms interacting with the psychopathological core of EDs (i.e., overvaluation of the importance of weight and its control) and obstructing progress during treatment. These mechanisms are: (1) clinical perfectionism (i.e., a dysfunctional self-assessment system where personal worth is judged by effort and success in achieving very demanding goals related to diet and weight), (2) low self-esteem (i.e., negative self-image inherent to one's own identity), (3) mood intolerance (i.e., inability to identify, express and cope with emotions), and (4) interpersonal difficulties.

Interestingly, insecure attachment has been consistently associated with such variables, that is, predicting the development of perfectionism (Wei et al., 2006; Ulu and Tezer, 2010), low self-esteem (Mikulincer and Shaver, 2012), inability to regulate emotions (Brenning and Braet, 2013), and interpersonal difficulties (Paech et al., 2016). Besides, due to the influence between these variables and EDs symptoms, their mediating role between insecure attachment and ED psychopathology has also been examined separately. In fact, previous studies showed that insecure attachment predicted the development and maintenance of unhealthy eating behaviors through clinical perfectionism (Dakanalis et al., 2014), low self-esteem (Shanmugam et al., 2012), emotion dysregulation (Jakovina et al., 2018; Pace et al., 2021), and interpersonal difficulties (Ty and Francis, 2013).

Thus far, it seems that both theory and empirical studies provide rationale to expect that insecure attachment, particularly to the mother, and the four Fairburn transdiagnostic mechanisms are associated with and partly explain ED symptoms (Fairburn et al., 2003; Tasca and Balfour, 2014). Furthermore, the role played by depressive symptoms in relation to insecure attachment (Dagan et al., 2018) and EDs (Puccio et al., 2016) cannot be neglected. On the one hand, the negative self-representations rooted in early insecure attachment relationships have a strong influence on the interpretation and response to future negative events, which in turn contributes to increased vulnerability to depression (Morley and Moran, 2011). On the other hand, depressive symptoms and disordered eating tend to co-occur (Puccio et al., 2016), and possibly, poor emotion regulation ingrained in individuals' early mental representations (Malik et al., 2015; Faber et al., 2018) may increase the risk of both (Vögele et al., 2018). For instance, eating symptoms such as binge eating or overeating may serve as a strategy to modify or dampen negative emotions, such as depressive symptoms (Vögele et al., 2018). Thus, substantial evidence suggests that depressive symptoms may be both rooted on insecure attachment relationships (Morley and Moran, 2011) and participate in the etiology of EDs (Stice, 2001). In fact, it has been observed that depressive symptoms may mediate the association between insecure attachment and disordered eating (Cortés-García et al., 2019). In this regard, insecurely attached individuals, who presumably perceive themselves negatively, may be extra vulnerable to the multiple challenges through adolescence and emerging adulthood resulting in increased depressive symptoms and may find refuge in abnormal eating practices (Tasca, 2018). Thus, it can be assumed that when depressive symptoms are considered, the mediating effect of the maintaining mechanisms in the association between insecure attachment and EDs symptoms could be modified. To date, no study has investigated the links between insecure attachment to the mother, the Fairburn's maintaining mechanisms and ED symptoms, while controlling for depressive symptoms, using clinical samples of young females. Accordingly, the aim of this study is two-fold: (1) to know how the quality of attachment to the mother and Fairburn's maintenance mechanisms are related in a clinical sample of female with different ED diagnoses and (2) to examine whether insecure attachment to the mother contributes to the development of EDs symptoms through the maintenance mechanisms, while controlling for depressive symptoms. Given that this is the first study that investigates the mediational effect of Fairburn transdiagnostic mechanisms in a multiple mediation model among patients with EDs, our hypotheses are exploratory in nature based on existing knowledge. We speculate that there will be no differences between the different diagnoses with respect to maternal attachment and transdiagnostic mechanisms, and we hypothesize that the transdiagnostic mechanisms will mediate between maternal attachment and eating symptoms, even controlling for the effect of depressive symptoms.

MATERIALS AND METHODS

Procedure and Participants

The study included 101 patients who consecutively accessed the Eating Disorders Unit of the Provincial Hospital of Conxo (Spain), and met the inclusion criteria (i.e., primary diagnosis of ED, being younger than 24 years old and female). The diagnoses were made following the Structured Clinical Interview for Axis 1 diagnoses of the DSM-IV-TR (First et al., 2002), which was administered by staff clinical psychologists. Concretely, 35 patients had a diagnosis of Anorexia Nervosa- restrictive subtype, 17 of Anorexia Nervosa-compulsive subtype, 31 of Bulimia Nervosa and 10 of ED-Non-Otherwise Specified according to the DSM-IV-TR (American Psychiatric Association, 2000). Eight patients were excluded from the investigation because they did not complete all questionnaires. Ages ranged from 15 to 24, with a

mean of 17.81 (*SD* = 1.9) and 93% of participants were Caucasian, 5% Latino, and 2% Asian.

All procedures were approved by the Bioethics Committee at the University of Santiago de Compostela (Spain) before data collection commenced. Informed, written consent was obtained from the patients after being provided with a full description of the study. Before receiving any form of treatment, all patients completed the battery of self-report measures, under the supervision of a member of staff.

Measures

The Inventory of Parent and Peer Attachment (Armsden and Greenberg, 1987) is a self-report measure of perceptions of the quality of attachment toward mother, father, and peers. For the present study, only the mother attachment scale was used; specifically, the revised version of 25 items, rated on a 5-point scale (from 1 = never to 5 = always). The overall score of attachment is obtained by summing responses of two subscales: degree of mutual trust and quality of communication, and by subtracting the score of the subscale of anger and alienation. Higher scores on trust and communication and lower score on alienation indicate higher attachment security. The Spanish-language version of the IPPA (Pardo et al., 2006) used in this study has shown satisfactory internal consistency and concurrent validity. In our sample, α coefficients ranged from 0.71 to 0.90: (a) trust (Cronbach's α = 0.89), (b) communication (α = 0.90), and (c) alienation (α = 0.71).

The Eating Disorder Inventory-3 (Garner et al., 1983) is a self-report questionnaire used to assess the presence of EDs. Each item is scored on a 6-point scale and the score for each subscale is then summed. For this study, we only took the measures of the subscales' low self-esteem (α = 0.59), perfectionism (α = 0.79), interpersonal distrust (α = 0.67), and interoceptive awareness (α = 0.75).

The Eating Attitudes Test-26 (EAT-26; Garner and Garfinkel, 1979) is a self-report questionnaire that assesses symptoms and concerns that are characteristic of EDs. It comprises 26 items that refer to thoughts, feelings, and behaviors common in EDs. Items are rated on a Likert scale ranging from 1 (never) to 6 (always). Higher scores indicate more disturbed eating pathology. In our study, the reliability of the EAT-26 was α = 0.87.

The Beck Depression Inventory-II (Beck et al., 1996) is a 21-item, self-report rating inventory that measures characteristic attitudes and symptoms of depression. The Spanish version of the BDI-II used in this study has shown satisfactory internal consistency, test–retest reliability, and concurrent and convergent validity (Sanz et al., 2003). In our study, the reliability of the BDI-II was α = 0.86.

Analytic Strategy

All analyses were conducted in IBM SPSS Statistics 26. Preliminary descriptive information and Pearson correlations were obtained between the main study variables (including depressive symptoms) and the demographic variables that were significantly related to the outcome variables, which were included in the mediational analyses as covariates. Additionally, differences between diagnostic groups in demographic and clinical variables were investigated using Kruskal–Wallis tests. Significant results found with this analysis were followed up by Bonferroni-corrected Mann–Whitney *U* tests as *post hoc* comparisons.

Multiple mediation analyses were conducted using the PROCESS macro (Hayes, 2018), to explore whether transdiagnostic mechanisms (mediators) could explain the effect of attachment to the mother on ED symptoms. All four mediators were tested simultaneously in the analysis with the total patient. Pairwise contrasts of the specific indirect effects involved in each mediator were calculated. The indirect effect provided by 20000 bootstrap samples was examined. In addition, a 95% bias-corrected confidence interval (BootCI) was used. Depressive symptoms were included as a covariate in the mediation analyses due to the high correlation with insecure attachment and EDs symptoms (Puccio et al., 2016; Dagan et al., 2018).

RESULTS

Descriptive statistics for and Pearson's correlations between the main study variables are presented in **Table 1**. These analyses revealed that insecure attachment to the mother was significantly related to more ED symptoms, more maladaptive perfectionism, less interoceptive awareness, less self-esteem, and more depressive symptoms. However, there was no significant association between attachment and interpersonal distrust.

The comparison between the different diagnostic groups is showed in **Table 2**. The analysis showed that there were significant differences between the groups only in terms of age ($H = 16.7$; $p < 0.001$; $\eta^2 = 0.202$; *post hoc* BN > AN restrictive subtype), therefore, age was included as a covariate in the mediation analyses.

Multiple mediational analyses results are presented in **Table 3**. The model accounted for 21.9% of the variance for ED symptoms ($R^2 = 0.219$). While controlling age, the total indirect effect of insecure attachment on eating symptoms through all the proposed mediators was significant. Specifically, the mediators reduced the non-standardized regression coefficient of insecure attachment on eating symptoms from −0.26 ($p < 0.001$) to −0.06 ($p = 0.34$), which reflected 77% [(−0.26 to −0.06)/ −0.26] of the association between attachment and eating symptoms. When examining the specific indirect effect of each mediator, all maintenance variables except interpersonal distrust presented significant values. When controlling for age along with for depressive symptoms, the model accounted for 29.8% of the variance for ED symptoms ($R^2 = 0.298$). The total indirect effect of insecure attachment on eating symptoms through all the proposed mediators was significant. Specifically, the mediators reduced the non-standardized regression coefficient of insecure attachment on eating symptoms from −0.19 ($p = 0.01$) to −0.05 ($p = 0.40$), which reflected 74% [(−0.19 to −0.05)/ −0.19] of the association between attachment and eating symptoms. When examining the specific indirect effect of each mediator, only low self-esteem and clinical perfectionism presented significant values. The pairwise contrasts revealed that in both models the specific indirect effects of insecure attachment

TABLE 1 | Descriptive information for and Pearson's correlations between main study variables (n = 93).

	M (SD)	1	2	3	4	5	6	7
Attachment	50.39 (16.32)	–						
Self-esteem	24.22 (3.84)	0.310**	–					
Perfectionism	1.12 (0.82)	−0.360**	−0.099	–				
Interoceptive awareness	1.04 (0.61)	−0.343**	−0.198	0.330**	–			
Interpersonal distrust	0.93 (0.51)	0.201	−0.001	0.009	−0.129	–		
Eating symptoms	35.30 (10.84)	−0.349**	−0.413**	0.477**	0.457**	0.023*	–	
Depressive symptoms	25.98 (9.54)	−0.354**	−0.299**	0.332**	0.443**	−0.372**	0.445**	–

$^{**}p < 0.01$; $^{*}p < 0.05$. M, mean; SD, standard deviation.

TABLE 2 | Group differences in demographic characteristics and main study variables.

Variables	AN restrictive subtype (n = 35)	AN compulsive subtype (n = 17)	BN (n = 30)	ED-NOS (n = 11)	Kruskal–Wallis H	p	*Post hoc* (Adjusted p = 0.008)
Age	16.89 (1.05)	17.71 (1.36)	18.97 (2.5)	17.73 (1.62)	16.719	0.001	BN > AN restrictive subtype
Attachment	53.16 (16.69)	49.06 (12.91)	47.38 (18.79)	51.53 (12.85)	1.778	0.620	
Self-esteem	23.40 (4.67)	25.47 (2.15)	24.73 (3.56)	23.45 (3.30)	6.756	0.080	
Perfectionism	1.24 (0.89)	1.22 (0.65)	1.06 (0.79)	0.74 (0.80)	4.079	0.253	
Interoceptive awareness	0.89 (0.44)	1.01 (0.51)	1.29 (0.77)	0.87 (0.58)	4.709	0.194	
Interpersonal distrust	0.95 (0.51)	0.94 (0.54)	0.86 (0.51)	1.07 (0.53)	1.398	0.706	

on eating symptoms *via* self-esteem and perfectionism were significantly different and greater to the indirect effect through interpersonal distrust.

DISCUSSION

Previous research has shown that insecure attachment increases the risk for the development of EDs (Skarderud and Fonagy, 2012; Tasca, 2018); however, such effect is often exerted through other intermediate variables (Cortés-García et al., 2019). In this regard, the four transdiagnostic mechanisms for EDs proposed by Fairburn et al. (2003) may be potential candidates for mediation due to their robust associations with both insecure attachment and ED symptoms (Tasca, 2018). However, to date, no study has tested simultaneously such mechanisms in a multiple mediation model using a clinical sample of young ED patients. To fill this gap, we analyzed, for the first time, the role that Fairburn's transdiagnostic mechanisms may play as links between insecure attachment to the mother and ED symptoms among young female ED patients. In addition, given the strong association of depressive symptoms with the model variables, we also explored such connections by controlling for their effect.

As expected, we found evidence for insecure attachment to the mother to be significantly related to ED symptoms (Tasca, 2018). In addition, all transdiagnostic mechanisms, except interpersonal distrust, were related to ED symptoms, which is partially in line with our hypothesis and previously mentioned research (Mikulincer and Shaver, 2012). Furthermore, results from comparison analyses revealed that there were no differences between the different ED diagnostic groups in the variables studied. Thus, our findings suggest that all four mechanisms could be involved in the persistence of eating psychopathology, regardless of diagnosis, as postulated by Fairburn et al. (2003).

The results from the mediation analyses further extends previous findings by demonstrating a multiple pathway between insecure attachment and ED symptoms among ED patients. In particular, low self-esteem, clinical perfectionism and low interoceptive awareness were found to mediate this association. However, when controlling for depressive symptoms, the mediating effect of interoceptive awareness disappeared and only low self-esteem and clinical perfectionism remained as significant mediators. These findings suggest that insecurely attached ED patients may develop dysfunctional cognitive representations of themselves based on early experiences with their first caregiver that come to undermine their self-esteem construction (Skarderud and Fonagy, 2012; Faber et al., 2018). Moreover, this negative self-image may be accompanied by a dysfunctional self-evaluation scheme that emphasizes the achievement of unrealistic goals in highly valued areas, such as success at controlling eating, shape and weight, in order to reinforce their self-worth (Fairburn et al., 2003; Faber et al., 2018). As a result, individuals who overestimate the importance of the aesthetics of thinness may maintain unhealthy eating behaviors to counter their feelings of worthlessness, especially after failing their unrealistic goals, that derived from their insecure attachment representations (Tasca, 2018).

As regards low interoceptive awareness, when controlling for depressive symptoms, the mediating effect was no longer significant. Such results pinpoint to the possibility that the effect of low interoceptive awareness in the link insecure attachment–EDs symptoms may be mostly due to depressive symptoms —which frequently occur concomitantly with EDs (Puccio et al., 2016). Thus, a possibility of these results is that unmet attachment needs could lead to depressive symptoms (Dagan et al., 2018)

TABLE 3 | Results of multiple mediation analyses of the effect of attachment on eating disorder symptoms.

Mediation pathway	Point estimate	SE	95% CI		R^2 change
			Lower	Upper	
Insecure attachment → Transdiagnostic mechanisms → Eating symptoms					
Total	−0.3044	0.0783	−0.4652	−0.1592	
Self-esteem	−0.0949	0.0390	−0.1792	−0.0281	0.073***
Perfectionism	−0.1475	0.0567	−0.2701	−0.0502	0.110***
Interoceptive awareness	−0.0691	0.0371	−0.1508	−0.0056	0.023
Interpersonal distrust	0.0071	0.0206	−0.0343	0.0526	0.001
Contrasts					
Self-esteem vs. Perfectionism	0.0526	0.0637	−0.0651	0.1864	
Self-esteem vs. Interoceptive awareness	−0.0258	0.0577	−0.1397	0.0886	
Self-esteem vs. Interpersonal distrust	−0.1019	0.0437	−0.1939	−0.0212	
Perfectionism vs. Interoceptive awareness	−0.0783	0.0728	−0.2312	0.0600	
Perfectionism vs. Interpersonal distrust	−0.1545	0.0590	−0.2791	−0.0480	
Interoceptive awareness vs. Interpersonal distrust	−0.0762	0.0440	−0.1668	0.0062	
Insecure attachment → Transdiagnostic mechanisms → Eating symptoms controlling depressive symptoms					
Total	−0.1318	0.0559	−0.2547	−0.0359	
Self-esteem	−0.0448	0.0244	−0.1015	−0.0073	0.058**
Perfectionism	−0.0665	0.0360	−0.1516	−0.0114	0.084***
Interoceptive awareness	−0.0236	0.0183	−0.0646	0.0056	0.013
Interpersonal distrust	0.0031	0.0114	−0.0184	0.0303	0.006
Contrasts					
Self-esteem vs. Perfectionism	0.0217	0.0380	−0.0457	0.1056	
Self-esteem vs. Interoceptive awareness	−0.0211	0.0297	−0.0864	0.0322	
Self-esteem vs. Interpersonal distrust	−0.0479	0.0253	−0.1053	−0.0068	
Perfectionism vs. Interoceptive awareness	−0.0428	0.0409	−0.1381	0.0224	
Perfectionism vs. Interpersonal distrust	−0.0696	0.0349	−0.1516	−0.0150	
Interoceptive awareness vs. Interpersonal distrust	−0.0267	0.0207	−0.0708	0.0106	

*Completely standardized indirect effects are reported. R^2 change when adding each mediator, while controlling for the rest of variables. *p < 0.05, **p < 0.01, ***p < 0.001.*

which interfere with the ability to identify emotions and body signals (e.g., hunger, satiety) (Lackner and Fresco, 2016) and contributes to the maintenance of disordered eating. In this regard, ED symptoms may be maintained among insecurely attached patients as ways to modulate their negative mood along with the inability to identify and understand body signs. However, cross-sectional data of this kind prevents conclusions being drawn about the causal direction of relationships.

Contrary to our expectations, interpersonal distrust did not significantly connect insecure attachment with eating symptoms, even though problems in interpersonal relations are common among ED patients reporting insecure attachment patterns (O'Shaughnessy and Dallos, 2009; Faber et al., 2018). It is possible that this null finding may be due, at least in part, to the use of the interpersonal distrust subscale of the EDI to measure interpersonal difficulties. Concretely, this subscale assesses disinterest in establishing close relationships and a general feeling of alienation in relationships (Garner et al., 1983), processes that, although certainly related to interpersonal difficulties, may not strictly target the interpersonal problems to which Fairburn's transdiagnostic mechanism referred to [e.g., excessive social comparison with other persons considered as referents (Bamford and Halliwell, 2009; Ty and Francis, 2013) or excessive sensitivity to social rejection (De Paoli et al., 2017a,b)].

Taken together, our findings suggest that some insecurely attached patients who perceive themselves as unlovable and unworthy may be more vulnerable to developing poor self-image and dysfunctional self-assessment schemas focused on achieving unrealistic high goals about controlling weight, eating, and body shape. Moreover, unmet attachment needs may influence the development of more disordered eating when depressive symptoms interact with low interoceptive awareness, which are more proximal factors that contribute to or maintain disordered eating (Stice, 2002; Fairburn et al., 2003).

Such findings encourage the integration of dysfunctional representations of the self, others and the world that stem from an insecure attachment as distal risk factors of EDs into the transdiagnostic model so that, along with more proximal maintaining factors, can be targeted in theoretical models. Likewise, such results are valuable in designing preventative and intervention efforts for individuals at risk. To date, only one case study has demonstrated the efficacy of a treatment for EDs integrating both attachment and cognitive-behavioral factors in two cases of bulimia nervosa and binge eating disorders (Szalai, 2016). However, more randomized controlled studies targeting insecure attachment representations and other cognitive-behavioral maintaining factors of EDs are needed.

The present study is limited by its small clinical sample size and by the inclusion of only female patients, who were mostly adolescents and Caucasian and, therefore, our results must be viewed with caution and cannot be generalized to the whole of

the ED population. In addition, the cross-sectional nature of the study design limits the ability to draw causal conclusions. Future studies should examine our model prospectively.

CONCLUSION

The present findings suggest that the distal risk influence of insecure attachment to the mother in the development of ED symptoms might be exerted through low self-esteem and high clinical perfectionism, controlling for depressive symptoms. Therefore, our study highlights the theoretical and practical importance of understanding eating disorders as the result of the interaction of proximal and distal risk factors for which longitudinal studies are highly recommended.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request. The data are not publicly available due to privacy and ethical restrictions.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Bioethics Committee at the University of Santiago de Compostela (Spain). Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

AUTHOR CONTRIBUTIONS

LC-G, CM, and CS: conceptualization and writing – review and editing. LC-G and CM: methodology and data curation. LC-G: formal analysis and writing – original draft preparation. All authors contributed and approved the final version of the manuscript for submission.

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Anorexia and Young Womens' Personal Networks: Size, Structure, and Kinship

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Anorexia is a serious threat to young women's wellbeing worldwide. The effectiveness of mental health intervention and treatment is often evaluated on the basis of changes in the personal networks; however, the development of such measures for young women with anorexia is constrained due to the lack of quantitative descriptions of their social networks. We aim to fill this substantial gap. In this paper, we identify the basic properties of these women's personal networks such as size, structure, and proportion of kin connections. The empirical analysis, using a concentric circles methodology, is based on 50 ego networks constructed on data drawn from interviews with Russian-speaking bloggers who have been diagnosed with anorexia and write about this condition. We conclude that young women with anorexia tend to support a limited number of social ties; they are prone to select women as alters, but do not have a preference to connect to their relatives. Further research is needed to elucidate whether these personal network characteristics are similar among women with anorexia who belong to different age, ethnic, cultural, and income groups.

Keywords: anorexia, networks, personal networks, mental health, young women

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INTRODUCTION

Anorexia is an eating disorder (ED) related to significant physical and mental health problems in adolescence and adulthood (Galmiche et al., 2019). This ED is characterized by restriction of food intake, fear of becoming fatter, and distortions of body image (American Psychiatric Association, 2013). Girls are 2–3 times more likely than boys to face anorexia in their teenage years (Steiner and Lock, 1998; Hoek, 2006; Nagl et al., 2016; Galmiche et al., 2019). This is often explained by the social expectations of women (especially women's bodies) in contemporary societies (Boskind-Lodahl, 1976; Mahowald, 1992; Malson, 1998; Bruch, 2001; Dahlenburg et al., 2019; Giordano, 2020).

Anorexia, as with other self-harming behaviors, is associated with difficulties in interpersonal relations (Tiller et al., 1997; Patel et al., 2016; Cardi et al., 2018; Pace et al., 2018; Birmachu et al., 2019; Okada et al., 2019). Although the relationship between anorexia and personal connections has been investigated, research on this topic has mostly provided qualitative descriptions or only indirectly focused on young women's social networks (Leonidas and dos Santos, 2014). Studies that have revealed quantitative features of the personal networks of young women with anorexia are scarce and were conducted in a limited number of countries (Quiles Marcos and Terol Cantero, 2009; Tubaro and Mounier, 2014; Pallotti et al., 2018). Additionally, we should note the lack of research on the social networks of people with anorexia in Eastern Europe, especially Russia. Therefore, further research is needed to shed light on the social contexts of these women.

The present study fills this gap. We describe the main characteristics of the personal networks of adolescents and young adult women with diagnosed anorexia. The analysis is based on self-reported ego-networks collected from 50 Russian-speaking young women in the summer (July–August) of 2020.

The contribution of our study is twofold. First, we provide quantitative descriptions of personal networks of young women with anorexia. There is a lack of information on such networks in the scientific literature and our paper provides this valuable data. Second, such information has practical significance because the measurement of the effectiveness of the many types of interventions and treatments targeted at the improvement of women's mental health is often based on the analysis of changes in their personal networks (Anderson et al., 2015; Siette et al., 2017; Ma et al., 2020).

The paper starts with an overview of network-based research on people with anorexia. It proceeds with a description of the methodology. Finally, the results are reported and discussed.

LITERATURE REVIEW

During adolescence, teenagers actively transform their personal social networks along with significant life events such as separating from their families, taking their first steps in their educational and professional development, and establishing new friends and romantic contacts (Giordano, 2003; Cotterell, 2013). People who surround young adults and adolescents at this time could either provide support and contribute to their wellbeing in various social spheres or influence their involvement in risky and practices deemed deviant by society (López et al., 1989; Wells and Rankin, 1991; Lorant and Tranmer, 2019; Webster et al., 2021).

Anorexia is one of the self-harming behaviors that often originates in adolescence and is most prevalent among girls (Galmiche et al., 2019). Moreover, it is associated with the highest rates of premature mortality among EDs (Arcelus et al., 2011; Keshaviah et al., 2014) and is connected with multiple comorbid mental health problems (Jordan et al., 2008; Martinussen et al., 2017; Marucci et al., 2018). Adult food intake and body image are both significantly dependent on the social networks that are formed in adolescence (Ali and Lindström, 2006; Fletcher et al., 2011; Simone et al., 2018; Grund and Tatum, 2019). For example, in social interactions within female peer groups during adolescence, women may acquire cultural values of beauty and practices of body care *via* the emulation of dieting practices, body size comparisons, and weight-based teasing that encourages them to lose weight (Allison et al., 2014). All in all, the effect of personal social networks turns out to be an important factor in behavior deemed deviant by society. Therefore, the quantitative analysis of personal networks of young women with anorexia could have significant implications for the prevention and management of this ED (Ferguson et al., 2011).

Network Characteristics of People With Anorexia

The psychological and sociological literature suggests that people with anorexia might experience difficulties with communication, feel socially isolated, and report lower levels of social support from family members and significant others (Tiller et al., 1997; Levine, 2012; Patel et al., 2016; Cardi et al., 2018; Pace et al., 2018; Birmachu et al., 2019; Okada et al., 2019). Specifically, they are described as having problems establishing new relationships and maintaining old ones, caused by a distrust of others (Patel et al., 2016; Cardi et al., 2018; Quiles et al., 2020; Datta et al., 2021; Rowlands et al., 2021). These difficulties are experienced both before and after anorexia. Some scholars argue that these problems usually become more severe during anorexia (Cardi et al., 2018). Although the interpersonal relationships of people with anorexia have been described in theoretical and empirical qualitative studies (Patel et al., 2016; Westwood et al., 2016; Paul et al., 2018), quantitative descriptions of these people's personal networks are scarce (Leonidas and dos Santos, 2014). This, consequently, significantly restricts perspectives for the exploration of social network factors in anorexia development.

To extend our knowledge of the structural characteristics of the personal networks of people with anorexia, we will focus on three interrelated aspects: (1) *network size*, (2) *network structure*, (3) *kinship network*. In this section of the paper, along with a literature review, we introduce our hypotheses and describe the characteristics of social networks.

Network Size

Network size, one of the central characteristics of the social network structure, is usually defined as the number of alters in a personal social network (Wasserman and Faust, 1994; Crawford et al., 2018). Literature on social support reports that the average size of the social support network of individuals with anorexia varies from 5 to 16 alters (Quiles Marcos and Terol Cantero, 2009; Tubaro and Mounier, 2014; Pallotti et al., 2018). Notably, two of these three studies include both men and women (Tubaro and Mounier, 2014; Pallotti et al., 2018), making it difficult to hypothesize whether the network size of people with diagnosed anorexia is gender-specific. Therefore, based on previous studies of mixed-gendered samples we hypothesize that: *The average network size of young women with anorexia will range from 5 to 16 actors (H1).*

Network Cohesion

Social cohesion is a widely applied concept in the social sciences (Friedkin, 2004). It might be defined as a resource of a group or society that affects individuals at both local and community levels (Lin, 2001; Martí et al., 2017). From a social network perspective, cohesion usually refers to the general level of network connectedness (Wasserman and Faust, 1994; Martí et al., 2017). In order to measure social cohesion, researchers usually calculate the density of the social network (Pallotti et al., 2018). In this paper, we consider network cohesion from a different perspective. We argue that the local sub-group structure within personal networks needs to be taken into account, because the extent to which an actor is connected to multiple cohesive subsets of alters plays a significant role in certain types of social support (Martí et al., 2017). Previous research demonstrates that individuals within the personal networks of people with anorexia are at least acquainted with each other or maintain other types of

relationships such as friendship (Tubaro and Mounier, 2014; Pallotti et al., 2018). Thus, as a measure of social cohesion we use the proportion of isolates in an individual's social network and based on previous empirical findings (Tubaro and Mounier, 2014; Pallotti et al., 2018), we hypothesize that: *The network structure of young women with anorexia will be of middle-high cohesiveness. This means that the proportion of isolates in the networks would be less than 0.5 (H2).*

Kinship Network

People with anorexia tend to have difficulties with emancipation from their families and are prone to having limited social contact with people outside their families (Ruuska et al., 2007). Moreover, they frequently mention their mothers among their primary social support providers (Quiles Marcos and Terol Cantero, 2009). However, scholars indicate that the social surroundings of people with anorexia have become more diverse due to technological advances, specifically the opportunity to establish and maintain relationships *via* the internet, and include a large number of partners and friends (Tubaro and Mounier, 2014; Pallotti et al., 2018). Some papers demonstrate that these connections may worsen their health condition because the members of these communities can motivate each other toward extreme weight loss, as in pro-ana communities, which treat anorexia as a manageable lifestyle (Rodgers et al., 2012; Mento et al., 2021; Osler and Krueger, 2021; Nova et al., 2022). At the same time, online communities comprising people with anorexia who support personal recovery exist, such as pro-recovery communities that encourage people with anorexia to get treatment and may help them improve their health (Branley and Covey, 2017; Lamarre and Rice, 2017; Kenny et al., 2019). Additionally, the personal networks of people with anorexia might include health workers such as psychologists or psychiatrists (Quiles Marcos and Terol Cantero, 2009; Tubaro and Mounier, 2014; Pallotti et al., 2018). Summarizing, current research suggests that kin would outnumber non-kin in personal social networks of people with anorexia, although the proportion of non-kin might increase for various reasons. This leads us to our third hypothesis: *Among the members of the young women with anorexia, kin will outnumber non-kin (H3).*

People with anorexia usually state that their body condition and weight management are the most important parts of their life, both after having anorexia and during its active phase, and scholars claim that people outside the family circle provide people with anorexia with dieting tips and related information; for example, friends might give advice on pills and exercise (Brotsky and Giles, 2007; Haas et al., 2011; Pallotti et al., 2018). While family members do not always share their attitudes toward food and body, we suppose that alters outside the family circle could be classified by people with anorexia as more significant to them than family members because of their potential function as providers of body management information. We therefore hypothesize that: *The non-kin members of the social networks of young women with anorexia will be perceived subjectively as being closer (H4).*

Finally, as the social networks of people with anorexia are usually predominantly composed of females (Tubaro and Mounier, 2014; Pallotti et al., 2018) we hypothesized that: *Of the non-kin personal network members of women with anorexia, a majority will be women (H5).*

Additionally, in the section "Results," we report the basic descriptive structural metrics of personal networks of women with anorexia. These descriptions contribute to the general understanding of the composition of the social networks of people with anorexia.

MATERIALS AND METHODS

Sample

We collected data from young Russian-speaking female bloggers who have public blogs on the Russian social networking site VK.[1] In these blogs, these young women write about their current health status and relationships with other people as well as other personal information. Additionally, bloggers interact with their audience *via* text and video on anorexia-related topics. The participants in our study were recruited using purposive sampling (Onwuegbuzie and Leech, 2015) to ensure the heterogeneity of narratives. Namely, we created a list of women who might be willing to participate in our research with a quota on the city and the number of subscribers on VK, then we contacted these people in personal text messages. Out of 156 women contacted, 50 agreed to participate in this study. As a result, in July and August 2020 we conducted biographical interviews with young female bloggers medically diagnosed with anorexia from more than 30 different Russian, Ukrainian, Kazakhstani, and Belarussian cities. Some of these bloggers hold pro-anorexia views (35), while the others support recovery (15). The age of participants ranges from 14 to 25. The description of the sample is in the **Supplementary Appendix Table 1**. The interviews were conducted *via* Skype due to the quarantine measures in Russia.

Data Collection

We gathered the data on the personal network connections of these young women using semi-structured biographical interviews (Rosenthal, 2004). The interviews consisted of the following parts: (1) The unstructured narratives of the young women about their lives from the very beginning to the time of the interview, (2) Clarifying questions, and (3) The elicitation of their personal social networks. The personal networks were obtained and analyzed using the concentric circles method (Altissimo, 2016; Tubaro et al., 2016; Van Waes and Van den Bossche, 2020). Participants (egos) were asked to name people they believed to belong to their social surroundings (alters) and to specify the relations between these individuals. In addition, the young women were asked to rate their alters' significance in their life and put them into three concentric circles according to this ranking, with the ego at the center (**Figure 1**). Alters subjectively considered to be more significant to ego are in the closest circle to her (1-rated) and those alters who were not included in these

[1]This dataset is a part of one of the authors' Ph.D. dissertations and can be obtained from the author directly if needed.

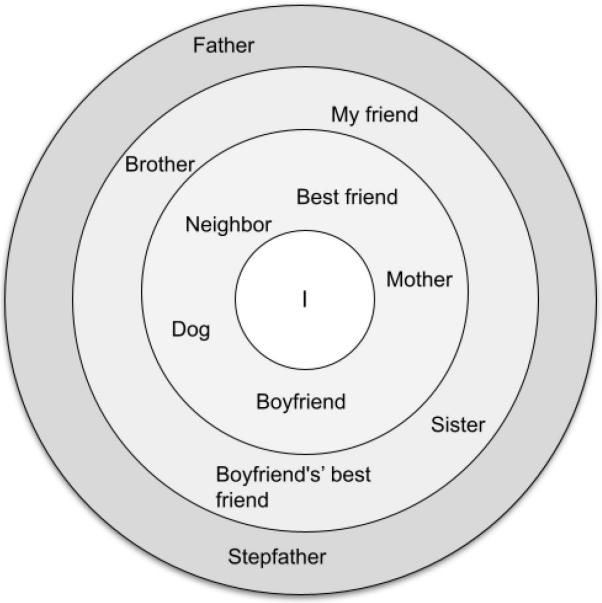

FIGURE 1 | The social contacts map of participant 2 (translated from Russian). In the center of the map is the blogger herself. In the first circle are people and an animal who she named the most significant to her (her dog, boyfriend, mother, neighbor, and best friend). In the second circle are people she claimed to be less important (brother, friend, sister, and boyfriend's best friend). The least close to the participant are her father and stepfather. These people are placed in the third circle. She placed no one outside the circles, i.e., this participant did not name people who are not important to her.

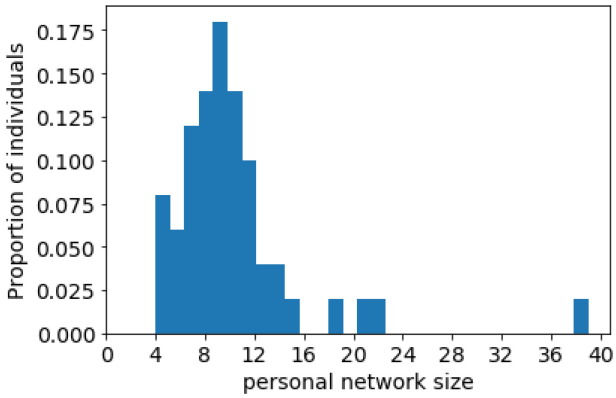

FIGURE 2 | Distribution of personal network size (No networks had fewer than four members).

circles were considered by the young women as not significant (4-rated). All the young women completed informed consent forms. The research complies with ethical norms of [the University name was removed for review purposes] University and was approved by the IRB.

In this paper we will focus on personal networks in which the ego is the female blogger with anorexia, the alters are the members of the perceived social surroundings, and the ties between these people are the social relations (talking and other forms of interaction) that, according to the ego's suggestions, exist between her and her alters.

Social Network Analysis: Measures

One of the central network characteristics is the *network size*. The sizes of network structures (graph) can be captured by calculating the number of nodes and edges. Within the framework of this study, we considered the network size to be the number of alters (nodes) connected (edges) to the ego (target node).

As a measure of social cohesion, we used the proportion of *isolates* in a given network. An isolate is an actor who does not have any connections within the network. The proportion of isolates is the ratio between the number of isolates and the network size.

We used Python 3.7.4 for the computations, with networkx Python package 2.6.2 employed to calculate the descriptive statistics of the network. Additionally, we used Pearson's correlation coefficient in and Student's *t*-test (SciPy 1.7.1 package).

RESULTS

The distribution of the personal network size is presented in **Figure 2**. The network size varied from 4 to 39. For the majority of the individuals (N = 47, 94% of the sample) it ranged between 5 and 16. On average, the number of alters was 10.24 (SD = 5.56); the median was 9. The distribution of the network size was not normal. We found a small proportion of outliers with extremely high numbers of alters, which aligns with network theory (Barabási and Albert, 1999), which predicts the presence of multiple actors with limited numbers of ties and a few individuals with many ties (so-called hubs). After the exclusion of the most popular individual (with 39 alters in their personal network), the average number of alters for the sample decreased to 9.65 (SD = 3.74). The median network size remained at 9. In further calculations, we analyzed the sample without this outlier.

Our findings support H1, in that the network size for the major part of young women with anorexia ranges from 5 to 16.

On average, there were 5.33 (SD = 3.33) isolated individuals in the observed personal networks, with a median of 5. The proportion of isolated individuals in personal networks was 0.53 (SD = 0.21) (**Figure 3**). These results support H2. These values might suggest that people tend to diversify their social relationships and maintain connections with both cohesive communities and isolated individuals. Approximately half of a given personal network consisted of isolated alters, while the rest of the network was a connected group of multiple cohesive communities.

On average, the individuals maintained relationships with 4.51 family members (SD = 2.47) (**Figure 4A**). For each network we computed the proportion of kin alters in personal networks. For the whole sample, the average fraction of kin alters was 0.47 (SD = 0.16) (**Figure 4B**). Thus, we conclude that the proportion of kin in personal networks of women with anorexia is not greater than the proportion of non-kin, in contradiction to H3.

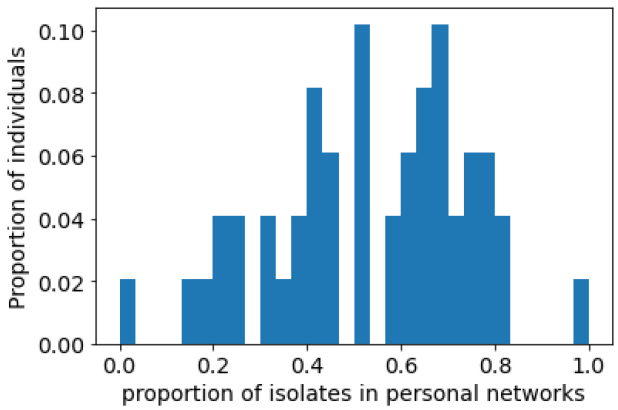

FIGURE 3 | Distribution of the proportion of isolates in personal networks.

To examine whether young women with anorexia tend to select non-kin members as the closest alters in their networks, for each personal network, we computed the average significance of the kin and non-kin members in the personal network (**Figures 5A,B**). The average significance of kin alters was 1.13 (SD = 0.59), and 1.12 (SD = 0.60) for non-kin alters (p-value = 0.95, t-test). Thus, we did not find a difference between the levels of significance for kin and non-kin alters, and the results do not support H4.

The average proportion of females in non-kin networks was 0.62 (SD = 0.27), and the median was 0.67 (**Figure 6**). In more than two thirds of the participants' networks (68%), the proportion of females among the non-kin alters was greater than half. Thus, the evidence supports H5, and we might conclude that participants tend to create ties with females, and that this tendency is independent of their overall network structure.

Additional descriptive statistics on personal networks of young women with anorexia and association between the variables are reported in the **Supplementary Appendix**.

DISCUSSION

This paper addresses the gap in the literature on the relationships of young women with anorexia by providing information on the quantitative aspects of their personal networks. Previous studies on this topic are scarce (Quiles Marcos and Terol Cantero, 2009;

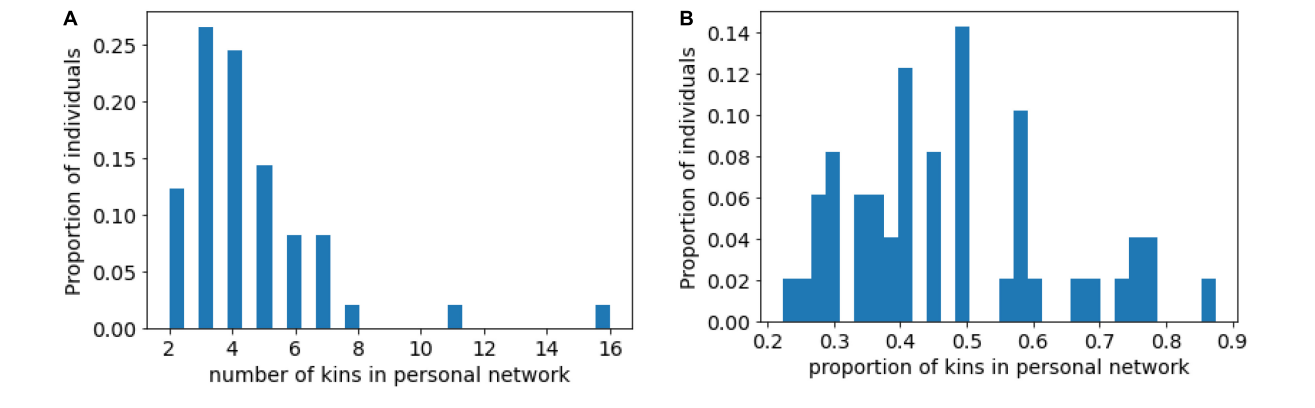

FIGURE 4 | (A) Distribution of number of kin alters in personal networks; **(B)** Distribution of proportion of kin alters in personal networks.

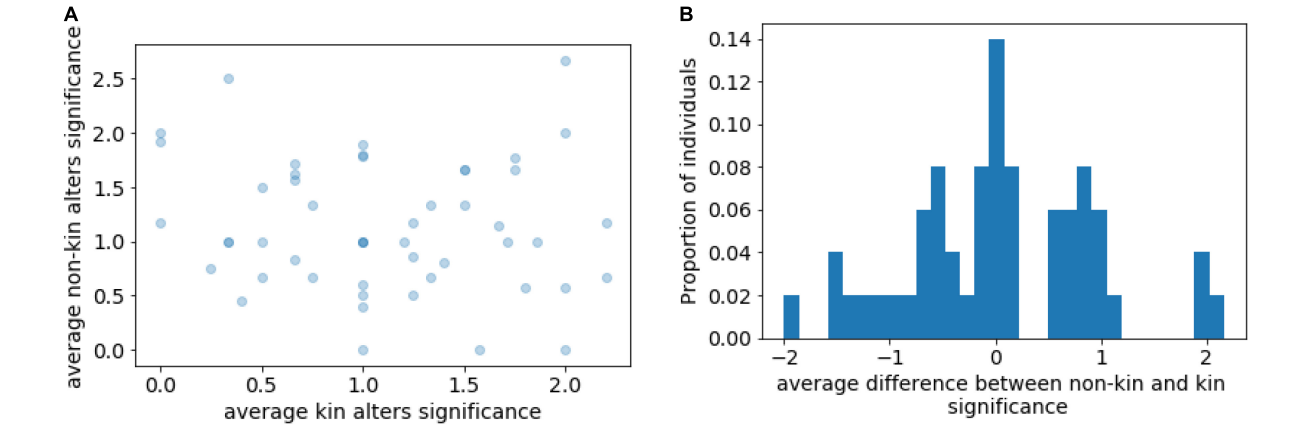

FIGURE 5 | (A) Relationship between average kin and non-kin alter significance; **(B)** Distribution of average difference between non-kin and kin alter significance.

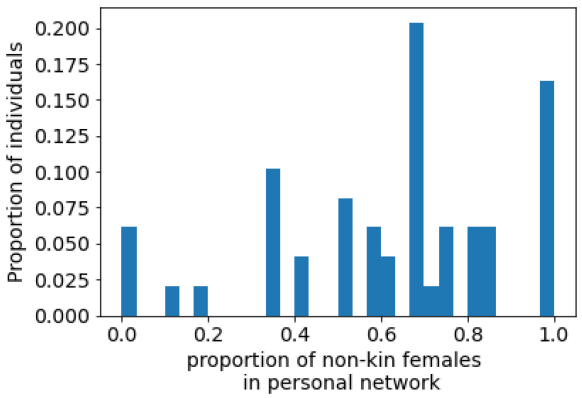

FIGURE 6 | Distribution of the proportion of non-kin female alters.

Tubaro and Mounier, 2014; Pallotti et al., 2018), and most is qualitative, which significantly limits scholars' and practitioners' abilities to develop reliable measures for interventions and treatment outcomes based on network indicators. We report on young women's personal networks in terms of size, structure, and kinship network. The calculations of these parameters were made on the basis of 50 ego networks described by Russian-speaking bloggers in qualitative interviews in the summer of 2020.

The results regarding the average personal network size of young women with anorexia largely agree with the previous research (H1). We demonstrated, consistent with Quiles Marcos and Terol Cantero (2009), Tubaro and Mounier (2014), and Pallotti et al. (2018) that on average, these women maintain relationships with 10 people. A personal network of this size does not, at first, appear critically small because studies show that the active network of a person in the general population usually comprises at least 20–30 people (Maguire, 1983; Lubbers et al., 2019). However, these numbers include both online and offline contacts. The literature on the utilization of mental health services demonstrates that a limited number of personal connections is often related to increased usage of mental health services (Mitchell, 1989; Albert et al., 1998; Thoits, 2011) because the person is not surrounded by people who can provide the necessary care and support. Moreover, small personal network size is associated with an elevated likelihood of compulsory hospital admission (Kogstad et al., 2013). Therefore, we suppose that in future studies it would be important to address the association between personal network size and the severity of anorexia outcomes for women with this condition. This could extend understanding of whether interventions tailored toward the improvement of the general social skills of young women (Spence, 2003) are also effective in the prevention of severe anorexia symptoms (Pratt and Woolfenden, 2002; Dimitropoulos et al., 2016; Hay et al., 2019; Gan et al., 2021).

In line with previous research, we found that our participants had connections with both cohesive communities and isolated individual actors (H2) (Tubaro and Mounier, 2014; Pallotti et al., 2018). By contrast, in the general population, a person's social network is made up of 10 percent or less of isolated alters on average (Golinelli et al., 2010; Martí et al., 2017; Stadel and Stulp, 2022). This means that the social network of the ordinary person is much denser than the networks of our research participants. The connection between social network density and diversity is complicated (Walker, 2015; Lee et al., 2020). Network density is positively related to personal wellbeing only when the individual is in a self-affirming social environment (Walker, 2015). Otherwise, being surrounded by many people who actively interact with each other does not have a positive effect on the individual's mental health because she feels trapped in the social groups in which she is included. Network diversity, despite being connected to improvements in psychological wellbeing, is not related to an increase in personal feelings of social support (Müller et al., 2007). This means that in a woman with anorexia, a high level of social contact diversity could coincide with personal feelings of loneliness. We believe this could be true of our study participants, who told us during the interviews that many people they interact with tend to produce negative body talk and collaborate on this production of negative statements (Mikhaylova, 2022). Young women often cannot cease communication with these abusive individuals because they are their classmates, teachers, or even family members (Shannon and Mills, 2015). Furthermore, our data do not allow us to quantitatively determine the way the diversity and density of the personal social networks of women with different incomes are connected to their experience of anorexia, which is a question that future studies can address. Economic inequality means that it might be easier for some women to change their social environments and, as a result, improve their psychological wellbeing; for others, such a move may be much more problematic.

Contrary to our assumptions based on previous studies (Quiles Marcos and Terol Cantero, 2009; Tubaro and Mounier, 2014; Pallotti et al., 2018), we found that the proportion of kin members in the participants' personal networks was not higher than the proportion of other members of these networks (H3). Furthermore, people in the general population also report that almost half of their personal network consists of relatives, and this figure holds across different country samples (Wellman and Wortley, 1989; Dunbar and Spoors, 1995; Grossetti, 2007). Because the quality of family relationships could influence the success of psychotherapy (Sapin et al., 2016; Fleming et al., 2021), we suggest cautious interpretations of the proportion of kin in the personal networks of people with psychological problems. Women with mental health problems who experience overload and ego-centered conflict in family relationships could show patterns of evaluated psychological distress (Sapin et al., 2016; Tournier et al., 2021). Therefore, we believe that future studies, preferably longitudinal, are necessary to clarify the connection between kinship networks and treatment outcomes for women with anorexia.

We found no statistically significant difference between the subjective closeness of kin and non-kin members of the participants' social networks (H4). This contradicts the assumptions formulated on the basis of the studies by Brotsky and Giles (2007), Haas et al. (2011), and Pallotti et al. (2018). Moreover, this contradicts the research on the general

population, which claims that people at various life stages tend to perceive their relatives as socially closer than non-kin members of their personal networks (Shulman, 1975; Wellman and Wortley, 1989; Aeby et al., 2018). Nevertheless, we deduced that women with larger personal networks maintain both deep and shallow relationships with non-kin members of their networks. Support from family members has been described in the literature as being more important for one's personal mental health than support from friends and significant others (Shor et al., 2013; Aeby et al., 2020). Nonetheless, as the importance of familial support increases with age (Shor et al., 2013; Widmer et al., 2018; Woods et al., 2020), we believe it likely that the value of family support for older women (Gadalla, 2008) with anorexia might be higher. This idea would need further investigation carried out on older individuals.

In accordance with Tubaro and Mounier (2014) and Pallotti et al. (2018), we discovered that young women with anorexia had a high proportion of female non-kin personal network members (H5). This finding corresponds with social comparison studies that have shown that body dissatisfaction and eating problems among women are related to the internalization of the body-related attitudes shared by significant women in their lives, such as mothers, sisters, and close female friends (Thompson et al., 1999; Lev-Ari et al., 2014a,b; Nerini et al., 2016; Betz et al., 2019; Pollet et al., 2021). Additionally, this result is in line with research on the general population, which has found that non-kin contacts account for more than half of people's personal networks (Dunbar and Spoors, 1995; McPherson et al., 2006; Roberts et al., 2008, 2009). Because our participants came from Russian-speaking countries, we acknowledge that gender ideology and social expectations of women in this cultural context (White, 2005; Barrett and Buckley, 2009; Kosterina, 2012; Turbine, 2012) could influence the functioning of social comparison mechanisms among women, especially in the family context. Therefore, we think that comparative research of the personal networks of women with anorexia from different regions worldwide is needed to show how the environments of the state and social institutions can moderate the effect of social connections on the wellbeing of such women.

Because the data was collected during a COVID-19 lockdown, participants were additionally asked about the perceived effects of the pandemic on their mental and physical health and social networks. They mentioned that lockdown and other consequences of the COVID-19 pandemic have influenced their eating behavior. As has been reported in comparable research (Phillipou et al., 2020; Schlegl et al., 2020), participants claimed that they started to exercise and control their food intake more. They associate these changes with lockdown restrictions. Women also reported that they felt more anxious about their current and future educational and career prospects, which corresponds with studies of emotional wellbeing during COVID-19 pandemic among people with eating disorders (Sideli et al., 2021; Linardon et al., 2022). These studies have demonstrated that during COVID-19 pandemic people with eating disorders have experienced elevated feelings of stress, fear, and anxiety. At the same time, our study participants did not note any change in their relations with people in their personal networks contrary to some of the other studies of the perceived social support among people with eating disorders during COVID-19 pandemic (Sideli et al., 2021; Linardon et al., 2022). Perhaps our participants were able to maintain relationships with people from their personal networks *via* digital technologies that is why they did not notice any changes in their social networks. Additionally, they could have felt peer support from the members of the online eating disorder communities as many researchers, for example, Albano et al. (2021) have discovered that during emergent global situations such as COVID-19 pandemic these communities may provide for the members the feelings of being understood by people with comparable life situations.

LIMITATIONS

Our research is not without shortcomings. First, the sample comprises young white women, whose personal networks may differ from those of women of color (Ajrouch and Antonucci, 2018) and those who belong to other minorities (Frost et al., 2016; Watson et al., 2019; Fischer, 2021), as well as those of women with anorexia who belong to other age groups (Midlarsky and Nitzburg, 2008; Lapid et al., 2010; Scholtz et al., 2010). Second, because women with anorexia are a hard-to-reach population, especially in Russian-speaking countries, where there is no officially gathered data on the prevalence of EDs, in this paper, we estimated the network characteristics of only 50 women. However, we hope that future studies can utilize larger samples, creating opportunities for a wider range of between-group comparisons. Third, our sample comprises women bloggers and we do not know whether their social contacts differ from those of young women with anorexia who do not blog. Fourth, reports on the personal relations that young women maintain should be regarded with caution due to memory (Brewer, 2000), sensitivity (Cronin et al., 2020), problems with the attribution of roles to the members of personal networks (Bush et al., 2017), and other interview-related issues (Feld and Carter, 2002; Kogovšek and Ferligoj, 2005). Fifth, when reporting on the personal networks of young women based on their narratives, we should remember that these are only the young women's perceptions of their relations (Bayer et al., 2020; Feld and McGail, 2020). Additional research is needed that includes the perspectives of the members of these personal networks (Suitor et al., 2020) to reveal how the members of these personal social circles perceive their relations with young women with anorexia.

CONCLUSION

Our study demonstrates that young women with anorexia do have small personal social networks. On average, half of the alters in their personal networks are in communication with each other and potentially might be involved in the same social circles. We did not find that kin alters outnumber non-kin in these social networks. At the same time, it could be argued that women with anorexia maintain relationships

primarily with other women. Further research, better on larger samples, is needed to elucidate whether these personal network characteristics are similar between women of different ages, incomes, ethnicities, and cultural groups.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by HSE University. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

Both authors listed have made a substantial, direct, and intellectual contribution to the work, and approved it for publication.

FUNDING

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2022.848774/full#supplementary-material

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