

Highlights in psychology: Social anxiety

Edited by

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Highlights in psychology: Social anxiety

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Editorial: Highlights in psychology: social anxiety

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social anxiety (SA), cognition, relationships, mental health, depression, cultural differences, emotions, neurobiology

Editorial on the Research Topic

Highlights in psychology: social anxiety

The aim of the Research Topic is to provide a comprehensive overview of the current research landscape surrounding social anxiety. Social anxiety is a pervasive mental health condition characterized by intense fear and discomfort in social situations, often leading to significant impairment in various areas of life such as relationships, work, and school.

Through this edition, the goal is to shed light on various aspects of social anxiety, including its cognitive, emotional, interpersonal, and cultural dimensions. The Research Topic seeks to showcase a diverse range of research methodologies and perspectives within the field of psychology, encompassing disciplines such as Personality and Social Psychology, Clinical Psychology, and Cognition.

The Research Topic delves into various specific themes, spanning errors in cognition like hypermentalizing and their correlation with social anxiety, along with exploring the repercussions of social anxiety on diverse relationship dynamics encompassing familial, romantic, professional, and platonic spheres. Additionally, it scrutinizes the comorbidity nexus between social anxiety and other mental health afflictions like depression and eating disorders, whilst also examining social anxiety across age demographics, from children to adolescents and young adults. The discourse extends to encompass assessment and treatment methodologies tailored for social anxiety, considering cultural dimensions including prevalence, manifestation, and treatment paradigms across different societies. Moreover, it investigates gender disparities and cultural influences on social anxiety, underlining the role of sociocultural factors in its formulation. Furthermore, it elucidates the intricate interplay between emotions, notably shame, and social anxiety, alongside delving into the neurobiological and psychophysiological underpinnings of this phenomenon.

The Research Topic contributes to our understanding of social anxiety and provide insights that can inform both theory and practice in psychology. This Research Topic includes articles that focus on social anxiety, demonstrating the wide range of research conducted in the field of Psychology, including areas such as Personality and Social Psychology, Clinical Psychology, and Cognition. Key conclusions drawn from the articles include the interdisciplinary nature of studying social anxiety, the introduction of concepts like “Alexinomia”, and the exploration of its relationships with other psychological factors such as olfactory reference disorder and childhood maltreatment. The role of personality traits, cultural influences, and technological advancements like social media are also highlighted, alongside the impact of current events such as the COVID-19 pandemic on social anxiety.

Articles within this Research Topic use methodologies from Personality and Social Psychology, Clinical Psychology, Cognition, and other related fields, highlighting the interdisciplinary nature of studying social anxiety. Several articles delve into the relationship between social anxiety and other disorders or conditions, such as olfactory reference disorder, childhood maltreatment, substance use disorders, and cognitive processing differences. This highlights the importance of understanding how social anxiety interacts with and may be influenced by other psychological factors.

The interplay between personality traits and social anxiety is a recurring theme, emphasizing the significance of individual differences in shaping the experience and expression of social anxiety. Cultural influences, such as self-construals among Chinese individuals, and technological advancements, such as social media use, are shown to have implications for social anxiety. These findings underscore the importance of considering cultural and technological contexts in understanding and addressing social anxiety.

Current events, such as the COVID-19 pandemic, can have significant implications for social anxiety and related behaviors. Understanding how contextual factors influence social anxiety is crucial for developing effective interventions and treatments. The exploration of therapeutic approaches, such as dialectical behavior therapy skills groups, suggests promising avenues for intervention in treating social anxiety disorder. Identifying effective treatment modalities is essential for improving outcomes for individuals with social anxiety.

This collection of articles enhances our comprehension of social anxiety across various domains, from its underlying mechanisms to its impact on individuals' lives, and explores potential avenues for intervention and treatment. Articles explore various aspects of social anxiety, including its interaction with different disorders, cognitive processes, technological influences, and cultural contexts. They also propose therapeutic approaches such as dialectical behavior therapy skills groups, aiming to improve interventions and treatments for social anxiety disorder. Each article contributes uniquely to the growing body of knowledge, shedding light on different aspects such as cognitive processing, cultural influences, therapeutic interventions, and the interplay with other psychological factors.

[Ditye et al.](#) introduce the concept of a specific fear related to social interaction.

[Reuter et al.](#) explore the relationship between specific disorders or conditions and social anxiety.

[Okano and Nomura](#) move into examining specific aspects of social anxiety and its interaction with other psychological factors.

[Macovei et al.](#) continue exploring the interplay between personality traits and social anxiety.

[Liu et al.](#) expand the discussion to include the influence of childhood experiences, cultural factors, and substance use disorders on social anxiety.

[Zhu et al.](#) shift focus to how social anxiety affects cognitive processes, particularly in interpreting non-verbal cues.

[Yang et al.](#) examine the relationship between social media use and social anxiety, adding a technological and cultural dimension to the discussion.

[Thériault et al.](#) explore the impact of social expectations and feedback on individuals with social anxiety.

[Bagheri et al.](#) offer a data-driven approach to understanding social dysfunction and its predictors, adding empirical evidence to the discussion.

[Xia et al.](#) consider the impact of current events (such as the COVID-19 pandemic) on social anxiety and related behaviors, incorporating relevant contextual factors.

[Villalongo Andino et al.](#) conclude by exploring potential therapeutic approaches for addressing social anxiety, suggesting avenues for intervention and treatment.

To conclude, the Research Topic deepens our understanding of social anxiety across multiple domains, offering insights into its mechanisms, impact on individuals' lives, and potential avenues for intervention and treatment.

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Alexinomia: The fear of using personal names

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Introduction: Preliminary research based on everyday observations suggests that there are people, who experience severe fear when addressing others with their personal names. The aim of this study was to explore the extent to which this hitherto little-known psychological phenomenon really exists and to investigate its characteristic features, considering the everyday experience of not being able to use names and its impact on affected individuals and their social interactions and relationships.

Methods: In this mixed-methods study based on semi-structured interviews and psychometric testing, 13 affected female participants were interviewed and evaluated using self-report measures of social anxiety, attachment-related vulnerability, and general personality traits. An inductive content analysis and inferential statistical methods were used to analyze qualitative and quantitative data, respectively.

Results: Our findings show that affected individuals experience psychological distress and a variety of negative emotions in situations in which addressing others with their name is intended, resulting in avoidance behavior, impaired social interactions, and a reduced quality of affected relationships.

Discussion: The behavior can affect all relationships and all forms of communication and is strongly linked to social anxiety and insecure attachment. We propose calling this phenomenon *Alexinomia*, meaning “no words for names”.

KEYWORDS

social anxiety, fear, attachment, identity, names, addressing, alexinomia

1. Introduction

“It has always been like that, as long as I can remember. I couldn’t address others with their names, and it took extreme efforts to try. I became really conscious of it, when I met my husband. I wanted to address him by name, but I could not do it. That’s when I realized that it’s a problem, that I can’t say other people’s names.”

In this article, we present an unknown psychological phenomenon characterized by *knowing* a name but *being unable to use it in personal communication*. For affected individuals, it is impossible to say, for example, “Good morning, Maria.” or “Armin! Great to see you.” They experience acute anxiety and a variety of other negative emotions in social situations in which using a personal name is intended. We refer to this undocumented psychological phenomenon as *Alexinomia*. *Alexinomia* is a compound of the Greek loanwords *á* (a-, “not”) + *λέξις* (*léxis*, “words”) + *ὄνομα* (*ónoma*, “name”) and literally means “no words for names.”

Personal names—in the context of this article defined as first names, given names, and forenames, rather than last names, family names—are of substantial social importance (Horne, 1986). We use personal names to address and to greet others, to personalize conversation, and to call people over a distance. Names can be indicative of a person's gender (Cassidy et al., 1999), age group (Lansley and Longley, 2016), socio-economic status (Bloothoof and Onland, 2011), and often have a literal or connotative meaning that people identify with (Brennen, 2000). In many situations, personal names are deliberately used to show respect, affection, and to create closeness. In this way, names determine our social interactions and, on an intra-individual level, are a fundamental factor for the sense of personal identity (Dion, 1983; Alford, 1987; Pilcher, 2016; Watzlawik et al., 2016).

The significance of using names in personal conversations has been highlighted in research in various fields. In education it has been claimed that teachers knowing and using the students' names creates an atmosphere of trust and community in the classroom that facilitates learning (Glenz, 2014). It has been argued that calling students by their names makes them feel cared about and taken seriously (Syverud, 1993). Deliberately using first names to establish connection and equality in a relationship is a well-established technique in sales and in other persuasion-based occupational areas (DeCormier and Jackson, 1998). Furthermore, the importance of using names has been discussed in psychoanalytic texts in the context of the unpleasant effects of forgetting someone's name on the affected individual (Murphy, 1957).

From a psychological perspective, the subjective experience of fear related to addressing others by name was preliminarily described by Welleschik (2019). Based on personal observations and unsystematic online research, Welleschik (2019) portrayed the case of a young woman who was unable to say her partner's name. The preliminary findings provided by this research suggest that being unable to address others by name has severe consequences for personal and professional life. With partners, friends, and family, not saying their names may be considered impersonal or even rude and can create a social distance that is usually neither intended nor appreciated. In other situations, such as work meetings or at school, being unable to name others can heavily limit someone's options, for example, when it comes to speaking up in groups, attracting attention, or to nuance conversation in a professional manner. The impact of this behavior on relationships is significant and concerns both the primarily affected individuals and the people around them. In severe cases, affected persons report to have never used their spouse's name or have not said anyone's name in many years.

Welleschik (2019) made references to the reports of other cases of affected individuals found online, which in the meantime have been confirmed by a systematic analysis of 257 online forum and blog posts by people expressing a problem in the specific social context of addressing others with their names (Bergert et al., unpublished data). Given the large scope of these materials, it is surprising that this distinct phenomenon is still undocumented. So far, there is no published scientific evidence based on systematic, empirical research showing that alexinomia really exists and describing how it affects those concerned and their relationships. The number of affected individuals is unknown, and so are the origins and causes of the problem.

To address the most fundamental open questions related to alexinomia, an explorative mixed-methods study was employed

that expanded qualitative (i.e., interview) with quantitative (i.e., psychometric) data. To identify the experiential grounds and constituting factors of alexinomia, we employed a descriptive approach to inquiry using qualitative semi-structured interviews and inductive content analysis.

In addition, a psychometric test battery, including a set of standardized psychological self-report questionnaires, was administered to test for links of alexinomia with already known psychological constructs. Given the social importance of names and the social nature of the situations in which alexinomia seems to occur most frequently, social anxiety was considered a likely candidate to underly the problem. The role of names in identity formation (Watzlawik et al., 2016) and the differentiation of oneself and others (Palsson, 2014) led us to assume that these factors are likely to play a crucial role in alexinomia. Further, alexinomia-related symptoms seem to become more severe the closer the affected relationship is. Therefore, it seemed likely that problematic name saying could originate from attachment-related vulnerabilities and insecurities. Additionally, a test of general personality traits (i.e., big 5) was administered to test for general peculiarities that might arise in the personality structure of individuals with alexinomia. See Table 1 for a complete list of all instruments.

By expanding qualitative data with already known psychological attributes using quantitative parameters, our intention was to provide an as comprehensive a picture of the phenomenon as possible. The method and results sections are therefore divided into qualitative and quantitative procedures and results. In the discussion, we draw links between the different levels of data and give a summarizing interpretation that allows a first systematic conceptualisation of alexinomia.

2. Materials and methods

2.1. Participants

Thirteen German-speaking women with a mean age of 28.1 years (range: 18–40 years) participated in the study. Participants were recruited from a patient database created by one of the authors (L.W.) in response to letters from affected individuals that were received *via* the author's personal website¹ over the past few years. At the time of data collection, the database included about 80 entries of affected individuals from all genders and many countries. Most contacts belonged to the group of young, female, German-speaking adults. Hence, for the purpose of this study, we recruited participants from this largest group of available contacts. The sample size was determined after iteratively analysing the contents of the first interviews. Once the central conceptual categories had emerged and started reappearing throughout most of the interviews, we stopped the sampling process.

Out of these 13 participants, 11 indicated noticing the problem of not being able to use names daily or multiple times per day. Nine participants reported noticing it for the first time as a child or teenager. The degree of psychological strain caused by the

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TABLE 1 Psychometric measures.

Instrument	Psychological constructs measured	Number of subscales/Cutoffs	Subscales	Number of items	References
Big Five Inventory 2 (BFI-2)	Big Five personality traits	Five subscales	Extraversion Agreeableness Conscientiousness Negative emotionality Open mindedness	60	Danner et al., 2016; Soto and John, 2017
Social Interaction Anxiety Scale (SIAS)	Social interaction anxiety	One cutoff	Social anxiety	20	Mattick and Clarke, 1998; Stangier et al., 1999
Differentiation of Self Inventory (DSI)	Differentiation of Self	Four subscales	Emotional reactivity Emotional cutoff I-Position Fusion with others	46	Maß et al., 2019; Skowron and Friedlander, 1998
Experience in Close Relationships (ECR-RD12)	Experience in close relationships	Two subscales	Attachment-related anxiety Attachment-related Avoidance	12	Brenk-Franz et al., 2018; Wei et al., 2007
Vulnerable Attachment Style Questionnaire (VASQ)	Vulnerable and insecure attachment	Three cutoffs	Vulnerability of attachment Insecurity of attachment Proximity seeking	22	Bifulco et al., 2003; Reck, 2009

problem was rated as 5.7 on average (min = 3; max = 10; scale: 0–10). A summary of participants' socio-demographic data and descriptive data with regards to the symptoms of alexinomia are shown in [Table 2](#).

2.2. Interviews

Semi-structured interviews were conducted with all participants to explore in depth their everyday lived experience in relation to using names. An interview guide including a set of open-ended questions was prepared before data collection that was flexible as to the sequence of questions and adapted according to the responses of the interviewees. The interview guide was structured into three main topics: (1) General experiences with the phenomenon of having difficulty addressing someone by their name, (2) coping strategies and (3) self-theories on alexinomia-related symptoms. This interview structure ensured that participants could develop their narratives openly to maximize our understanding of the phenomenon by allowing participants' own frame of reference and concepts to unfold naturally (Willig, 2013). Where necessary, the interviewers posed individualized follow-up questions to be responsive to the interviewees and encourage them to expand on their experiences, feelings and/or self-theories. Follow-up questions were either probing questions aimed at further elaboration or specifying questions.

At the end of the interview, the interviewers asked for the relevant socio-demographic data that would allow for a sufficient contextualization of the interview data. The following factors were addressed: age, gender, partnership, the highest level of education, occupation, frequency of experiencing difficulties with using names (*How often do you experience these difficulties?*), history (*When did it first occur?*), personal psychological strain (0 to 10), and interest in a therapy to treat the problem.

2.3. Psychometric measures

The following psychometric instruments were used to measure personality factors that might be linked to alexinomia. We used the German versions of all listed scales: (1) Big Five Inventory (BFI-2; [Soto and John, 2017](#)): The BFI-2 assesses the Big Five personality domains Extraversion, Agreeableness, Conscientiousness, Negative Emotionality, and Open-Mindedness; (2) Social Interaction Anxiety Scale (SIAS; [Mattick and Clarke, 1998](#)): The SIAS measures the degree of psychological distress when interacting with other people and provides a cutoff score for Social Anxiety (i.e., generalized irrational fears across numerous social situations with avoidance and impairments) (3) Differentiation of Self Inventory (DSI; [Skowron and Friedlander, 1998](#)): A measure of the ability to experience intimacy with and independence from others; the test includes the subscales Emotional Reactivity (i.e., the degree to which a person responds to environmental stimuli with emotional flooding, emotional lability, or hypersensitivity), Emotional Cutoff (i.e., feeling threatened by intimacy and feeling excessive vulnerability in relationships with others), I-Position (i.e., presence of a clearly defined sense of self and the ability to thoughtfully adhere to one's convictions when pressured to do otherwise), and Fusion with Others (i.e., emotional overinvolvement with others, including triangulation and overidentification with parents); (4) Experience in Close Relationships (ECR-RD12; [Wei et al., 2007](#)): Assesses individual differences with respect to Attachment-related Anxiety (i.e., the extent to which people are insecure vs. secure regarding the availability of and responsiveness to the people they are romantically involved with) and Attachment-related Avoidance (i.e., the extent to which people feel uncomfortable being close to others vs. secure in depending on others); and (5) Vulnerable Attachment Style Questionnaire (VASQ; [Bifulco et al., 2003](#)): This instrument provides a total measure of the Vulnerability of Attachment including the subscales Insecurity of Attachment (i.e.,

TABLE 2 Socio-demographic data.

Subject no.	Age	Gender	Nat.	Relationship status	Education	Frequency of symptoms ^a	First occurrence ^b	Psychological strain ^c	Therapy interest ^d
1	31	Female	DE	Married	High school	Daily or more	Age 13; first relationship	7	Yes
2	35	Female	DE	In relationship	Middle school	Daily or more	Age 14; first relationship	6.5	Yes
3	21	Female	CH	Married	High school	Daily or more	Childhood	10	Unsure
4	25	Female	DE	Single	High school	Daily or more	Age 12	5	N/A
5	30	Female	DE	Single	Higher education	A few times a month	N/A	3	Yes
6	30	Female	RO	Married	Middle school	Daily or more	first relationship	7.5	N/A
7	30	Female	DE	In relationship	Higher education	Daily or more	Age 15	4.5	N/A
8	22	Female	AT	Single	Higher education	Daily or more	Age 20	6	Yes
9	23	Female	DE	Single	High school	Daily or more	Age 15	5	N/A
10	35	Female	CH	In relationship	N/A	A few times a week	Age 28	7	Unsure
11	18	Female	DE	Single	Middle school	Daily or more	Always	3	Yes
12	25	Female	DE	In relationship	High school	Daily or more	Childhood	6	Yes
13	40	Female	DE	In relationship	High school	Daily or more	Age 21	3	N/A

^aFrequency of symptoms: how often do you experience any symptoms related to alexinomia?

^bFirst occurrence: when did you notice any difficulty related to saying names for the first time?

^cPsychological strain: subjective degree of psychological strain related to alexinomia on a scale from 0 to 10.

^dTherapy interest: would you be interested in therapy to treat the problems related to alexinomia or are you already in therapy?

feelings and attitudes relating to discomfort with, or barriers to, closeness with others, including inability to trust and hurt or anger at being let down) and Proximity Seeking (i.e., dependence on others and approach behavior).

All instruments are listed in **Table 1**.

2.4. Study design

The study was designed following a mixed-methods approach by which qualitative data as the primary source of data were expanded with quantitative data. This design allowed us to fully exploit the breadth of content and scope by using different methods for different parts of the study (Kuckartz, 2014). Therefore, we aimed at characterizing the phenomenon of interest based on the qualitative data and supplementing it with the results of psychometric testing to also situate it in existing psychological discourses.

The two parts of the study were conducted in the following order: (i) interview and (ii) psychometric testing. Interviews were conducted for each participant individually with two interviewers (T.D. and L.W.). Due to the security measures in place at the time of the data collection caused by the Covid-19 pandemic, the interviews were conducted online using the video meeting software Microsoft Teams (Microsoft 365, Version 1.5.00.22362). Video and audio channels were used for the entire meeting by all parties. Audios were recorded using an external digital voice recorder (Olympus WS-853, Tokyo) placed next to the interviewers' computers. The video was not recorded. Participants were informed about the audio recordings prior to the start of

the interviews. Participants were also informed about the general aim of the study and the interview procedure, stating that the interview will address how people with alexinomia feel and how it affects everyday life. Additionally, participants were informed about the GDPR-conform processing of personal data. Raw data audio files were kept on secure storage media at the university and stored locally and separately from any identifying personal data. Participants gave written consent to all described procedures.

The interviews lasted 32–61 min, with a mean duration of 42.2 min. For the second part of the study, the link to the questionnaire was provided by email. The online questionnaire was realized using SoSci Survey (Leiner, 2019) and was made available to participants on the website <https://onlinebefragungen.sfu.ac.at/>. It included five standardized psychological instruments (**Table 1**). There were 160 items in total; completing the questionnaire took about 60 min. All participants fully completed all parts of the study. All procedures were approved by the Sigmund Freud University (SFU) ethics committee.

2.5. Data analysis

2.5.1. Analysis of qualitative data

The interviews were transcribed word for word. Content analysis focused on summarizing the main topics directly uttered, therefore, dialect and intonation were not transcribed. All interviews were conducted and analyzed in German. Participants' quotes presented as text examples in this paper were translated from German to English by the authors for publishing purposes. Translations were

made literally, meaning that the translation was kept as close as possible to the original wording but that the grammar rules of the target language (English) were applied. Personal data (i.e., names, places, etc.) were replaced with pseudonyms.

The interview data were coded according to Mayring's procedure of an inductive, summarizing content analysis (Mayring, 2014, 2015). Mayring's methodical concept is particularly useful at the interface with quantitative methods to enable the triangulation of qualitative and quantitative data. The procedure employs a hermeneutical logic in assigning categories to text passages, resulting in a hierarchical category scheme of main categories and subcategories of multiple order. This procedure aims at reducing a large body of data to its relevant thematic constituents, identifying a content structure, which can unravel and display the different layers of a phenomenon.

The inductive, summarizing coding process was structured into the following seven steps (Mayring, 2014): (1) Defining the category, (2) paraphrasing all utterances of all interviews that were relevant according to category definition, (3) generalizing the paraphrases to their main content, (4) first reduction, (5) second reduction, (6) listing all identified categories in the form of a category scheme, and (7) revising the category scheme including repetition of steps 2–5 in case the categories and codes did not work for additional data.

Further, the category scheme was summarized by revising the list of categories and generalized again by combining categories with similar meanings, thus identifying main- and subcategories. This step was repeated multiple times to carve out the main factors of the phenomenon.

The category definition focused on the identification of all relevant intra- and inter-personal factors characterizing the phenomenon of having difficulty with saying names in everyday practice including interactions where it occurs and their subjective experience, coping strategies when it happens, and self-theories on the development of the difficulty throughout the lifespan. To ensure reliability, two researchers coded the first interview. From this first interview, the initial main categories as well as the subcategories were created and on this practice the coding guidelines for the analysis of further interviews were developed. According to these guidelines, all other interviews were coded independently by two researchers.

2.5.2. Analysis of quantitative data

To analyze the questionnaire data, participants' test scores were subjected to a series of summary independent-samples *t*-tests, one for each subscale of each instrument for which norm data (i.e., sample sizes, means, and standard deviations) were available. These instruments were the BFI-2, DSI, and ECR-RD12. Questionnaires using cutoff-scores to indicate the presence or absence of a psychological trait (i.e., SIAS and VASQ) were analyzed separately for each subscale using one-sample *t*-tests tested against these respective cutoff values. The alpha-level was set to 0.05 for all analyses. All *p*-values were corrected for multiple comparisons (Holm-Bonferroni) across

the entire data set. Hedges' *g* is reported for all analyses as a measure of effect size.

3. Results

3.1. Qualitative data

We identified the following four main categories that, based on our data, constitute alexinomia: (1) Factors of subjective experience when trying to address others by their personal names such as emotional states and physical reactions, (2) general characteristics of alexinomia such as first occurrences, affected relationships, and affected forms of communication, (3) effects on relationships and on communication in relationships and strategies to cope, (4) vulnerability factors based on biographical information and current relationship patterns. Table 3 shows the complete category scheme in detail. In the following, the main categories are presented with significant quotes from the interviews to support our conclusions. In addition, the most important subcategories are elaborated to detail the phenomenon.

3.1.1. Factors of subjective experience

All participants in the study reported having problems with addressing persons by their names. When, for instance, asked to describe the problem in their own words, they said:

It has always been like that, as long as I can remember, in kindergarten, in school. I couldn't address classmates with their names, and it took extreme efforts to try. I used to think twice about whether I really needed to say the name, whether my question was important enough or not. (...) I then became really conscious of it, when I met my husband about one and a half years ago. I wanted to address him by name, but I could not do it. I wanted to, but I couldn't. That's when I realized that it's a problem, that I can't say other people's names. (...) I tried to practice his name alone, because I thought maybe it's because I'm afraid that I pronounce it wrong or something like that, and I still couldn't do it. And yes, even to this day it's still difficult for me to address him by name, I always say "you" or "hey," things like that (Participant 3).

It's very difficult for me to call someone by name, but also when I talk about someone, to say the name. (...) I always say "I was walking with my neighbor" or "I meet with my fellow student." I wouldn't say their first names. That's when I really notice how difficult it is for me, no matter whether it's a good friend or not such a good friend, to say the name. (...) To give an example, I was helping in the field to dig up potatoes. We were up at the back of the harvester and my ex-boyfriend was driving the tractor. And then the ladies who were also helping asked me to please tell him to slow down, otherwise it's going too fast. I was completely overwhelmed, and I shouted "Hey, hey, hey!", because I just could not call the first name. He didn't hear me and finally one of the other ladies then said his first name and he then heard that and stopped. So that was a situation where they actually hoped for me to tell him to please slow down. But

I just couldn't do it, I just didn't call his name, I said "Hey, hey!", I was like, I failed (Participant 8).

In situations in which saying a name is intended, participants frequently reported experiencing negative emotions such as anxiety/panic, shame/embarrassment, regret/frustration, and feelings of inadequacy/failure. These feelings are often accompanied by unpleasant physical reactions that, for example, were described as "a tight feeling in the chest" (Participant 10) and were compared to how it feels to "touch someone" (Participant 11) and "to look someone into the eyes" (Participant 11). In the words of participant 2:

It feels almost a bit like the beginning of a panic attack. Like loss of control and nervousness, agitation (...) a feeling of discomfort, an "I'm about to be the center of attention" feeling or like when you have to give a lecture, like stage fright, really extremely uncomfortable and scary. It's insecurity. Insecurity (Participant 2).

Participants further highlighted what seems to be a complex relationship of the inability to say a name and the control of closeness and distance in a (often romantic) relationship. While about half of our participants reported experiencing forms of alexinomia in all their social relationships (7 participants), several participants reported that the problem became more severe the closer the relationship (4 participants) and many claimed that it is strongest in romantic relationships (10 participants). Saying the name of a loved one was frequently described as too close, too personal, too intimate, and thus overwhelming and emotionally exposing. Therefore, some affected individuals speculated that not saying a name could have the function of keeping the other person at a certain distance. This distance, however, puts strain on the relationship and affected individuals expressed a strong desire to be able to overcome it. Almost contrary to the above situations, for some participants using names was also described as distancing and impersonal, as if using a partner's personal name would take away "the magic" (participant 4) between them and thus create an unwanted distance. Along these lines, some participants indicated the use of names deliberately to control the distance in a relationship. Participant 10 described the dilemma of a deep longing for closeness and worries about the vulnerability that would come with it as follows: "I'm not sure if I would be able to cope with this, this closeness that would then be there. The vulnerability that would then be there, although this is what I want so badly." (Participant 10).

Participant 12 addressed the complexity of the impact of naming on the experienced closeness or distance in social relationships:

It's strange, at first I thought that somehow it had something to do with closeness, but then I realized that on the other hand you can use it very well to maintain distance. It's somehow this autonomy, closeness, distance, where that plays a big role, especially with hierarchies, like bosses or superiors, or in love relationships, where you're kind of afraid of showing yourself vulnerable, where you think "oh, there is suddenly someone above yourself." (...) There is also a bit of fear that it sounds

funny for him because I might pronounce it somehow special or that he could hear my emotions because of me pronouncing it somehow differently. (...) To me, saying his name would feel closer, but when he says my name, I feel more of a distance. Because everybody calls me that. It's nothing special (Participant 12).

3.1.2. General characteristics

Affected relationships included mainly romantic relationships, close friends, and family. However, several participants reported experiencing alexinomia in all relationships, regardless of the level of closeness. Hierarchy seems to play a role in a way that the symptoms are more severe in interactions with persons of authority such as bosses, superiors, and teachers. For example:

At school it was sometimes unpleasant to address teachers by name, especially those who were very authoritarian. (...) I couldn't say the names of people who were hierarchically superior. (...) In relationships with a power dynamic it is more pronounced (Participant 7).

Some participants indicated that the severity of the problem also depends on the name in question. Unusual names, names that are difficult to pronounce, and names that are considered particularly beautiful or unattractive can make the symptoms more severe.

Other factors that contribute to the name saying difficulties of our participants included the relationship to one's own name, whether one likes to be addressed by name or not, and the general attitude toward naming others and being named by others. Most participants said that they liked to be addressed by name and that they considered it a sign of respect. Some participants, however, associated being called by the name with a certain seriousness that feels strict, cold, and generally unpleasant. Interestingly, even in very severe cases of alexinomia, there were usually certain individuals whose names could be said (e.g., the name of a pet animal or of a sibling).

Frequently, the symptoms of alexinomia extend to conversations with others about the person with the problematic name. For some participants however, the symptoms were limited to only direct personal conversations. Participant 1 described the situation of saying her partner's name when talking to someone else about her partner while he was present: "With very great restraint and with a low tone, it works. But so that he almost doesn't hear it. It's unpleasant, but I somehow manage." (Participant 1) In conversations with others, names are often avoided even if the respective person is absent by referring to their social role such as "my friend," "my cousin," etc. Symptoms can be less severe in written compared to verbal direct communication. About half of our participants have no difficulty writing someone's name in Emails and texts. For participant 1 it "just feels safer in writing." Other participants on the other hand indicated avoiding names also in writing, for example participant 13 who prefers to use nick names, such as "sweetheart" to greet a female friend in a written conversation.

TABLE 3 Category scheme.

Main category	First level subcategory	Second level subcategory	Third level subcategory
A Subjective experience	A1 Negative emotions	A11 Anxiety/panic A12 Shame/embarrassment A13 Nervousness/restlessness A14 Discomfort A15 Regret/frustration A16 Perplexity/confusion/ lack of understanding A17 Stress/restriction A18 Pressure/pressure to perform A19 Anger A110 Rumination A111 Failure/overload/inability A112 Effort	–
	A2 Negative self-concept	A21 Impolite A22 Inadequate/inappropriate A23 Strange/odd/funny/not normal A24 Crazy A25 Socially insecure A26 Not worth it A27 Quiet A28 The only one	–
	A3 Expectations and perceived functions of saying names	A31 Expected effect on others/what names stand for	A311 Seems forced/stupid/funny A312 Creates the feeling of being the center of attention A313 Triggers a negative reaction in the other person A314 Creates the feeling of being caught out A315 Feeling of being caught red-handed A316 Pronunciation could be wrong/one could make a mistake A317 Creates seriousness/strictness A318 Stands for respect A319 Stands for the whole person A3110 Has a magical quality A3111 Stands for identity/uniqueness A3112 Is invasive A3113 One is seen A3114 Could feel distant, formal, unemotional A3115 One shows oneself/makes oneself vulnerable A3116 Is personal/intimate A3117 Is beautiful A3118 It might disturb/distract the person A3119 It feels trivial/not special A3120 It could sound very emotional
		A32 Social functions	A321 Creates (too much) closeness/connection A322 Creates the feeling of being at the mercy of others A323 Dissolves closeness (when I say your name, I am someone other than you; dissolves symbiosis) A324 Establishes a boundary
	A4 Possible benefits of not (!) saying names	A41 Preserves something of one's own A42 Protects from being hurt A43 Preserves a boundary/creates distance A44 Serves to express aggression A45 Serves to express repressed anger	–
	A5 How it feels to try to address someone by their name	A51 As if you were holding your breath A52 Blockage/inhibition/overcoming A53 Pausing A54 A little shock A55 Crossing a border A56 Feeling physically bad A57 Nausea A58 Chest area contracts A59 Feelings need to be turned off A510 Like looking someone in the eyes A511 Like physical contact A512 An inside-verbalization that cannot come out	–

(Continued)

TABLE 3 (Continued)

Main category	First level subcategory	Second level subcategory	Third level subcategory
B General characteristics	B1 Affected relationships	B11 Romantic relationships B12 Father/stepfather B13 People with funny names (e.g., names that are difficult to pronounce) B14 Men B15 In (almost) all relationships B16 Parents B17 Strangers B18 People with beautiful names B19 Colleagues in education B110 Adults/older people B111 Teachers/lecturers B112 Close/people known for quite some time/friends/important persons B113 Persons of authority B114 Very specific people	–
	B2 Affected forms of communication	B21 Personal contact B22 When saying first names B23 In serious situations B24 In conversation with third parties B25 In writing B26 In direct conversation	–
	B3 Using nicknames	B31 Nicknames are not used in affected relationships B32 Nicknames are used in non-affected relationships B33 Nicknames are used in affected relationships	–
	B4 Relation to one's own name	B41 No identification with own name B42 Negative attitude toward own name B43 Pleasant when others say own name B44 Unpleasant when others say own name B45 One's own name stands for punishment/annoyance B46 Being called by one's own name creates distance B47 Being addressed by one's own name creates an inferior position	—
	B5 Frequency (first occurrence, occurrences, duration, etc.)	B51 The difficulty always occurs in the affected relationships B52 The difficulty occurs over the entire duration of an affected relationship (e.g., throughout marriage) B53 The difficulty occurs consistently since the first romantic relationship B54 As early as kindergarten B55 In adolescence B56 Always B57 It is the normal state	–
	B6 Non-affected relationships/situations	B61 Interactions with women B62 With friends/colleagues/acquaintances (male and female) B63 Animals B64 Siblings B65 Formal relationships B66 Parents B67 With new acquaintances B68 At sports B69 With particularly good friends B70 With children	–
	B7 Non-affected forms of communication	B71 In Conversation with Third Parties B72 In writing B73 In playful situations	–
C Effects and coping strategies	C1 Effects on making contact	C11 Is difficult C12 Long waiting times until contact is made/conversation begins C13 None (because coping strategy works so well) C14 No contact C15 Attempt to attract attention “telepathically”	–

(Continued)

TABLE 3 (Continued)

Main category	First level subcategory	Second level subcategory	Third level subcategory
	C2 Effects on affected relationships	C21 Noticed by others C22 Unnoticed by others C23 Perceived as impersonal/cold/distant C24 Offends/hurts/makes people sad C25 Not understood C26 Creates a barrier/distance C27 Some things remain unsaid C28 Mistrust arises C29 No significant influences	-
	C3 Coping strategies	C31 Starting a conversation without address C32 Establishing contact through eye contact C33 Use of impersonal forms of address (hey, etc.) C34 Making contact by touching (e.g. tapping on the shoulder) C35 Masking/avoidance C36 Attempt to say names (unsuccessful) C37 Use of nicknames C38 Use of surnames C39 Use of text messages instead of face-to-face conversation C310 Saying names in a funny way/with dialect/as a joke C311 Joking about it	-
	C4 Intervention/therapy	C41 Talking about it (with affected people) C42 Psychotherapy C43 Trying to break through the problem C44 Exercise/dry training C45 Fear of therapy C46 Researching the topic	-
D Vulnerability factors	D1 Childhood and family	D11 Early signs of social anxiety (e.g., shyness, frequent blushing, etc.) D12 Trauma/neglect/parental abuse/violence D13 Mental disorders in the family (e.g., depression, addiction, narcissism, etc.) D14 Absent parent (e.g., early death of a parent, absent father, etc.) D15 Unstable family relationships (e.g., separation, divorce, strongly changing caregivers) D16 Hardly any or no contact with family members D17 Conflict avoidance in childhood/birth family D18 Little communication/openness in the family D19 Distant relationship with family D110 Psychological problems in childhood D111 Good family relationships in childhood D112 Few friendships/bullying D113 Dispute in the family D114 Pressure to perform	-
	D2 Current relationship patterns	D21 Conflict avoidance D22 Difficulty perceiving and communicating one's own boundaries D23 Dependent relationships D24 Symbiotic relationships, desire to merge D25 Difficulty trusting/relating/jealousy D26 Few/no positive relationships D27 Few male friends D28 Good/happy/trusting current relationship D29 Low self-worth	-
	D3 Difficulty in the expression of emotions	D31 Difficulty expressing feelings verbally (general) D32 Difficulty expressing affection verbally D33 Difficulty expressing gratitude verbally D34 Difficulty expressing aggression D35 Difficulty expressing needs	-

Characteristically the signs of alexinomia were there from the very beginning of the affected relationships and, if untreated, were present throughout the entire duration of the relationship.

Most of our participants reported that they recall having the problem since they were children or teenagers or that it “has always been there” (participant 11). In several cases,

participants first noticed having the problem in their first romantic relationship.

3.1.3. Effects and coping mechanisms

Alexinomia affects communication in relationships in a multitude of ways. Instead of using names, most affected individuals reported starting a conversation without using a personal address or by using an impersonal address such as “Hey” or “Hi.” Often, they would wait for some time before saying something until they got the addressees’ attention *via* eye contact, physical touch (e.g., tapping on the shoulder) or using “telepathy” (Participant 10). If none of these worked, several participants reported that they would rather stay silent and forget about the intended conversation than using the name. To give an example:

I wait for eye contact. When sitting at a large table with many people talking, it’s sometimes a bit difficult. I really have to wait until he looks directly at me and then say, “Can you please pass me something?”. So stupid. Or just “You” or “Hey,” so rude actually. Or I touch him, tap him and just start talking. (...) Anyway, apparently I have done really well, no one has noticed until now (Participant 2).

According to some participants, it sometimes helps to use nicknames or to say the name in a playful way (4 participants). Most participants, however, said that using nicknames was also not an option for them (9 participants).

While these compensatory strategies can help avoiding names and hiding the problem successfully, alexinomia can put a serious strain on a relationship due to the distance and insecurities that it facilitates in both partners:

With my husband, I notice that it burdens him. (...) He spoke to me directly about it and said that he thinks it’s a shame

that I never address him by his name. He said that it annoys him and that he finds it impersonal and kind of disrespectful, like when you’re not looking at each other in a conversation. That’s how it feels, like I’m looking away. I then tried to explain to him, it’s just the opposite. (...) It is very hard for me to realize that he feels offended and put down. We have very, very different views on what it means that I am not saying his name (Participant 1).

When my partner confronted me, that was actually the most unpleasant thing, it was like getting caught, “Oh my God, now someone has caught me, after all these years someone has now really caught me.” Yes, that was the most unpleasant thing. (...) It was very, very, very embarrassing, I felt ashamed that I had to admit having a problem with this. It was a feeling of extreme shame (Participant 2).

It burdens me, because I see that it burdens him. Because he says that he is also a normal person, like me, and that he also needs love and to hear his name from my mouth and that he never gets that from me. I get it from him, but he does not get it (Participant 6).

3.1.4. Vulnerability factors

The main purpose of this study was to describe alexinomia with regards to its main characteristics and attributes, thus the underlying causes of the problem will be the subject of future research. However, there were details that were mentioned multiple times in the interviews that could constitute factors of vulnerability which might contribute to the development and maintenance of alexinomia. From the category of biographical details participants mentioned early signs of social anxieties as a child (e.g., shyness; blushing; etc.), childhood trauma, violence, and neglect, and the presence of psychological disorders such as depression, addiction, and personality disorders in

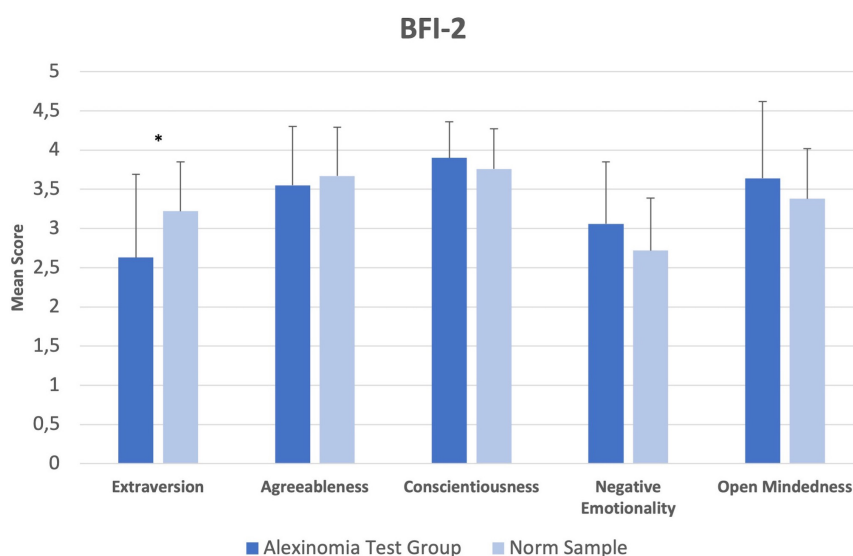
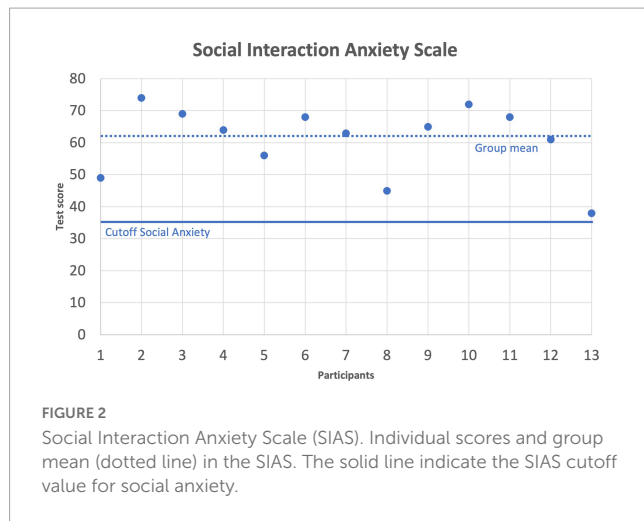


FIGURE 1
BFI-2. Comparisons of group means in the BFI-2. Error bars indicate 1 SD. * $p < 0.05$.



the family. From the category of current relationship patterns participants displayed a tendency to avoid conflicts and to enter symbiotic relationships and to have low levels of self-esteem and self-confidence in relationships and social interactions. Another category was formed from reports of having difficulty in expressing emotions. Participants reported having problems with expressing emotions in general and especially with verbally expressing love, affection, and gratefulness (3 participants).

3.2. Quantitative data

All participants completed all questionnaires. There were no missing data and no outliers. Therefore, all available data was included in the analysis.

3.2.1. Big Five personality traits (BFI-2)

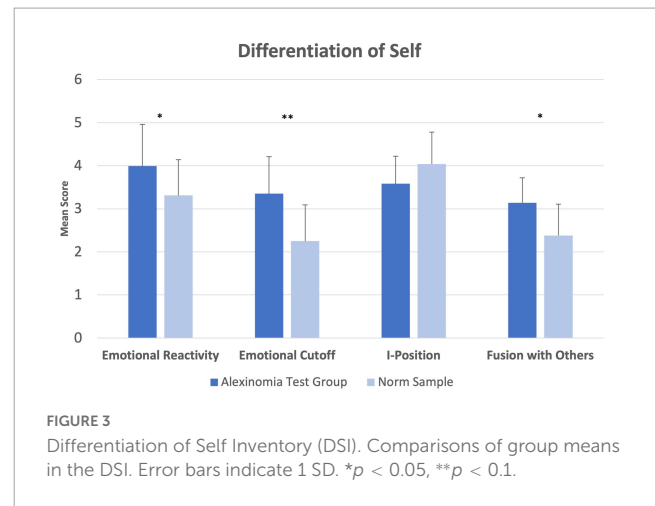
Summary independent-samples *t*-tests were calculated for each of the five subscales of the BFI-2. The mean test score of the test group was significantly lower in the scale *Extraversion* ($M = 2.63$; $SD = 1.06$) compared with norms ($M = 3.22$; $SD = 0.63$), $t(781) = -3.302$, $p = 0.014$, $g = 0.92$. Comparisons of the other subscales were not significant (Figure 1).

3.2.2. Social anxiety (SIAS)

To analyze data related to social anxiety as measured by the SIAS, participants' test scores were compared with the cutoff value for social anxiety. All participants scored above the cutoff of 36 which indicates the presence of social anxiety (Mattick and Clarke, 1998). The group mean in the SIAS was $M = 60.92$ ($SD = 10.94$). A one-sample *t*-test against the test value of 35 confirmed a significant group effect for social anxiety, $t(12) = 8.547$, $p < 0.001$, $g = 2.22$ (Figure 2).

3.2.3. Differentiation of self (DSI)

The four scales of the DSI were analyzed using summary independent-samples *t*-tests. Group means were compared to norm data. This comparison revealed significantly higher scores of the test group compared with norms in the following scales:



Emotional Reactivity ($M = 3.99$; $SD = 0.97$ vs. $M = 3.31$; $SD = 0.83$; $t(270) = 2.859$, $p = 0.035$, $g = 0.82$), *Emotional Cutoff* ($M = 3.35$; $SD = 0.87$ vs. $M = 2.25$; $SD = 0.84$; $t(270) = 4.600$, $p = 0.010$, $g = 1.31$), and *Fusion with Others* ($M = 3.14$; $SD = 0.58$ vs. $M = 2.38$; $SD = 0.73$; $t(74) = 3.525$, $p = 0.011$, $g = 1.07$). Comparisons of the subscale *I-Position* were not significant (Figure 3).

3.2.4. Experience in close relationships (ECR-RD12)

Our sample differed significantly from norms in both scales of the ECR-RD12, *Attachment-related Anxiety* ($M = 3.64$; $SD = 1.59$ vs. $M = 2.35$; $SD = 1.36$; $t(260) = 3.306$, $p = 0.013$, $g = 0.94$) and *Attachment-related Avoidance* ($M = 3.78$; $SD = 1.11$ vs. $M = 2.31$; $SD = 1.28$; $t(260) = 4.060$, $p = 0.012$, $g = 1.16$) as revealed by summary independent-samples *t*-tests (Figure 4).

3.2.5. Vulnerability of attachment (VASQ)

The VASQ includes three scales, and it offers cutoff values for each of these. In our sample, 10 out of 13 participants scored above the cutoff of 57 which indicates the presence of general *Vulnerability of Attachment*. The cutoff for the scale *Insecurity of Attachment* of 30 was met or exceeded by 10 participants and eight participants scored 27 or higher in the scale *Proximity Seeking* (Figure 5). One-sample *t*-tests against the respective test values of each scale showed a significant group effect for *Vulnerability of Attachment*, $t(12) = 3.619$, $p = 0.032$, $g = 0.94$. Differences in the other scales were not significant ($ps > 0.05$).

Table 4 shows a summary of the results of the quantitative analysis of questionnaire data.

To summarize, results from psychometric testing show that our sample of individuals affected by alexinomia fulfilled the criteria for the presence of social anxiety both on individual and group levels. In addition, participants scored significantly higher on several attachment- and relationship-related anxiety and vulnerability scales compared with the respective norms. The ability to regulate emotions was reduced and participants showed decreased levels of extraversion. This pattern of results is well in line with previous research showing that social anxiety is related to insecure attachment (Manning et al., 2017), impaired regulation of emotions (Jazaieri et al., 2015), and negatively correlated with extraversion (Kaplan et al., 2015).

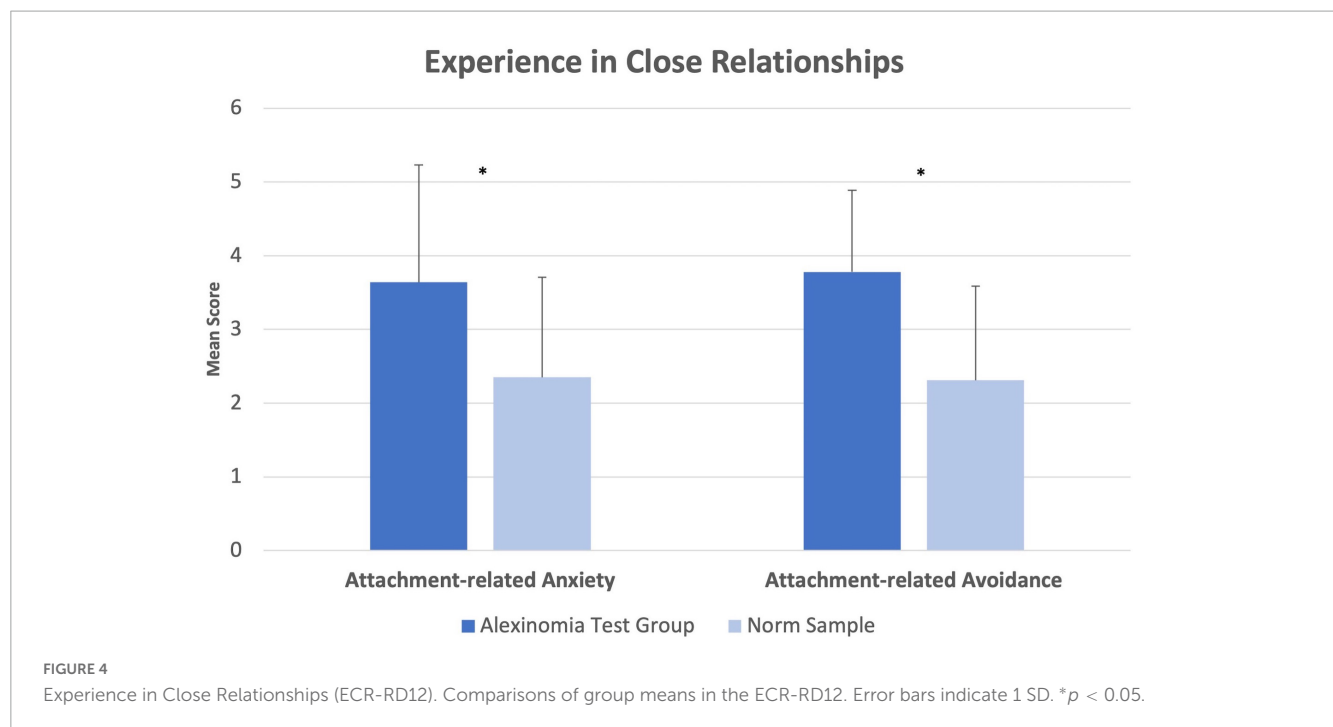
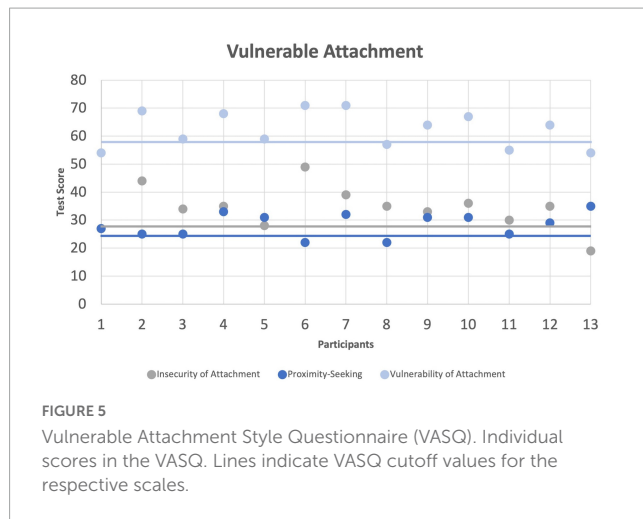


TABLE 4 Quantitative analysis of questionnaire data.

Scale	Test sample		Norm sample		t	df	P (corr.)	Effect size (Hedges' g)
	N	M ± SD	N	M ± SD/Cutoff				
BFI-2								
Extraversion	13	2.63 ± 1.06	770	3.22 ± .63	−3.302	781	0.014*	0.92
Agreeableness	13	3.90 ± 0.46	770	3.76 ± .51	0.983	781	> 0.05	–
Conscientiousness	13	3.55 ± 0.75	770	3.67 ± .62	−0.690	781	> 0.05	–
Negative emotionality	13	3.06 ± 0.79	770	2.72 ± .67	−1.781	781	> 0.05	–
Open mindedness	13	3.64 ± 0.98	770	3.38 ± .64	1.438	781	> 0.05	–
SIAS								
Social anxiety	13	60.92 ± 10.94	–	36	8.547	12	> 0.001***	2.22
DSI								
Emotional reactivity	13	3.99 ± 0.97	259	3.31 ± .83	2.859	270	0.035*	0.82
Emotional cutoff	13	3.35 ± 0.87	259	2.25 ± .84	4.600	270	0.010**	1.31
I-Position	13	3.58 ± 0.64	259	4.04 ± .74	−2.199	270	> 0.05	-
Fusion with others	13	3.14 ± 0.58	63	2.38 ± .73	3.525	74	0.011*	1.07
ECR-RD12								
Attachment-related anxiety	13	3.64 ± 1.59	249	2.35 ± 1.36	3.306	260	0.013*	0.94
Attachment-related avoidance	13	3.78 ± 1.11	249	2.31 ± 1.28	4.060	260	0.012*	1.16
VASQ								
Vulnerability of attachment	13	62.46 ± 6.44	–	56	3.619	12	0.032*	0.94
Insecurity of attachment	13	34.15 ± 7.55	–	29	2.462	12	> 0.05	-
Proximity seeking	13	28.31 ± 4.25	–	26	1.958	12	> 0.05	-

All *p*-values were corrected for multiple comparisons (Holm-Bonferroni).

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.



Taken together, and as a very first attempt to conceptualize alexinomia from a clinical diagnostics point of view, data from both qualitative and quantitative analyses suggest the following key symptoms of alexinomia: (i) The individual experiences fear or anxiety in situations, in which using personal names is intended; (ii) Intending to use a name almost always provokes fear or anxiety in the individual in at least one relationship; (iii) the feared situations are avoided or dealt with using compensatory strategies, (iv) the fear, anxiety, or avoidance is persistent; (v) the fear, anxiety, or avoidance causes significant distress or impairment in social, occupational, or other important areas of functioning.

This preliminary symptom list is based on the diagnosis of Social Anxiety Disorder according to the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5), is not exhaustive and should be seen as a first proposal to the scientific community to inspire the generation of new hypotheses to testify the construct in a more rigorous statistical fashion.

4. Discussion

The aim of the study was to explore and describe the distinctive features of alexinomia—a previously unknown and scientifically undocumented psychological phenomenon characterized by an inability to use personal names in communication. Using a mixed-methods approach combining qualitative data from personal interviews with participants who are personally affected by alexinomia, and quantitative data gained from psychometric testing of the same sample, our findings allowed us to describe alexinomia on a phenomenological level and to get an understanding of its key attributes and potential links to other psychological constructs including social anxiety and attachment.

Results indicated that all participants had the desire to use personal names in everyday social interactions, especially in their closest relationships. The phenomenological experience of alexinomia, however, is that of an inability to do so. This inability is accompanied by feelings of anxiety, panic and physical as well as psychological discomfort. The affected individuals' experience is further characterized by feelings of regret, embarrassment, and shame, especially when confronted with their behavior by others.

Our data suggest that alexinomia usually occurs for the first time in childhood or adolescence and is then ongoing. It affects all forms of relationships and communication and is strongest in romantic relationships and in direct verbal communication. Interestingly, the problem becomes increasingly severe the closer the relationship, which often puts a heavy strain on also the romantic relationships of the people affected. There operates a painful ambiguity in individuals affected by alexinomia in the form of a longing for closeness and intimacy in a relationship on the one hand and feelings of vulnerability and being emotionally overwhelmed, that come with saying a loved ones' name on the other hand. Such feelings of emotional exposure and fear of unbearable closeness seem to constitute the core features of the name saying avoidance behaviors described here.

Results based on the analysis of psychometric tests suggest a strong link between alexinomia-related behaviors and social anxiety (Stein and Stein, 2008). All participants of our sample fulfilled the criterion for the presence of social phobia according to the Social Interaction Anxiety Scale (Mattick and Clarke, 1998). This finding is well in line with the main findings from the interviews showing that feelings of anxiety and embarrassment are among the main symptoms of alexinomia. Social anxiety has been shown to be linked to low intimacy and decreased satisfaction in romantic relationships (Davila and Beck, 2002; Rodebaugh, 2009) and, thus, can also be conceptualized from an attachment viewpoint. Participants in our study displayed increased levels of attachment-related anxiety and avoidance as measured by the ECR-RD12 and vulnerability of attachment as measured by VASQ. These findings indicate that those affected by alexinomia are insecure with regards to the availability of and responsiveness to the people they are romantically involved with and tend to feel uncomfortable being close to others. Moreover, measures of the ability to experience intimacy with and independence from others, indicated increased levels of emotional reactivity (i.e., emotional flooding, emotional lability, or hypersensitivity), increased levels of feeling threatened by intimacy, and an emotional overinvolvement with others, including triangulation and overidentification with parents. Additionally, our sample showed significantly lower levels of extraversion compared with norms as measured by the BFI-2. These results from standardized psychological instruments are well in line with the qualitative data gained from the interviews.

Taken together our findings based on both qualitative and quantitative data suggest alexinomia lies at the center of where social anxiety, fear of attachment, and impaired emotional processing with regards to social interactions meet.

Several additional factors that relate to and/or potentially interact with alexinomia were observed but not elaborated in depth in the present study. These included participants' attitudes toward their own names, whether they liked their name and being called by it or not and its co-existence with related phenomena of impaired communication, including an inability to call one's parents "Mom" and "Dad" and to say "I love you." So far, we do not have any data on whether or not affected individuals are able to say and write their own names. Another potentially directly related concept is name idealization in in-love couples, which, together with name avoidance, has been suggested to be a sign of the partners' name being a taboo (Leisi, 1980).

Alexinomia should be differentiated from physical and cognitive impairments that affect the ability to produce language,

known as aphasia. Also, alexinomia is not caused by impaired memory for names. Further, deliberately refusing to say someone's name to humiliate a person or to show dominance or disrespect, in our opinion, is also fundamentally different from the type of name avoidance described here.

Our sample consisted of German-speaking women aged between 18 and 40 years, therefore all conclusions drawn from this study are limited to this sociocultural group, which was selected based on the availability of contacts of affected individuals. With these limitations in generalizability of our findings in mind, findings from ongoing online research suggest alexinomia to be prevalent also in other sociocultural groups (unpublished data). Hence, future research will explore whether alexinomia also occurs in other genders, age groups, cultural regions and how it is affected by language and cultural aspects of naming and name usage in everyday language. A scale to measure the presence and severity of alexinomia-related symptoms is warranted for statistically validating the construct further and for the development of a clinical diagnostic. Future quantitative research on larger samples might further address the prevalence of alexinomia in the general population, its neurobiological foundations, and psychosocial origins and causes. Not at least, the research presented here was mainly focused on the impact of alexinomia on primarily affected individuals. However, our findings also suggest a significant impact on family and other affiliates; therefore, looking at these secondarily affected individuals will be another important next step in this line of research to further understand alexinomia and to work toward a potential treatment of it.

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 Sigmund Freud University (SFU) Ethics Committee.

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Author contributions

TD and LW collected the data. TD and NR analyzed the data. TD wrote the first draft of the manuscript. NR wrote sections of the manuscript. All authors contributed to the conception and design of the study, manuscript revision, 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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Incongruent gestures slow the processing of facial expressions in university students with social anxiety

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In recent years, an increasing number of studies have examined the mechanisms underlying nonverbal emotional information processing in people with high social anxiety (HSA). However, most of these studies have focused on the processing of facial expressions, and there has been scarce research on gesture or even face-gesture combined processing in HSA individuals. The present study explored the processing characteristics and mechanism of the interaction between gestures and facial expressions in people with HSA and low social anxiety (LSA). The present study recruited university students as participants and used the Liebowitz Social Anxiety Scale scores to distinguish the HSA and LSA groups. We used a 2 (group: HSA and LSA) × 2 (emotion valence: positive, negative) × 2 (task: face, gesture) multifactor mixed design, and videos of a single face or gesture and combined face-gesture cues were used as stimuli. We found that (1) there is a distinction in the processing of faces and gestures, with individuals recognizing gestures faster than faces; (2) there is an attentional enhancement in the processing of gestures, particularly for negative gestures; and (3) when the emotional valence of faces and gestures align, it facilitates the recognition of both. However, incongruent gestures have a stronger impact on the processing of facial expressions compared to facial expressions themselves, suggesting that the processing of facial emotions is more influenced by environmental cues provided by gestures. These findings indicated that gestures played an important role in emotional processing, and facial emotional processing was more dependent on the environmental cues derived from gestures, which helps to clarify the reasons for biases in the interpretation of emotional information in people with HSA.

KEYWORDS

social anxiety, facial expression, gesture, attentional bias, context effect

1. Introduction

Social anxiety (SA) refers to anxiety in response to interpersonal communication with others (Pierce, 2009; Ran et al., 2018). People with high SA (HSA) have persistent fear and avoidance of social settings and cannot easily communicate with their peers (Stein and Stein, 2008). In recent years, studies have shown that social anxiety disorder (SAD) is one of the most frequently diagnosed anxiety disorders (Crome and Baillie, 2015; McBride et al., 2022) after major depressive disorder and alcohol dependence, with a greater risk of prevalence in adolescents (Jefferies and Ungar, 2020). Individuals with HSA are prone to bias in some stages

of information processing. For example, in the early stage of information processing, they are more likely to shift their attention to threatening stimuli (Schmidt et al., 2009) and find it difficult to disengage from threatening stimuli (Moriya and Tanno, 2011). This feature of attention fixation and attention enhancement is called attentional bias (Atkinson et al., 2004). The cognitive model theory of SA holds that this attentional bias toward negative or threatening stimuli is not only a key process that leads to anxiety (Mogg and Bradley, 2018) but also underlies the persistence of symptoms in people with HSA (Heimberg et al., 2010; Jiang et al., 2019).

In our daily life, recognition, understanding and expression emotions are key to human social communication. Emotion recognition refers to the ability of humans to identify emotional states, which is an inherent multimodal phenomenon that is based on different cues (e.g., verbal, facial, body posture or vocal cues) that are arranged in various patterns (e.g., visual, auditory or multichannel processing) (Atkinson et al., 2004; Matsumoto and Hwang, 2014). In addition to facial expressions, body expressions are a major source of information for identifying an individual's emotional state (De Gelder, 2006; de Gelder et al., 2014; Borhani et al., 2015; Bachmann et al., 2020). Research has found that there may be similar mechanisms between individual processing of the body and facial expression processing (Ding et al., 2017, 2018). In real life, facial expressions do not exist alone but are often accompanied by corresponding body movements, scenes, voice and intonation. These cues can also help us to identify emotions effectively. Compared to other emotional cues, body expressions can provide us with more realistic emotional information and help us identify the emotional state of others. In real life, people receive more combined physical and facial stimulation. Studies on the interaction between face and body began with Meeren et al. (2005), who found that body and facial expressions may produce similar Stroop effects (Meeren et al., 2005). Other researchers have also begun using combined emotional stimuli of face and body posture in their studies. This is a challenge to the standard pattern of emotional expression while also emphasizing the role of body language in expressing and perceiving emotions (Aviezer et al., 2012).

In recent years, with the deepening of research in the field of nonverbal emotional cue processing, many researchers have found that body expressions can have an impact on individual facial expression processing. A study showed that emotional body posture affects the processing of facial expressions, especially when the emotions conveyed by the body suggest danger (Poyo Solanas et al., 2018). Some researchers have used four basic emotions to study the asynchronous effect of facial expressions on body expressions. The results indicated that the perception of affective facial expressions significantly influenced the categorization of body-based emotion, particularly for bodily expression of happiness. The findings show that facial expressions influence the recognition of bodily expressions, despite asynchrony (Zhang et al., 2019). In addition, it was previously believed that body expression only works when facial expressions are ambiguous. However, research has found that body expressions have the greatest effect on facial expression recognition among the two expressions of happiness and fear (De Gelder et al., 2015). More interestingly, a study using temporal visual integration methods to examine the temporal and spatial integration of facial and body expressions showed that strong integration occurs when they are presented synchronously, indicating that the integration between emotional faces and bodies may be more sensitive than previously assumed (Lecker et al., 2017).

Gesture is a rich information carrier, including not only emotional information transmission but also semantic information. For example, the 'OK' gesture means 'OK' in China and the United States, while it means 'money' in Japan and 'nothing' in France. For that reason, it is necessary to pay attention to the cross-cultural study of gestures when selecting gestural stimuli as experimental materials (Wood et al., 2019). It is precisely because people's interpretations of gestures are more diverse than facial expressions that gesture cues are often complementary. Therefore, gesture cues have significant advantages over facial expressions when expressing some implicit meaning or inexpressible information (Trofater et al., 2015). Another study explored the effect of ambiguous faces on the semantic understanding of gestures through ERPs, and the results showed that gestures facilitated the understanding of emotional information when face processing resources were scarce (Proverbio et al., 2018).

Studies have shown that people with HSA pay more attention to the hands that express their physical emotions than people with LSA, possibly to avoid eye contact (Liedtke et al., 2018). Furthermore, people of different genders show significant differences in response times when recognizing complex face and gesture stimuli (Wood et al., 2019), which may be related to individual attentional characteristics and personality traits, such as those of people with SAD and anxiety disorders. At present, most of the studies on the processing of nonverbal affective cues are about faces, while the processing characteristics and neural basis of "gestures" as a neglected cue in emotion recognition remain to be explored. In recent years, increasing attention has been given to physical stimuli and combined stimuli. Incorporating body expressions, especially gestures, into emotional processing is important for adapting social situations and interactive behaviors in people with SAD.

Combining the shortcomings of previous studies with a more ecological perspective, we use video material of face-gesture combined emotional stimuli to explore the following two questions: Is there a dominant processing of compound emotional stimuli in individuals with HSA? Does gestural expressive information have a greater effect on emotion recognition in individuals with HSA? Therefore, the following research hypotheses can be obtained: (1) People with HSA have an emotionally congruent effect on combined expression stimuli recognition. (2) There is reversible interference between the processing of gestures and facial expressions. Specifically, the influence of gestures on facial expressions is greater than that of faces on gestures, and this difference is more significant in the HSA group.

2. Materials and methods

2.1. Participants

G* Power 3.1.9.7 was used for computation of the sample size. With reference to Cohen's (1988) study, we set a medium effect size F (the value is 0.25), given the α value (0.05) and power value (0.95), and a total sample size of 36, i.e., at least 18 people in each social anxiety group. We recruited 150 participants via online advertising portals (e.g., Bulletin Board System) in the College of Education, Wenzhou University. Inclusion criteria were Asian ethnicity, young adults aged 18–23 years (to avoid the effect of age-related changes in vision and cognition that may affect task performance), and normal or corrected-to-normal vision. All participants were right-handed, had no mental illness, and had no

TABLE 1 Demographic information and scale scores of the HSA and LSA groups (n , $M \pm SD$).

	HSA ($n = 39$)	LSA ($n = 40$)	t/χ^2	p
Female	35	33	0.863	0.353
Average age	19.77 ± 1.307	19.85 ± 1.442	0.261	0.508
LSAS score	82.44 ± 15.04	27.45 ± 11.346	-18.305	<0.001
Trait anxiety score	48.17 ± 7.560	37.40 ± 7.096	-6.531	<0.001

previous medical history. Participants were offered 1 hour of course credit or cash in return for their time. The demographic information and questionnaire scores of all participants are shown in Table 1.

Participants were asked to complete two questionnaires to measure psychopathology. Participants completed the Chinese version of the Liebowitz Social Anxiety Scale (LSAS, Liebowitz et al., 1987; He and Zhang, 2004) and the Trait Anxiety Inventory (T-AI, King et al., 1976). Groups were defined according to the total LSAS score. Finally, 39 people (35 women and 4 men) with an LSAS score higher than 70 (above the 73th percentile) were assigned to the HSA group, and 40 people (33 women and 7 men) with a score lower than 40 (below the 27th percentile) were assigned to the LSA group, with a total of 79 participants ($M = 19.62$ years, $SD = 1.288$ years). Independent sample t tests and chi-square tests revealed no significant difference in age and gender between the HSA and LSA groups ($p > 0.05$), and the LSAS and Trait Anxiety Inventory (T-AI) scores were significantly different between the two groups ($p < 0.001$). Ethical approval was provided by the Wenzhou University Ethics Committee. Participants provided written informed consent.

2.2. Questionnaires

The Liebowitz Social Anxiety Scale (LSAS, Liebowitz et al., 1987) is the most applicable instrument for assessing social anxiety, including clinical and self-report forms. It has 24 items and measures the rate of fear and avoidance of functional and social interaction situations on a 4-point Likert scale. The fear scale assesses levels of intensity ranging from 0 (none) to 3 (severe fear), while the avoidance scale assesses frequency of avoidance ranging from 0 (never) to 3 (usually). The total score was created by summing all the fear and avoidance scores, with higher scores reflecting more severe social anxiety symptoms. The validity of its self-report form has been supported in several studies (Safren et al., 1999; Baker et al., 2002; Mennin et al., 2002). The Chinese version of the LSAS has been validated in previous studies with good reliability and validity (He and Zhang, 2004). The Cronbach's α of the LSAS in this study was 0.961.

Trait-anxiety was also measured to distinguish and evaluate personality trait anxiety and provide a more informed characterization of the sample. To achieve this, the State-Trait Anxiety Inventory (King et al., 1976) was used. It has a total of 40 items, 20 for trait anxiety measurement. Ratings are made on a 4-point Likert scale from 0 (never) to 3 (almost always). The trait version of the STAI has been found to have good convergent, discriminant, and construct validity and reliability (Bieling et al., 1998). Trait anxiety ranged from 0 to 67 ($M = 44.99$, $SD = 6.68$). The Cronbach's α of the STAI in this study was 0.733.

2.3. Experimental stimuli and apparatus

The video stimuli were derived from online files made by Wood et al. (2019), and the experiment and stimuli files are available online.¹ The video stimuli were taken by four white actors (two female, two male). We chose happy and excited emotions as positive facial expressions, while frightened and angry acted as negative facial expressions. The hand gestures were thumbs-up, A-OK, thumbs-down, and a fist raised as if in anger (see Figure 1). The dynamic facial expressions began from neutral and ended at the apex of the expression. The dynamic hand gestures began with the hand off-camera, then the actor raised their hand, emphasized the gesture with 2 superimposed beats (i.e., pulses), and held the position still for the remainder of the video (Wood et al., 2019). "Congruent" face-gesture pairs were combinations of positive facial expressions and positive hand gestures or negative facial expressions and negative hand gestures. "Incongruent" face-gesture pairs were combinations of a negative (either face or hand) stimulus and a positive (hand or face, respectively) stimulus. For the single stimuli phase, we also used gesture-only (16 in total) and face-only (16 in total) videos from each actor. The face-only stimuli showed the actors' heads (with hands not visible), and the gesture-only stimuli showed the actors' hands (with faces not visible).

Experimental materials were evaluated by 30 college students from Wenzhou University who did not participate in the formal experimental process. Both pleasantness and arousal were scored on a 9-point scale ranging from 1 to 9, with 1 representing the lowest degree and 9 representing the highest degree. A total of 32 videos with 16 facial expression stimuli and 16 gesture stimuli were statistically analysed. Independent sample T tests showed that the pleasantness of negative facial expression videos was significantly lower than that of positive facial expressions ($t(58) = 19.079$, $p < 0.001$, $d = 4.926$). The pleasantness of the negative gesture video was significantly lower than that of the positive gesture video ($t(58) = 10.668$, $p < 0.001$, $d = 2.755$). There was no significant difference in arousal between negative and positive gesture expression videos ($t(58) = 0.656$, $p > 0.05$, $d = 0.169$), while the arousal between negative and positive facial expression videos had a significant difference ($t(58) = 2.750$, $p < 0.05$, $d = 0.551$) (Table 2).

The experiment was conducted in a room with good sound insulation, soft light, and a comfortable temperature. Stimuli were programmed using PsychoPy 3.0 (Jonathan Peirce, University of Nottingham, United Kingdom). All participants sat during the computer task (viewing distance = 44 cm; vertical viewing angle = 19.9°; horizontal viewing angle = 30.8°). The faces and gestures of the characters in the experimental materials were presented in fixed positions on a liquid crystal display monitor (Dell: 17-inch LCD, resolution 1,024 × 768, refresh rate of 60 Hz; i7-6,700 processor; solid-state hard disk 120 GB + 1 TB mechanical hard disk; independent graphics card 1,070 GTX; 16 GB memory), and the background was set to gray (RGB was 128 × 128 × 128).

2.4. Procedure and design

A three-factor mixed design of 2 (group: HSA and LSA) × 2 (emotional valence: positive and negative) × 2 (task type: face and

¹ <https://osf.io/9xs48/>

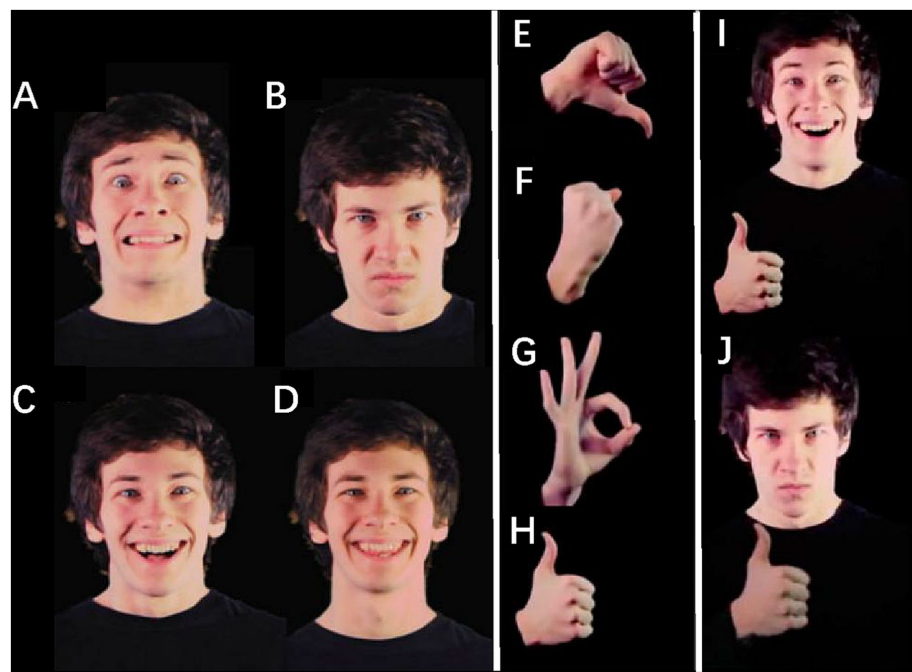


FIGURE 1
Still frames from Actor 1's video stimuli. The dynamic facial expressions began from neutral and ended at the apex of the expression. We used 2 negative facial expressions, frightened (A) and angry (B), and 2 positive expressions, excited (C) and happy (D). For the dynamic hand gestures, all actors started with their hand off-camera, then raised it, emphasized the gesture with 2 pulses, and held it still for the remainder of the video. The negative gestures were thumbs-down (E) and fist (F), and the positive gestures were A-OK (G) and thumbs-up (H). Sample congruent (I) and incongruent (J) stimuli for the face-hand phase are also shown. Adapted from Wood et al. (2019).

TABLE 2 Evaluation results of different emotional facial and gestures materials (*n*, *M* ± *SD*).

Valence	Video type		Pleasantness	Arousal
Positive	Facial gesture	Happy	6.80 ± 0.94	5.96 ± 1.05
		Excited	7.15 ± 1.98	6.69 ± 0.90
		Thumb up	6.96 ± 1.02	6.23 ± 1.20
		OK	6.41 ± 1.15	5.33 ± 1.44
Negative	Facial gesture	Anger	2.97 ± 0.82	5.23 ± 1.48
		Frightened	2.91 ± 0.85	5.64 ± 1.73
		Thumb down	2.63 ± 1.07	5.51 ± 1.57
		Fist	4.78 ± 1.78	5.56 ± 1.41

gesture) was adopted. The accuracy rate (%) and response time (ms) of the participants' key responses were recorded.

Participants completed the demographic questionnaire, LSAS, T-AI, and then the emotional valence discrimination experiment. The experimental process includes a practice experiment and a formal experiment. The practice experiment consisted of 12 trials, and the experimental stimuli were four kinds of facial expressions and gestures. In each trial, participants were presented with a gray screen for 1,500 ms followed by a facial or gesture video that was presented for 4,000 ms each. Participants were assigned two tasks: one was to judge emotions based on facial expressions, and the other was to judge emotions based on gestures. The order of presentation between the two tasks was balanced within subjects. According to the instructions, the participants

were supposed to press the 'F' key when judging the emotion of face/gesture as positive, while as negative, they pressed the 'J' key (adjusted according to the left or right handedness of the participants).

The formal experiment consisted of a single phase and a combined phase. In the single phase, 28 trials were presented randomly (16 trials of a single face and 12 trials of a single gesture). Participants could take a break after completing the single-phase task. The combined-stimulus phase was divided into two blocks, with appropriate rest between each block. There were 112 trials in this experimental phase, including face-target tasks and gesture-target tasks. There are 28 stimuli for each of the two tasks, and each stimulus is presented twice. The procedure is shown in Figure 2.

2.5. Statistical analysis

Accuracy (ACC) and reaction time (RT) for performance of the emotional valence discrimination experiment in both single and combined phases were collected. Data were imported into Excel for preprocessing. SPSS 25.0 (IBM, Somers, United States) statistical software was used for statistical analysis. Independent sample T tests were used to analyze the questionnaire scores of the two groups. Independent sample T tests were used to analyze the pleasantness and arousal of stimuli of two different valences (positive and negative). To explore the potential differences in participants' performance at different task stages, we conducted 2 × 2 × 2 repeated measures analyses of variance (ANOVAs) for behavioral data with the group (HSA and LSA) as between-subject factors and the task stage (single and combined) and the task type (face and gesture) as within-subject factors. Then, we focused on the combined

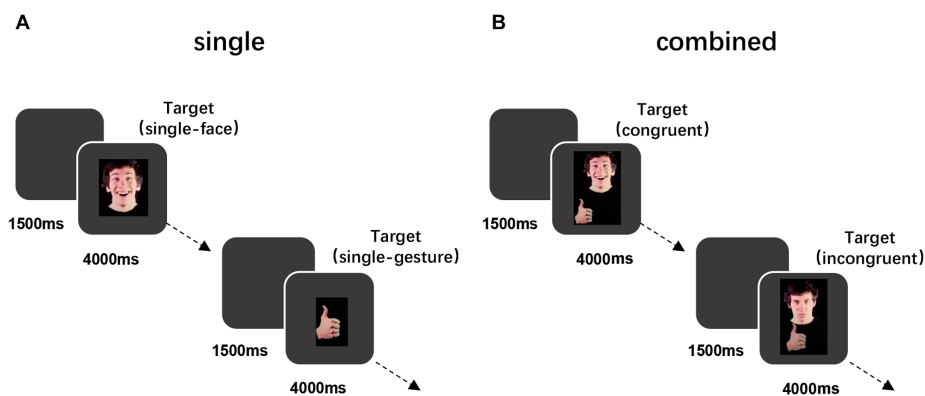


FIGURE 2

Schematic of trials in the single video stage (A) and combined video stage (B). (A) Example of positive trials in which participants viewed a single positive face or gesture. (B) Example of positive-gesture trials in which participants viewed a positive gesture paired with a positive face (congruent) or a negative face (incongruent). See the online article for the color version of this figure. Adapted from Wood et al. (2019).

stage and conducted $2 \times 2 \times 2$ repeated measures analyses of variance (ANOVAs) with the group (HSA and LSA) as between-subject factors and the task type (face and gesture) and emotional valence (positive and negative) as within-subject factors. At last, we divided the emotional valence into two conditions (congruent and incongruent) and conducted another ANOVAs with the task type (face and gesture) and congruency (congruent and incongruent) as within-subject factors.

3. Results

SPSS 25.0 was used for statistical analysis. Trials that were 3 standard deviations higher than average or faster than 150 milliseconds were excluded. We first conducted a $2 \times 2 \times 2$ three-factor repeated-measures ANOVA with two tasks (face and gesture) and two stages (single and combined) as between-subject factors and found significant interactions between groups, task types and task stages ($F(1, 77) = 3.959, p = 0.050, \eta^2 = 0.049$). It was found that the main effect of task type was significant ($F(1, 77) = 11.033, p = 0.001, \eta^2 = 0.125$), with the RT of the gesture (1309.33 ± 18.68) being significantly shorter than that of the face (1388.54 ± 29.29); the main effect of the task stage was significant ($F(1, 77) = 208.242, p < 0.001, \eta^2 = 0.73$), and the RTs to the single stage (1177.24 ± 29.52) were significantly shorter than those to the combined stage (1520.61 ± 18.29), indicating that the RT of the stimuli-combined presentation was prolonged relative to the face and gesture presented alone. Furthermore, the interaction between task type and task stage was also significant ($F(1, 77) = 22.31, p < 0.001, \eta^2 = 0.225$), and a simple effect analysis showed that in the single stage, the RTs of facial stimuli were significantly longer than those of gesture stimuli ($p < 0.001$). In the combined stage, there was no significant difference in facial and gesture processing ($p > 0.05$) (see Figure 3). The difference in accuracy of the subjects was not significant ($Ps > 0.05$). Descriptive statistical analysis is shown in Table 3.

Due to the dynamic nature of the stimulus, there are differences in the start and end times of different facial expressions and gesture videos, which may lead to systematic errors in response time (RT). To eliminate those differences, the study calculated the average RT for each subject at a single phase for each hand or facial stimulus. The RT of the face-gesture phase was then adjusted by subtracting the mean single RT of the

relevant subject and stimulus. The data were first subjected to a three-way mixed ANOVA of 2 (emotion valence: positive, negative) \times 2 (task type: face, gesture) \times 2 (group: HSA and LSA). It was found that the main effect of group was approaching significance ($F(1, 77) = 3.669, p = 0.059, \eta^2 = 0.045$), with the RT of the HSA group (252.69 ± 339.66) being significantly shorter than that of the LSA group (53.22 ± 503.95); the main effect of emotion type was significant ($F(1, 77) = 29.261, p < 0.001, \eta^2 = 0.275$), and RTs for positive emotional stimuli (126.36 ± 472.04) were significantly shorter than those for negative emotions (179.55 ± 470.57). However, there was a significant interaction between task type and emotion type ($F(1, 77) = 143.586, p < 0.001, \eta^2 = 0.651$), and a simple effect analysis showed that when the emotion type was positive, the difference in RT between face and gesture stimuli was not significant; when the emotion type was negative, the RT for gesture stimuli was significantly shorter than the face stimuli ($F(1, 77) = 6.226, p = 0.015, \eta^2 = 0.075$) (see Figure 4), indicating that there was an attentional enhancement in subjects' processing of gestures, and this attentional bias was more pronounced in the processing of negative gestures. Other main effects and interactions were not found ($Ps > 0.05$). Descriptive statistical analyses are presented in Table 4. None of the results for ACC were significant ($Ps > 0.05$), and subjects' ACC was above 90% in all conditions.

From the perspective of emotion congruency of face and gesture, the data were then subjected to a three-way mixed ANOVA of 2 (congruency type: congruent, incongruent) \times 2 (task type: face, gesture) \times 2 (group: HSA and LSA). From the results of RTs, it was found that the main effect of group was marginally significant ($F(1, 77) = 3.779, p = 0.056, \eta^2 = 0.047$), with the RT of the LSA (54.03 ± 503.97) being significantly shorter than that of the HSA group (256.57 ± 439.37); the main effect of the congruency type was significant ($F(1, 77) = 61.604, p < 0.001, \eta^2 = 0.444$), and the RTs to congruent stimuli (110.56 ± 460.38) were significantly shorter than those to incongruent stimuli (200.04 ± 482.96). The interaction between task type and congruency type was significant ($F(1, 77) = 13.448, p < 0.001, \eta^2 = 0.664$), and a simple effect analysis showed that under congruent conditions, there was no significant difference in facial and gesture processing ($F(1, 77) = 0.257, p = 0.614, \eta^2 = 0.003$). Under incongruent conditions, the RTs of facial stimuli were significantly longer than those of gesture stimuli, indicating that compared to the influence of incongruent faces on gestures,

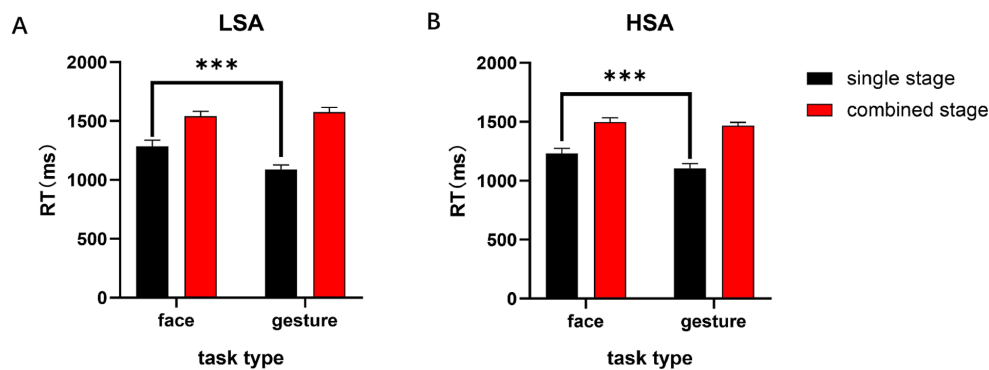


FIGURE 3

RTs of different stages and tasks in both the LSA and HSA groups. (A) RTs of facial and gestural expressions in single and combined stages in the LSA group. (B) RTs of facial and gestural expressions in single and combined stages in the HSA group. Error bars represent the mean SE. *** $p < 0.001$.

TABLE 3 Reaction times (RT) and accuracy (ACC) of both single and combined emotional stimuli in the HSA and LSA groups ($M \pm SD$).

Group	Type-stimuli	Reaction time (ms)	Accuracy (%)
HSA ($n = 39$)	Single-face	1236.65 \pm 237.22	97.33 \pm 4.70
	Combined-face	1506.54 \pm 218.92	94.73 \pm 5.37
	Single-gesture	1111.13 \pm 243.76	79.89 \pm 10.55
	Combined-gestures	1455.19 \pm 159.76	86.81 \pm 15.32
LSA ($n = 40$)	Single-face	1276.53 \pm 338.72	97.47 \pm 4.74
	Combined-face	1532.40 \pm 260.26	92.94 \pm 7.68
	Single-gesture	1084.10 \pm 240.30	79.02 \pm 10.26
	Combined-gestures	1584.42 \pm 257.01	83.25 \pm 13.66

incongruent gestures had a greater impact on facial expression processing ($F(1, 77) = 7.481$, $p < 0.01$, $\eta^2 = 0.089$). Both in facial and gesture conditions, the RT of congruent stimuli was significantly shorter than that of incongruent stimuli ($F(1, 77) = 104.984$, $p < 0.001$, $\eta^2 = 0.577$; $F(1, 77) = 17.691$, $p < 0.001$, $\eta^2 = 0.187$), as shown in Figure 5. None of the results for ACC were significant ($P_s > 0.05$), and subjects' ACC was above 90% in all conditions (see Table 5).

4. Discussion

The findings of this study, which investigated how individuals with social anxiety recognize facial expressions and gestures using a behavioral experiment, revealed that participants responded faster to gestures than faces when the stimulus was presented alone (single stage). However, when a combined gesture-face stimulus was presented, there was no significant difference between the two in both the high social anxiety (HSA) and low social anxiety (LSA) groups. The results also showed that participants responded more quickly and attentively to negative gestures but slower to negative faces, indicating two distinct types of attentional bias - attentional enhancement and attentional fixation - for different task types. This suggests that cognitive emotion processing may differ between faces and gestures. Additionally, the findings demonstrated that when faced with incongruent situations, participants processed gestures faster than

faces, suggesting that incongruent gestures had a stronger impact on face processing than incongruent faces on gestures.

Regarding processing for a single task type (face or gesture), the recognition time of facial expressions was longer than that of gestures, contrary to the view by previous scholars that face recognition has more advantages (Wang, 2021). This implies that facial expressions may not be the most direct and rapid cue for judging emotions. In this study, hand gestures were recognized more quickly than facial expressions, supporting the idea of asynchronous effects of body posture on emotion recognition.

Upon examining the processing of combined face-gesture stimuli, it was found that the inclusion of combined stimuli seemed to increase the participants' cognitive load, resulting in significantly longer response times compared to the single phase. Interestingly, we discovered that participants had quicker and more attentive responses to negative gestures, while responses to negative faces were slower. This suggests the presence of two distinct types of attentional bias - attentional enhancement and attentional fixation - for different types of tasks. Previous studies (Tang, 2018; Kong et al., 2022) have shown that individuals with high social anxiety (HSA) tend to develop a bias toward negative faces, especially those that are threatening. This bias may be due to inadequate information processing by individuals with social anxiety (Zimmer-Gembeck and Nesdale, 2013) or a lack of understanding of the implied meaning of the stimuli. Consequently, individuals with HSA may exhibit increased or fixed attention toward negative gestures or facial expressions. However, in our experiment, individuals with HSA did display some degree of bias in processing negative cues (particularly toward gesture cues), but the difference compared to individuals with low social anxiety (LSA) was not statistically significant. We speculate that this could be attributed to the limited sample size of our study and the potential interference of other factors, such as individual differences or stimulus material, which may have influenced the experimental results.

Further analysis of the congruency effect for both types of stimuli revealed that response times in the emotion-incongruent condition were significantly longer than those in the congruent condition for both the face-target and gesture-target tasks. This aligns with previous studies on the emotional congruency effect of the visual channel, where nontarget stimuli sharing similar emotional valence can somewhat alleviate the participants' cognitive load and enhance the recognition of target stimuli (Kret et al., 2013). Additionally, response times in the face-target task were significantly longer than those in the gesture-target

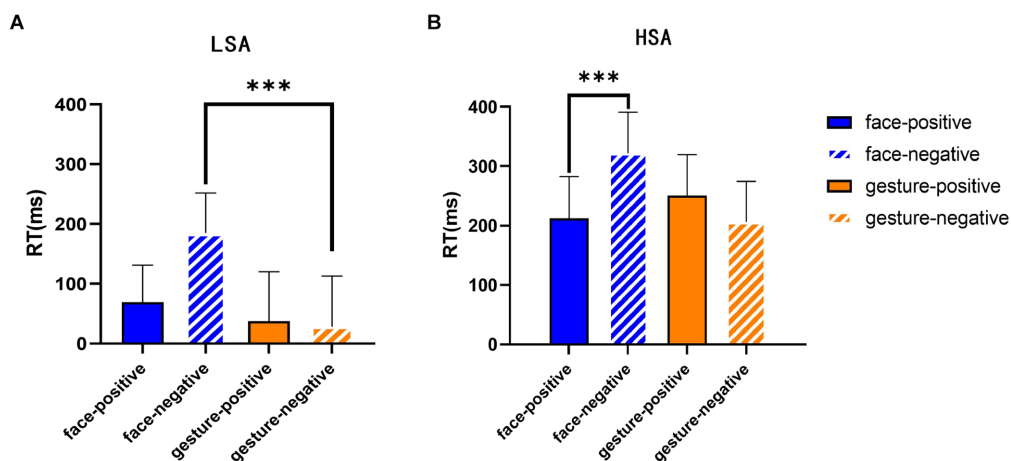


FIGURE 4

RTs of different expressions with different emotional valences. (A) RTs of facial and gestural expressions with different emotional valences in the LSA group. (B) RTs of facial and gestural expressions with different emotional valences in the HSA group. Error bars represent the mean SE. *** $p < 0.001$.

TABLE 4 Reaction times (RTs) and accuracy (ACC) of both face and gesture emotional stimuli of different valences in the HSA and LSA groups ($M \pm SD$).

Group	Type-valence	RT (ms)	ACC (%)
HSA ($n = 39$)	Face-Positive	212.08 \pm 439.98	94.75 \pm 6.39
	Face-Negative	330.09 \pm 438.34	94.71 \pm 7.16
	Gesture-Positive	257.08 \pm 439.51	96.31 \pm 11.88
	Gesture-Negative	211.50 \pm 436.82	96.47 \pm 9.04
LSA ($n = 40$)	Face-Positive	-1.330 \pm 487.54	93.73 \pm 6.93
	Face-Negative	148.43 \pm 472.59	92.11 \pm 10.35
	Gesture-Positive	37.61 \pm 521.13	95.46 \pm 11.75
	Gesture-Negative	28.16 \pm 534.52	95.00 \pm 11.60

task in the incongruent condition, indicating a heightened emotion-conflict effect associated with incongruent gestural contextual cues on facial expression recognition during cognitive processing. In other words, gesture cues have a greater influence on face processing, while facial expression cues have less influence on gesture processing. The findings of this study somewhat align with the second view in the ongoing debate on the influence of facial expressions and gesture cues in emotional cue processing. Previous studies have provided divergent interpretations, with some supporting the notion that facial expressions influence gesture expression processing and others arguing that gesture cues dominate in influencing facial expression processing.

The study revealed significant individual differences in the interpretation of gestural stimulus materials. For example, the validity of the gesture “fist” was rated as neutral rather than negative, and its ACC was less than 30% of the total “fist-target” trials in the formal experiment. This suggests that different individuals had different interpretations of the “fist” gesture, leading to its exclusion from the final results. Interestingly, some subjects perceived the fist gesture not as an aggressive gesture but as a signal of encouragement toward their friends. In a related study that investigated the relationship between gesture comprehension and semantic brain regions using homemade gesture picture materials, in which the researchers described the corresponding statement of

“clenched fist” as “look how strong I am,” the results showed significant congruency between gesture understanding and the description (Proverbio et al., 2018). Therefore, in this study, the subjects perceived “fist” as “cheer,” probably because they thought the gesture could convey some power and thus judged it as a positive gesture. Since the average recognition results of all subjects on fist gestures tend to be neutral, we suspect that at least half of the subjects consider the gesture to be negative. Another explanation for the above phenomenon is that gestures may be divided into two conditions: strength and powerlessness. Studies have found that the effect of gestures with strength on emotional face recognition was more pronounced. However, the dynamic gestures used in this study were apparently stronger in action amplitude than static fists, and the action amplitude of gestures could be appropriately reduced in the future to avoid subjects’ comprehension errors.

The study has several limitations. First, the lack of open-source localized emotional materials in China resulted in the use of facial stimuli from previous foreign research. This may have introduced the other-race effect, potentially affecting participants’ response time and leading to inaccurate experimental results. Furthermore, the dynamic nature of the materials meant that different participants had varying abilities to gather stimulus information, which could explain the large standard deviation in the data. Second, there were noticeable cultural differences in the interpretation of gesture materials. For instance, the “waving fist” action was perceived as a positive expression of cheering for the other person by a significant number of subjects. The performance in judging emotional gestures was clearly inferior to that for faces. Additionally, the differences in arousal between certain facial expressions may have influenced participants’ responses in the experiment. Future studies will explore the effects of positive and negative facial expression arousal on the HSA group. Last, although the Liebowitz Social Anxiety Scale and Trait Anxiety Inventory have been proven to be highly effective measurement tools, the reliability of online data collection methods remains poor.

5. Conclusion

The present study explored the attentional characteristics and mechanisms of the interaction between gesture

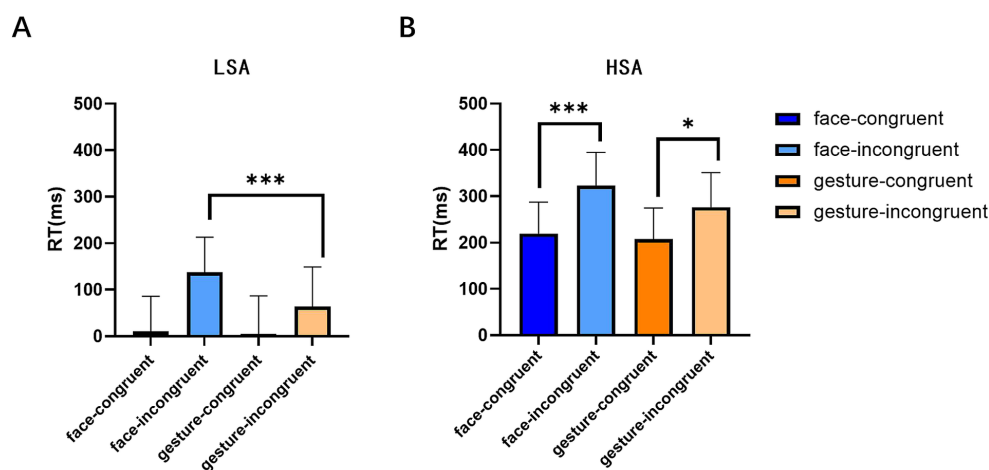


FIGURE 5

RTs of different expressions under different conditions in both the LSA and HSA groups. (A) RTs of facial and gestural expressions under congruent and incongruent conditions in the LSA group. (B) RTs of facial and gestural expressions under congruent and incongruent conditions in the HSA group. Error bars represent the mean SE. * $p < 0.05$, *** $p < 0.001$.

TABLE 5 Reaction times (RTs) and accuracy (ACC) of both face and gesture emotional stimuli in different conditions in the HSA and LSA groups ($M \pm SD$).

Group	Type-condition	RT (ms)	ACC (%)
HSA ($n = 39$)	Face-Congruent	219.55 \pm 423.19	97.74 \pm 3.56
	Face-Incongruent	322.59 \pm 450.89	91.72 \pm 9.27
	Gesture-Congruent	207.47 \pm 419.33	99.14 \pm 2.56
	Gesture-Incongruent	276.65 \pm 464.06	93.58 \pm 20.27
LSA ($n = 40$)	Face-Congruent	10.079 \pm 481.49	97.38 \pm 3.50
	Face-Incongruent	137.10 \pm 479.53	88.41 \pm 14.61
	Gesture-Congruent	5.139 \pm 517.50	98.12 \pm 5.16
	Gesture-Incongruent	63.81 \pm 537.37	92.50 \pm 20.04

processing and facial expression processing among university students with high and low social anxiety and reached the following conclusions: (1) There is a distinction in the processing of faces and gestures, with individuals recognizing gestures faster than faces; (2) There is an attentional enhancement in the processing of gestures, particularly for negative gestures; and (3) Emotional cues from facial expressions and gestures have a contextual effect on their processing. When the emotional valence of faces and gestures align, it facilitates the recognition of both. However, incongruent gestures have a stronger impact on the processing of facial expressions compared to facial expressions themselves, suggesting that the processing of facial emotions is more influenced by environmental cues provided by gestures.

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 authors.

Ethics statement

The studies involving humans were approved by Wenzhou University Ethics Committee. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

XZ and YG carried out research and data analysis. LF and SX conceived the project and prepared the manuscript. TX and WL reproof the data and improved the manuscript. All authors contributed to the article 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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Whether and how will using social media induce social anxiety? The correlational and causal evidence from Chinese society

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Background: Prior literature has well established the relationship between social media use and social anxiety, but little attention has been paid to the underlying mechanisms. Additionally, the causal evidence concerning the effect of social media use on social anxiety is scarce.

Objective: Given that, two studies were conducted to examine the effect of social media use on social anxiety and the underlying mechanisms.

Methods and results: In Study 1, with 470 undergraduates as participants, we applied the questionnaire survey to investigate the relationship between social media use and social anxiety. The results showed that higher social media use intensity was significantly related to higher social anxiety, and social media use was related to social anxiety via two possible mediation paths: (1) social media use → upward social comparison → social anxiety, (2) and social media use → upward social comparison → self-esteem → social anxiety. In Study 2, with 180 undergraduates as participants, we conducted a lab experiment, in which participants were assigned to the experimental (exposed to the content that undergraduates frequently access on social media) or control (exposed to landscape documentaries) condition, and then measured their upward social comparison, self-esteem and social anxiety. The results showed that participants in the experimental condition reported higher social anxiety than those in the control condition, demonstrating the causality between social media exposure and social anxiety. The subsequent mediation analysis basically replicated the findings of Study 1. That is, upward social comparison played the mediating role between social media exposure and social anxiety, and upward social comparison and self-esteem played the chain-mediating role between them.

Conclusion: The current research firstly demonstrated the causality between social media use and social anxiety in Chinese society, and also revealed the mediating mechanisms between them, which would deepen our understanding of how social media use will increase social anxiety.

KEYWORDS

social media, social anxiety, social comparison, self-esteem, cyberpsychology

1. Introduction

Imagine that you meet your best friend again after a long separation and you have a nice dinner together. Now, you are so excited and happy, and want to share this wonderful experience with others around you. What will you do? In China-Mainland, the answer may be sharing your reunion on WeChat Moments,¹ which allows users to share their personal photos, wonderful life experiences, and feelings at the moment with online friends, and also allows users to view the content shared by other users. Across the world, there are numerous online-platforms having similar functions with WeChat, such as Facebook, Instagram, YouTube, MicroBlog and so on, and these platforms can be collectively called as social media (Kaplan and Haenlein, 2010; Carr et al., 2016). During the past two decades, social media has become a part of everyday life and yields a profound influence on our cognition, mood, and behaviors (Olson et al., 2012; O'Day and Heimberg, 2021). A large body of research suggests that social media function as a double-edged sword: on one hand, social media helps people free from the restriction of time and space, and communicate with each other more effectively; on the other hand, excessively using social media also brings some detrimental effects on people's mental health (She et al., 2023).

Past research demonstrates that individuals with high social media use intensity tend to report high social anxiety (e.g., Davidson and Farquhar, 2014; Dobrea and Pasarelu, 2016; Jiang and Ngien, 2020). However, prior research concerning social media use and social anxiety in general adopts the questionnaire survey to provide correlational evidence for the correlation between them, resulting in the lack of causal evidence about the effect of social media use on social anxiety. In other words, the questionnaire survey method allows us to test the correlation between social media use intensity and social anxiety, but fails to make us confirm whether higher social media use intensity will lead to higher social anxiety.

Additionally, it is somewhat surprising that researchers so far have paid little attention to the underlying mechanisms between social media use and social anxiety (Jiang and Ngien, 2020). Thus, to make clear how social media use in daily life will induce users' social anxiety, more work should be done to uncover the mechanisms behind the effect of social media use on social anxiety.

Finally, prior research with respect to social media use and social anxiety is exclusively conducted in Western society and the involved social media platforms include Facebook and Instagram, which both are popular social media platforms in Western society. However, due to the regulation of Chinese government, the mentioned above social media platforms failed to provide services in China-Mainland. In this situation, we actually do not know whether the results-pattern observed in Western society can be generalized to Chinese society. Moreover, the cultural differences about social anxiety have been found to exist between Eastern and Western societies (Heinrichs et al., 2006). Therefore, it is necessary for us to examine the possible effect of using social media on social anxiety in Chinese society.

To fill the above gaps existing in the field of social media use and social anxiety, we aimed to conduct two studies—a questionnaire survey and a lab experiment, to exclusively examine the effect of using

social media on social anxiety in China-Mainland, thus firstly providing both correlational and causal evidence for the effect of social media use on social anxiety and the underlying mechanisms.

2. Literature review

2.1. Social media

According to the definition proposed by Kaplan and Haenlein (2010), social media can refer to any social networking sites or various of Internet-based applications, which was considered to developed based on the Web 2.0 platforms and the ideology of "User Generated Content" (Kaplan and Haenlein, 2010; Tartari, 2015). A typical characteristic of social media is that it allows all users to participate in the creation of the presented content and communicate with each other among social media users. Now, social media has become a part of people's lives in modern society, through which people can maintain interpersonal relationships, document those meaningful moments in life, gain knowledge and information from the external world, and share whatever you are willing to share with others (Boyd and Ellison, 2007). Besides, it is readily for social media users to perceive social support from others on the platform, which is considered to be a protective factor for our self-esteem and subjective well-being (Rozzell et al., 2014; Carr et al., 2016; Tao and Cheng, 2018).

Despite the fact that people benefit a lot from social media, researchers also reveal some detrimental influences on individuals' mental health and social adaptation resulting from excessive social media (O'Keeffe et al., 2011; Amedie, 2015; Tartari, 2015). For example, previous research consistently shows that individuals who spend too much time on Facebook are inclined to exhibit classic symptoms of depression, called "Facebook depression" (Jelenchick et al., 2013; Steers et al., 2014; Alfasi, 2019). Additionally, due to the positive self-presentation tendency on social media, individuals with excessive social media use often suffer from upward social comparison and mistakenly perceive that they are inferior than others round them, which further harms their self-esteem (Jan et al., 2017). In some cases, social media provides an ideal place for some criminals to hide their identity and spread criminal ideas, such as cyber bullying, cyber terrorism, and drug dealing (Amedie, 2015).

2.2. Social media and social anxiety

The term social anxiety refers to a phenomenon existing in social situations that one person has a strong desire to make a good impression on others while the person is quite not sure whether he/she has the ability to this end (Yen et al., 2012; Morrison and Heimberg, 2013). The cognitive-behavioral model of social anxiety posits that individuals with social anxiety tend to exhibit three tendencies: (1) applying an excessively high standard for their performances in social situations, (2) presupposing that the encountered others will give negative evaluations for their social performances, and (3) being inclined to believe that others' evaluations about themselves are true (Clark and Wells, 1995; Rapee and Heimberg, 1997). As a result, when interacting with others in social situations, socially anxious individuals often experience fear or anxiety that they will be negatively evaluated or judged by others (Clark and

¹ <https://weixin.qq.com/>

Wells, 1995; Alden and Taylor, 2004; Hofmann, 2007; O'Day and Heimberg, 2021). And for these individuals, this excessive fear for poor social performances will further reduce the possibility to develop new interpersonal-relationships and also have a detrimental influence on the existing interpersonal-relationships (O'Day and Heimberg, 2021). It should be pointed out, despite the fact that social anxiety is detrimental to developing normal social interaction, anxiety symptoms have been widely observed in nonclinical samples and most people actually have experienced more or less social anxiety in daily life (Purdon et al., 2001).

Prior literature has documented that there is a significant correlation between social media use and social anxiety (Davidson and Farquhar, 2014; Dobrea and Pasarelu, 2016; Jiang and Ngien, 2020; Sternberg et al., 2020; O'Day and Heimberg, 2021). For instance, in a questionnaire survey conducted in Singapore, researchers found that those participants with higher Instagram use intensity were inclined to report higher social anxiety, suggesting excessive social media use may elevate users' social anxiety (Jiang and Ngien, 2020). Similarly, in another study by Davidson and Farquhar (2014), researchers examined the relationship between Facebook use intensity and social anxiety and revealed a significant correlation between them. Even for those individuals having suffered from social anxiety, using social media will further enhance their social anxiety although they initially intend to compensate for their "deficits" in social skills via the online interactions on social media (Carruthers et al., 2019). It should be pointed out, several existing studies examining the effect of social media use on social anxiety adopted a single questionnaire approach, so such studies in nature are a correlational design (Davidson and Farquhar, 2014; Qiu et al., 2017; Jiang and Ngien, 2020). And a single study conducted in the lab consisted of clinical samples (individuals suffering from social anxiety) but not community samples (Carruthers et al., 2019). As a consequence, we so far cannot draw a causal inference about whether social media use will increase social anxiety of users in daily life. To fill this gap, the current research sought to provide first evidence for the causality between social media use and social anxiety. Correspondingly, our first hypothesis was that,

Higher social media use intensity would lead to higher social anxiety (Hypothesis 1).

2.3. Social media, upward social comparison, and social anxiety

According to the propositions of social comparison theory, we often intentionally or unconsciously compare ourselves with others around us in order to assess our self-worth or gain our self-enhancement (Festinger, 1954). When comparing ourselves with someone who is better than us on specific domains, we can call this comparison as upward social comparison; in contrast, when comparing ourselves with someone who is worse than us on specific domains, we can call this comparison as downward social comparison (Wills, 1981; Wood, 1989). Past research suggests that compared to downward social comparison, upward social comparison is more likely to be associated with a series of negative health outcomes, such as envy, lower well-being, depressive symptoms, and lower self-esteem (Feinstein et al., 2013; Charoensukmongkol, 2018; Tao and Cheng,

2018; Alfasi, 2019; Schmuck et al., 2019). In contrast, comparing oneself with others inferior than the self has been found to be helpful for elevating self-esteem, receiving mental gratifications, and maintaining good mood states (Gibbons and Gerrard, 1989; Lew et al., 2007; Huang and Zhou, 2018). Notably, although a large body of research demonstrates the negative effect of upward social comparison and the positive effect of downward social comparison, the opposite patterns are also possible in given circumstances. As an example, for an individual with a self-improvement motive, comparing the self with a better one will provide hope and inspiration for the individual (Wood, 1989).

On social media, users can autonomously determine which aspects of them will be presented on the platform, and if necessary, they also can employ the beauty filter to construct perfect self-images following their aesthetic preference (Arroyo and Brunner, 2016; Yao et al., 2020). As a result of this characteristic of social media, it is a common phenomenon that social media users tend to present positive self-presentations on various of social media platforms (Haferkamp and Krämer, 2011). In this situation, social media users often mistakenly perceive that the lives of others always seem to be exciting and colorful, but their own lives seem to be mediocre and boring, which will result in the generation of upward social comparison (Chou and Edge, 2012; Steers et al., 2014).

Upward social comparison, a phenomenon commonly observed on social media platforms, has been found to be a risk factor inducing social anxiety (for a review, see McCarthy and Morina, 2020). The Cognitive-behavioral model of social anxiety has defined the fear of evaluation as a core feature of the disorder, and upward social comparison seems to readily induce this fear, especially the fear of negative evaluations from others (Clark and Wells, 1995; Rapee and Heimberg, 1997; Weeks et al., 2009; McCarthy and Morina, 2020). For example, Antony et al. (2005) used a questionnaire survey method to examine the relationship between social comparison and social anxiety among individuals with high and low social anxiety, and found that for individuals in both groups, upward social comparison was significantly and positively correlated with social anxiety. In another lab experiment by Mitchell and Schmidt (2014), researchers asked participants to view a profile of a fellow student with excellent performance (the upward social comparison condition) or with normal performance, and then measured participants' social anxiety via the Social Interaction Anxiety Scale (Mattick and Clarke, 1998). The results showed that male participants with social anxiety tended to report higher social anxiety after experiencing upward social comparison in the lab. Following the above reasoning, we proposed our second hypothesis that,

Using social media may have an influence on social anxiety via the mediating role of upward social comparison (Hypothesis 2).

2.4. Social media, upward social comparison, self-esteem, and social anxiety

In addition to directly inducing social anxiety, upward social comparison may also lead to lower self-esteem of social media users, and lower self-esteem may further lead to higher social anxiety.

Krause et al. (2021) have proposed that social comparison can produce the opposite influences on self-esteem depending on the comparison direction—upward social comparison will harm self-esteem and downward social comparison will benefit self-esteem. Consistent with this proposition, empirical research revealed that, due to the positive self-presentation on social media, social media users in general experienced upward social comparison rather than downward social comparison when they use social media (Jan et al., 2017). And upward social comparison has been widely demonstrated to be correlated with lower self-esteem (Mitchell and Schmidt, 2014; Alfasi, 2019; Midgley et al., 2021). As an example, using an experimental approach, researchers found that participants reported lower self-esteem when they were assigned to the upward comparison condition (reading an introduction about an excellent college student) than the downward comparison condition (reading an introduction about an average college student; Mitchell and Schmidt, 2014).

Sociometer theory proposes that self-esteem represents “an internal, subjective gauge of interpersonal acceptance and Rejection”—high self-esteem means an individual perceives good interpersonal relationships and the individual can receive social acceptance from others, while low self-esteem means an individual perceives poor relationships and the individual may suffer from social exclusion (Leary and Baumeister, 2000; Leary, 2005). So, according to this theory, due to the threat of social exclusion, low self-esteem should have a close connection with social anxiety. In line with the proposition of the sociometer theory, empirical research also suggests that individuals with lower self-esteem tend to report higher social anxiety (van Tuijl et al., 2014; Fatima et al., 2017). Recently, with 388 Singaporeans as participants, Jiang and Ngien (2020) used the questionnaire survey to clarify the mechanisms underlying the relationship between Instagram use intensity and social anxiety, and found that upward social comparison on social media had a significantly negative prediction on self-esteem and self-esteem further had a significantly negative prediction on social anxiety. On the basis of previous research, we hypothesized that,

Using social media may yield an influence on users' social anxiety via the chain-mediating role of upward social comparison and self-esteem (Hypothesis 3).

3. The current research

As we have documented in the beginning section, although there has been a large body of research demonstrating the significant correlation between social media use and social anxiety, the causal evidence between them is still scarce, which makes us fail to provide causal evidence for the effect of social media use on social anxiety. Additionally, there is little research exploring the acting mechanisms between social media use and social anxiety (Jiang and Ngien, 2020). Given the above considerations, we conducted two studies to examine the effect of social media use on social anxiety and the mechanisms underlying the effect. In Study 1, we employed the questionnaire survey to examine the correlation between social media use and social anxiety, and the mediating roles of upward social comparison and self-esteem between them, thus providing preliminary evidence for our hypotheses. In Study 2, we conducted a lab experiment to examine

the causal relationship between social media use and social anxiety, and the mediating roles of upward social comparison and self-esteem, thus providing compelling evidence for our hypotheses.

4. Study 1

To provide initial evidence for our hypotheses, in Study 1, we conducted a questionnaires survey in Study 1 to examine the relationship between social media use intensity and social anxiety, and the mediating roles of upward social comparison and self-esteem between them.

4.1. Participants

Participants of Study 1 were 470 college students (182 males, 282 females, 6 participants did not provide gender information) from a university in Shandong Province of China-Mainland, whose average age was 20.99 years ($SD = 1.33$), ranging from 18.58 to 30.08 years. All participants took part in this survey on the voluntary basis and they signed the informed consent prior to the formal survey. Participants could receive 5 RMB as a return (approximately 0.8 USD) after completing the survey. Eight participants (3 males, 5 females) were regarded as invalid participants resulting from their excessive answer omissions, so there were 462 participants involved in final data analysis.

4.2. Measures

4.2.1. The measure of social media use intensity

In the current research, the modified Facebook use intensity scale was used to assess participants' social media use intensity. Specifically, to measure individuals' use intensity of social media in Chinese society, Qiu et al. (2017) modified the Facebook use intensity scale developed by Ellison et al. (2007) to generate the social media use intensity scale. In the modified scale, the item “about how many total Facebook friends do you have at MSU or elsewhere” existing in the original scale was deleted, and the term “Facebook” was entirely replaced by the term “social media”. As a result, the social media use intensity scale in the current research includes six items—one item assesses the average time spent on social media per day and the other five items assess individuals' attitudes toward social media use (e.g., *social media has become part of my daily routine*). For each item, participants needed to indicate their agreement on the 7-point scale (1 = *strongly disagree*, 7 = *strongly agree*). The social media use intensity of participants was assessed by summing the scores on all items. In the current research, the internal consistency coefficient of the scale was 0.72.

4.2.2. The measure of upward social comparison

The Chinese version of the Iowa-Netherlands Comparison Orientation Measure was used to assess the tendency of upward social comparison, which was developed by Bai et al. (2013) on the basis of the original scale by Gibbons and Buunk (1999). In line with previous research (Qiu et al., 2017; Kong et al., 2021), only the ability subscale was used in the current research and a total of 6 items were included

in the subscale [e.g., *I often compare how I am doing socially (e.g., social skills, popularity) with other people*]. For each item, participants needed to report their agreement on the 5-point scale (1 = *strongly disagree*, 5 = *strongly agree*) with higher scores indicating higher social comparison tendency (the item 5 was reversely scored). The internal consistency of the scale was 0.78.

4.2.3. The measure of self-esteem

The Chinese version of the Rosenberg Self-Esteem Scale was employed to measure participants' self-esteem (Rosenberg, 1965; Ji and Yu, 1999). The scale includes 10 items and participants needed to indicate their agreement for each item on the 4-point scale (1 = *strongly disagree*, 4 = *strongly agree*). It should be pointed out that, when participants filled out the scale, we instructed them to report their evaluations about themselves after using social media rather than their evaluations about themselves in general. After the item 3, 5, 8, 9, and 10 were reversely scored, self-esteem score was calculated by summing the score on each item, with higher scores indicating higher self-esteem. The Cronbach's α of the scale was 0.83.

4.2.4. The measure of social anxiety

The Chinese version of the Interaction Anxiousness Scale developed by Leary (1983) was used to measure the social anxiety of participants (Leary, 1983; Peng et al., 2004). The scale contains 15 items (e.g., *I get nervous when I must talk to a teacher or boss*) and participants needed to indicate their agreement on the 5-point scale (1 = *strongly disagree*, 5 = *strongly agree*). After the item 3, 6, 10, and 15 were reversely scored, we assessed participants' social anxiety by summing the score on each item, with higher scores indicating more social anxiety. In the current research, the internal consistency coefficient of the scale was 0.87.

4.2.5. The measure of demographic information

In addition to the measures of the above key variables, we also measured participants' demographic information, including their age, gender, residential location (city/country), and subjective social status. One thing we wanted to explain was that, although parental income, job, and education were commonly used to represent social status of a family (e.g., Pinderhughes et al., 2000; Suleman et al., 2012), considering that most college students in China-Mainland actually are not clear how much their family earns each year, we did not assess participants' objective social status in the current research. Instead, we asked participants to report their subjective social status by marking an "X" next to one of 10 rungs on a ladder to indicate their own social class rank relative to other college students all over China (Kraus et al., 2009).

4.3. Procedure

We carried out our questionnaire survey in a group of 40–60 participants. Before the formal survey, we told participants that we were conducting a survey about social media use and social anxiety. We also explicitly alleged that the collected data was used only for academic purpose, and if participants were willing to continue the survey, they needed to assign the informed consent. After that, we instructed participants to fill out several scales mentioned above and also report their demographic information. When they completed

all measurements, they would receive their rewards (5 RMB). The whole survey lasted for approximate 10–15 min.

4.4. Results

4.4.1. Descriptive results

We applied the SPSS 23.0 to sort the database and generate descriptive results. The correlations among variables were presented in Table 1. As shown in Table 1, social media use intensity was significantly and positively correlated with upward social comparison and social anxiety, $r_s = 0.23, 0.20$, respectively, $p_s < 0.01$. Upward social comparison was found to be significantly and negatively correlated with self-esteem, $r = -0.22$, $p < 0.01$, but positively correlated with social anxiety, $r = 0.25$, $p < 0.01$. In addition, self-esteem was significantly and negatively correlated with social anxiety, $r = -0.37$, $p < 0.01$.

In addition to the above significant correlations, an independent-samples t -test showed that female participants reported higher social anxiety than male participants ($M_{\text{female}} = 49.94$, $M_{\text{male}} = 45.19$), $t(460) = 5.67$, $p < 0.001$, $d = 0.54$, displaying the same pattern with previous research (Asher et al., 2017). Another independent-samples t -test showed that male participants tended to report higher subjective social status than female participants, $t(460) = 3.37$, $p = 0.001$, $d = 0.32$. Additionally, we found there was a significantly negative correlation between age and subjective social status, $r = -0.16$, $p < 0.05$, suggesting that senior college students perceived lower subjective social status than younger college students.

4.4.2. The mediating roles of upward social comparison and self-esteem

The Macro PROCESS (model 6) by Hayes (2013) was applied to examine the possibly mediating effects of upward social comparison and self-esteem between social media use intensity and social anxiety. The process tests the mediating effect by using the bootstrapping method (5,000 bootstrapped resampling in this study) to create a 95% confidence interval, and if the interval does not contain a zero, the mediating effect will be considered to be reliable (Preacher and Hayes, 2008). Prior to the mediation analysis, we conducted the multicollinearity test and found that tolerance values and variance inflation factors were greater than 0.20 (0.79–0.98) and less than 10 (1.07–1.25), respectively. So, there were no problems with respect to multicollinearity between variables (Kutner et al., 2004). Additionally, the possible effects of demographic variables (gender, age, and subjective social status) were controlled when performing the mediating effect analysis.

The results showed that the overall model was significant, $R^2 = 0.07$, $F(5, 456) = 6.52$, $p < 0.001$. As shown in Table 2, the direct effect between social media use intensity and social anxiety was significant, $f = 0.13$, 95% CI [0.04, 0.21]. Additionally, the indirect effect between social media use intensity and social anxiety via the mediating role of upward social comparison was significant, $f = 0.04$, 95% CI [0.02, 0.07]. As illustrated in Figure 1, social media use intensity significantly and positively predicted upward social comparison, $\beta = 0.24$, $p < 0.001$, and upward social comparison further significantly and positively predicted social anxiety, $\beta = 0.17$, $p < 0.01$. In addition to the mediating role of upward social comparison, we also found the chain-mediating role of upward social comparison and

Table 1 The correlations among variables in Study 1.

	Social media use intensity	Upward social comparison	Self-esteem	Social anxiety	Subjective social status	Age
Social media use intensity	1					
Upward social comparison	0.23**	1				
Self-esteem	−0.09	−0.22**	1			
Social anxiety	0.20**	0.25**	−0.37**	1		
Subjective social status	−0.04	0.07	0.34**	−0.17**	1	
Age	0.06	0.04	−0.18**	0.14**	−0.16*	1

* $p < 0.05$, ** $p < 0.01$.

Table 2 Direct and indirect effects between social media use intensity and social anxiety in Study 1.

	Effect size	Boot SE	95%LLCI	95%ULCI	Ratio
Direct effect					
Social media use intensity → social anxiety	0.13	0.04	0.04	0.21	67.36%
Indirect effect					
Social media use intensity → upward social comparison → social anxiety	0.04	0.01	0.02	0.07	20.73%
Social media use intensity → upward social comparison → self-esteem → social anxiety	0.02	0.005	0.01	0.03	10.36%
Social media use intensity → self-esteem → social anxiety	0.003	0.01	−0.02	0.03	1.55%

SE, standard error; LLCI, lower limit of confidence interval; ULCI, upper limit of confidence interval.

self-esteem between social media use intensity and social anxiety, $f = 0.02$, 95% CI [0.01, 0.03]. As displayed in Figure 1, social media use intensity significantly and positively predicted upward social comparison, $\beta = 0.24$, $p < 0.001$, and upward social comparison significantly and negatively predicted self-esteem, $\beta = -0.25$, $p < 0.001$. The self-esteem, in turn, further significantly and negatively predicted social anxiety, $\beta = -0.26$, $p < 0.001$.

4.5. Discussion

In Study 1, we used a questionnaire survey to examine the relationship between social media use and social anxiety, and the underlying mediating-mechanisms. Consistent with Hypothesis 1, we found that there was a significantly positive correlation between social media use and social anxiety, which implies that individuals with high use intensity of social media were more likely to display social anxiety than individuals with low use intensity of social media.

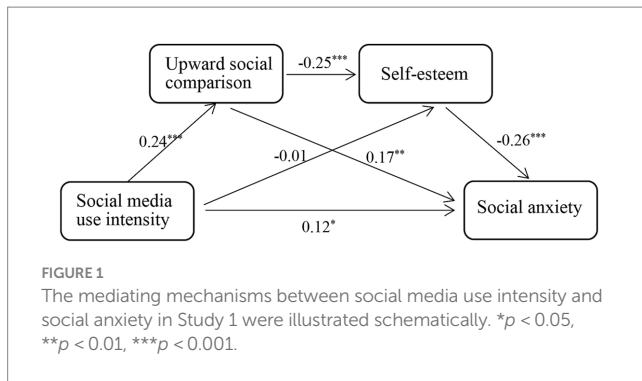
Besides the direct effect between social media use intensity and social anxiety, we also found that higher social media use intensity was significantly correlated with higher upward social comparison, showing the same results-pattern with previous research (Lee, 2014; Jan et al., 2017). The higher upward social comparison, on one hand, directly induced social media users' social anxiety, resulting in the mediating role of upward social comparison between social media use and social anxiety (Hypothesis 2); on the other hand, the higher upward social comparison was further correlated with lower self-esteem and lower self-esteem finally induced social anxiety, thus supporting the chain-mediating role of upward social comparison and self-esteem between social media use and social anxiety (Hypothesis 3).

It should be pointed out, Study 1 employed the questionnaire survey to examine the relationship and the underlying mechanisms between social media use and social anxiety, which should belong to the correlational research-design. As we have discussed in the introduction section, the correlational research-design allowed us to test whether there was a significant correlation between social media use and social anxiety, but did not enable us to confirm the causality between them. So, Study 1 indeed provided preliminary supports for our hypotheses. Given that, we aimed to conduct a lab experiment to further demonstrate the causality between social media use and social anxiety.

5. Study 2

To provide more convincing evidence for our hypotheses, we conducted a lab experiment—Study 2, in which we randomly assigned participants to the experimental or control condition and asked them to watch approximate 15 min videos shared on Bilibili,² a social media platform widely popular among Chinese college students. In social media exposure condition (the experimental condition), the 15 min videos consisted of three different vlogs: one concerning fitness experiences-sharing, one concerning postgraduate entrance examination experiences-sharing, and the last one concerning travel experiences-sharing. In the control condition, the 15 min videos consisted of three vlogs about natural scenery: one called *Overlooking China*, one called *Beautiful China*, and the last one called *Wild China*. After that, we measured participants' upward social comparison,

² <https://www.bilibili.com/>



self-esteem, and social anxiety. We provided more detailed introductions in the following *materials* and *procedure* sections.

5.1. Participants and design

We determined the sample size of Study 2 based on the calculation of G*power 3.1 (Faul et al., 2009), which suggested that the presupposed medium effect size $d = 0.8$ and the significance at 0.05 level required at least 88 participants in each condition to conduct an independent-samples t -test. Given that, we finally recruited 180 college students (79 males, 101 females, $M_{\text{age}} = 19.74$, $SD = 0.93$, ranging from 18.33 to 22.42) to participate in Study 2. As a return for their participation, they would receive 10 RMB (approximate 1.4 USD) when they complete all tasks. Due to excessive answer omission, 5 participants were regarded as invalid participants and excluded from the following data analysis. As a result, a total of 175 participants (79 males, 96 females) were included in final data analysis.

5.2. Materials

5.2.1. The manipulation of social media exposure

Inspired by Tiggemann and Zaccardo (2015), in Study 2, we manipulated social media exposure of participants by inviting them to watch different short videos shared on Bilibili depending on the assigned conditions. In the experimental condition, the three videos presented for participants included fitness experiences-sharing, postgraduate entrance examination experiences-sharing, and travel experiences-sharing. Prior literature has documented that sharing fitness and travel experiences on social media is popular among young people (Tiggemann and Zaccardo, 2015). This is why the fitness experiences-sharing and travel experiences-sharing were included in the experimental condition. Additionally, considering that the participants of Study 2 were college students, the study also included the postgraduate entrance examination experiences-sharing. According to a survey from Beijing News (2019), it is common for college students to share and view some tips about important exams (e.g., the post-graduate entrance examination).

In the control condition, three short videos presented for participants were all about natural scenery. For college students, it is indeed less common to view natural scenery documentary on social media platforms. The underlying logic was that, in the control condition, we sought to create a situation without priming the mindset of social media use. In a pretest ($n = 32$), we asked participants to

report perceived quality and visual attractiveness of videos across the two conditions. They declared that they did not perceive significant differences for the selected videos, $t(31) < 1.23$, $ps > 0.23$. We also asked participants to report their frequencies of accessing such types of videos on social media platforms. The results showed that the mean values of accessing the three activities in the experimental condition were significantly higher than the median 4 on the 7-point scale ($Ms = 5.37, 4.81, 4.50$, respectively), $t(31) > 2.1$, $ps < 0.05$, while the mean value of accessing the natural scenery documentary was significantly lower than the median ($M = 2.94$), $t(31) = -4.33$, $p < 0.001$. During the session of the experiment, we sent the video links to participants' cellphone and they watched such videos on their own cellphone. Upon completing the task of watching short videos, they were asked to put their cellphones away and continue the following task.

5.2.2. The measure of upward social comparison

Following Vogel et al. (2014), we measured participants' upward social comparison by explicitly asking "when comparing yourself to others on social media, to what extent do you focus on people who are better off than you?" Participants needed to give their answer on the 5-point scale (1 = *never*, 5 = *always*), with a higher value indicating higher upward social comparison.

5.2.3. The measure of self-esteem

As did in Study 1, the Chinese version of the Rosenberg Self-Esteem Scale was used to measure participants' self-esteem. According to the recommendation by Alfasi (2019), we instructed participants to report their feeling "at this moment" when they filled out the scale. The internal inconsistency coefficient of the scale was 0.87.

5.2.4. The measure of social anxiety

Following previous research (Carruthers et al., 2019), we asked participants to report to what extent they felt the listed 10 emotions at this moment on the 11-point scale (0 = *not at all*, 10 = *very much*). The 10 emotions included happy, excited, anxiety, proud, fearful, nervous, scared, guilty, grateful, and enthusiastic, but only the score on the anxiety item was analyzed (Carruthers et al., 2019). A higher value represents higher social anxiety.

5.2.5. The measure of demographic information

As did in Study 1, we asked participants to report their gender and age after completing the above several scales. Because residential location did not significantly correlate with any variables in Study 1, we did not collect this information in Study 2. Additionally, considering that subjective social status in nature represented participants' subjective evaluations toward themselves and may be susceptible to the experimental manipulation, we thus did not collect this information either.

5.3. Procedure

Study 2 was conducted in the lab. At the appointed time, participants arrived at the lab in a group of 6–8 people. Upon arrival, we introduced the academic purpose of the study for participants, and they needed to assign the informed consent prior to the formal task. After that, we sent the video links to participants and instructed

them to view these short videos on their own cellphone. Then, participants successively reported their upward social comparison, perceived self-esteem, perceived anxiety, and demographic information. When they completed all tasks, we gave each participant 10 RMB as a return for their participation. We explained any questions raised by participants in a detailed way. The whole experiment lasted for about 25~30 min.

5.4. Results

5.4.1. Descriptive results in each condition

Means, standard deviations, and correlations among variables were provided in Table 3. As shown in Table 3, there were significantly negative correlations between upward social comparison and self-esteem in both conditions, $r_s = -0.27, -0.54$, respectively, $p_s < 0.05$. In contrast, there were significantly positive correlations between upward social comparison and social anxiety in both conditions, $r_s = 0.38, 0.23$, respectively, $p_s < 0.05$. Additionally, there were significantly negative correlations between self-esteem and social anxiety in both conditions, $r_s = -0.37, -0.32$, respectively, $p_s < 0.01$. On the whole, Study 2 showed the same descriptive-results pattern with Study 1.

5.4.2. The comparisons for the key variables between two conditions

We conducted several independent-samples *t*-tests to examine whether there were any differences for upward social comparison, self-esteem, and social anxiety between the experimental and control conditions. The results showed that participants in the experimental condition reported that they made more upward social comparisons when using social media than those participants in the control condition ($M_s = 4.16, 3.79$, respectively), $t(173) = 2.77$, $p = 0.006$, $d = 0.42$. The independent-samples *t*-test for self-esteem showed that participants in the experimental condition reported lower self-esteem than participants in the control condition ($M_s = 26.31, 28.47$, respectively), $t(173) = -3.14$, $p = 0.002$, $d = 0.47$. And the

independent-samples *t*-test for social anxiety showed that participants in the experimental condition reported higher social anxiety than participants in the control condition ($M_s = 3.73, 2.25$, respectively), $t(173) = 6.46$, $p < 0.001$, $d = 0.98$.

5.4.3. The mediating roles of upward social comparison and self-esteem

To test the possibly mediating roles of upward social comparison and self-esteem between social media exposure condition and social anxiety in Study 2, we coded social media exposure condition as a dummy variable (0 = control condition, 1 = experimental condition) and then applied the Macro PROCESS (model 6) by Hayes (2013) to examine the mediating mechanisms between social media use and social anxiety. The results showed that the overall model was significant, $R^2 = 0.09$, $F(3, 171) = 5.35$, $p = 0.0015$. As shown in Table 4, the direct effect between social media use and social anxiety was significant, $f = 0.67$, 95% CI [0.39, 0.94], suggesting the same result-pattern with Study 1. Additionally, Table 4 showed that the single-mediating role of upward social comparison, and the chain-mediating role of upward social comparison and self-esteem were small but both significant, $f_s = 0.06, 0.04$, respectively, 95% CI [0.01, 0.14], [0.01, 0.09], respectively, thus keeping in line with Study 1. In Study 2, an unexpected finding was that the mediating role of self-esteem between social media use and social anxiety was significant, $f = 0.09$, 95% CI [0.03, 0.21].

Specific coefficients were provided in Figure 2. As displayed in Figure 2, social media exposure condition had a significantly positive prediction on upward social comparison, $\beta = 0.38$, $p = 0.02$, and upward social comparison further had a significantly positive prediction on social anxiety, $\beta = 0.16$, $p = 0.03$, suggesting the mediating role of upward social comparison. Besides producing a significant prediction on social anxiety, upward social comparison also had a significantly negative prediction on self-esteem, $\beta = -0.39$, $p < 0.001$, and self-esteem in turn significantly and negatively predicted social anxiety, $\beta = -0.24$, $p = 0.001$, demonstrating the chain-mediating role of upward social comparison and self-esteem. In addition, social media exposure condition was found to have a significantly negative prediction on self-esteem, $\beta = -0.39$, $p = 0.008$, and self-esteem also had a significantly negative prediction on social anxiety, $\beta = -0.24$, $p = 0.001$, supporting the mediating role of self-esteem between social media exposure condition and social anxiety.

5.5. Discussion

In Study 2, we conducted a lab experiment in which we assigned participants to the experimental and control conditions, and then compared participants' social anxiety between the two conditions. In the experimental condition, participants were exposed to several wonderful and excited experiences shared by others, which actually also belonged to the content that they often view on social media platforms in daily life. In the control condition, participants were exposed to several short videos related to natural scenery. The results showed that participants viewing wonderful and excited experiences of others (the experimental condition) reported higher social anxiety than participants viewing natural scenery documentaries (the control condition), which suggested that social media use in daily life may

Table 3 Means, standard deviations, and correlations among variables in each condition of Study 2.

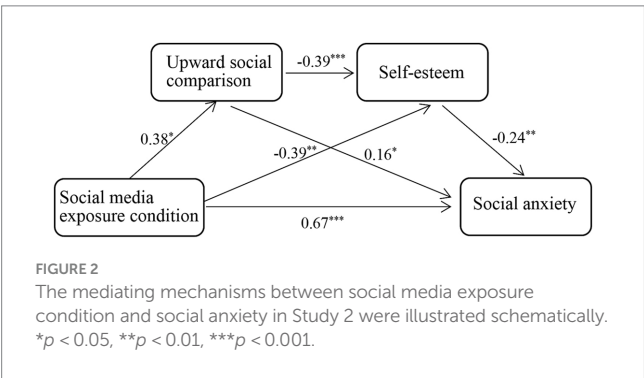
	<i>M</i>	<i>SD</i>	1	2	3	4
Experimental condition						
Upward social comparison	4.16	0.81	1			
Self-esteem	26.31	4.55	-0.27*	1		
Social anxiety	3.73	1.57	0.38**	-0.37**	1	
Age	19.48	0.40	0.01	-0.02	-0.08	1
Control condition						
Upward social comparison	3.79	0.93	1			
Self-esteem	28.47	4.56	-0.54**	1		
Social anxiety	2.25	1.45	0.23*	-0.32**	1	
Age	20.07	1.13	-0.07	-0.14	-0.02	1

M, mean; *SD*, standard deviation. * $p < 0.05$, ** $p < 0.01$.

Table 4 The direct and indirect effects between social media exposure condition and social anxiety in Study 2.

	Effect size	Boot SE	95%LLCI	95%ULCI	Ratio
Direct effect					
Social media exposure → social anxiety	0.67	0.14	0.39	0.94	77.90%
Indirect effect					
Social media exposure → upward social comparison → social anxiety	0.06	0.03	0.01	0.14	6.98%
Social media exposure → upward social comparison → self-esteem → social anxiety	0.04	0.02	0.01	0.09	4.65%
Social media exposure → self-esteem → social anxiety	0.09	0.04	0.03	0.21	10.47%

SE, standard error; LLCI, lower limit of confidence interval; ULCI, upper limit of confidence interval.



increase users' social anxiety. By demonstrating the causality between social media exposure and social anxiety, Study 2 thus provided compelling evidence for Hypothesis 1.

When social media exposure condition was coded as a dummy variable, we investigated the mediating roles of upward social comparison and self-esteem between social media exposure condition and social anxiety. The results revealed the single-mediating role of upward social comparison and the chain-mediating role of upward social comparison and self-esteem between social media exposure condition and social anxiety, thus providing collaborating evidence for our Hypothesis 2 and 3. Additionally, Study 2 also revealed an unexpected finding that self-esteem played a mediating role between social media exposure and social anxiety. We attempted to explain this unexpected finding in terms of the self-evaluation maintenance model (SEM) proposed by Tesser and Campbell (1980) and Tesser et al. (1988), which contends that an individual's self-esteem will be threatened when confronting other in-group members who are superior than the individual on ability domains. For example, previous research has found that college students may perceive lower self-esteem when they were exposed to other excellent college students (Blanton et al., 2000). In the experimental condition of Study 2, one of the presented short-videos documented a college graduate sharing the experiences that how she successfully passed the post-graduate entrance examination and entranced Tsinghua University, a top university that many Chinese college students have been longing for. Obviously, the protagonist is an excellent college student and this may yield a threaten for participants' self-esteem. As a consequence, participants in the experimental condition perceived lower self-esteem, and lower self-esteem further contributed to higher social anxiety. Considering this unexpected mediating role of self-esteem was not our major concern, we thus did not make further

investigation on this issue. We will keep an eye on this issue in future research.

There was another finding that may need our explanation. That is, considering that participants in the control condition just viewed natural scenery documentaries, we asked participants in both conditions to report the tendency of upward social comparison when using social media rather than viewing short videos. Even so, participants in the experimental condition still report significantly stronger upward social comparison than participants in the control condition. This difference, in nature, may reflected a priming effect, a widespread phenomenon in daily life (for a detailed discussion, see Higgins, 2012). Past research has suggested that when individuals are exposed a specific kind of stimuli, the knowledge accessibility relevant to the stimuli will be elevated and such knowledge constructs correspondingly get priority in the following information processing (Higgins et al., 1982; Higgins and Brendl, 1995; Bargh et al., 1996). For instance, the research regarding stereotypes demonstrates that individuals may form impressions or make decisions following the guidance of stereotypes when stereotypic knowledge constructs are accessible, but if counter-stereotypic knowledge constructs are accessible, individuals may also rely on counter-stereotypic information to process information (Power et al., 1996; Finnegan et al., 2015). With respect to the current research, participants in the experimental condition were presented with the content that college students often browse on social media platforms, and such videos were more likely to activate knowledge constructs relevant to social media use than natural scenery documentaries. As a result, those experiences suffering from upward social comparison may also be activated (Steers et al., 2014; Liu et al., 2017). From this perspective, it seemed to be reasonable and acceptable for the finding that participants in the experimental condition reported more upward social comparisons than participants in the control condition.

6. General discussion

In the represent research, we conducted two studies to investigate the effect of social media use on social anxiety and the mechanisms underlying the effect. The results showed that higher social media use intensity led to higher social anxiety. Besides the direct effect, social media use also increased social anxiety of social media users via the single-mediating role of upward social comparison and the chain-mediating role of upward social comparison and self-esteem. The research carried some implications in the field of social media use and social anxiety.

6.1. The effect of social media use on social anxiety

As we have discussed in the introduction section, although past research has consistently demonstrated the significant correlation between social media use and social anxiety, the causal evidence that higher social media use causes higher social anxiety is still scarce (Davidson and Farquhar, 2014; Xie and Karan, 2019; Jiang and Ngien, 2020; Sternberg et al., 2020). The current research extended prior research in the field of social media use and social anxiety by providing the first evidence that excessive social media use could increase social anxiety. Moreover, in Study 2, participants were temporarily exposed to the content that they often view on social media platforms or the natural scenery documentaries that they are less likely to view on social media platforms. The results showed that, even this temporary exposure in the artificial laboratory-setting, still induced higher social anxiety of participants, which significantly strengthened our confidence to conclude that social media use will increase social anxiety. Interestingly, it has been widely documented that individuals with social anxiety are inclined to avoid the face-to-face interaction and construct their social networks on social media platforms, so that they can alleviate their social anxiety (Shepherd and Edelman, 2005; Caplan, 2007; Carruthers et al., 2019). However, according to our results, social anxious individuals may experience less social anxiety in a specific online interaction, but their social anxiety may be further exacerbated in the long run. In other words, the online interaction indeed cannot replace the face-to-face interaction.

We noticed that when the indirect effects were taken into account, the direct effect of social media use on social anxiety was still significant across two studies, which was inconsistent with previous research by Jiang and Ngien (2020). We speculated that this inconsistency may be because the participants included in the research were all college students. Specifically, compared to other age groups, college students often have more free time and also spend more time on various of social media platforms (She et al., 2023). And correspondingly, prior research suggests that social anxiety actually is quite common among college students and the majority of them have experienced social anxiety in social situations from time to time (Purdon et al., 2001). For individuals with social anxiety, when encountering some cues relevant to social interactions, they may spontaneously imagine an anxiety-provoking social situation and look at themselves from an observer's perspective, which will further increase their social anxiety (Hackmann et al., 2000; Hirsch et al., 2004; Morrison and Heimberg, 2013). In the current research, maybe our explicit declaration that participants would complete the survey relevant to social media use and social anxiety immediately induced college students' social anxiety in both studies, resulting in relatively strong direct effect of social media use on social anxiety. Of course, we must realize that this explanation is tentative and premature, and needs further investigation in future work.

6.2. The mediating roles of upward social comparison and self-esteem

Consistent with previous research, the present research found that individuals with higher social media use intensity experienced more upward social comparisons, and upward social comparisons further increased social anxiety (Jiang and Ngien, 2020). In simple words,

social media use would increase users' social anxiety via the mediating role of upward social comparison. It should be pointed out, although prior research has revealed a series of negative effects on mental health, several studies have revealed some factors that may alleviate the negative effects of upward social comparison on mental health (Cramer et al., 2016; Kong et al., 2021; Latif et al., 2021). For example, prior research indicates that if individuals realize that they are making social comparison with superior others, they may hold positive evaluations for themselves and tend to believe they can do as well as the reference target (Collins, 2000; Suls et al., 2002). Following this logic, in daily life, we may can relieve social anxiety of social media users by explicitly reminding them that they are suffering from upward social comparison when using social media. Besides, we also can alleviate social anxiety of social media users by encouraging them to use social media with a self-improvement motive, because past research has suggested that, for individuals with a self-improvement motive, even exposed to superior others, they are still inclined to believe that they can improve the ability of themselves (Lockwood and Kunda, 1997; Cramer et al., 2016).

Beside the single-mediating role of upward social comparison, we also found that social media use could increase social anxiety through the chain-mediating role of upward social comparison and self-esteem. This mediation path inspired us that we may can alleviate social anxiety of social media users by elevating their self-esteem. For instance, past research found that positive feedback received from social media platforms enhanced users' self-esteem while negative feedback received from social media platforms decreased users' self-esteem (Valkenburg et al., 2006). And compared to casual acquaintances, individuals are more likely to receive feedback from close friends (Carr et al., 2016). Thus, for individuals with social anxiety, it is better for them to construct a "small but intimate" online social network than a "large but loose" online social network. Because the former enables users to receive more positive feedback from close friends, which will be helpful for alleviating social anxiety. Moreover, close friends are considered to be a primary source of social support and social support is an important protective-factor for self-esteem (Goodwin et al., 2004; Rozzell et al., 2014). On a broader level, considering that social media use may increase users' social anxiety through decreasing self-esteem, those measures that are helpful for elevating self-esteem may deserve an attempt to examine whether they also can relieve social anxiety of social media users.

6.3. Limitations and future work

There were several limitations existing in the current research. Firstly, the indirect effect was relatively small in comparison with the direct effect across two studies. As we have explained in the previous section, this may be because some cues relevant to social interactions immediately induced social anxiety of college students (e.g., the instruction that we explicitly told participants that they would take part in a survey about social media use and social anxiety), resulting in the relatively small indirect effect across two studies. Despite this, considering that previous research has revealed similar results-pattern with the current research (Jiang and Ngien, 2020), we still have confidence for our findings and their implications for deepening our understanding about how social media use will increase social anxiety of social media users.

Secondly, in Study 2, we revealed an unexpected mediating-effect that social media use produced an effect on social anxiety via the mediating role of self-esteem. According to our explanation, this

unexpected effect may result from presenting an introduction about an excellent undergraduate who had successfully entered Tsinghua University. That means, viewing different kinds of content on social media might have different psychological consequences for social media users. Additionally, the event that an individual successfully entered Tsinghua University may occasionally raise social status concerns of participants, which in turn increased social anxiety of participants. Given that, in future work, we can attempt to explore whether the effect of social media use on social anxiety will vary with the presented content on social media.

Thirdly, excessive social media use has been found to have close connections with a series of negative mental consequences. However, to date, there is little causal evidence that social media use will increase social anxiety. So, the primary goal of the present research was to provide causal evidence for whether and how social media use will increase social anxiety. Nevertheless, we must realize that prior research has shown that individuals with social anxiety are more likely to use social media to compensate for their social deficit (Lee-Won et al., 2015; Stănculescu and Griffiths, 2022), displaying the reversed pattern with the present research. For this phenomenon, we speculate that the relationship between social media use and social anxiety may not be a simple causality in a single direction. Rather, there may be a mutually reinforcing relationship between social media use and social anxiety—individuals with social anxiety tend to excessively use social media, which will further exacerbate their social anxiety. Considering this possibly mutually reinforcing relationship between social media use and social anxiety, it may be necessary to develop a unified theoretical framework to interpret this relationship.

Fourthly, in Study 2, the baseline social anxiety of participants was not taken into account, which may constitute a confounding factor for our findings. Because prior literature has indicated that individuals with high social anxiety are more vulnerable to risk factors in external environment than those with low social anxiety (e.g., Mitchell and Schmidt, 2014). On a broad level, to thoroughly answer the question whether social media use will elevate social anxiety, we need to take possible individual differences into account in future research (e.g., lower trait self-esteem individuals are more likely to suffer from social anxiety than higher trait self-esteem individuals; Fatima et al., 2017). Given such potential limitations, in future research, we need to replicate our findings in both community and clinical samples, and compare potential results-pattern differences between the two samples.

Finally, due to the regulation of Chinese government, many social media platforms popular in Western society fail to provide service in China-Mainland. Correspondingly, those social media platforms popular in China-Mainland actually have a relatively small user base. Given that, although the current research showed the similar results-pattern with previous research in Western society (Davidson and Farquhar, 2014; Xie and Karan, 2019; Sternberg et al., 2020), it may be still necessary for us to examine to what extent our findings can be generalized to Western society.

7. Conclusion

By conducting a questionnaire survey (Study 1) and a lab experiment (Study 2), the current research investigated the effect of social media use on social anxiety of social media users, and the underlying mechanisms. The results demonstrated that higher social media user intensity would induce higher social anxiety of social media

users. In addition to the direct effect, higher social media use would lead to higher upward social comparison and higher upward social comparison would increase social anxiety. Besides, upward social comparison induced by social media use may also have a detrimental effect self-esteem, which further contributed to increasing social anxiety. The current research deepens our understanding of how social media use will increase social anxiety and also carries implications for how we can alleviate social anxiety induced by excessive social media use.

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 humans were approved by the Ethics Committee of Taishan University. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

FY provided the research design and wrote the manuscript. ML collected the data, involved in the research, and conducted data analyses. YH corroborated with FY to conduct data analyses. All authors contributed to the article 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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The role of personality traits in mediating the relation between fear of negative evaluation and social interaction anxiety

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Introduction: Social interaction anxiety and fear of negative evaluation have many maladaptive outcomes and, in order to counteract their effects, it is essential to identify those psychological or social factors that make people vulnerable to them. One of these factors is the individual's personality structure: some personality traits increase the individuals' vulnerability to symptoms of social anxiety, while others protect them.

Methods: The aim of this paper is to analyse the role of HEXACO personality traits in mediating the relationship between fear of negative evaluation and social anxiety, in a sample of 352 cadets from the Land Forces Academy of Sibiu. The relationships between these concepts were analysed using structural equation modeling (SEM) in several hypothetical models, two of which were ultimately validated.

Results: In the first model, the fear of negative evaluation has an indirect effect on social interaction anxiety through the mediation of extraversion, conscientiousness, and altruism, separately. Furthermore, extraversion, conscientiousness, and altruism play a serial mediating role in the association between the fear of negative evaluation and social interaction anxiety. In the second model, the fear of negative evaluation has an indirect effect on social interaction anxiety through the mediation of social boldness, liveliness, and organization, separately, but not through altruism. Social boldness, liveliness, and organization played a serial mediating role in the relationship between the two constructs, while altruism moderated the relationship between liveliness, organization, and social interaction anxiety.

Discussion: Analysing the relationship between the individuals' personality traits, social anxiety, and fear of negative evaluation facilitated the identification of ways to cultivate desirable behaviours in social environments typified by compliance, discipline, uniformity, and rigor.

KEYWORDS

fear of negative evaluation, social interaction anxiety, personality traits, personality facets, serial mediation

1. Introduction

Social anxiety is one of the most commonly experienced forms of anxiety; throughout their life, most individuals have experienced low to moderate anxiety symptoms in various social situations. Their role is to energize the individual in social interactions or situations where he/she has to perform in front of or with others, but they must dissipate after the interactions or

situations have ceased. If they do not disappear, these symptoms end up profoundly affecting ever larger areas of the individual's life.

Certain cognitive models support the idea that social anxiety is generated to a significant extent by fears of perceived negative evaluation; as a latent construct, fear of negative evaluation is partially inherited and is closely correlated with trait anxiety, social avoidance, general fears and psychopathologies (Carleton et al., 2007).

Therefore, fear of negative evaluation and social interaction anxiety are two strongly correlated constructs and they have many maladaptive outcomes: depression (Wang et al., 2012; Kim and Duval, 2022), poor academic adjustment (Archbell and Coplan, 2022) alcohol-related problems and alexithymia (Lyvers et al., 2018; Kumar et al., 2022; Caumiant et al., 2023), interpersonal relationships problems (Tonge et al., 2020; Alexandru, 2022) isolation and social avoidance (Lee et al., 2022; Lyngdoh et al., 2022; Chen et al., 2023). Recently, increasingly extensive use of social media, connectivity, and high digital visibility are associated with high levels of social anxiety (Lee-Won et al., 2015; Carruthers et al., 2019; Rad et al., 2019, 2020). Fayaz et al. (2021), for example, show that people with an intense fear of negative evaluation become compulsive social media users.

Personality traits play significant roles in the emergence, maintenance, and development of social anxiety throughout an individual's life (Costache et al., 2020; Chung et al., 2022). Some personality traits facilitate the onset of social anxiety symptoms, while others protect the individual from them. Studies that analyze the relationship between personality traits, social interaction anxiety and fear of negative evaluation are relatively few, because most of the researchers prefer to focus on analyzing the role of traits in the etiology of anxiety disorders. Therefore, our study set out as its main objective to examine this relationship; since social interaction anxiety and fear of negative evaluation are strongly correlated, we set out to analyze the possibility that personality traits play a mediating role between the two, using structural equation modeling (SEM) as the method of statistical analysis.

This research used the HEXACO model of personality developed by Ashton and Lee (2007), which consists of six personality dimensions, namely honesty-humility (H), emotionality (E), extraversion (X), agreeableness (A), conscientiousness (C) and openness to experience (O), to which the interstitial trait called altruism (versus antagonism) has been added.

In order to determine which of the six personality traits could be entered into the structural model, a hierarchical regression analysis was performed, with social interaction anxiety as a criterion variable and the fear of negative evaluation, the six personality traits and the interstitial facet of altruism as independent variables. The results indicated the fact that only extraversion, conscientiousness and altruism predict the level of social interaction anxiety, after controlling the influence of the fear of negative evaluation. These were the variables entered in the SEM analysis.

As personality traits, extraversion and conscientiousness each consist of four facets. The extraversion facets are: social self-esteem, social boldness, sociability, and liveliness. The facets associated with conscientiousness are: organization, diligence, perfectionism, and prudence. In the next stage of the research, we set out to analyze the possibility that these facets also play a mediating role in the relationship between social interaction anxiety and fear of negative evaluation. In order to determine which of these facets could be included in an appropriate structural model, a hierarchical

regression analysis was performed, with social interaction anxiety as criterion variable and the fear of negative evaluation, the eight facets of personality listed above and the interstitial facet of altruism as independent variables. The results indicated the fact that only social boldness, liveliness, organization, and altruism predict the level of social interaction anxiety, after controlling the influence of the fear of negative evaluation. These were the variables entered in the SEM analysis.

During data processing, several possible models of the relationship between these variables were proposed and tested. The two models that met the validity criteria are presented in this paper.

2. Social interaction anxiety

Social anxiety can manifest in two forms: as social interaction anxiety, when the individual experiences anxiety when interacting with others in different social situations (eating, walking, talking etc), or as performance anxiety, when they are being observed and evaluated by others while performing a task (Mattick and Clarke, 1998). A person may feel anxious in one or both types of situations. Individuals with a very high level of social interaction anxiety usually receive the diagnosis of social anxiety disorder, which implies an intense fear of social interactions or of situations involving observation by others (Heimberg et al., 1992). One model that explains very clearly the psychological processes underlying social anxiety disorder is the cognitive model of social anxiety proposed by Clark and Wells (1995). The model describes six factors that perpetuate social anxiety:

1. *Maladaptive social-evaluative beliefs*; these are of three types: (a) high standards for social performance (b) conditional beliefs regarding social evaluation and (c) unconditional beliefs about the self;
2. *Self-focus attention*: the anxious person turns their attention inward to monitor their physical reactions, emotions, and thoughts in social situations or when they have to solve a task in front of others; with people suffering from social anxiety, this mechanism results in the accentuation of negative beliefs about their social performance;
3. *Attention toward threat in the environment* refers to the tendency of anxious people to detect threatening stimuli very quickly (facilitation bias), to remain anchored to them (difficulty of disengagement) or to move away quickly after detecting them (avoidance bias);
4. *Anticipatory processing* occurs when the anxious person experiences intrusive and persistent negative thoughts about themselves and their past failures, expects rejection from others before a social event or poor performance before solving a task in front of others;
5. *Post-event processing* is a form of rumination that refers to the retrospective analysis of one's own performance in social situations; in the case of anxious people, this analysis is vitiated by maladaptive beliefs about oneself and one's own performance (Katz et al., 2019);
6. *Safety behaviors* are mainly mental strategies by which the anxious person tries to prevent the consequences they fear from occurring or to minimize their effects. They are not only ineffective, but also harmful in the long term, because "they

prevent the individual from discovering that the feared outcome was unlikely and/or not catastrophic; they intensify self-focus; they may increase feared symptoms; they can draw attention to feared symptoms; and they can also interfere with the social interaction” (Leigh et al., 2021, p. 2).

The six factors described above can affect an individual’s social and interpersonal behavior in different proportions and combinations, even if the individual does not have a diagnosis of social anxiety disorder (Sagliano et al., 2014; Heeren et al., 2020; Seinsche et al., 2023).

3. Fear of negative evaluation

Fear of negative evaluation is included in all studies as a main indicator of social anxiety (Weeks et al., 2010; Van der Molen et al., 2014; Preston et al., 2023). It is a psychological state characterized by an intense fear of being judged, criticized, humiliated or just perceived negatively by others, “apprehension about others’ evaluations, distress over their negative evaluations, avoidance of evaluative situations and the expectation that others would evaluate oneself negatively” (Watson and Friend, 1969, p. 449).

Individuals with high levels of fear of negative evaluation often experience extreme anxiety and discomfort in social situations, which triggers avoidance behaviors or intense stress (Reichenberger et al., 2018). As symptoms, individuals may experience a range of unpleasant states physically (Weeks and Zoccola, 2016), intellectually (Maresh et al., 2017), emotionally, and behaviorally (Takagishi et al., 2016). Physical symptoms can include rapid heartbeat, sweating, trembling, nausea, and difficulty breathing. Emotionally, people may feel intense fear, embarrassment, or self-consciousness. Behaviorally, they may avoid social situations, struggle with public speaking, or have difficulty initiating or maintaining conversations.

The intensity and modes of manifestation of the fear of negative evaluation may be influenced by educational factors (Downing et al., 2020; Salazar-Ayala et al., 2021; Busch et al., 2023), by the individual’s life experiences (Liu T. et al., 2022; Lucero et al., 2022), and by cultural and societal norms that place a high value on social acceptance and conformity (Vaswani et al., 2022).

In the context of professional life, fear of negative evaluation is positively correlated with interview anxiety and social-evaluative workplace anxiety (Zhang et al., 2022). In educational contexts, some research results indicate significant differences between women and men, as well as between undergraduate and graduate students. Thus, “female students showed more fear of negative evaluation and social anxiety than male students; similarly, undergraduate students showed more social anxiety” (Iqbal and Ajmal, 2018, p. 49).

4. Personality traits and social anxiety

Social anxiety has a positive relationship with neuroticism and is negatively associated with extraversion while its relationship with conscientiousness, agreeableness, and openness to experience is a mixed one.

Neuroticism is a strongly genetically determined personality trait that predisposes the individual to the development of mood disorders

or social anxiety disorder or to the manifestation of symptoms specific to them but at a non-clinical level (Scaini et al., 2014; Stein et al., 2017; Vinograd et al., 2020). Newby et al. (2017) found that self-consciousness, vulnerability, and impulsiveness as facets of neuroticism predict interaction anxiety. Allan et al. (2017) studied the role of vulnerabilities to emotional distress in the relationship between neuroticism and social anxiety and found that inhibitory intolerance of uncertainty, fear of negative evaluation, and anxiety sensitivity to social concerns significantly influence this relationship. Also, in Clague and Wong’s (2023) study, neuroticism was positively associated with social-evaluative beliefs, self-focus, and post-event processing as components of social anxiety.

Extraversion is generally associated with low levels of social anxiety (Watson et al., 2005; Naragon-Gainey et al., 2009). Duffy et al. (2018) show that people with a high level of extraversion expect and relate positively to changes in affective experience following social interaction, while people with a low level of extraversion have negative expectations from social interactions and anticipate negative evaluations from others and therefore avoid them. However, in the experiment conducted by these authors, participants “with the most fear about being negatively evaluated do better: their partners find them more skilled than their low-extraversion counterparts who do not share this fear of negative evaluation” (Duffy et al., 2018, p. 17). Therefore, people with a high level of fear of negative evaluation seem to put more effort into their social interactions in order not to give others reasons to evaluate them negatively.

Spinhoven et al. (2014) analyzed the relationship between lower level facets of extraversion (positive affectivity, sociability and activity), depression and social anxiety and found a significant association between low sociability, lack of positive affectivity and trait social anxiety. People with high levels of extraversion and openness have an increased tendency “to seek external support, actively reconstruct stressful events, provide alternative cognitive strategies for rumination, and form harmonious interpersonal relationships, and all these will make them less prone to anxiety” (Liu et al., 2023a, p. 2).

In the study conducted by Costache et al. (2020) neuroticism and extraversion had the highest ability to discriminate between the social anxiety disorder group and the control group of healthy individuals. These authors identified a low level of conscientiousness in patients with social anxiety disorder, a moderate correlation of agreeableness and conscientiousness with the psychopathology included in the study and the total lack of association between openness and anxiety and depression symptoms.

The combination of high levels of neuroticism and low levels of extraversion is found in many emotional disorders, including social anxiety disorder and depression (Naragon-Gainey et al., 2014). In the study conducted by Kaplan et al. (2015), social anxiety was positively correlated with neuroticism and negatively with extraversion, with confidence as a facet of agreeableness and with self-efficacy as a facet of conscientiousness; also, a high level of openness to experience was correlated with a decrease in the level of social anxiety associated with low trust.

In their meta-analytic study, Kotov et al. (2010) studied the relationship between the Big Five personality traits and specific depressive, anxiety, and substance use disorders (SUD) in adult samples and found that all groups with these disorders were characterized by high levels of neuroticism and low levels of conscientiousness. Many of these disorders involved low levels of

extraversion while agreeableness and openness were very weakly or not at all associated with them.

Watson and Naragon-Gainey (2014) found that conscientiousness, agreeableness, and openness have a weak association with emotional disorders and have a very low contribution to predicting their symptoms, even when the influence of neuroticism and extraversion is controlled.

Regarding altruism, there are few studies relating this concept to social anxiety or fear of negative evaluation. Among the effects of altruism on individuals, Post (2005) mentions positive social integration, distraction from personal problems and from anxiety. It was demonstrated that individuals who display helping behavior (as a type of altruism) have a lower score of fear of negative evaluation than individuals who do not help in some situations (Karakashian et al., 2006).

5. Materials and methods

5.1. Participants and procedure

The sample consisted of 352 first-year students at “Nicolae Bălcescu” Land Forces Academy of Sibiu, 149 girls (42.32%) and 203 boys (57.67%), with ages between 18 and 21 years. All students enrolled in the discipline *Military Psycho-Sociology* in the first semester completed the scales used in this study as a part of a seminar activity between October and December 2022. Students were asked to give written consent for their responses to these scales to be processed and the results to be used in this article, with the assurance that responses would be anonymized. In order to better understand the processing of their answers, the students were briefly presented the statistical procedures used. Responses from students who did not give their consent were excluded from the processing.

5.2. Instruments

1. *Social Interaction Anxiety Scale (SIAS)* is a 20 items scale developed by Peters (2000) to measure social anxiety triggered by communication or interaction with other people that may involve scrutiny. The participants need to give their answers on a five-point Likert scale, from (0) Not at all characteristic or true of me to (4) Extremely characteristic or true of me. The Cronbach's alpha coefficient for the entire scale was 0.92.
2. *Brief Fear of Negative Evaluation Scale* is a 12-items version of the original scale developed by D. Watson and R. Friend in 1969. This brief version was developed by Leary (1983) and uses a five-point Likert scale, from (1) Not at all characteristic of me to (5) Extremely characteristic of me. The Cronbach's alpha coefficient for the entire scale was 0.84.
3. *Personality traits and facets* were measured using *HEXACO-100* personality inventory (Lee and Ashton, 2018), a 100-item measure using a five-point Likert scale, from (1) strongly disagree to (5) strongly agree. This inventory consists of six scales: honesty-humility (H), emotionality (E), extraversion (X), agreeableness (A), conscientiousness (C), and openness to experience (O) and an interstitial scale, entitled altruism (versus antagonism). The Cronbach's alpha coefficient for the

entire inventory was 0.88, and it ranged from 0.77 to 0.83 for the main six scales.

5.3. Data analysis approach

The statistical software package SPSS 28.0 with Amos 28.0 was used for data analysis. The relationships between these constructs were analyzed by structural equation modeling (SEM; ML method, 5,000 Bootstrap samples, 95% CI).

In order to determine the adequacy of the models, goodness-of-fit indexes and path coefficients were analyzed. In the first stage of structural equation modeling, a set of analyses was applied to determine the discriminant and convergent validity of the constructs included in the hypothesized models, according to the recommendations of Anderson and Gerbing (1988). A first analysis was aimed at identifying those items with an acceptable level of loading for social interaction anxiety, fear of negative evaluation and altruism scales. For the HEXACO personality traits scales, the Cronbach alpha and composite reliability coefficients were calculated.

The second analysis aimed at identifying those personality traits that have a mediating effect on the relationship between fear of negative evaluation and social interaction anxiety (first structural model), as well as those facets of the previously identified traits that also exert this mediating effect (second structural model). Having identified some defensible measurement models, SEM analyses were conducted to test the proposed relationships and assess them against fit indices proposed by Byrne (2006), Hu and Bentler (1999), and Schumacker and Lomax (2016).

6. Results

Table 1 presents the items retained in the scales measuring social interaction anxiety, fear of negative evaluation and altruism, together with alpha reliability (α), composite reliability (CR) and average variance extracted (AVE) for each scale. Items with loadings lower than 0.60 were removed from the scale so that the AVE value reached the acceptable threshold of 0.50 (Peterson et al., 2020).

6.1. First structural model

In order to determine which of the personality traits could be entered into the structural model, a hierarchical regression analysis was performed, with social interaction anxiety as a criterion variable and the fear of negative evaluation, the six personality traits and the interstitial facet of altruism as independent variables.

In the first step, *fear of negative evaluation* accounted for 52% of the variance and the model was significant [$F(1,350) = 387.64$, $p < 0.001$], with *fear of negative evaluation* as significant predictor ($\beta = 0.72$, $p < 0.001$).

By adding the *personality traits* as independent variable in the second step of the regression model, and by controlling the influence of the *fear of negative evaluation*, the predictive value of the second model increased to 61% ($\Delta R^2 = 0.084$; $F(2,348) = 37.47$, $p < 0.001$), with *fear of negative evaluation* ($\beta = 0.58$, $p < 0.001$), *extraversion* ($\beta = -0.22$, $p < 0.001$) and *conscientiousness* ($\beta = -0.14$, $p < 0.001$) as significant predictors.

TABLE 1 Items loadings, composite reliability (CR), average variance extracted (AVE) and alpha Cronbach (α) for the scales measuring social interaction anxiety, fear of negative evaluation and altruism.

Scales	Item loading	CR	AVE	α
Social Interaction Anxiety (SIA)		0.94	0.50	0.93
1. I have difficulty making eye-contact with others.	0.750			
2. I find it difficult mixing comfortably with the people I work with.	0.694			
3. I tense- up if I meet an acquaintance in the street.	0.782			
4. When mixing socially, I am uncomfortable	0.735			
5. I feel tense if I am alone with just one person.	0.728			
6. I have difficulty talking with other people.	0.720			
7. I worry about expressing myself in case I appear awkward.	0.794			
8. I find it difficult to disagree with another's point of view.	0.657			
9. I have difficulty talking to a potential romantic partner.	0.709			
10. I find myself worrying that I will not know what to say in social situations.	0.797			
11. I am nervous mixing with people I do not know well.	0.698			
12. I feel I'll say something embarrassing when talking.	0.811			
13. When mixing in a group, I find myself worrying I will be ignored.	0.741			
14. I am tense mixing in a group.	0.828			
Fear of negative evaluation (FNE)		0.92	0.62	0.92
1. I worry about what other people will think of me even when I know it does not make any difference.	0.778			
2. I am frequently afraid of other people noticing my shortcomings.	0.794			
3. I am afraid others will not approve of me.	0.749			
4. I am afraid that people will find fault with me.	0.786			
5. When I am talking to someone, I worry about what they may be thinking about me.	0.884			
6. I am usually worried about what kind of impression I make.	0.695			
7. I often worry that I will say or do the wrong things.	0.852			
Altruism (Alt)		0.80	0.57	0.62
1. I try to give generously to those in need.	0.681			
2. It would not bother me to harm someone I did not like. (R)	0.747			
3. People see me as a hard-hearted person. (R)	0.841			

Items indicated with R are reverse-keyed items.

In the third step, *altruism* was added to the regression model resulting in an increase of the predictive value of the model to 62% ($\Delta R^2 = 0.016$; $F(1,347) = 15.19$, $p < 0.001$), after controlling the influence of *the fear of negative evaluation* and *personality traits*, with *altruism* ($\beta = -0.13$, $p < 0.001$), *fear of negative evaluation* ($\beta = 0.57$, $p < 0.001$), *extraversion* ($\beta = -0.21$, $p < 0.001$) and *conscientiousness* ($\beta = -0.10$, $p = 0.008$) as significant predictors. As observed, the power of conscientiousness to predict the level of social interaction anxiety decreases when altruism is introduced in the model as an independent variable. Therefore, the above-mentioned psychological constructs have been introduced into the SEM model. Considering the values provided by the hierarchical regression analysis, the following hypotheses regarding the relationships between the measured constructs were formulated:

H1: Fear of negative evaluation is positively associated with social interaction anxiety.

H2: Fear of negative evaluation is negatively associated with extraversion, conscientiousness, and altruism.

H3: Extraversion is positively associated with conscientiousness.

H4: Conscientiousness is positively associated with altruism.

H5: Extraversion, conscientiousness, and altruism are negatively associated with social interaction anxiety.

H6: Extraversion, conscientiousness, and altruism play a serial mediating role in the association between fear of negative evaluation and social interaction anxiety.

Table 2 shows the means, standard deviation, and correlations between the variables included in this model.

In the hypothesized model, fear of negative evaluation was entered as the independent variable (IV), social interaction anxiety was entered as the dependent variable (DV), extraversion was entered as first mediator (M1), conscientiousness was entered as second mediator (M2), and altruism was entered as third mediator (M3). According to this model, there are five possible pathways linking fear of negative

TABLE 2 Correlation matrix between social interaction anxiety, fear of negative evaluation, extraversion, conscientiousness, and altruism.

	Variables	<i>M</i>	<i>SD</i>	1	2	3	4	5
1	Social interaction anxiety (SIA)	0.87	0.82	(0.93)				
2	Fear of negative evaluation (FNE)	0.60	0.67	0.725**	(0.92)			
3	Extraversion (Ext)	3.80	0.50	−0.536**	−0.409**	(0.82)		
4	Conscientiousness (Con)	3.91	0.47	−0.444**	−0.322**	0.496**	(0.81)	
5	Altruism (Alt)	4.16	0.68	−0.370**	−0.239**	0.271**	0.354**	(0.62)

N = 352; Extraversion, Conscientiousness = HEXACO Personality Traits; Altruism = HEXACO Interstitial personality facet; Values of the internal consistency alphas are displayed in round brackets. **p* < 0.05. ***p* < 0.01. The composite reliability coefficient of both extraversion and conscientiousness scales is 0.87.

TABLE 3 Goodness-of-fit of the first structural model.

Fit index	χ^2/df	IFI	CFI	TLI	GFI	NFI	RFI	AGFI	SRMR	RMSEA
Suggested value	0–3	> 0.90	> 0.95	> 0.95	> 0.95	> 0.95	> 0.90	> 0.90	< 0.08	< 0.06
Values of this study	2.18	0.99	0.99	0.97	0.99	0.99	0.96	0.96	0.016	0.058

evaluation to social interaction anxiety – one direct path and four indirect paths. As expected, the direct path linked fear of negative evaluation to social interaction anxiety. The first indirect pathway was through extraversion (M1), the second indirect pathway was through conscientiousness (M2) and the third indirect pathway was through altruism (M3). The fourth indirect pathway was through extraversion (M1), conscientiousness (M2) and altruism (M3), in serial.

All the values of the tested model reached the suggested values, indicating that the model is adequate (Table 3). The validated model is presented in Figure 1.

6.2. Hypotheses tested

As illustrated in Table 4, the hypotheses H1 to H5 and the relationships paths were supported by the SEM results. Therefore:

- Fear of negative evaluation significantly and positively predicted social interaction anxiety ($\beta = 0.57$, $p < 0.001$), hence H1 was verified;
- Fear of negative evaluation significantly and negatively predicted extraversion ($\beta = -0.41$, $p < 0.001$), conscientiousness ($\beta = -0.14$, $p = 0.004$), and altruism ($\beta = -0.14$, $p = 0.008$), therefore H2 was supported;
- Extraversion was positively associated with conscientiousness ($\beta = 0.44$, $p < 0.001$) and conscientiousness was positively associated with altruism ($\beta = 0.31$, $p < 0.001$), therefore H3 and H4 were supported;
- Extraversion ($\beta = -0.21$, $p < 0.001$), conscientiousness ($\beta = -0.11$, $p = 0.007$), and altruism ($\beta = -0.14$, $p < 0.001$) significantly and negatively predicted social interaction anxiety, hence H5 was supported.

Based on these results, we can conclude that fear of negative evaluation can have an indirect effect on social interaction anxiety through the mediation of extraversion, conscientiousness, and altruism, separately.

To test H6, which states that extraversion, conscientiousness, and altruism play a serial mediating role in the association between fear of

negative evaluation and social interaction anxiety, the mediation chain FNE--->Ext--->Con--->Alt--->SIA has been specified and tested in Amos 28.0, using the Bootstrapping procedure (95%CI, 5,000 random samples). The results were as follows: $\beta = 0.007$, BootLL = 0.002, BootUL = 0.013, $p < 0.001$. Based on these results, it can be stated that extraversion, conscientiousness, and altruism play a serial mediating role in the association between fear of negative evaluation and social interaction anxiety; therefore, H6 was supported. The values of the effects of indirect path relationships of this model are presented in Table 5.

6.3. Second structural model

In order to determine which facets of extraversion (social self-esteem, social boldness, sociability, and liveliness) and conscientiousness (organization, diligence, perfectionism, and prudence) could be included in an appropriate structural model, a hierarchical regression analysis was performed, with social interaction anxiety as criterion variable and the fear of negative evaluation, the eight facets of personality listed above and the interstitial facet of altruism as independent variables.

In the first step *fear of negative evaluation* accounted for 52% of the variance and the model was significant [$F(1,350) = 387.65$, $p < 0.001$], with *fear of negative evaluation* as significant predictor ($\beta = 0.72$, $p < 0.001$).

By adding the *personality facets* as independent variable in the second step of the regression model, and by controlling the influence of the *fear of negative evaluation*, the predictive value of the second model increases to 61% ($\Delta R^2 = 0.09$; $F(3,347) = 27.80$, $p < 0.001$), with *fear of negative evaluation* ($\beta = 0.56$, $p < 0.001$), *social boldness* ($\beta = -0.13$, $p = 0.001$), *liveliness* ($\beta = -0.16$, $p < 0.001$) and *organization* ($\beta = -0.15$, $p < 0.001$) as significant predictors.

In the third step, *altruism* was added to the regression model, resulting in an increase of the predictive value of the model to 63% ($\Delta R^2 = 0.017$; $F(1,346) = 15.81$, $p < 0.001$), after controlling the influence of the *fear of negative evaluation* and *personality facets*, with *altruism* ($\beta = -0.14$, $p < 0.001$), *fear of negative evaluation* ($\beta = 0.55$, $p < 0.001$), *social boldness* ($\beta = -0.14$, $p < 0.001$), *liveliness* ($\beta = -0.12$, $p = 0.002$) and *organization* ($\beta = -0.12$, $p = 0.003$) as significant predictors. As it can be observed from the results of the regression

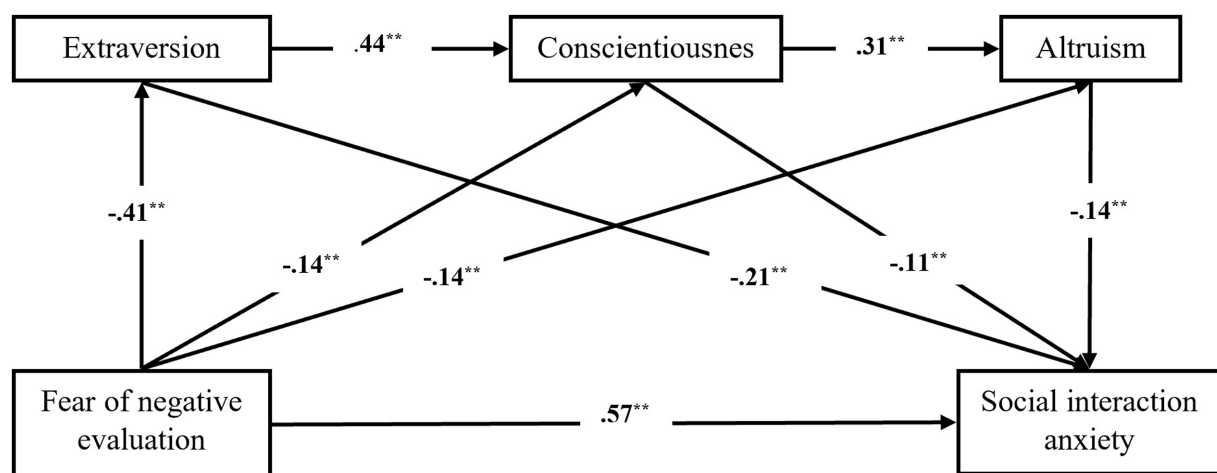


FIGURE 1

The path diagram of the relationships between fear of negative evaluation, extraversion, conscientiousness, altruism, and social interaction anxiety.

TABLE 4 The test results of path relationships between fear of negative evaluation, social interaction anxiety, extraversion, conscientiousness, and altruism.

Hypothesis	Path	Unstandard estimates	S.E.	C.R.	Sig.	Standard estimates	LL 95%CI	UL95%CI	Hypothesis test
H1	FNE--->SIA	0.466	0.030	15.634	***	0.572	0.493	0.640	Supported
H2	FNE--->Ext	-0.251	0.030	-8.389	***	-0.409	-0.494	-0.315	Supported
	FNE--->Con	-0.083	0.029	-2.859	0.004	-0.144	-0.243	-0.035	
	FNE--->Alt	-0.117	0.044	-2.672	0.008	-0.139	-0.255	-0.026	
H3	Ext--->Con	0.412	0.047	8.713	***	0.437	0.345	0.524	Supported
H4	Con--->Alt	0.446	0.075	5.923	***	0.309	0.195	0.410	Supported
H5	Ext--->SIA	-0.281	0.052	-5.380	***	-0.213	-0.304	-0.128	Supported
	Con--->SIA	-0.149	0.056	-2.682	0.007	-0.106	-0.177	-0.029	
	Alt--->SIA	-0.135	0.034	-3.932	***	-0.139	-0.221	-0.053	

FNE, Fear of negative evaluation; SIA, Social interaction anxiety; Ext, Extraversion; Con, Conscientiousness; Alt, Altruism.

TABLE 5 Bootstrap analysis of the significance test of the intermediate model effects in the first model.

	Path	Standard indirect effect	Unstandardized indirect effect	p	Bootstrap (95% CI)	
					Lower Limit	Upper Limit
Intermediary effect	FNE--->Ext--->SIA	0.086	0.071	<0.001	0.043	0.107
	FNE--->Con--->SIA	0.015	0.012	0.008	0.002	0.031
	FNE--->Alt--->SIA	0.019	0.016	0.010	0.002	0.040
	FNE--->Ext--->Con--->Alt--->SIA	0.007	0.006	0.001	0.002	0.013
Total intermediation effect		0.127	0.105		0.049	0.191

FNE, Fear of negative evaluation; SIA, Social interaction anxiety; Ext, Extraversion; Con, Conscientiousness; Alt, Altruism.

analysis, the power of liveliness and organization to predict the level of social interaction anxiety decreases after altruism is introduced as an independent variable in the model.

Therefore, the above-mentioned psychological constructs have been introduced into the SEM model. Taking into account the values provided

by the hierarchical regression analysis, the following hypotheses regarding the relationships between the measured constructs were formulated:

H7: Fear of negative evaluation is positively associated with social interaction anxiety.

H8: Fear of negative evaluation is negatively associated with social boldness, liveliness, organization, and altruism.

H9: Social boldness is positively associated with liveliness.

H10: Liveliness is positively associated with organization.

H11: Organization is positively associated with altruism.

H12: Social boldness, liveliness, organization, and altruism are negatively associated with social interaction anxiety.

H13: Social boldness, liveliness, organization, and altruism play a serial mediating role in the association between fear of negative evaluation and social interaction anxiety.

Table 6 shows the HEXACO items measuring social boldness, liveliness, and organization together with alpha reliability (α), composite reliability (CR) and average variance extracted (AVE) for each subscale. All of the item loadings are above the accepted threshold of .60, and validity coefficients also exceeded the generally accepted threshold.

Table 7 presents the correlation matrix between social interaction anxiety, fear of negative evaluation, social boldness, liveliness, organization, and altruism.

In the hypothesized model, fear of negative evaluation was entered as the independent variable (IV), social interaction anxiety was entered as the dependent variable (DV), social boldness was entered as first mediator (M1), liveliness was entered as second mediator (M2), organization was entered as third mediator (M3), and altruism was entered as fourth mediator (M4). According to this model, there were six possible pathways linking fear of negative evaluation to social interaction anxiety – one direct path and five indirect paths. As expected, the direct path connected fear of negative evaluation to social interaction anxiety. The first indirect pathway was through social boldness (M1), the second indirect pathway was through liveliness (M2), the third indirect pathway was through organization (M3) and the fourth indirect pathway was through altruism (M4). The fifth indirect pathway was through social boldness (M1), liveliness (M2), organization (M3) and altruism (M4), in serial. Not all the values of the hypothesized model reached the suggested values, indicating that the model is not adequate (Table 8).

TABLE 6 Items loadings, composite reliability (CR), average variance extracted (AVE), and alpha Cronbach (α) for the scales measuring social boldness, liveliness, and organization.

Personality facets	Item loading	CR	AVE	α
Social boldness (Sb)		0.82	0.54	0.71
1. I rarely express my opinions in group meetings. (R)	0.737			
2. In social situations, I'm usually the one who makes the first move.	0.764			
3. When I'm in a group of people, I'm often the one who speaks on behalf of the group.	0.694			
4. I tend to feel quite self-conscious when speaking in front of a group of people.(R)	0.757			
Liveliness (Liv)		0.82	0.57	0.74
1. I am energetic nearly all the time.	0.713			
2. On most days, I feel cheerful and optimistic.	0.834			
3. People often tell me that I should try to cheer up.(R)	0.765			
4. Most people are more upbeat and dynamic than I generally am.(R)	0.706			
Organization (Org)		0.82	0.53	0.70
1. I clean my office or home quite frequently.	0.649			
2. I plan ahead and organize things, to avoid scrambling at the last minute.	0.709			
3. People often joke with me about the messiness of my room or desk.(R)	0.779			
4. I sometimes feel that I am a worthless person. (R)	0.784			

Items indicated with R are reverse-keyed items.

TABLE 7 Correlation matrix between social interaction anxiety, fear of negative evaluation, social boldness, liveliness, organization, and altruism.

	Variables	M	SD	1	2	3	4	5
1	Social interaction anxiety (SIA)	0.87	0.82					
2	Fear of negative evaluation (FNE)	0.60	0.67	0.725**				
3	Social boldness (Sb)	3.61	0.68	−0.422**	−0.305**			
4	Liveliness (Liv)	3.92	0.67	−0.515**	−0.412**	0.479**		
5	Organization (Org)	4.22	0.62	−0.423**	−0.314**	0.242**	0.360**	
6	Altruism (Alt)	4.16	0.68	−0.370**	−0.239**	0.106*	0.322**	0.325**

N = 352; Social boldness, Liveliness, Organization = HEXACO Personality facets; Altruism = HEXACO Interstitial personality facet. * $p < 0.05$. ** $p < 0.01$.

6.4. Hypotheses tested

As can be seen from Table 9, the hypotheses H7 to H12 and the relationships paths were supported by the data. Therefore:

- Fear of negative evaluation significantly and positively predicted social interaction anxiety ($\beta=0.56$, $p<0.001$), hence H7 was verified;
- Fear of negative evaluation significantly and negatively predicted social boldness ($\beta=-0.30$, $p<0.001$), liveliness ($\beta=-0.29$, $p<0.001$), and organization ($\beta=-0.20$, $p<0.001$) but *not* altruism ($\beta=-0.07$, $p=0.127$), therefore H8 was partially supported;
- Social boldness was positively associated with liveliness ($\beta=0.39$, $p<0.001$), liveliness was positively associated with organization ($\beta=0.28$, $p<0.001$) and organization was positively associated with altruism ($\beta=0.24$, $p<0.001$) therefore H9, H10 and H11 were supported;
- Social boldness ($\beta=-0.15$, $p<0.001$), liveliness ($\beta=-0.13$, $p=0.002$), organization ($\beta=-0.12$, $p=0.003$) and altruism ($\beta=-0.14$, $p<0.001$) were negatively associated with social interaction anxiety, hence H12 was supported.

All these results allow us to conclude that fear of negative evaluation has an indirect effect on social interaction anxiety through the mediation of social boldness, liveliness, and organization, separately. In this model, fear of negative evaluation does not have an indirect effect on social interaction anxiety through altruism.

The decrease in the power of liveliness and organization to predict the level of social interaction anxiety after altruism was introduced as an independent variable in the regression analysis suggested modifying the

model by introducing altruism as a moderator variable between liveliness, organization, and social interaction anxiety. The relationships between variables were modified as illustrated in Figure 2 and the new model was tested. All the values of the new model reached the suggested values, which is an indicator that the model is appropriate (Table 10).

These results invalidated the serial mediation hypothesis (H13) which stated that social boldness, liveliness, organization, and altruism play a serial mediating role in the association between fear of negative evaluation and social interaction anxiety. The bootstrap analysis of the significance test of the intermediate model effects in the second structural model is presented in Table 11.

The pathway FNE--->Sb--->Li--->Org--->SIA was also tested, and the following results were obtained: $\beta=0.003$, BootLL=0.001, BootUL=0.007, $p<0.001$. Based on these results, it can be stated that social boldness, liveliness, and organization play a serial mediating role in the association between fear of negative evaluation and social interaction anxiety.

The new pathway Liv--->Org--->Alt--->SIA has been tested and found to be significant: $\beta=-0.009$, BootLL=-0.022, BootUL=-0.003, $p=0.001$.

After correlating all these results, it can be concluded that the model illustrated in Figure 2 is a moderated mediation model.

7. Discussion

This study aimed to examine the potential mediating effects of HEXACO personality traits on the relationship between fear of negative evaluation and social interaction anxiety. The preliminary analysis indicates that fear of negative evaluation has a positive

TABLE 8 Goodness-of-fit of the invalidated model.

Fit index	χ^2/df	IFI	CFI	TLI	GFI	NFI	RFI	AGFI	SRMR	RMSEA
Suggested value	0–3	> 0.90	> 0.95	> 0.95	> 0.95	> 0.95	> 0.90	> 0.90	< 0.08	< 0.06
Values of this study	5.90	0.97	0.97	0.88	0.98	0.97	0.86	0.88	0.036	0.118

TABLE 9 The test results of path relationships between fear of negative evaluation, social interaction anxiety, social boldness, liveliness, organization, and altruism.

Hypothesis	Path	Unstandard estimates	S.E.	C.R.	Sig.	Standard estimates	LL 95%CI	UL95%CI	Hypothesis test
H7	FNE--->SIA	0.453	0.030	15.250	***	0.559	0.478	0.628	Supported
H8	FNE--->Sb	-0.255	0.042	-5.991	***	-0.305	-0.403	-0.203	Partially supported
	FNE--->Liv	-0.241	0.038	-6.301	***	-0.294	-0.387	-0.200	
	FNE--->Org	-0.152	0.041	-3.729	***	-0.200	-0.312	-0.084	
H9	Sb--->Liv	0.382	0.046	8.354	***	0.390	0.297	0.468	Supported
H10	Liv--->Org	0.258	0.050	5.180	***	0.278	0.165	0.397	Supported
H11	Org--->Alt	0.264	0.058	4.556	***	0.240	0.118	0.358	Supported
H12	Sb--->SIA	-0.144	0.036	-3.987	***	-0.149	-0.246	-0.065	Supported
	Liv--->SIA	-0.125	0.041	-3.084	0.002	-0.127	-0.211	-0.046	
	Org--->SIA	-0.130	0.039	-3.348	***	-0.122	-0.191	-0.051	
	Alt--->SIA	-0.138	0.034	-4.036	***	-0.142	-0.224	-0.062	
-	Liv--->Alt	0.240	0.054	4.470	***	0.235	0.124	0.347	-

FNE, Fear of negative evaluation; SIA, Social interaction anxiety; Sb, Social boldness; Liv, Liveliness; Org, Organization; Alt, Altruism.

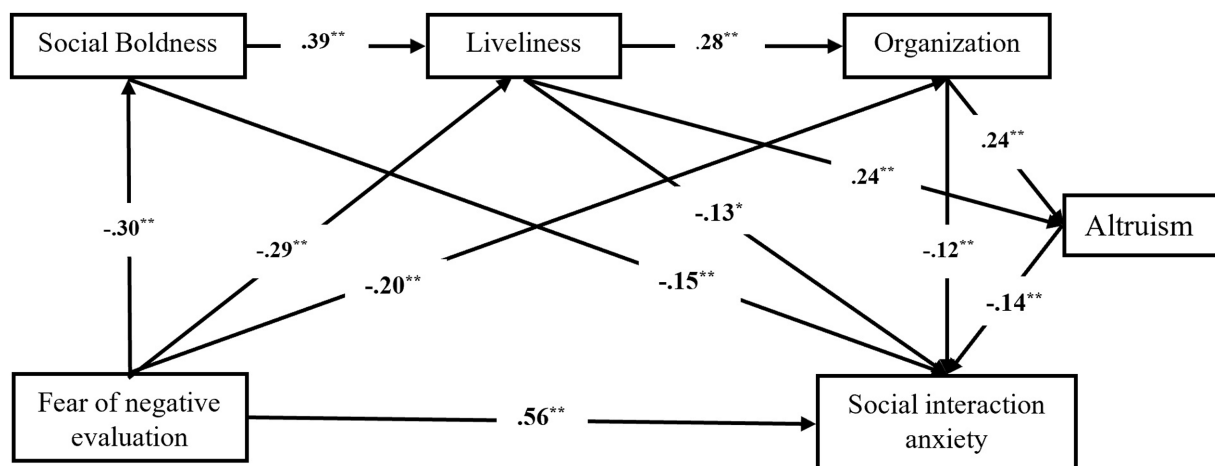


FIGURE 2

The path diagram of the relationships between fear of negative evaluation, social boldness, liveliness, organization, altruism, and social interaction anxiety.

TABLE 10 Goodness-of-fit of the second structural model.

Fit index	χ^2/df	IFI	CFI	TLI	GFI	NFI	RFI	AGFI	SRMR	RMSEA
Suggested value	0–3	> 0.90	> 0.95	> 0.95	> 0.95	> 0.95	> 0.90	> 0.90	< 0.08	< 0.06
Values of this study	2.18	0.99	0.99	0.97	0.99	0.99	0.95	0.95	0.022	0.058

TABLE 11 Bootstrap analysis of the significance test of the intermediate model effects in the second model.

	Path	Standard indirect effect	Unstandardized indirect effect	p	Bootstrap (95% CI)	
					Lower Limit	Upper Limit
Intermediary effect	FNE--->Sb--->SIA	0.045	0.037	<0.001	0.016	0.068
	FNE--->Liv--->SIA	0.037	0.030	0.002	0.010	0.059
	FNE--->Org--->SIA	0.024	0.020	0.001	0.006	0.042
	FNE--->Sb--->Liv--->Org--->SIA	0.003	0.003	0.001	0.001	0.007
Total intermediation effect		0.109	0.090		0.033	0.176
	Liv--->Alt--->SIA	−0.033	−0.033	< 0.001	−0.068	−0.013
	Liv--->Org--->SIA	−0.033	−0.034	0.001	−0.067	−0.013
	Liv--->Org--->Alt	0.067	0.068	< 0.001	0.032	0.128
	Org--->Alt--->SIA	−0.036	−0.036	0.001	−0.076	−0.014
	Liv--->Org--->Alt--->SIA	−0.009	−0.009	0.001	−0.022	−0.003
Total intermediation effect		−0.044	−0.044		−0.201	−0.085

FNE, Fear of negative evaluation; SIA, Social interaction anxiety; Sb., Social boldness; Liv., Liveliness; Org., Organization; Alt., Altruism.

association with social interaction anxiety and a negative association with extraversion, conscientiousness, and altruism. The relationship between fear of negative evaluation and social interaction anxiety was found to be fully mediated by the serial mediation pathway *via* extraversion, conscientiousness, and altruism. Also, the individual pathways between fear of negative evaluation and each of the mediators and social interaction anxiety were significant.

After validating the previous model, the potential mediating effects of the facets that make up extraversion (social self-esteem, social boldness, sociability and liveliness) and conscientiousness (organization, diligence, perfectionism and prudence) were tested. Each of the individual pathways between fear of negative evaluation and social boldness, liveliness and organization and social interaction anxiety turned out to be significant. The analysis has shown that the

relationship between fear of negative evaluation and social interaction anxiety was fully mediated by the serial mediation pathway *via* social boldness, liveliness, and organization. The individual pathway between fear of negative evaluation, altruism and social interaction anxiety was not significant. The testing of the path relationships has shown the presence of significant direct relationships between (1) liveliness, organization, and altruism and (2) between altruism and social interaction anxiety; therefore, the moderating effect of altruism in the relationship between liveliness, organization, and social interaction anxiety was highlighted. Taking all these results into consideration, it can be stated that the relationship between fear of negative evaluation and social interaction anxiety is a moderated serial mediation pathway *via* social boldness, liveliness, organization, and altruism.

The levels of fear of negative evaluation and social interaction anxiety of the students included in the sample are extremely low. As military students, training and interacting at platoon level is likely to develop their ability to initiate and develop effective and rewarding interpersonal relationships. However, certain aspects of community life can generate fear of negative evaluation, especially in first-year students, such as those included in this study's sample: insecurity about how they are perceived by others, the desire to be liked, appreciated and approved of, the desire to project a positive image, etc. They may experience episodes of social anxiety when having to speak in front of a group or a superior officer, isolate themselves in groups of friends to feel safe in platoons or battalions, feel anxious at social events or have difficulty initiating dyadic relationships, etc. The cadets sampled in this study are in the midst of a peer socialization process that is, by its nature, a comparative process in which cadets constantly adjust their behavior to match not only organizational norms but also those of their peers (Rubin and Burgess, 2001). They live on campus under the constant gaze of dozens of people ready to detect any deviation from the norm and correct it; in this context, peer relationships act as a social control factor that can generate negative evaluations of one's own behavior, determined by how one is judged/appreciated by others (Perrot et al., 2012).

The strong mediating effect of extraversion on the relationship between fear of negative evaluation and social interaction anxiety was predictable because the influence of extraversion on various psychological constructs is well documented in many studies. Naturally, people with a high level of extraversion have a positive self-image, have a high level of self-confidence that helps them interact easily with people and groups, and feel comfortable in social gatherings; the higher their level of extraversion, the more they want to be the center of attention (Ashton and Lee, 2007). Two facets of extraversion have a mediating effect between fear of negative evaluation and social interaction anxiety: social boldness and liveliness. Individuals with a high level of social boldness are not only comfortable, but also very confident in social situations, are eager to assume leadership positions, speak easily in groups and approach strangers with confidence. People with a high level of liveliness are very energetic, optimistic, and enthusiastic. Therefore, even if an extroverted person experiences a certain degree of fear of being negatively evaluated by others, they will overcome it, thus lowering their level of anxiety in social interactions.

The second mediator in the first model analyzed in this paper is conscientiousness; it is a mediator with a weaker effect than extraversion, but nevertheless significant. Individuals with a high level

of conscientiousness have a strong tendency to organize their time, activities, and environment, to achieve their goals through hard work, discipline, and patience. These individuals aspire to perfection in solving their tasks, often take on challenging goals, and carefully weigh alternatives and consequences when making decisions (Ashton and Lee, 2007). Because they have a natural tendency to adhere to socially prescribed norms, especially those pertaining to impulse control, these individuals can avoid anxiety in ambiguous social situations and orient themselves in these situations according to social norms that they are very familiar with (Bogg and Roberts, 2013). In general, a conscientious person will maintain a high level of cognitive control, including over the process of forming cognitive biases (Lonigan and Vasey, 2009) and the rumination that underlies anxiety (Noda et al., 2022; Liu et al., 2023a). As mentioned earlier, of all four facets of conscientiousness, only organization had a mediating effect between fear of negative evaluation and social interaction anxiety. A person with a strong tendency toward organization constantly seeks to maintain order, both in the way they approach tasks – in a highly structured way – and physically, where they rigorously maintain cleanliness and order.

The third mediator is altruism, described by the HEXACO authors as a person's tendency to have sympathy and compassion for other people, to avoid hurting others, and to be generous toward them (Ashton and Lee, 2007). Altruism can determine a person to offer help and support to people in difficult situations, despite fear of negative evaluation or various negative feelings generated by social anxiety. In this way, a person can create a social network that acts over time as a factor in reducing social anxiety, simultaneously reducing the loneliness and isolation associated with the latter. The desire to help can lead to overcoming difficulties in interpersonal communication and the stress associated with fear of negative evaluation. In the case of our sample, the intense training program, consisting of military and academic training modules, creates situations where stress can reach peak levels, triggering intense emotional reactions; in these cases, the cadets' behavior can become problematic, especially under the influence of feelings of deep insecurity. In this case, cadets are taught, through various methods, to provide emotional and instrumental support and to show empathy, sympathy, and compassion toward their colleagues. These are manifestations of altruism and each cadet learns and exercises them according to their own capabilities and dispositions. However, for the cadets sampled in this research, altruism is a significant mediator in the relationship between fear of negative evaluation and social interaction anxiety.

8. Practical implications

The analysis of the links between personality traits, fear of negative evaluation and social interaction anxiety facilitates the understanding of individualized risk trajectories and allows the creation of personalized interventions. Personality traits are involved in a multitude of cognitive and socio-emotional skills that can be learned, trained, and developed through education, so that fear of negative evaluation and social interaction anxiety do not manifest in the individuals' behaviors. For example, Glinski and Page (2010) observed significant changes in the behavior of individuals with clinical levels of social anxiety. These people were part of a group undergoing cognitive-behavior therapy that addressed interpersonal issues. The

authors argue that these changes were not due to alterations in the personality traits, but to modifications in their behavioral expression; however, any intervention that modifies the behaviors associated with the personality traits in order to increase the individual's coping capacity is desirable.

In terms of extraversion, interventions can focus on the development of skills that belong to its facets: social self-esteem, social boldness, and sociability. Young people can learn to improve their self-esteem (Liu X. et al., 2022), to cultivate positive self-regard and self-beliefs (Hulme et al., 2012; Golde et al., 2023), self-compassion (Werner et al., 2012; Liu et al., 2020; Holas et al., 2023), self-efficacy, optimism, hope and resilience (Fatima et al., 2017; Serrano et al., 2021; Hui et al., 2022), emotional intelligence (Kahraman, 2022) and coping strategies (Takács et al., 2021).

Liu et al. (2023b) show that, beyond traditional approaches in the treatment of anxiety disorders, digital mental health interventions prove to be very effective due to low costs, rapid diagnosis, effective treatment and positive effects. Current digital interventions – web-based or computer-based programs, mobile applications, artificial intelligence based chatbots, virtual reality tools – can be perfected according to the demands and needs of students but also of stakeholders (country, society, colleges, and families).

In their studies, Cao and Liu (2023) and Cao (2023) concluded that practicing sports and sleeping have a positive effect on cognitive achievement, but time spent on homework, surfing the Internet, watching TV has a negative effect on it, when using depression symptoms as mediators. Thus, students can learn ways to optimally manage their time in the various tasks and activities specific to campus life in order to avoid anxiety or depression symptoms build-up.

Finnerty et al. (2021) believe that students should be offered certain extracurricular activities in which they can engage according to their preferences, depending on their personality traits, in order to increase their well-being. According to their research findings, students higher in conscientiousness or extraversion or emotional stability would prefer physical activities, while students higher in openness to experience would prefer to engage in journaling, playing a musical instrument, or singing.

As for the trait of conscientiousness, it encompasses socio-emotional skills that can also be learned: self-confidence, self-regulation, self-discipline, and sensitivity to fairness (Nasti et al., 2023).

Altruism can be developed in specific ways: through activities that involve volunteering and cooperation, by rewarding altruistic actions, by modeling caring behaviors (altruistic role models), through activities that develop individuals morally, by developing empathy, and by understanding social norms of reciprocity and social responsibility (Batson, 2011).

9. Limitations and future directions

Although the data of this study were processed by rigorous structural modeling techniques, the cross-sectional data does not allow the specification of causal relationships; for this, longitudinal or experimental studies are needed to allow a much clearer identification of causality and mutual influences between variables. All responses were collected by self-report procedures which are generally affected by social desirability bias; furthermore, all problems associated with

“common method variance” are valid. However, since the tested models demonstrated a very good fit, and the correlations among the construct were not high, the issue of common method variance is not very problematic.

Another limitation of this study is given by the fact that it uses observed variables (a simple average of scale items). This approach is correct when the observed variables are entered into a regression analysis to test for mediation, which was the first stage in the statistical processing of our data. But statisticians usually recommend mediation testing by using latent variables in structural equation modeling. Latent variable models are capable of fitting the data better because they are using more parameter estimates than observed variable models; moreover, the latter tend to underestimate the amount of variation that is explained by the mediating variable. Nevertheless, while the latent variable models are able to produce more accurate estimates, the observed variable models are able to produce more precise estimates. Another element that must be considered is the reliability level of the measures used in the research: “As reliability decreases, both approaches become more troublesome. Even with an alpha of 0.7, which is typically considered an acceptable level of reliability in our field, observed variable approaches greatly underestimate path coefficients and can produce highly inflated Type I error rates, and latent variable approaches lose considerable power and (especially with large effect sizes) can occasionally yield wildly inaccurate estimates.[...] not only are observed variable analyses potentially biased, but latent variable analyses are potentially unstable” (Ledgerwood and Shrout, 2011, p. 15). Taking into account all this information, we consider that the first tested model has a high degree of validity (few variables, high reliability of the measures), while the second model requires a latent variables analysis for a definitive conclusion regarding its accuracy.

Although the research sample has not been established by a specific sampling procedure, but is rather a convenience sample, it can still be considered representative for the military student population, which is characterized by a high level of homogeneity. Numerous selection criteria are successively applied to candidates during admission to the military academies, in a cascade: minimum and maximum age limit, physical and clinical standards, sports scales, psychological and personality tests, assessment of specialized knowledge and evaluation of language skills. Subsequently, the military organizational culture, and the military lifestyle imbues future officers with a common set of values. All these result in a high level of homogeneity of the military student population, as compared to other populations.

As future research directions, we propose an examination of the relationships between fear of negative evaluation and social interaction anxiety and the other personality traits and facets measured by the HEXACO inventory. In the course of processing the data collected from the students, other significant relationships emerged that suggest the existence of a more complex model in which it is possible to introduce more traits or facets and to test complex mediating and moderating relationships between all the measured constructs.

10. Conclusion

The results presented in this paper pave the way for understanding the role of personality traits in mediating the

relationship between fear of negative evaluation and social interaction anxiety in a social environment characterized by discipline, uniformity, and rigor, where any behavioral deviation is noticed. In the context of the present work, the analysis of personality traits of individuals in relation to social anxiety and specifically to the fear of negative evaluation can contribute to the identification of ways to stimulate desirable behaviors in the military organization, which is typified by compliance, conformity and predictability.

Military education and training are largely guided by traditional values, rules, and practices, repeatedly imposed to individual and group levels. In order to update and improve the educational approaches on scientific basis, a more comprehensive understanding of the cadets' behaviors and attitudes in specific social contexts is needed. Since the professional activity of an officer involves constant social interactions and his/her permanent exposure in front of subordinates, it is important for the cadets to develop their ability to appropriately manage social interactions at any level of the organization.

Data availability statement

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

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

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CM: Conceptualization, Formal analysis, Investigation, Methodology, Project administration, Supervision, Writing – original draft, Writing – review & editing. SB: Investigation, Writing – original draft, Writing – review & editing. FM-B: Investigation, Writing – original draft, Writing – review & editing.

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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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A study of the relationship between social anxiety and mask-wearing intention among college students in the post-COVID-19 era: mediating effects of self-identity, impression management, and avoidance

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Introduction: During the 2019 coronavirus (COVID-19) pandemic, wearing masks not only prevented transmission of the virus but also reduced social anxiety to some extent. With the end of the epidemic, the intention to wear masks to prevent transmission declined, but the effect of social anxiety on the intention to wear masks is unclear. The current study investigated the effects of social anxiety and fear of COVID-19 on mask-wearing intentions in the post-epidemic era, using self-identity, impression management and avoidance as mediating variables.

Methods: In total, 223 college students participated in the current study, and the related variables were measured using the social anxiety scale, the social behavior questionnaire, the self-identity questionnaire, and the mask-wearing intention questionnaire.

Results: The results showed that social anxiety was significantly positively correlated with avoidance, impression management, and intention to wear masks, and significantly negatively correlated with self-identity. The fear of COVID-19, avoidance, and impression management were significantly positively correlated with mask-wearing intentions, while self-identity was significantly negatively correlated with mask-wearing intentions. Social anxiety affected college students' intention to wear masks through three main pathways: the mediating role of avoidance, impression management, and the chain mediating role of self-identity and avoidance. The fear of COVID-19 directly and positively affected mask-wearing intentions.

Discussion: The current study reveals the differential pathways of the effects of COVID-19 fear and social anxiety on mask-wearing intentions in the post-COVID-19 era, and the findings have some practical implications for social anxiety interventions.

KEYWORDS

social anxiety, mask-wearing intention, college students, impression management, avoidance, self-identity

1 Introduction

During the 2019 coronavirus (COVID-19) epidemic, numerous precautionary measures were recommended by the health authorities to avoid the spread of the virus, such as keeping a social distance and wearing masks, which had a significant impact on people's lives and social interactions (Saladino et al., 2020; Litwinowicz et al., 2022; Sukul et al., 2022). Studies have shown that COVID-19 led to profound psychological and behavioral changes in college students (Alemany-Arrebola et al., 2020; Ma et al., 2020). The epidemic limited social interactions, and, for a large portion of the time, most college students were unable to access places where they interacted face-to-face with peers, faculty members, and others, especially on campus and in indoor public spaces (Barankevich and Loebach, 2022). Previous research has found that although the direct impact of wearing masks during the first social interaction may be quite small, it is still disruptive (Crandall et al., 2022). With the advent of the post-COVID-19 era, countries are gradually removing regulations related to mandatory mask-wearing and no longer require masks to be worn in public. The anti-epidemic situation has entered a phase of normalization, but there is always the possibility of small-scale outbreaks of localized epidemics, and vigilance against epidemics still cannot be relaxed. Research on whether people will reduce mask-wearing in response to changes in policy toward openness or continue to wear masks for hygienic reasons or social psychology could help to explain individual behavioral and psychological changes in the post-COVID-19 era.

Social anxiety (SA) has been identified as a risk factor for future health problems among college students. The global prevalence of social anxiety among college students is about 7–33% (Honakeri et al., 2017; Jaiswal et al., 2020), and social anxiety is as prevalent among college students in the United States as it is in the general population (Schry et al., 2012). Likewise, in China, social anxiety is one of the serious public health problems in the college student population (Sun et al., 2019; Xia et al., 2023). If social anxiety is not ameliorated or corrected, it may develop into severe social anxiety disorder (SAD) and negatively affect college students' academic performance, academic achievement and social relationships (Brook and Willoughby, 2015). According to an exploratory review of the effects of mask-wearing on social anxiety (Saint and Moscovitch, 2021), in the context of an epidemic, mask-wearing may be perceived as a social norm, with behaviors being influenced more by perceived norms than by the perceived protective value of the mask (Nakayachi et al., 2020); while mask-wearing can also be perceived as a self-concealing behavior. Thus researchers believe that wearing masks relieves anxiety and promotes mask use, a finding that suggests that people think more about subjective feelings than objective risks (Nakayachi et al., 2020). Previous studies have scrutinized the role of mask-wearing in clinical applications and explored the perceptions of mask-wearing (Howard, 2021; Luo et al., 2021; Schneider and Leonard, 2022; Vann et al., 2022). However, the other psychological and sociological mechanisms behind mask-wearing remain largely unexamined. Therefore, in the post-COVID-19 context, the present study aimed to explore the differences in the mechanisms between the two, and how the fear of COVID-19 or social anxiety has an impact on mask-wearing intentions when wearing masks is no longer defined as a social norm, and wearing or not wearing masks has become a matter of personal choice.

1.1 Fear of COVID-19 and mask-wearing intentions

Fear was prevalent among patients, healthcare workers and the public during the COVID-19 epidemic (Liu et al., 2020). Previous research has shown that fear of an epidemic affects psychological responses and behavior (Di Crosta et al., 2020). The World Health Organization recommends wearing face masks in public places because there is evidence that wearing masks is effective in controlling the spread of COVID-19 (Howard et al., 2021; Rader et al., 2021). In addition, researchers in Taiwan revealed the importance of fear as a driver of public adherence to protective measures during the COVID-19 pandemic (Chin et al., 2021), and the mechanism may be that fear induces vigilance against personal threats, which leads individuals to take measures to protect themselves from harm (Witte and Allen, 2000). Wearing masks can make people to feel safer (Cartaud et al., 2020). Regardless of the actual ability of masks to prevent infections, wearing masks can alleviate people's anxiety (Nakayachi et al., 2020). Currently, although COVID-19 has greatly abated, the behavioral and psychological effects of the outbreak on people still exist. Fear of COVID-19 significantly predicts people's preventive behaviors (Frounfelker et al., 2021; Roberto et al., 2021).

People may be inclined to continue wearing masks to ward off the disease if they perceive that COVID-19 still poses a possible threat to their personal health. Therefore, this study proposed Hypothesis:

H1: Fear of COVID-19 positively influences college students' mask-wearing intentions.

1.2 Social anxiety and mask-wearing intentions

Social anxiety is fundamentally driven by the fear that one's appearance or behavior does not conform to societal expectations and norms (Clark and Wells, 1995; Rapee and Heimberg, 1997). According to Baldwin and Main (2001), underlying social anxiety is the "fear of judgment," where people worry about what others think of them, especially negatively. The YouGov UK Mask Wearership Survey, conducted in May 2020, found that non-mask-wearers were more likely to feel a lack of self-consciousness and to worry about being judged negatively compared with mask-wearers (Smith, 2020). Sim et al. (2014) highlighted the benefits and effects of wearing masks in their study, including discomfort and embarrassment for the individual. The findings of Warnock-Parkes et al. (2021) suggested that it is not only health-related beliefs that lead to mask-wearing, but also the thoughts that people have when wearing masks (e.g., looking confident, looking anxious, etc.) also predicted mask use. Additionally, a report during the COVID-19 epidemic mentioned that wearing a mask was seen as a "security blanket" (Ray, 2020), which, in part, alleviated social pressure due to a fear of exposing cosmetic flaws or anxious behavior (Ray, 2020; Sloat, 2020). Thus, the fear associated with negative judgments in social interactions in socially anxious people may be closely related to their intentions and behavior regarding mask-wearing. Therefore, the present study aimed to investigate the factors that influence the relationship between social anxiety and the intention to wear masks in order to elucidate the mechanisms of their influence.

1.2.1 Avoidance

According to the cognitive model of SA, safety behavior is a self-protective strategy that people use to prevent exposure to a feared outcome (Goetz et al., 2016), and it is one of the most important ways that socially anxious people reduce their anxiety. Research usually classifies safety behaviors into two types (Plasencia et al., 2011; Gray et al., 2019), namely avoidance and impression management. Avoidance refers to behaviors that attempt to hide or control social engagement, such as avoiding eye contact or hiding one's face. Social anxiety can contribute to avoidance behaviors. Those suffering from social anxiety are prone to overestimate the level of fear they will experience, and previous research has emphasized the predictive role of fear, with overpredictions of fear (Rachman and Lopatka, 1986; Rachman, 1994) motivating avoidance behaviors. It is likely that wearing a mask serves the dual function of preventing infections and masking obvious deficits in physical appearance or obvious signs of anxiety (Saint and Moscovitch, 2021). Therefore, it is further hypothesized that mask-wearing behavior may be driven by avoidance-related thoughts or behaviors, and therefore individuals may show a stronger intention to wear masks due to motivations of avoidance. Therefore, this study proposed the following hypotheses:

H2: Social anxiety positively influences the avoidance behaviors of college students;

H3: Avoidance positively influences mask-wearing intentions, and avoidance mediates the relationship between social anxiety and mask-wearing intentions.

On the other hand, past research on the effects of NCP has focused on understanding the nature of excessive fear or anxiety responses (overreactions) (Ahorsu et al., 2020; Jungmann and Witthöft, 2020; Tang et al., 2020). The Cognitive Behavioral Model of Health Anxiety (Taylor et al., 2004) proposes that beliefs are important determinants of emotions and health-related behaviors. Some research on past epidemics suggested that anxiety or lack of anxiety is an important driver of behavior (Taylor, 2022). Individuals who are overly anxious are likely to engage in socially disruptive behaviors (e.g., panic buying), may overly avoid social interactions, and may even stay at home for fear of being infected (Asmundson and Taylor, 2020; Taylor and Asmundson, 2020; Taylor, 2022). Thus, when people are fearful of COVID-19, they may show avoidance behaviors such as reducing use of public transportation, wearing masks or reducing mobility (Ito et al., 2022) in order to inhibit the spread of infectious diseases. In addition, recent research has shown that avoidance-based affective states are associated with stricter adherence to health behaviors (Wendel and Gable, 2023). On the basis of their fear of COVID-19, people are more inclined to wear masks to avoid infection. Therefore, this study proposed Hypothesis:

H4: Fear of COVID-19 positively predicts avoidance behaviors in college students, which indirectly predicts mask-wearing intentions.

1.2.2 Impression management

Unlike avoidance behaviors, impression management primarily manifests strictly monitoring and controlling one's behavior to attempt to create a favorable social image (Hirsch et al., 2004; Plasencia et al., 2011). Impression management behaviors are often viewed as adaptive behaviors in which individuals promote social connections by

mimicking pro-social behaviors. However, in the process, these behaviors are still actually used in response to perceptions of threats, which can lead to persistent negative perceptions (Foa et al., 1996; Hofmann, 2004), thus entering a malignant cycle that further aggravates social fears. When the behaviors of impression management cannot be effectively controlled, there may be an increase in negative perceptions or a persistent fear of negative evaluations, further contributing to more severe avoidance behaviors, thus enhancing the intention to wear masks. Therefore, this study proposed the following hypotheses:

H5: Social anxiety positively regulates impression management;

H6: Impression management positively influences avoidance, and impression management may mediate between social anxiety and avoidance.

1.2.3 Self-identity

Self-identity refers to the perception and internalization of an individual's identification with his or her role (Rousseau, 1998). Self-concept formation, also known as personal identity formation, includes acceptance of physical changes, development of social and emotional competencies, and self-efficacy; self-concept deficits are characterized by low self-esteem, unclear descriptions of self, and difficulties with social roles, values, and choices, among other things (Erikson, 1968). The core features of SA are negative self-perceptions and fear of negative judgments (Clark and Wells, 1995; Rapee and Heimberg, 1997). Thus, low self-identity, that is, low acceptance of one's role and negative or inadequate self-perception, so higher SA may predict lower self-identity. In a study by Hirsch et al. (2003), a link was found between negative self-image and increased anxiety, particularly among social anxious individuals. Cognitive models of SA emphasize the maintenance of the self in such situations and the role of the self in the etiology of the condition (Clark and Wells, 1995; Rapee and Heimberg, 1997; Hofmann, 2007; Stopa, 2009). Negative self-appraisals as a result of social anxiety may lead to lower self-identity, resulting in greater avoidance and avoidance of negative appraisals. A transient reduction in anxiety may be achieved by wearing masks.

According to Clark and Wells' (1995) model, socially anxious individuals turn their attention to themselves in social situations and monitor themselves closely, which prevents them from detecting others' reactions to them; physical sensations of anxiety and anxious mental states make it easy for them to use these feelings as confirmation of their negative beliefs. This further exacerbates self-focus, which may increase symptoms of fear and interfere with social interactions (Leigh et al., 2021). Furthermore, Erikson (1968) proposed that self-identity is a process of maturation along a continuum that involves the integration of an individual's development of personality, which is primarily formed during youth. Meanwhile, during adolescence, neurocognitive changes support the development of key social and cognitive competencies such as self-awareness, the management of emotional expression, regulating emotion and sensitivity to social exclusion (Blakemore and Choudhury, 2006; Burnett et al., 2011; Haller et al., 2015). The development of these social and cognitive competencies are likely to influence the performance of safety behaviors (Leigh and Clark, 2018). Higher levels of self-identity increase both individuals' motivation to play roles and the likelihood that they will actively do so (Li et al., 2022); conversely, low self-identity (i.e., an unstable sense of self and a lack of awareness of one's own social

roles) may lead to abandoning playing roles in interpersonal interactions and may lead to self-concealment, i.e., avoidance behaviors. Therefore, this study proposed the following hypotheses:

H7: Social anxiety negatively moderates self-identity.

H8: Self-identity negatively influences avoidance behavior, and self-identity mediates between social anxiety and avoidance.

1.3 Purpose of the study

In this study, we constructed a structural equation model (SEM) to systematically explore the relationship between college students' fear of COVID-19 and mask-wearing intentions, and to explore the effects of social anxiety on self-identity, impression management, avoidance, and mask-wearing intentions, with the intention of exploring the differences between the two mechanisms. On the basis of previous studies, we proposed a theoretical model containing eight hypotheses in five pathways, (1) fear of COVID-19 directly and positively affects college students' mask-wearing intentions (H1); (2) fear of COVID-19 positively affects college students' mask-wearing intentions, with avoidance playing an indirect mediating role (H3, H4); (3) social anxiety positively affects college students' mask-wearing intentions, with avoidance playing a mediating role (H2, H3); (4) social anxiety positively affects college students' mask-wearing intentions, and impression management and avoidance play a mediating role between social anxiety and intention (H3, H5, H6); (5) social anxiety positively influences college students' mask-wearing intentions, social anxiety negatively moderates self-identity, self-identity negatively influences avoidance, and self-identity and avoidance mediate the relationship between social anxiety and intention to wear masks (H3, H7, H8) (Figure 1).

2 Materials and methods

2.1 Participants

A questionnaire was distributed at Guangdong University of Technology to recruit subjects, who were screened for self-reported

social anxiety with scores greater than 30 on the Liebowitz social anxiety scale. This work has been approved by the Departmental Ethics Committee and the Institutional Review Board of the Guangdong University of Technology (No. GDUTXS2023123). All the participants provided informed consent before participation.

In total, 422 questionnaires were collected, and after excluding invalid questionnaires (e.g., those with regular responses and inattentive responses), subjects with self-reported social anxiety scores greater than 30 were screened, and finally 223 valid questionnaires were returned. The mean age of all subjects was 22.07 years ($SD = 2.04$), with 59 male and 164 female subjects.

2.2 Measures

2.2.1 COVID-19 fear questionnaire

The COVID-19 fear questionnaire was developed by [Chen and Lei \(2022\)](#). In this study, the Chinese version of the COVID-19 Fear Scale ([Feng et al., 2021](#)) was used to assess the participants' fear of COVID-19 (e.g., "I am most afraid of coronavirus-19"). The scale consists of 7 items and is rated on a Likert-5 scale ranging from 1 (not at all compliant) to 5 (fully compliant), with higher scores indicating higher levels of fear. The scale had good internal consistency with a Cronbach's α of 0.85.

2.2.2 Liebowitz social anxiety scale

The Liebowitz social anxiety scale (LSAS) was developed by [Liebowitz \(1987\)](#) to aid in the assessment of social anxiety disorders. The LSAS was originally conceptualized as a clinician-administered rating scale, but has since been validated as a self-reporting scale ([Rytwinski et al., 2009](#)). It contains ratings of fear and avoidance for 24 items on a Likert-4 scale ranging from 0 (never) to 3 (often). All fear and avoidance scores are summed to give a total score ranging from 0 to 144. [Rytwinski et al. \(2009\)](#) found that individuals with LSAS scores below 30 were less likely to develop SAD, so a cutoff score of 30 was used to screen valid subjects in this study. The scale has excellent internal consistency (Cronbach's $\alpha = 0.94$). The study used the social fear subscale (e.g., "Calling in public-your level of fear or anxiety") for analyzing the data.

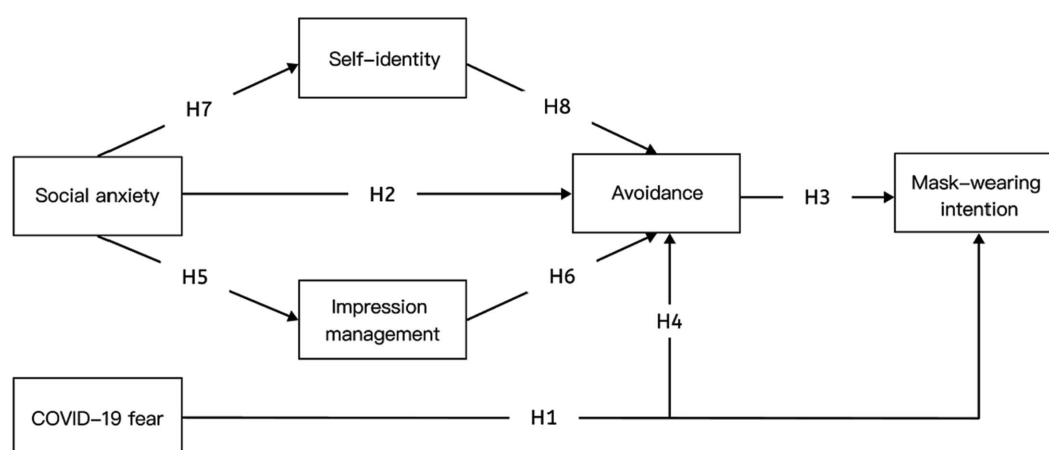


FIGURE 1
Research model.

2.2.3 Avoidance and impression management

Avoidance and impression management subscale was taken from the social behavior questionnaire (SBQ), which is primarily used to measure the use of safety behaviors in a range of social situations (Clark et al., 1995). The scale consists of 28 items on a 4-point Likert-type scale ranging from 0 (no safety behaviors) to 3 (very frequent safety behaviors), with higher scores indicating more frequent safety behaviors. The entries in the SBQ are divided into two types (Evans et al., 2021): 8 items for impression management (e.g., “Trying to get my words right”) and 13 items for avoidance (e.g., “Trying not to draw attention to myself”). The scale has good internal validity and good internal consistency (Total: Cronbach's $\alpha = 0.91$; Avoidance: Cronbach's $\alpha = 0.86$; Impression Management: Cronbach's $\alpha = 0.87$).

2.2.4 Self-identity scale

The self-identity scale was developed by Oakes and Prager based on Erickson's theory (Burger, 2000). The scale consists of 19 items (e.g., “I do not know what kind of person I am”) scored on a 4-point Likert-type scale ranging from 1 (not at all) to 4 (very much). Twelve of the questions are reverse-scored for the analysis. The higher the score, the higher the self-identity. The scale has good internal consistency (Cronbach's $\alpha = 0.80$).

2.2.5 Mask-wearing intentions

The questionnaire provided pictures of relevant scenarios on campus and types of events (e.g., scenarios such as classes, group discussions), and the subjects were asked to imagine scenarios in which they would be active on campus and then to answer a question to indicate mask-wearing intentions (“Would you still wear a mask when you are active in the campus environment?”) The scale ranged from 1 (absolutely not) to 10 (absolutely would), with higher scores indicating greater mask-wearing intentions.

3 Results

3.1 Analyses of reliability and validity

The results of assessing the validity are detailed in Table 1. For convergent validity, the variables exhibited average variance extracted (AVE) values surpassing the threshold of 0.50, accompanied by composite reliability (CR) coefficients ranging from 0.76 to 0.87, all of which exceeded the critical value of 0.70. This underscores that the condition of convergent validity was met. In the domain of discriminant validity the square roots of the AVE values for each

variable consistently exceeded the magnitudes of the correlation coefficients among the variables. This substantiates the successful achievement of the benchmarks of discriminant validity.

Pearson's correlation analysis was used to explore the correlations among social anxiety, impression management, avoidance, self-identity and mask-wearing intentions. The results in Table 1 show that social anxiety was significantly positively correlated with avoidance, impression management, and mask-wearing intentions, and significantly negatively correlated with self-identity; avoidance, impression management, and mask-wearing intentions were significantly positively correlated with each other; and self-identity was significantly negatively correlated with mask-wearing intentions. In addition, fear of COVID-19 was significantly positively associated with mask-wearing intentions and avoidance. A good statistical foundation was laid for the subsequent tests of the hypotheses.

3.2 Structural model and test of the hypotheses

We constructed a structural equation model (SEM) using AMOS 24.0 to test the hypothesized model framework and to explore the relationship between each variable and individuals' mask-wearing intentions. Firstly, the model's fit was tested, with CMIN/DF = 1.52, CMIN = 3372.79, DF = 2,456, CFI = 0.796, TFI = 0.788, and RMSEA = 0.048, indicating that the model's fit was good.

The interrelations among the variables were expressed as path coefficients, which effectively gauged the magnitude of influence between distinct variables. Positive coefficients signified positive correlations, while negative coefficients signified negative correlations. A comprehensive depiction of the parameters' estimates and the hypotheses for the model of college students' intentions to wear masks is presented in Table 2. The findings validate a substantial number of the hypotheses, further fortified by robust support from the amassed subject data. Specifically, our proposed model of college students' intentions to wear masks was approached from two perspectives: psychological factors and social factors. On one hand, the study clearly confirmed the direct effect of the fear of COVID-19 on the intention to wear masks (H1, $\beta = 0.625$, $p = 0.005$). On the other hand, social anxiety indirectly affected college students' intention to wear masks through the mediating role of avoidance (H2, $\beta = 0.388$, $p < 0.001$; H3, $\beta = 0.745$, $p < 0.001$), and the mediating role of impression management was verified (H5, $\beta = 0.607$, $p < 0.001$; H6, $\beta = 0.415$, $p < 0.001$), as was and the mediating role of self-identity (H7, $\beta = -0.510$, $p < 0.001$; H8, $\beta = -0.211$, $p = 0.006$). Notably, the fear of COVID-19 did not emerge

TABLE 1 Mean, standard deviation, the correlation matrix of each variable, convergent validity, and discriminant validity ($n = 223$).

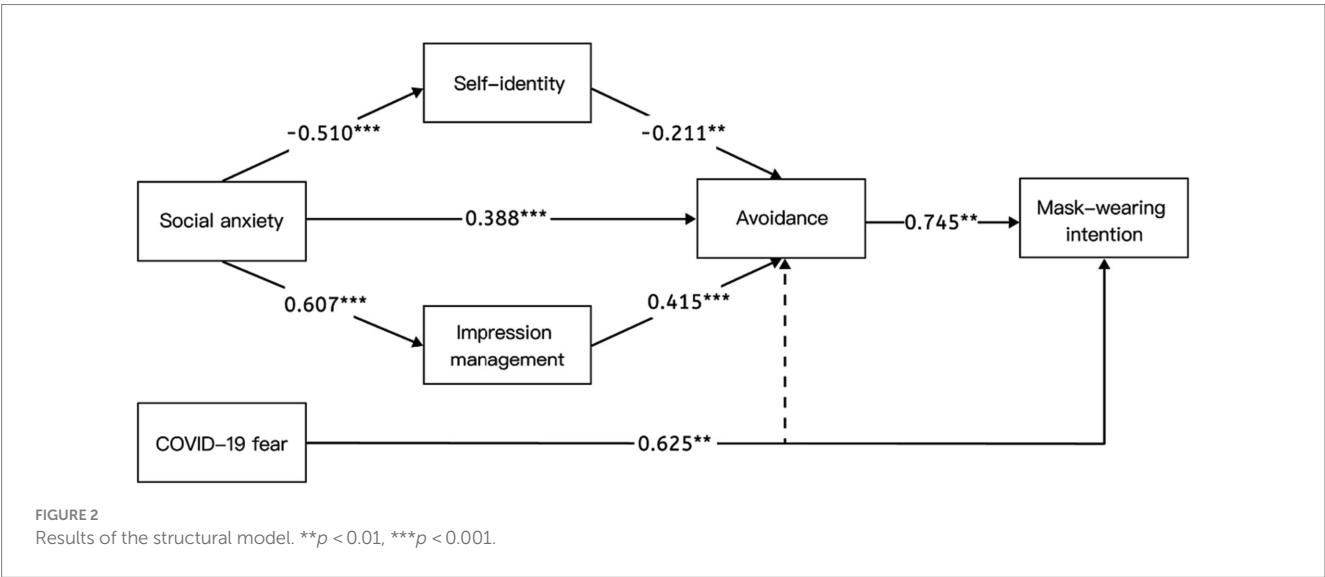
	M	SD	CR	AVE	1	2	3	4	5	6
1. Social anxiety	1.46	0.43	0.83	0.51	–					
2. Avoidance	1.35	0.55	0.77	0.53	0.69***	–				
3. Impression management	1.86	0.65	0.87	0.52	0.53***	0.63***	–			
4. Self-identity	2.69	0.38	0.76	0.62	–0.45***	–0.45***	–0.28***	–		
5. COVID-19 fear	1.85	0.83	0.84	0.52	0.21**	0.25***	0.25***	–0.15*	–	
6. Mask-wearing intention	6.10	2.50	–	–	0.19**	0.28***	0.16*	–0.19**	0.25***	–

$n = 223$; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. M, Mean; SD, Standard deviation; CR, Composite reliability; AVE, Average variance extracted.

TABLE 2 Structural model results.

Dependent variable	Hypothesis	Path	β	p value	Hypothesis supported
MWI	H3	Avoidance→MWI	0.745	0.001**	Supported
	H1	COVID-19 → MWI	0.625	0.005**	Supported
Avoidance	H2	SA → avoidance	0.388	<0.001***	Supported
	H4	COVID-19 → avoidance	0.059	0.271 ^{n/s}	Not Supported
	H6	IM → avoidance	0.415	<0.001***	Supported
	H8	Self-identity→avoidance	−0.211	0.006**	Supported
IM	H5	SA → IM	0.607	<0.001***	Supported
Self-identity	H7	SA → self-identity	−0.510	<0.001***	Supported

** $p < 0.01$; *** $p < 0.001$; n/s, not significant. MWI, Mask-wearing intention; SA, Social anxiety; IM, Impression management.



as a significant predictor of avoidance (H4, $\beta = 0.059$, $p > 0.05$), unlike social anxiety. Detailed results are shown in Table 2; Figure 2.

3.3 Test of the mediating effects

This study used the bootstrap analysis technique by running model6 in PROCESS to conduct an analysis of the mediated effects to test the mediating roles of avoidance, impression management, and self-identity in the relationship between social anxiety and mask-wearing intentions, controlling for gender, age, and fear of COVID-19. The results of the regression analyses (see Table 3) showed that social anxiety was able to significantly and positively predict impression management ($\beta = 0.71$, $p < 0.001$) and avoidance ($\beta = 0.53$, $p < 0.001$), while social anxiety was able to significantly and negatively predict self-identity ($\beta = -0.39$, $p < 0.001$) among college students. Avoidance, as a mediating variable, was able to positively predict college students' mask-wearing intentions ($\beta = 1.13$, $p < 0.05$), whereas impression management significantly and positively predicted avoidance ($\beta = 0.30$, $p < 0.001$), and self-identity significantly and negatively predicted avoidance ($\beta = -0.23$, $p < 0.01$).

The bootstrap method was used to repeat the sampling process 5,000 times to calculate the 95% confidence intervals for the results of the mediation effect analysis and the mediation path diagram (see Table 4; Figure 2). Specifically, the mediating effect consisted of indirect effects in three pathways: Indirect Effect 1 acted through the pathway of social anxiety → avoidance → mask-wearing intentions; Indirect Effect 2 acted through the pathway of social anxiety → self-identity → avoidance → mask-wearing intentions; and Indirect Effect 3 acted through the pathway of social anxiety → impression management → avoidance → mask-wearing intentions.

4 Discussion

Social anxiety is common among college students (Peng, 2004). Social anxiety can have a negative impact on several aspects of life, including performance, interpersonal communication, and psychological status. The removal of regulatory measures after COVID-19 may be particularly distressing for people with high social anxiety, as they face increased uncertainty and fear (Saint and Moscovitch, 2021). In this study, the effects of fear of COVID-19, social anxiety, avoidance, impression management, and

TABLE 3 The mediating role of self-identity, impression management, and avoidance between social anxiety and mask-wearing intention.

	Self-identity			Impression management			Avoidance			Mask-wearing intention		
	<i>b</i>	<i>se</i>	<i>t</i>	<i>b</i>	<i>se</i>	<i>t</i>	<i>b</i>	<i>se</i>	<i>t</i>	<i>b</i>	<i>se</i>	<i>t</i>
Constant	3.30	0.09	37.60***	0.81	0.38	2.12*	0.59	0.25	2.33*	5.36	1.70	3.14**
Social anxiety	−0.39	0.05	−7.16***	0.71	0.10	7.45***	0.53	0.07	7.51***	−0.16	0.52	−0.30
Self-identity				−0.07	0.11	−0.69	−0.23	0.07	−3.29**	−0.47	0.48	−0.97
Impression management							0.30	0.04	6.81***	−0.22	0.33	−0.69
Avoidance										1.13	0.45	2.51*
<i>R</i> ²	0.59			0.30			0.21			0.12		
<i>F</i>	78.64			31.45			28.81			5.86		

p* < 0.05, *p* < 0.01, ****p* < 0.001; *se*, Standard error.

TABLE 4 Bootstrap 95% confidence interval of mediating effect path.

	Effect	BootSE	BootLLCI	BootULCI	Relative mediation effect
Ind1: SA → avoidance → MWI	0.51	0.25	0.06	1.06	64.16%
Ind2: SA → self-identity → avoidance → MWI	0.09	0.05	0.01	0.22	10.87%
Ind3: SA → IM → avoidance → MWI	0.21	0.10	0.03	0.45	26.31%

Boot SE, Bootstrap standard error; Boot LLCI, Bootstrap lower limit confidence interval; Boot ULCI, Bootstrap upper limit confidence interval; MWI, Mask-wearing intention; SA, Social anxiety; IM, Impression management.

self-identity on mask-wearing intentions were comprehensively examined by structural equation modeling using college students as the study population. This study revealed the effect of social anxiety on mask-wearing intentions and its internal mechanism of action, and also explored the differences between this effect and the effect of the fear of COVID-19 on mask-wearing intentions. The results of this study help us to understand the mechanism of social anxiety on the willingness to wear masks, to explore the psychological factors of whether and why socially anxious college students choose to wear masks, and to provide valuable guiding suggestions for safeguarding the physical and mental health of college students as well as adapting to the post-COVID-19 era.

4.1 The effect of the fear of COVID-19 on mask-wearing intentions

This study found that the fear of COVID-19 was significantly and positively associated with college students' mask-wearing intentions, a result that demonstrates that in the post-COVID-19 period, people still choose to wear masks because of the perceived protection they provide. This finding is consistent with previous research. People reported that the primary motivation for choosing to wear masks was to protect themselves and others (Binter et al., 2023) from viral transmission and exposure. COVID-19, as an infectious disease, can lead to psychological distress, depression, anxiety, and fear (Duong, 2021; Satici et al., 2021; Lee and Crunk, 2022). The reason for the ability of fear of

COVID-19 to directly predict mask-wearing intentions may lie in people's perceptions of the risk of COVID-19. The degree of worry or fear associated with the threat of the disease is an important component of the perceived risk, while this aspect may be a strong motivator for engaging in certain behaviors or behavioral change (Crosby et al., 2001). Studies have shown a link between disease-related worry and behavioral intentions (Crosby et al., 2001; Sales et al., 2009). Fear of COVID-19 is also associated with following social distance guidelines (Broomell et al., 2020; Taylor et al., 2020; Harper et al., 2021). Thus, when college students still perceive the threat of COVID-19 in their daily socialization, they are more likely to choose to wear masks to ward off illness and maintain good health.

4.2 Influence of social anxiety on mask-wearing intentions

This study found that college students' social anxiety was significantly and positively correlated with their mask-wearing intentions, and the results proved the effect of social anxiety on mask-wearing intentions, namely that socially anxious people may choose to wear masks due to their fear of exposing their appearance or their desire to hide themselves in a group, which is in line with the results of a previous study (Saint and Moscovitch, 2021). However, the direct predictive effect of social anxiety on mask-wearing intentions was not significant. The likely reason for this is that fear of COVID-19 was significantly positively correlated with mask-wearing intentions in the study, and college students may have perceptions of the consequences

of contracting COVID-19 and of the protective function of masks, and thus choose to wear a mask (Nakayachi et al., 2020). Further, wearing a mask obscures a major portion of the face, which includes elements that provide key information about an individual's identity (e.g., trustworthiness, attractiveness, age, and gender), and face masks can have a significant impact on social interactions (Bruce and Young, 1986). Because a face mask is an obstacle to accurately recognizing facial expressions and evaluating emotions (Bassili, 1979), socially anxious college students may worry about the uncertainty caused by others' misinterpretation of their facial emotions, and fear being observed and judged, which can lead to adverse social experiences. As a result, they may be more inclined not to wear a mask during social interactions. It can be seen that willingness to wear a mask may be associated with differences in social anxious college students' assessment of situations, which, in turn, indirectly affects their mask-wearing intentions.

4.2.1 Mediating role of avoidance

In the present study, we found that avoidance acted as a common mediator of the three indirect effects and positively predicted college students' mask-wearing intentions. Hirsch et al. (2004) showed that avoidance behaviors were associated with negative perceptions of observers, whereas impression management behaviors were not. In addition, several studies have shown that high levels of social anxiety significantly increase the risk of increased negative self-perception, and that the fear of being negatively evaluated in social situations, in turn, can lead to high levels of interpersonal distress and avoidance (Clark and Wells, 1995; Rapee and Heimberg, 1997; Hofmann, 2007; Moscovitch, 2009). Therefore, for those who are concerned about being negatively evaluated by others, wearing a mask can be viewed as a form of self-concealment that enhances comfort and reduces anxiety in social interactions (Saint and Moscovitch, 2021). A possible mechanism by which social anxiety indirectly affects mask-wearing intentions is that college students may have more severe negative thoughts after evaluating a social interaction, which leads to a greater tendency to choose to avoid negative evaluations by avoiding them in order to alleviate social tension. They may choose to continue to wear masks as an avoidance strategy, so their mask-wearing intentions will be stronger.

In conclusion, avoidance mediates the relationship between social anxiety and mask-wearing intentions, which may be because individuals tend to avoid negative evaluations and social stress by wearing a mask, thus enhancing mask-wearing intentions.

4.2.2 Mediating role of impression management and self-identity

Furthermore, our study revealed an association between social anxiety and impression management, which is consistent with the assumptions of the cognitive-behavioral model of SA (Clark and Wells, 1995). According to this model, safety behaviors are used as a means of preventing or minimizing the feared outcomes. Thus, the reason why social anxiety in college students positively predicted impression management but ultimately influence mask-wearing intentions through avoidance may be that the cognitive-behavioral model of SA has long emphasized the negative effects of safety behaviors, and research has shown that the use of safety behaviors actually impairs social performance while increasing perceptions of anxiety and negative social outcomes (Plasencia et al., 2011; Moscovitch et al., 2013; Rowa

et al., 2015), which is a maintaining factor of social anxiety (Wong and Rapee, 2016). As social anxiety increases, individuals may face more severe outcomes. In this case, college students may practice self-concealment to reduce the perceived social threat, and wearing a mask will make them feel safer and reduce social distress.

Research has also found that self-identity mediates the relationship between social anxiety and avoidance among college students. In the cognitive-behavioral model of SA (Clark and Wells, 1995), it was argued that socially anxious individuals tend to develop negative self-thoughts as a result of early unpleasant experiences, which leads to negative perceptions in social situations. They turn their attention to themselves and infer others' perceptions of themselves from information within themselves (Cheng et al., 2015; Ran et al., 2018), thus developing a poor self-image. The college students with high social anxiety in this study had relatively low self-reported self-identity, which is consistent with previous research (Gao and Hu, 2021). Additionally, the reason that social anxious of college students reversely predict self-identity but ultimately influence intentions to wear a mask through avoidance may be that the basis for the assumed relationship between self-identity and behavioral intentions relies on identity theory (Stryker, 1968, 1987). Terry et al. (1999) argued that self-identity influences intentions because performing a behavior allows the individual to come to validate the self-concept derived from role identity and helps the individual to develop a positive and significant self-evaluation. Because of their perceived low self-image, social anxiety groups are more inclined to engage in avoidance behaviors and to engage in behaviors that are perceived to be more in line with personal norms or social roles (wearing masks to avoid interactions). Another point in the results that was consistent with existing research is that when they have a poor self-image, individuals may believe that others are evaluating them in the same way, thereby producing a range of expressions such as nervousness, lowering the head and gaze avoidance (Cheng et al., 2015). The psychological barriers brought about by low self-identity will further affect individuals' behaviors in daily social situations, and college students are very likely to choose to avoid social interactions. Even if masks are no longer required in the post-COVID-19 era, these college students may still choose to continue using masks as an avoidance strategy.

4.3 Research implications and limitations

Our findings make important contributions to theory and practice, and it is worth mentioning that while the existing literature has mainly focused on mask-wearing intentions in the context of health behaviors during epidemics, the present study takes a new perspective by exploring the motivations of individuals to use masks outside of health behaviors, and by analyzing and investigating the differences in the mechanisms of these two different motivations.

In summary, this study revealed two mechanisms that influence mask-wearing intentions. The first is the direct mechanism, through which fear of COVID-19 affects mask-wearing intentions, and the second is the internal mechanism, through which social anxiety affects mask-wearing intentions, revealing the psychological influences on college students' choices about

mask-wearing in the post-epidemic era. First, on the one hand, the high risk of post-pandemic post-traumatic stress disorder, as demonstrated by Cavalera et al. (2023), suggests that COVID-19 has had a dramatic impact on individual's mental health; Focusing on the negative self-conscious emotions and counterfactual thoughts associated with the trauma of COVID-19 fears or related experiences may provide answers to questions about individual's willingness to wear masks in the post- COVID-19 era. On the other hand, it's also some theoretical grounding is provided for how college students with social anxiety may be able to comply with the trend to remove their masks. Although the use of self-concealment strategies may allow them to feel safer and more protected in social situations, this tends to impair social performance and reduce the quality of social interactions (Rowa et al., 2015). Low-quality social interactions may lead college students to develop negative memories of social situations and thus choose to avoid them in all future interactions, creating a vicious cycle in which the symptoms of social anxiety are not alleviated or improved. Therefore, the teachers and parents should pay more attention to students' psychological state, be aware of the impact of post-traumatic stress disorder caused by negative experiences of the pandemic on life, and promptly solve the psychological problems the students may have in facing social situations. In addition, removing masks may also be associated with existing exposure therapies for treating social anxiety, and attempting to remove a mask may imply the abandonment of safety behaviors, which can significantly improve the symptoms of social anxiety in the course of treatment (Cogle et al., 2020). Of course, future research needs to further explore how safety behaviors, including mask-wearing, can be improved to facilitate the effective implementation of exposure therapy. In addition, focusing on the feature of masks shielding the face, there have been studies to explore the use of masks for normal people (Carbon, 2020; Miyazaki et al., 2022) and those with severe mental illness (Bulgari et al., 2020) pose challenges in interpreting the emotions of others, and future research should more fully explore the social impact of mask wearing on other vulnerable groups, including those with social anxiety as presented in this study.

Nonetheless, there are some limitations to this study. Firstly, the study used a self-reporting approach, and college student subjects may not be able to report clinically true emotions or behaviors. Secondly, the selection sample is narrow and consists only of college students. Moreover, this study used a cross-sectional research method, the predictive effects of the main variables were based on existing theoretical assumptions, and temporal causality was not been verified. This is expected to be confirmed in a larger sample size and other subjects in China in the future and to also reveal the behavioral basis of the association of mask-wearing intentions and other factors further with social anxiety through more measures (such as EEG, fMRI and other tools to measure anxiety), to develop more targeted interventions.

5 Conclusion

In this study, we constructed a model of college students' mask-wearing intentions that included the factors of fear of COVID-19, social anxiety, self-identity, impression management and avoidance. It

was found that fear of COVID-19 positively predicted mask-wearing intentions; college students' social anxiety positively predicted self-identity, avoidance and impression management; social anxiety positively predicted avoidance through the mediating effect of impression management; social anxiety negatively predicted avoidance through the mediating effect of self-identity; and avoidance acted as a common mediator to positively predict college students' mask-wearing intentions. Our study provides important insights into understanding the mechanisms by which both fear of COVID-19 and social anxiety influence mask-wearing intentions in the post-epidemic context.

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 humans were approved by the Departmental Ethics Committee and the Institutional Review Board of the Guangdong University of Technology (No. GDUTXS2023123). The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

TX: Conceptualization, Writing – original draft. XX: Conceptualization, Investigation, Methodology, Writing – original draft. SD: Conceptualization, Supervision, Writing – review & editing.

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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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The relationship between childhood maltreatment and social anxiety among Chinese male individuals with drug use disorders: a moderated mediation model of fear of negative evaluation and self-construals

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Background: Social anxiety (SA) is prevalent among individuals with drug use disorders, playing a significant role in the etiology and maintenance of drug addiction. The etiological model of SA suggests a link between the development of SA and childhood maltreatment. Childhood maltreatment not only acts as a complex trauma with negative effects on individuals' selves and other cognitions but also exerts a negative influence through early negative parent-child interactions on individuals' internal working models, leading to the development of fear of negative evaluation and SA. Furthermore, self-construals, as a personality trait that emerges from the framework of the theory of sociocultural models, may exert a moderating effect on these mechanisms. The present study utilized a moderated mediation model to examine how childhood maltreatment relates to SA in individuals with drug addiction, aiming to provide support for a comprehensive understanding and effective resolution of SA in this group.

Methods: A total of 618 Chinese male individuals with drug addiction ($M = 34.13$, $SD = 8.76$) participated, and they completed the Childhood Trauma Questionnaire Short Form, the Fear of Negative Evaluation Scale, the Self-Consciousness Scale's Social Anxiety Subscale, and the Self-Construal Scale. SPSS PROCESS Macro was used to analyze the data.

Result: Correlation analysis revealed weak correlations among all variables but strong correlations between the SCS subscales. Mediation analyses revealed that fear of negative evaluation partially mediated the association between childhood maltreatment and SA. Moderated mediation analyses revealed that the link between fear of negative evaluation and SA was moderated by independent self-construal. The association was stronger among those with high independent self-construal than among those with low independent self-construal. An integrative moderated mediation analysis indicated that independent self-construal positively moderated the indirect association between childhood maltreatment and SA via fear of negative evaluation. However, interdependent self-construal did not show a moderated effect.

Conclusion: Fear of negative evaluation plays a partial mediating role in the relationship between childhood maltreatment and SA, while independent self-construal enhances the association between fear of negative evaluation and SA. Decreasing the fear of negative evaluation and intervening in self-construals may attenuate the association between childhood maltreatment and SA among Chinese male individuals with drug addiction.

KEYWORDS

childhood maltreatment, fear of negative evaluation, self-construals, social anxiety, Chinese male individuals with drug use disorder

1 Introduction

Social anxiety (SA) is a negative emotion that individuals experience in real or imaginary social interaction situations due to the fear or apprehension of receiving negative evaluations from others (Zhao et al., 2020). When this emotion reaches a pinnacle of severity such that functioning is impaired, we refer to it as social anxiety disorder (SAD) or social phobia (Morrison and Heimberg, 2013). The SA theoretical model proposed by Heimberg et al. (2010) highlights the significant role of adverse social experiences and/or distorted self-perceptions in maintaining SA within potential social evaluation environments. More specifically, the negative self-image resulting from adverse social experiences and/or distorted self-perceptions leads socially anxious individuals to doubt their ability to meet high standards in social situations. The perceived likelihood of negative evaluation from the audience and the undesirable social consequences that follow from it (e.g., rejection, loss of status) is likely to be high. Anticipation of negative evaluation elicits anxiety and the devaluation of the mental representation of the self as seen by others, creating a maladaptive negative feedback loop. Data from the NCS indicates that the overall lifetime prevalence of SA disorder in the general population is 13.3%, with a rate of 15.5% for female people and 11.1% for male people (Kessler et al., 1994). In a meta-analysis conducted by Tang et al. (2022), it was found that the prevalence of SA disorder among children, adolescents, and young adults in China is 2.1%, while the prevalence of SA symptoms is 23.5%. Multiple findings indicate a prevalent occurrence of SA among individuals with drug use disorders. For example, Grenyer et al. (1992) reported that approximately 25% of a sample of opioid users experienced SA. Buckner et al. (2016) demonstrated that 31.7% of cannabis users were diagnosed with SA disorder. Shams Eldin et al. (2019) conducted a study on anxiety disorders in patients recovering from drug dependence and found that 18% of the individuals in the recovered group had SA disorder. The National Comorbidity Study (NCS) revealed a substantial comorbidity between drug use and SA disorder, with nearly one-third to one-fourth of individuals with cannabis dependence also having SA disorder (Agosti et al., 2002).

Based on the above data, it is evident that individuals with drug addiction exhibit higher levels of SA than the general population. While there is currently no precise data regarding SA or SAD among Chinese individuals with drug use disorders, it is our belief that the levels of SA may be high among them. Existing research has shown that the prevalence of SA in East Asian countries is higher than in Western nations (Norasakkunkit and Kalick, 2009; Woody et al.,

2015). Surveys indicate that Chinese university students exhibit significantly higher levels of SA compared to American norms (Ling et al., 2005). The underlying reasons behind these research findings might be attributed to the relatively strong emphasis on interpersonal harmony in collectivist cultures (Han and Humphreys, 2016), which places higher demands on individual social interactions. Hence, the negative social image of individuals with substance use disorders exacerbates their interpersonal challenges within a collectivist cultural context. Survey research indicates that Chinese individuals with drug use disorders commonly experience social prejudice, workplace discrimination, and family misunderstanding (Yan, 2019), which contribute to the high prevalence of SA among this population. Furthermore, individuals with drug use disorders exhibit impaired executive functioning, which may lead to difficulties in social interactions and result in emotional distress (Lewis et al., 2009). At the same time, executive function deficits can also give rise to challenges in emotion regulation, limiting an individual's ability to regulate negative emotions, thus potentially leading to more severe SA (Formiga et al., 2021). Research has demonstrated that male people tend to display higher levels of implicit negative emotion than explicit expression (Lan and Zhang, 2015). This disparity in emotional expression partly reflects male coping mechanisms, characterized by emotional repression, which may intensify psychological conflicts and hinder the resolution of negative emotions such as SA. Buckner et al. (2012) confirmed that SA plays a significant role in the etiology and maintenance of drug addiction, and this effect may be more pronounced in the male population. A study conducted on community adolescents has provided evidence that relative to female people, male people exhibit a stronger relationship between SA and their substance use (Wu et al., 2010). In conclusion, SA exhibits higher prevalence and adverse consequences among Chinese male individuals with drug use disorders. To gain a comprehensive understanding and effectively address SA among Chinese male individuals with drug use disorders, it is crucial to investigate the underlying mechanisms involved in their experience of SA.

Childhood maltreatment (CM) serves as a significant influencing factor in the emergence of numerous psychological issues (DiLillo et al., 2007; Aff et al., 2012; Kong et al., 2019), of which SA is one. According to the World Health Organization (WHO), CM can be defined as “all forms of physical and/or emotional ill-treatment, sexual abuse, neglect or negligent treatment, or commercial or other exploitation, resulting in actual or potential harm to the child's health, survival, development, or dignity in the context of a relationship of responsibility, trust, or power,” and the WHO categorizes CM into five

main types: childhood physical abuse, childhood sexual abuse, childhood emotional abuse, childhood physical neglect, and childhood emotional neglect (WHO, 2016). A review of the environmental risk factors for SA has proven that maladaptive parenting and early traumatic events are associated with the development of SA (Brook and Schmidt, 2008). Additionally, etiological models of SA disorder propose a link between the development of SA and CM (Kuo et al., 2011), a widely recognized global public health issue frequently observed among individuals with drug use disorders. Grice et al. (1995) reported that more than 60% of individuals with drug addiction experienced physical and/or sexual abuse during their childhood. A meta-analysis study on the prevalence of CM in individuals with opioid use disorder (OUD) revealed that the prevalence of sexual abuse was 41% among women and 16% among men. Among all individuals with OUD, prevalence estimates were 38% for physical abuse, 43% for emotional abuse, 38% for physical neglect, and 42% for emotional neglect (Santo et al., 2021). Khoury et al. (2010) found that 34% of individuals with cocaine dependence reported a history of physical and/or sexual abuse. Comparatively, the detection rate of CM is lower in the general population. A comprehensive review study on CM among the general population worldwide revealed that nearly one-quarter of adults globally (22.6%) experienced physical abuse during childhood, 36.3% endured emotional abuse, and 16.3% experienced physical neglect. Gender differences were observed in childhood sexual abuse, with a prevalence of 18% among girls and 7.6% among boys (Abbasi et al., 2015). Importantly, CM exposes individuals to long-term negative interpersonal experiences during a critical period of growth. These experiences can influence the development of internal working models that guide social interactions in adulthood (Bretherton and Munholland, 1999; Feeny et al., 2008). Attachment theory considers that the internal working models built by early parent-child interactions influence the characteristics of individual lifelong interpersonal adaptation. Griffin and Bartholomew (1994) defined two underlying dimensions of internal working models: the self-model and the others model. By considering the positivity and negativity of each dimension, four distinct prototypes can be identified. Individuals who have experienced CM may develop negative internal working models of both the self and others. Consequently, they are more likely to exhibit heightened attention to negative information in interpersonal environments, underestimate their own self-image (Reyes, 2008), and overestimate the potential threat posed by others during social interactions (Huh et al., 2017), which leads to fear of negative evaluation and associated SA.

At the same time, due to its typically chronic nature and its cumulative impact on psychological adjustment, CM is considered a complex trauma (Courtois, 2004), which contributes to the risk of developing complex post-traumatic stress disorder (CPTSD; Herman, 2012; Cloitre et al., 2019; Ford and Courtois, 2021). The CM environment fails to facilitate the development of age-appropriate adaptive coping strategies for dealing with stress and negative emotions in children. Instead, children often rely on negative coping strategies such as aggression, dissociation, and avoidance to manage the stress and extreme emotions resulting from maltreatment (Cicchetti and Valentino, 2006). While short-term negative coping may serve a self-protective function, excessive reliance on these strategies hinders the processing and integration of memories and experiences. This, in turn, is believed to lead to a fragmented or

distorted self and other understandings, forming the basis for many symptoms related to complex trauma (Bailey et al., 2007). Courtois (2004) summarized seven consequences of complex trauma, among which three may serve as significant foundations associated with the link between CM and SA: emotional dysregulation, negative self-concept, and disturbances in relationships. These factors constitute essential components of the core symptoms of ICD-11 complex post-traumatic stress disorder (CPTSD), distinguishing CPTSD from PTSD (Maercker, 2021), and they play a significant role in the emergence of SA. A study on CM and suicidal ideation found an association between CM and negative emotions such as guilt and shame. These dysregulated negative emotions, which reflect the identification of the abused individuals with their abusers (Sekowski et al., 2020), play a significant role in the emergence of SA (Cândeia and Szentagotai-Tătar, 2018). Penner et al. (2019) conducted research that confirmed that CM affects identity integration during adolescence, resulting in identity diffusion. This is believed to lead to chronic issues in social relationships (Beeney et al., 2015). In recent years, researchers have begun to focus on the development of the sense of self in individuals with substance use disorder (SUD) and its relationship with early adverse experiences. Wojtynkiewicz et al. (2021) confirmed that individuals with SUD exhibited lower levels of self-identity than the control group. Furthermore, a study conducted on individuals with SUD demonstrated a negative association between insecure attachment and individual self-identity (Wojtynkiewicz and Sekowski, 2022). This indicates that substance-dependent individuals who have experienced CM struggle to form a healthy self-identity, which affects the stability and consistency of their self-awareness, subsequently influencing the formation and shaping of self-concept and rendering their social interactions susceptible to negative influences, thus contributing to the emergence of SA. At the same time, fear of negative evaluation is a typical variable reflecting negative self-image in interpersonal situations (Ng et al., 2014), and it not only is influenced by early negative interpersonal experiences (Zlomke et al., 2016) but also constitutes a cognitive component of SA (Heimberg et al., 2010). Moreover, research has confirmed that different self-construals produced under the influence of an acquired sociocultural environment make individuals have different attitudes and cognitions toward others and the environment to which they belong (Lam, 2006). This factor influences individuals' perceptions of themselves and others within interpersonal situations and their related social emotions. Overall, this study is designed to assess the mediating role of fear of negative evaluation and the moderating role of self-construals in the association between CM and SA among Chinese male individuals with drug use disorders.

1.1 The mediating role of fear of negative evaluation

Fear of negative evaluation is a typical issue of social communication that manifests as apprehension about others' evaluations, distress over their negative evaluations, avoidance of evaluative situations, and the anticipation that others would evaluate oneself negatively (Watson and Friend, 1969; Collins et al., 2005; Ng et al., 2014). The cognitive model of SA posits that the fear of negative evaluation serves as an important integral component of the cognitive aspects of SA (Weeks et al., 2008; Heimberg et al., 2010). According to

this model, the core fear that drives SA is the negative perception of oneself, described as “characteristics of the self that one perceives as being deficient or contrary to perceived societal expectations.” It is the key to triggering fear of negative evaluation and associated SA (Moscovitch, 2009).

The looking-glass self-theory implies that people shape their self-concept based on their understanding of how others perceive them (Oikawa and Yoshida, 2007). People with a CM history develop negative internal working models, in turn leading to the formation of a negative self-view because they lose necessary positive support from others and are treated negatively by others (Speidel et al., 2023). At the same time, children learn their self-worth from the reactions of others, especially caregivers. CM as complex trauma leads to alterations in self-perception and difficulties with self-concept (Herman, 2015). Studies have found a significant positive correlation between CM and negative views of the self (Devi et al., 2013; Flynn et al., 2014), which accounts for the association between CM and fear of negative evaluation. Therefore, CM may be a predictive factor of fear of negative evaluation. Researchers have started investigating the mediating effect of fear of negative evaluation and related concepts on the relationship between CM and affective problems. Lucero et al. (2022) found that fear of negative evaluation mediates the association between childhood trauma and affective disorders. Garety et al. (2001) and Morrison et al. (2003) proposed a cognitive model of affective problems or disorders that suggests that childhood adverse experiences may lead to a cognitive vulnerability of affective problems characterized by negative self and environmental evaluations. As a result, CM contributes to the development of fear of negative evaluation, which, in turn, leads to SA among Chinese male individuals with drug use disorders. Therefore, we propose the following hypothesis:

Hypothesis 1: Fear of negative evaluation may play a mediating role in the relationship between CM and SA.

1.2 The moderating role of self-construals

The theory of sociocultural models (TSCM) considers that the sociocultural environment of which individuals are a part plays an important role in influencing individuals' cognitions, motivations, emotions, selves, and other mental capacities (Chirkov, 2020). Self-construal is a personality characteristic that arises in this theoretical context. It is a significant cultural feature that influences human behavior and explains cultural differences in behavior, cognition, and emotion (Han and Humphreys, 2016). Furthermore, self-construal is conceptualized as a constellation of thoughts, feelings, and actions related to one's relationship with others and self-identity that shape how a person perceives and interprets the self (Singelis, 1994). The core of the concept is the “self-other” relationship, that is, to what extent an individual considers the self and others to be related (interdependent self-construal) or separated (independent self-construal; Cross et al., 2010). Markus and Kitayama (1991) proposed that Western culture encourages an independent self-construal that conceptualizes the self as an autonomous and bounded entity, emphasizing the independence and uniqueness of the self. In contrast, East Asian culture promotes an interdependent self-construal that conceptualizes the self as interconnected and

overlapping with close others, emphasizing harmony with these close others. Studies have confirmed that individuals with different kinds of self-construals use information from different sources when making global self-evaluations. Specifically, independent self-construal uses relatively stable internal information, and interdependent self-construal uses relatively variable external information (Suh et al., 2008), which may generate distinct effects on the stability of self-evaluation (Kanagawa et al., 2001) and further influence the fear of negative evaluation and associated SA. In addition, the importance of self-construal in emotional regulation has been recognized in past decades. Studies have proven that compared to individuals with high levels of independent self-construal, those with high levels of interdependent self-construal are more likely to seek and receive social support from others, especially in collectivist cultures (Ringeisen and Buchwald, 2008; Heintzelman and Bacon, 2015). A study of the self-construal of Vietnamese–American adolescents shows that interdependent self-construal as a protective factor can help them have more family cohesion, less adverse neighborhoods, and a stronger sense of community (Lam, 2006). Ogihara and Uchida (2014) show that independent self-construal adversely predicts the number of close friends Japanese people have. Based on these findings, we speculate that different kinds of self-construals lead to varying moderated effects on the relationship between the fear of negative evaluation and SA in Chinese male individuals with drug use disorders.

Specifically, independent self-construal results in a self-definition that is “bounded, unitary, stable,” and separate from social context (Singelis, 1994). Individuals with high independent self-construal tend to think of themselves as independent of the environment to which they belong. They validate their unique internal attributes and goals and are prone to self-identification (Cross et al., 2010). They are not easily affected by the external environment and mostly analyze problems by means of decontextualization. Therefore, Chinese males with drug use disorders who exhibit a high level of independent self-construal may solidify their fear of negative evaluation, leading to the development of more severe SA. Norasakkunkit et al. (2011) confirmed the relationship between independent self-construal and SA, revealing that independent self-construal was associated with the self-focused component of SA. Individuals with a high level of independent self-construal tend to direct their attention primarily inward as a means of self-monitoring. This inward focus may amplify negative self-attributes and intensify the fear of negative evaluation, leading to excessive worry about potential embarrassment or failure to make a positive impression in public settings, thereby giving rise to SA. In terms of perceived social support, although being high in independent self-construal does not mean being disconnected from society in collectivist cultures, their loose social connections may make them lack effective social resources to act as a buffer against psychosocial problems (Barry, 2000). Studies have confirmed that independent self-construal predicts less perceived social support and more serious psychosocial problems in the cultural background of collectivism (Taniguchi and Kaufman, 2019). Therefore, we propose the following hypothesis:

Hypothesis 2: Independent self-construal may positively moderate the relationship between fear of negative evaluation and SA among Chinese male individuals with drug use disorders.

Interdependent self-construal is a representative personality trait in collectivist cultures; it results in self-definitions that are “flexible, variable” (Singelis, 1994), and connected to, or in harmony with, social contexts. Individuals with high interdependent self-construal tend to see themselves as intricately connected and integrated with others in their social groups. They pay more attention to social relations and others and tend to adjust to the environment to which they belong (Colzato et al., 2012). Thus, their attitude toward the environment may render them susceptible to life events and the influence of significant others. Studies have shown that the early views of the self and others are not immutable (Ammaniti et al., 2000) and that significant life events and the presence of important others are likely to contribute to the improvement of individuals’ internal working models and self-cognitions. Therefore, interdependent self-construal may help male individuals with drug use disorders obtain opportunities to ameliorate their fear of negative evaluation, thereby alleviating SA. Additionally, studies have shown that interdependent self-construal allows individuals to acquire social resources and enhance their ability to regulate psychosocial problems (Ren et al., 2013). Research on trauma-exposed American college students showed that interdependent self-construal promotes the emergence of posttraumatic growth outcomes through social support seeking (Yeung and Chow, 2019). Therefore, we propose the following hypothesis:

Hypothesis 3: Interdependent self-construal may negatively moderate the relationship between fear of negative evaluation and SA in Chinese male individuals with drug use disorders.

In summary, from a sociocultural perspective, based on attachment theory and the cognitive model of SA, this study constructed a moderated mediation model, aiming to further explore the mechanism of SA among Chinese male individuals with drug use disorders. Specifically, it investigated the following: first, whether fear of negative evaluation plays a mediating role between CM and SA in Chinese male drug addicts, and second, whether the different types of self-construal may play different moderating roles in the second half path of the mediating process and whether independent self-construal positively moderates the relationship between fear of negative evaluation and SA, while interdependent self-construal does the opposite (Figure 1).

2 Methods

2.1 Participants and procedure

Individuals with drug use disorders were divided into teams (approximately 100 people per team) for daily management. The division of teams was randomized, and the present study employed cluster sampling, with teams as the units. The study included 700 male individuals with drug use disorders from two drug rehabilitation institutes in the Southwest China region. Among them, 82 participants were excluded from the analysis either because they selected the same option for more than 50% of the total items or due to missing data exceeding 10% of the total items. As a result, the final sample consisted of 618 Chinese male individuals with drug use disorders. The inclusion criteria for the study followed the definition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-V) of “substance use disorder” (American Psychiatric Association, 2013). Among the participants, 546 (88.35%) were of Han ethnicity, and 72 (11.65%) belonged to minority groups. Regarding housing, 489 (79.13%) owned their houses, 94 (15.21%) rented houses, and 35 (5.66%) had changed their rented accommodations more than twice within a 6-month period. A total of 167 (27.02%) exclusively used opioids, 323 (52.27%) exclusively used methamphetamine, 67 (10.8%) engaged in opioid-dominated mixed drug use, and 61 (9.91%) engaged in methamphetamine-dominated mixed drug use. The participants’ ages ranged from 18 to 61 years, with an average age of 34.13 (SD = 8.76), and the average age of first drug use was 24.27 (SD = 7.14). The demographic characteristics of the total sample are provided in Table 1.

The study was approved by the Research Ethics Committee of the Sichuan Psychology Association. Before starting the test, we provided each participant with an informed consent form and obtained their consent. The participants completed the questionnaires in groups while seated in a classroom at each drug rehabilitation institute. The researchers, who were doctoral students majoring in psychology, used a standardized set of instructions to explain the requirements for completing the measures to all the participants and confirmed their understanding of the instructions while emphasizing the importance of the authenticity and completeness of their answers. The participants were not required to provide any information revealing their identity. They were reassured that their responses would be kept confidential and would have nothing to do with treatment effectiveness.

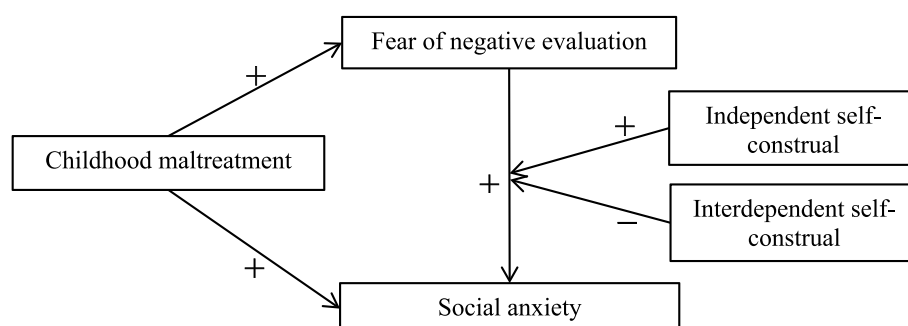


FIGURE 1
Hypothetical model.

TABLE 1 Distribution table of demographic variables.

Variables	Classification	Quantity	Proportion (%)
Ethnic group	Han ethnicity	546	88.35
	Minorities	72	11.65
Drug type	Opioids-type	167	27.02
	Amphetamines-type	323	52.27
	Opioids-dominated mixed-type	67	10.8
	Methamphetamine-dominated mixed-type	61	9.91
Living conditions	Have their own houses	489	79.13
	Rented houses	94	15.21
	Rented houses more than twice within half a year	35	5.66

2.2 Materials

2.2.1 Childhood maltreatment

The Childhood Trauma Questionnaire short form (CTQ-SF) was developed by Bernstein et al. (2003) and was later translated into Chinese by Zhao et al. (2005). Existing research has confirmed that the CTQ-SF demonstrates good reliability and validity when used among various population groups in China (Chen et al., 2019; He et al., 2019). The scale is a retrospective self-report questionnaire consisting of 25 clinical items that measure the extent to which respondents have experienced five categories of CM, including physical, sexual, and emotional abuse, as well as physical and emotional neglect. Each of the 5 categories of maltreatment is measured using 5 items. The participants responded on a 5-point-type scale (1 = never true to 5 = very often true) based on the frequency of each event having occurred. A quantitative score for each maltreatment category is computed and based on a validated cutoff score, and the severity of each category of maltreatment is quantified as “none or minimal,” “low to moderate,” “moderate to severe,” or “severe to extreme” (Bernstein and Fink, 1998). In this study, the cutoff scores for “low to moderate” exposure were used to examine the prevalence rates of various types of CM in Chinese male individuals with drug use disorders. The CTQ cutoff scores were as follows: physical abuse ≥ 8 , sexual abuse ≥ 6 , emotional abuse ≥ 9 , physical neglect ≥ 8 , and emotional neglect ≥ 10 . The reported sensitivity and specificity for these cutoff scores reached 89% and 97%, respectively (Tietjen et al., 2010). In this study, McDonald's ω of this scale was calculated to be 0.777.

2.2.2 Fear of negative evaluation

The Fear of Negative Evaluation scale (brief version; BFNES) was developed by Leary (1983), was translated into Chinese by Chen (2002), and has demonstrated good reliability and validity when used to measure Chinese populations (Wei et al., 2015; Lee et al., 2022). The scale consists of a total of 12 items, including 8 forward-scored and 4 reverse-scored items. All the items are rated on a scale from 1 (strongly disagree) to 5 (strongly agree). A higher score indicates a greater fear experienced by the individual when threatened to be negatively evaluated by others. BFNES is widely used as a measurement tool in the field of SA. In this study, McDonald's ω of this scale was calculated to be 0.772.

2.2.3 Social anxiety

The Social Anxiety Subscale of the Self-Consciousness Scale was developed by Scheier and Carver (1985) and translated into Chinese

by Wang et al. (1999), is widely used in China, and has been confirmed to possess good reliability and validity (Xu et al., 2017; You et al., 2019). The scale consists of a total of 6 items, all of which are rated on a scale from the weakest (totally not compliant = 0) to the strongest (fully compliant = 4). The situations described in the scale include unfamiliar situations, being stared at, embarrassing events, talking to strangers, public speaking, and large groups of people. The lowest score of the scale is 0, the highest score is 24, and higher scores imply more severe SA. In this study, McDonald's ω of this scale was calculated to be 0.811.

2.2.4 Self-construals

The self-construal scale (SCS) was developed by Singelis (1994) and then translated into Chinese by Wang et al. (2008), and it demonstrates good reliability and validity when used to measure Chinese populations (Wang and Wang, 2016; Li et al., 2022). It is a 24-item scale used to measure independent self-construal (12 items) and interdependent self-construal (12 items). The participants respond on a 7-point Likert scale, ranging from the weakest (strongly disagree = 1) to the strongest (strongly agree = 7). Higher scores on each dimension indicate the individual's corresponding self-construal tendency to be more pronounced. In this study, the McDonald's ω for the interdependent self- and independent self-dimensions was calculated to be 0.853 and 0.906, respectively.

2.3 Data analyses

Statistical analyses were conducted using SPSS 24.0 and PROCESS 3.0. First, the prevalence of CM was tested. Second, descriptive statistics (means and standard deviations) and correlation analyses of the study variables were computed. Third, Harman's single-factor test was used to assess common method bias. Fourth, Hayes's (2013) procedure was used to test the mediation model and the moderated mediation model. In the moderated mediation analysis, all variables were standardized. In addition, previous research found that the SA of individuals with drug use disorders was associated with age (Caballo et al., 2008), age at first drug use (Han et al., 2010), and drug type. We used the above variables as control variables in this study. Among them, age and age at first drug use were continuous variables. A study on SA among individuals aged 16 and above from 18 different countries, involving a total of 16,940 participants, revealed distinct patterns of significant correlations between age and various

dimensions of SA (Caballo et al., 2008). Furthermore, the age at first drug use indirectly reflects the duration and severity of an individual's drug addiction, exhibiting a significant negative correlation with the health status of individuals with drug use disorders (Han et al., 2010). Moreover, drug type was a categorical variable. In this study, drug types were categorized into four categories: opioid-type, methamphetamine-type, and mixed-type (mixed-type was further divided into opioid-dominated mixed-type and methamphetamine-dominated mixed-type). Opioids and methamphetamine are groups of illegal materials that are different from each other in terms of chemical structure, physical and psychological effects, and potential risk for individuals with drug use disorders (Parvaresh et al., 2015; Cumming et al., 2023). Methamphetamine is a highly addictive central nervous system stimulant (Haight et al., 2005), and opioids cause great damage to the central nervous system, which is manifested as excitation at first and then, mainly, inhibition (Watanabe et al., 2002). Studies have confirmed that mixed use has more serious consequences than single use (Cumming et al., 2023).

3 Results

3.1 Prevalence of childhood maltreatment

In the present study, among 618 male individuals with drug addiction, 586 (94.82%) had experienced emotional neglect, 594 (96.12%) had experienced physical neglect, 137 (22.17%) had experienced emotional abuse, 124 (20.06%) had experienced physical abuse, and 280 (45.31%) had experienced sexual abuse.

3.2 Common method bias

The data in this study were obtained through the self-reports of the participants. To avoid common method bias, appropriate controls, such as anonymous responding and reverse-scoring some of the items, were utilized. We also used the Harman single-factor test to conduct a common method bias test. The result of the unrotated exploratory factor analysis showed that the first factor can explain only 17.78% of the variance, far less than the critical value of 40%. This indicates that no serious common method bias was present in the data.

3.3 Preliminary analyses

The descriptive statistical results and correlation matrix of the variables in the current study are shown in Table 2. CM was weakly positively correlated with fear of negative evaluation and SA. Fear of negative evaluation was weakly positively correlated with SA. CM and fear of negative evaluation were weakly positively correlated with independent and interdependent self-construals. In general, the results of the correlation analysis indicated weak correlations among all variables in the study, except for the strong relationships between the SCS subscales.

3.4 Testing the mediation model

When fear of negative evaluation was the mediating variable, we used model 4 in the PROCESS Macro to test the mediation model. After controlling for age, age at first drug use, and drug type, the relationship between CM and SA revealed that CM significantly and positively predicted SA ($\beta=0.12$, $p<0.01$). CM significantly and positively predicted fear of negative evaluation ($\beta=0.12$, $p<0.01$), and the latter also significantly and positively predicted SA ($\beta=0.15$, $p<0.001$). After including the mediator, CM still significantly and positively predicted SA ($\beta=0.10$, $p<0.01$). The results of the bootstrapping analysis revealed that fear of negative evaluation partially mediated the relationship between CM and SA, and the indirect effect was 0.02, boot SE=0.01, 95% CI=[0.005, 0.037], accounting for 16.67% of the total effect. Hypothesis 1 is verified.

3.5 Testing the moderated mediation model

After controlling for age, age at first drug use, and drug type, we examined the moderated mediating model by using Model 14 of PROCESS Macro 3.0 for SPSS. As shown in Table 3 and Figure 2, CM significantly and positively predicted SA ($\beta=0.11$, $p<0.01$). In addition, fear of negative evaluation significantly and positively predicted SA ($\beta=0.16$, $p<0.001$), and independent self-construal had no significant effect on SA ($\beta=-0.04$, $p>0.05$). However, the interaction between fear of negative evaluation and independent

TABLE 2 Means, standard deviations, and correlations of study variables ($N = 618$).

Variables	M	SD	4	5	6	7
1. Drug type	-	-				
2. Age	34.13	8.76				
3. Age of first drug use	24.29	7.14				
4. CM	50.89	6.66	1			
5. FNE	24.07	5.86	0.13***	1		
6. SA	6.17	2.94	0.12**	0.17***	1	
7. INDESC	4.73	1.00	0.10**	0.24***	0.02	1
8. INTDESC	4.64	0.94	0.16***	0.21***	0.02	0.75***

M, mean; SD, standard deviation; CM, childhood maltreatment; FNE, fear of negative evaluation; INDESC, Independent self-construal; INTDESC, Interdependent self-construal. Drug type was dummy coded.

* $p<0.05$, ** $p<0.01$, *** $p<0.001$.

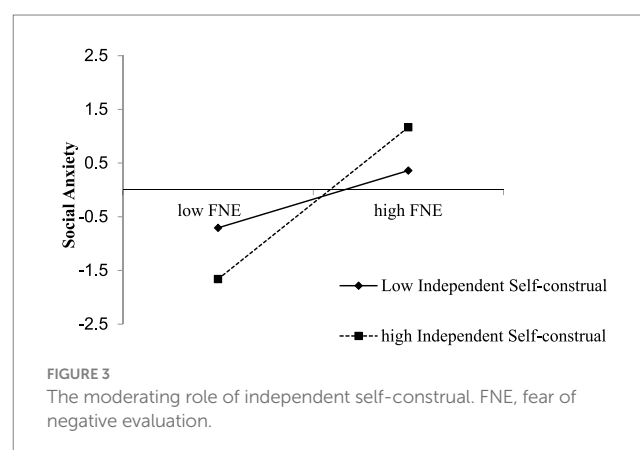
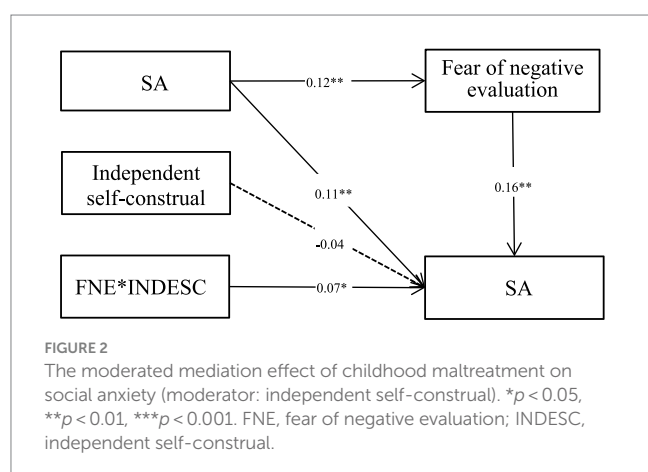
TABLE 3 The results of moderated mediation analyses (moderator: INDESC, $N = 618$).

Predictors	Mediator: FNE			Dependent variable: SA		
	β	SE	t	β	SE	t
Drug type	0.09	0.05	1.89 [†]	0.07	0.05	1.56
Age	0.01	0.06	2.21*	−0.01	0.01	−1.14
Age of first drug use	−0.01	0.01	−1.89 [†]	0.01	0.01	1.60
CM	0.12	0.04	3.03**	0.11	0.04	2.73**
FNE				0.16	0.04	3.86***
INDESC				−0.04	0.04	−0.87
FNE*INDESC				0.07	0.03	2.01*
R ²	0.03			0.05		
F	4.87***			4.77***		

The levels of moderator: INDESC	Indirect effects	95%LLCI	95%ULCI
Low level ($M - 1SD$)	0.01	−0.003	0.030
High level ($M + 1SD$)	0.03	0.008	0.052

CM, childhood maltreatment; FNE, fear of negative evaluation; INDESC, independent self-construal; LL, lower limit; UL, upper limit; CI, confidence interval. Drug type was dummy coded. The bootstrap sample size was 5,000.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.



self-construal had a significant effect on SA ($\beta = 0.07$, $p = 0.045$). Hypothesis 2 is verified.

To visually show the moderating effect of independent self-construal on the relationship between fear of negative evaluation and SA, a simple slope test was conducted (Figure 3). According to the mean ± 1 standard deviation, independent self-construal was divided into high ($M + 1SD$) and low ($M - 1SD$) groups, from low independent self-construal ($\beta_{\text{simple}} = 0.09$, $SE = 0.06$, 95% $CI = [-0.019, 0.198]$) to high independent self-construal ($\beta_{\text{simple}} = 0.23$, $SE = 0.05$, 95% $CI = [0.125, 0.332]$), and the effect of fear of negative evaluation on SA changed from insignificant to significant.

When the mediating process was moderated, it was necessary to check whether the indirect effect changed with the moderating variable (Table 3). The indirect effect was stronger at high ($M + 1SD$) independent self-construal ($\beta = 0.03$, Boot $SE = 0.012$, 95% $CI = [0.008, 0.052]$) than at low ($M - 1SD$) independent self-construal ($\beta = 0.01$, Boot $SE = 0.008$, 95% $CI = [-0.003, 0.030]$). For low independent self-construal, the indirect effect value accounted for 8.3% of the total effect; for high independent self-construal, it

accounted for 25% of the total effect. These results indicate that independent self-construal positively moderated the indirect effect of CM on SA in male individuals with drug use disorders via fear of negative evaluation.

We used the same method to construct a moderated mediation model to test the moderated effect of interdependent self-construal on the second half path of the mediation model. The results show that interdependent self-construal ($\beta = -0.04$, $p = 0.31$) and the interaction between fear of negative evaluation and interdependent self-construal ($\beta = 0.05$, $p = 0.14$) had no significant effect on SA. That is, interdependent self-construal had no moderating effect on the link between fear of negative evaluation and SA, and Hypothesis 3 was unconfirmed.

4 Discussion

This study confirms that CM has not only a direct positive relationship with SA but also an indirect relationship with SA through

the mediating factor of fear of negative evaluation among Chinese male individuals with drug use disorders. In addition, independent self-construal positively moderates the indirect association between CM and SA among Chinese male individuals with drug use disorders via the fear of negative evaluation. Specifically, the indirect association between CM and SA is stronger among individuals with high independent self-construal than among those with low independent self-construal. The results of this study help to explain the mechanism of SA in Chinese male individuals with drug use disorders and demonstrate a certain theoretical and practical significance in alleviating their SA.

The mediation analysis indicates that CM is not only directly associated with SA in Chinese male individuals with drug use disorders but can also be indirectly linked to SA through the mediation of fear of negative evaluation. The integration of CM as complex trauma with the causal mechanisms of internal working models and the cognitive model of SA can provide an explanatory framework for these findings. Specifically, CM, as a form of complex trauma, provides ample conditions for the development of negative self- and others' cognition, given its negative impact on self-concept, emotional regulation, and interpersonal relationships (Courtois, 2004; Maercker, 2021). These serve as a significant foundation for the emergence of SA. Shahar et al. (2015) established a sequential mediation model in a non-clinical adult sample, demonstrating that childhood emotional abuse predicted shame proneness, which, in turn, predicted self-criticism, and self-criticism subsequently predicted symptoms of SA. These findings offer preliminary evidence that supports the role of negative emotions and negative self-concept in the development and maintenance of SA among individuals with a history of CM. Wang et al. (2022) confirmed that emotional dysregulation can explain the relationship between harsh parenting by parents and adolescent SA. Based on the perspective of attachment theory, early caregiving experiences create internalized representations of interpersonal relationships, and thus, many interpersonal issues are closely associated with CM. Fitzgerald (2022) confirmed that CM has a significant indirect impact on SA symptoms through relationship quality. Moreover, CM, as a negative form of early parent-child interaction, can result in insecure attachment, prompting individuals to process information in a schema-driven manner consistent with their negative attachment experiences (Dykas and Cassidy, 2011). This processing pattern contributes to the formation of negative internal working models, which also provide the conditions for the development of fear of negative evaluation. Fear of negative evaluation is the core cognitive component of SA, which makes individuals prioritize the allocation of attention resources to detect social threats in the environment, monitor the environment to find evidence of negative evaluation, and monitor themselves to find defects that may cause others' negative evaluations (MacLeod and Mathews, 1991). In summary, negative self- and others' cognition and internal working models resulting from CM lead to the establishment of a relationship between CM and the development of fear of negative evaluation and SA.

Second, the study results indicate that independent self-construal moderates the association between fear of negative evaluation and SA among Chinese male individuals with drug use disorders. We found that as the level of independent self-construal increased, the positive association between fear of negative evaluation and SA also increased. This result is consistent with our research hypothesis. However,

previous research has confirmed a negative correlation between independent self-construal and SA. The contradictions in the research results mainly stem from differences in cultural backgrounds. In individualistic cultures, a negative relationship between independent self-construal and SA is confirmed (Park et al., 2011; Krieg and Xu, 2018), while in collectivistic cultures, a positive correlation is observed (Xie et al., 2008). Self-construal is shaped within the cultural context, so an incongruence between these two aspects often signifies a form of maladaptation. When an individual's self-construal is out of sync with their cultural milieu, they may encounter a series of adaptation challenges. These challenges can encompass diminished social acceptance, increased social pressure, and the inability to meet the expectations set by their culture's norms, leading to negative self-view, emotional distress, and psychological discomfort (Sakman and Sümer, 2022). Consequently, the conflict between self-construal and the cultural environment is commonly regarded as an indicator of adaptation issues. Norasakkunkit and Uchida (2011) confirmed that independent self-construal serves as an indicator of social adaptation difficulties within a collectivist cultural context, and a high level of independent self-construal often reflects interpersonal adaptation issues among individuals in collectivist cultures. A study on cross-cultural differences in social emotions showed that in cultures with a stronger collectivistic orientation, independent self-construal was negatively associated with positive affect (Nezlek et al., 2008). Additionally, the strong self-identification tendency and decontextualized thinking patterns associated with a high level of independent self-construal result in individuals having a stable self-view (Singelis, 1994). Consequently, Chinese male individuals with drug use disorders characterized by a high level of independent self-construal may be inclined to collect more evidence along with their pre-existing negative self-definition to maintain or exacerbate their fear of negative evaluation and associated SA. At the same time, studies have proven that the loose social connection of independent self-construal makes individuals lack enough social support to resist the influence of negative social emotions in the cultural background of collectivism (Taniguchi and Kaufman, 2019). Based on the above analysis, with the increase in independent self-construal, the fear of negative evaluation is more stable or even aggravated, contributing to the development and maintenance of SA.

Markus and Kitayama (1991) proposed that collectivist cultures promote an interdependent self-construal that conceptualizes the self as interconnected and overlapping with close others, emphasizing harmony with these close others. Individuals with high interdependent self-construal are characterized by their connectedness and coordination with the social environment, demonstrating a "flexible" and "adaptable" self-view (Singelis, 1994; Colzato et al., 2012). Research has demonstrated that a close social connection with high interdependent self-construal can help individuals acquire social resources more easily and enhance their ability to regulate social emotions, especially in the context of collectivist cultures (Ren et al., 2019). Ren et al. (2013) demonstrated through experimental research that an interdependent self-construal enables people from collectivistic cultures to recover from the negative effects of interpersonal rejection. At the same time, the compatibility between an individual's self-construal and their cultural environment, particularly the alignment of the primary components of self-construal with the cultural context, typically facilitates better adaptation and reduces the likelihood of interpersonal difficulties (Sakman and Sümer, 2022). Based on the

traits of interdependent self-construal, we speculate that it may negatively moderate the relationship between the fear of negative evaluation and SA of Chinese male individuals with drug use disorders. However, the aforementioned hypothesis has not been corroborated in this study. Through further analysis, we found that the self-construal characteristics of the participants in this study were incongruent with those typically observed in a collectivist cultural background. Specifically, their scores on independent self-construal were significantly higher than their scores on interdependent self-construal ($t = -3.323, p = 0.001$). This indicates that the participants in this study exhibited weaker traits related to interdependent self-construal. This incongruity may explain why the moderating effect of interdependent self-construal on the latter part of the mediating model pathway was not significant.

Individuals with a collectivist cultural background are expected to exhibit a higher degree of interdependent self-construal. The self-construal characteristics observed in Chinese male drug use disorders in this study are incongruent with the collectivist cultural background and may be indicative of sociocultural deviance. A study of Hikikomori in Japan confirms that self-construal is an index of sociocultural deviance, and groups with sociocultural deviance show high independent self-construal, which is particularly prominent in cultures that emphasize collectivism (Norasakkunkit and Uchida, 2011). Sociocultural deviance theory suggests that the tendency to deviate from mainstream sociocultural attitudes and values is a risk factor for interpersonal adaptation problems (Norasakkunkit and Uchida, 2014). Studies have proven that sociocultural deviance is closely associated with a negative self-view and deviant behaviors (Wells, 1978; Torkaman et al., 2020; Alison et al., 2021). It may reduce the extent to which individuals with drug use disorders see themselves as members of society and increase the probability of deviant behaviors. These two aspects can influence each other, gradually leading them to adopt deviant values, thus inducing deviant self-identification and further reinforcing the degree of sociocultural deviance. In fact, a negative view of the self and sociocultural deviance are mutually causal, creating a vicious circle that leads to the alienation of individuals with drug addiction from society. The attitudes of society toward Chinese male individuals with drug use disorders may serve as a breakthrough point for breaking this vicious cycle. Specifically, understanding and destigmatizing assessments from the general public have the potential to ameliorate the extent of sociocultural deviance among Chinese male drug addicts, enhance their negative self-evaluations, reduce their levels of SA, and decrease the probability of engaging in deviant behaviors. However, there has been a persistent tendency among the Chinese general public to hold relatively negative perceptions of drug use disorders, with biases and stigma being widespread (Luo et al., 2014), which can potentially pose a barrier for individuals with substance addiction, confining them to a subculture diverging from mainstream culture and impeding their social adaptation. Therefore, it may be evident that the social stigma and prejudice faced by Chinese individuals with drug use disorders are significant influencing factors that need to be considered when addressing the social adaptation of this population. Based on sociocultural deviance theory, the high independent self-construal of Chinese male individuals with drug use disorders in this study may indicate

their sociocultural deviance and associated negative view of the self and others. This belief in negative evaluations from social situations strengthens the fear of negative evaluation, which further reinforces their SA.

5 Limitations and future research directions

Some limitations of this study merit exploration in future research. First, this study exclusively focused on male individuals with drug use disorders in China. While the findings offer insights into understanding SA within this group, the limitation of the study's sample being exclusively male restricts the generalizability of the results. Therefore, in future research, we will first consider expanding the participant pool to include female individuals and possibly other racial or cultural groups. Second, the research subjects of this study were all individuals with drug use disorders in the isolation detoxification stage, and their interpersonal situations were distorted, which might have influenced the test results to some extent. Future research should include individuals with drug use disorders in community detoxification programs, which would increase the ecological validity of the study. Third, although the variables we selected for inclusion are grounded in theory, our research design remained cross-sectional. Fairchild and McDaniel (2017) concluded in their study that examining mediation in cross-sectional data implicitly undermines an assumption of the statistical mediation model: the presumption that the temporal ordering of variables in the causal chain of mediation is correct. Thus, any estimations of a mediation effect in such data are fundamentally correlated in nature. Hence, it is advisable for readers to interpret the study results regarding variable relationships with caution. Moreover, conducting longitudinal studies or experimental research with the correct temporal ordering of variables is the direction for our future research efforts to further explore the relationships between variables. Fourth, in retrospective self-report measurements, there is a possibility of recall bias that can affect the measurement results, for instance, in the assessment of CM. Previous research has demonstrated that retrospective reports of CM can impact the validity of findings regarding the association between childhood adversity and mental illness (Gayer-Anderson et al., 2020). The source of recall bias lies in autobiographical memory (Kuyken and Brewin, 1995), which is not an objective account of events but is subject to reconstructive and selective processes related to the self, leading individuals to recall their past experiences influenced by subsequent life events during development. Thus, this research suggests that, in future studies on CM among individuals with drug use disorders, structured interviews should be incorporated as a supplement to enhance the quality of measuring CM in this population. Fifth, based on the characteristics of fear of negative evaluation, combined with the issue of small effect sizes in the research, we speculate that the focus of this study on explicit fear of negative evaluations may not capture the complete extent of fear of negative evaluations in this population. Exploring the implicit fear of negative evaluations in individuals with drug addiction is a research topic worthy of attention. Sixth, this study extensively

cites concepts such as attachment theory and social support to justify the relationships between these variables. However, the utilization of these theories and variables in this study is still at the theoretical confirmation stage, and these variables have not been measured. Given the substantial value of these theories and concepts to research in this field, we intend to measure and analyze these variables in future studies, empirically substantiating their support for the hypotheses presented in the current research. Seventh, the current study has an underlying research question, namely, whether the high prevalence of CM among individuals with drug use disorders may be attributed to the impact of using drugs as a means to cope with post-traumatic symptoms resulting from CM experiences. Although this specific issue was not examined in this article, it will be a research direction to enhance our understanding of the relationship between CM and drug use. Eighth, this study extrapolates potential sociocultural deviations among Chinese male individuals with drug use disorders based on the characteristics of their self-construal. It suggests that these deviations need to be further validated in future research, and the factors influencing the occurrence of sociocultural deviations in Chinese individuals with drug use disorders need to be explored. This holds significant and far-reaching implications for a deeper understanding of social adaptation issues within the drug addiction population and the proposal of effective strategies.

6 Implications

Although the present study has certain limitations, the relevant results nonetheless have significant implications. First, our findings prove that the past life experiences of individuals with drug use disorders influence their social adjustment. Therefore, a relatively personalized and targeted social adjustment intervention and guidance program based on the adverse life experiences of individuals with drug use disorders is the direction we are working toward. Self-construal is the innovation considered in this work. Previous studies have proven that self-construal can be primed and shaped. Therefore, in the later stage, based on relevant research, we can try to link treatment to the self-construal traits of individuals with drug use disorders to formulate a plan to shape their self-construals. At the same time, social discrimination and stigma may act with traumatic childhood experiences against drug addicts, further enhancing the sociocultural deviation of the group and thereby inducing deviant self-identification. Therefore, public awareness campaigns to prevent discrimination and stigma toward drug addicts are necessary to alleviate their sociocultural deviation, which may help improve their social adjustment.

7 Conclusion

In conclusion, the findings from this study deepen the understanding of the relationship between the CM and SA of Chinese male individuals with drug use disorders. Specifically, CM has not only a direct positive relationship with the SA of Chinese male individuals with drug use disorders but also an indirect relationship with SA through the mediating factor of fear of negative evaluation. Additionally, independent self-construal

moderates the indirect predictive association between CM and SA via the fear of negative evaluation. Moreover, the gap in the scores of the two kinds of self-construal among Chinese male individuals with drug use disorders suggests that the social adjustment of this group may be affected by sociocultural deviance. These findings may help researchers and practitioners by providing insight into future social adaptation interventions for this discussed population, which need to be individualized and implemented for those who have experienced CM, and self-construal provides a path for that work.

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.

Ethics statement

The studies involving humans were approved by the Research Ethics Committee of the Sichuan Psychology Association. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

YL: conceptualization, methodology, data collection and analysis, writing—original draft, and writing—review. HZ: data collection. HM: revisions. JZ: revisions. CG: revisions and supervision. All authors contributed to the article 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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Unmet expectations: social inclusion and the interaction between social anxiety and ambiguous or positive feedback

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Introduction: This study explores the impact of preferential inclusion on fulfilling basic needs following ambiguous or positive social feedback, considering the moderating effect of social anxiety.

Methods: Participants ($N = 438$) received either positive or ambiguous social feedback and engaged in a social participation or preferential social inclusion task. They completed measures of the fulfillment of their fundamental needs, social anxiety, and other personality traits.

Results: The results indicate that preferential social inclusion (Uberball condition) enhances the fulfillment of fundamental needs compared to social participation (Cyberball inclusion condition). Furthermore, receiving positive social feedback considerably strengthens the negative relationship between social anxiety and fundamental need fulfillment when followed by ordinary social participation relative to preferential social inclusion presumably because these individuals react more strongly to unmet expectations of extreme social acceptance.

Discussion: This research suggests that individuals with high social anxiety may not experience the usual benefits of social participation unless they experience extreme social inclusion.

KEYWORDS

social inclusion, social participation, fundamental needs, fear of negative evaluation, social anxiety, Uberball, Cyberball

Introduction

Interpersonal acceptance and rejection have powerful psychological consequences. Social acceptance is vital to wellbeing, whereas social exclusion causes negative emotions and hinders psychological health (Leary and Baumeister, 2000; Williams et al., 2000; Williams, 2007; Leary, 2010; Williams and Nida, 2011; Hales and Williams, 2021). Explicit cues that others dislike or reject us are also among the most powerful contributors to feelings of low self-esteem (Leary and Baumeister, 2000). Being abandoned, romantically rejected, or excluded from social groups are highly distressing events, usually followed by self-esteem drops (Leary and Baumeister, 2000). Moreover, social rejection thwarts one's fundamental needs of belonging, meaningful existence, self-esteem, control, and certainty, leading to negative emotional, cognitive, behavioral, and neural consequences (Williams et al., 2000; Eisenberger et al., 2003; Williams, 2007; Williams and Nida, 2011; Hales and Williams, 2021).

To experimentally manipulate or induce feelings of ostracism, Williams and colleagues developed the Cyberball paradigm, where participants play a ball-tossing game on the computer in which they experience either social exclusion (other players stop throwing the ball to the participant) or social "inclusion" (other players throw the ball to the participant and other

players equally; Williams et al., 2000; Williams and Jarvis, 2006). The main purpose of the Cyberball paradigm was to investigate to effect of ostracism. Despite the wealth of knowledge on the effects and consequences of social rejection, little empirical research has investigated the effects and conditions needed to promote and increase feelings of social *acceptance*. Until recently, the Cyberball *inclusion* condition was assumed to have the opposite effects of the Cyberball *exclusion* condition. Being included in the ball-tossing game would increase participants' fundamental needs of self-esteem, belonging, meaning, control, and certainty (Hales and Williams, 2021). However, researchers showed that this was not the case and that the Cyberball *inclusion* condition is more akin to a control social participation task (Simard and Dandeneau, 2018; Dvir et al., 2019).

Making participants the *specific* target of inclusion while another player is excluded (an inclusion condition called *Uberball*) showed significant *increases* in fundamental need fulfillment (of belongingness, self-esteem, meaningful existence, but not control; Simard and Dandeneau, 2018) relative to a neutral control condition, whereas the standard Cyberball *inclusion* condition did not. In other words, it seems that increasing feelings of acceptance, above and beyond pre-existing levels, requires more than simply "participating or being included" in a game—it requires explicit and overt cues, indicating that we are "chosen" as part of the group. These effects were not explained by the participant's feelings of sympathy toward the "excluded" participant or mood but rather by the overt social cues that the others chose *them* and not someone else. Furthermore, the positive effects of the preferential inclusion of the *Uberball* condition were strongest for participants with relatively high levels of social anxiety (and null for participants with low levels of social anxiety), suggesting that unambiguous social cues of social inclusion benefit those who tend to construe their context as a socially hostile environment (Simard and Dandeneau, 2018).

These results highlight two important aspects of social functioning (1) that merely participating in a social task does not seem to boost feelings of group acceptance—one needs clear and overt cues that indicate one's inclusion to feel an increase in acceptance from baseline, and (2) clear and overt inclusion may counteract the negative interpretation bias shown in socially insecure individuals. One cognitive factor that contributes to social anxiety is the tendency to interpret ambiguous social information negatively. A recent systematic review and meta-analysis indicates that socially anxious individuals hold a negative or threat bias for ambiguous social situations and report catastrophic interpretations of mildly negative social situations (Chen et al., 2020). It also provides evidence for the cognitive theoretical framework that socially anxious individuals interpret ambiguous social information more threateningly than non-anxious individuals (Chen et al., 2020; see also Beard and Amir, 2008).

Ambiguous social information can be perceived as a social threat due to the brain's propensity to prioritize negative information in social contexts. According to the negativity bias theory, negative information, such as ambiguous social cues, is more salient and impactful on an individual's emotional and cognitive processes than positive information (Baumeister et al., 2001). Ambiguity is inherent in many social interactions, and individuals must rely on social cues, such as facial expressions, tone of voice, and body language, to navigate and interpret these interactions. For some people, namely, those with highly sensitive and anxious social radars, ambiguity in these social interactions can result in misinterpretation and negative

perceptions of social situations (Amir et al., 2005; Yun and Hyun, 2023). Ambiguity can lead to uncertainty, triggering anxiety and stress in individuals, especially those with heightened social vulnerability (Carleton et al., 2006). Furthermore, social ostracism is also frequently experienced as an ambiguous experience that threatens feelings of certainty (Hales and Williams, 2021). It is thus possible that ambiguous social feedback is perceived and experienced as social ostracism.

Research has shown that individuals with high anxiety and social anxiety levels are particularly susceptible to interpreting ambiguous social information as threatening. For example, one study found that individuals with high social anxiety were more likely to interpret neutral faces as threatening, suggesting they have a heightened sensitivity to ambiguous social cues (Hirsch et al., 2006). Moreover, individuals with social anxiety often have negative self-evaluations and a fear of negative evaluation by others. This leads to a heightened sensitivity to ambiguous social cues that may be perceived as social threats (Heinrichs and Hofmann, 2001).

The perception of ambiguous social information as a social threat may also stem from one's cognitive biases, that is, systematic errors in thinking that can influence perception, judgment, and decision-making (Tversky and Kahneman, 1974). One such cognitive bias is the confirmation bias, where one tends to seek out information that confirms pre-existing beliefs or attitudes and ignore information that contradicts them. In this light, individuals with social anxiety may be more likely to display a confirmation bias when interpreting ambiguous social cues, leading to a greater likelihood of perceiving such cues as threatening (Carleton et al., 2007), possibly influencing their behavior in a self-fulfilling prophecy fashion (Stinson et al., 2009, 2011).

In the current study, we extend previous research by integrating positive and ambiguous social feedback (Anthony et al., 2007; Schröder-Abé et al., 2007; Yang and Girgus, 2018) with the *Uberball* condition to test whether fortifying participant's fundamental needs can mitigate the effects of ambiguous social feedback. Social ostracism seems to motivate people to restore their basic needs and make them more sensitive to future social information (Hales and Williams, 2021); therefore, in the current study, participants should be particularly sensitive to the group's inclusive behavior following ambiguous feedback. We reasoned that if ambiguous feedback strongly affects socially insecure individuals, these individuals would benefit the most from the *Uberball* condition's restorative power, consistent with previous research (Simard and Dandeneau, 2018). We thus initially predicted that fostering preferential inclusion (e.g., through the *Uberball* condition) after receiving ambiguous social feedback would strengthen the fundamental needs of socially anxious participants.

On the other hand, we also recognize that the complicated nature of social anxiety and acceptance makes this prediction rather simplistic, given that social anxiety may change the way individuals interpret social interactions relative to non-anxious individuals. Indeed, previous research did not include a positive or ambiguous feedback manipulation *prior* to experiencing social inclusion; therefore, it is plausible that the effect would not be strictly linear. In particular, as mentioned earlier, the dynamics of confirmation bias and self-fulfilling prophecies in socially anxious individuals may, on the one hand, make them less receptive to future experiences of inclusion—even overinclusion—and under-detect acceptance if they have been primed with potentially ostracizing ambiguous social feedback (e.g., Cameron et al., 2010).

Present study

This study aimed to replicate and extend previous findings regarding the preferential social inclusion condition of Uberball. Based on previous research (Simard and Dandeneau, 2018), we hypothesized that the Uberball condition (vs. the Cyberball inclusion condition) would lead to higher fulfillment of fundamental needs and perceived relational value. Our central objectives were to test (1) whether experiencing preferential social inclusion (Uberball condition) mitigates the adverse effects of ambiguous social feedback on the fulfillment of fundamental needs and perceived relational value and (2) whether participants' level of fear of negative evaluation moderates this effect. Specifically, we predicted that those *high* in fear of negative evaluation would benefit more from the Uberball condition than the Cyberball inclusion condition after receiving *ambiguous* feedback. We did not expect such an effect when the feedback is *positive* or for those with a *low* fear of negative evaluation.

Method

Participants and design

The sample size was determined before any data analysis. Power analyses with an alpha level of 0.05 and 80% power suggested sample sizes of at least 104 per group (208 total) for *t*-tests (with an expected small-medium Cohen's *d* effect size of 0.39 based on Simard and Dandeneau, 2018) and at least 395 for moderation analyses (with an expected small *f* of 0.02 for the three-way interaction). We recruited five hundred participants through Amazon Mechanical Turk to participate in the online study, anticipating the loss of approximately one-third of the data due to incomplete or missing data (Litman et al., 2017). We excluded data from 16 participants due to incomplete or invalid data, 10 for failing the attention check, and 36 for knowing the purpose of the Cyberball paradigm before starting the experiment. This left 438 participants (58.7% women) with a mean age of 39.0 years (*SD* = 12.1 years) for the analyses (61% from the USA, 31% missing location data, and 8% from other countries). No demographics on racial/ethnic identity or language spoken were collected. Sensitivity analyses suggested such a sample size provided sufficient power to detect Cohen's *d* effects greater than 0.26 (for main effects comparing two collapsed groups of 219 in each condition) and *f* effects greater than 0.017.

The study consisted of a 2 (Feedback condition: Positive vs. Ambiguous) × 2 (Inclusion Type: Uberball condition vs. Cyberball condition) between-subject design where participants were randomly assigned to one of the four combinations of conditions. We report all tasks and measures below.

Conditions

Feedback conditions

Based on Anthony et al. (2007) methodology, we presented positive or ambiguous feedback relative to participants' involvement in an upcoming group task. Participants were asked to answer (yes/no) to the following questions: "Do you like heavy metal music? Do you tend to give money to homeless people? Are you a sports person?

Do you like going to amusement parks?" ostensibly to provide a brief "profile" to their team members. Participants were asked to wait 1 min while the system compiled responses from their group members, and during this time, they viewed other team members' "answers" to the same questions.

Participants in the *positive feedback* condition (*n* = 212) were told that other participants responded to their profile questions with the following responses: "This person seems nice. I hope she will join us." "This person sounds nice. I'm looking forward to working with them," or "I think she'll really gel with the group in no time at all."

Participants in the *ambiguous feedback* condition (*n* = 226) were told that other group members' responses to their profile were "We seem pretty different, but I'm willing to give it a try," "I think we'll get along well after we really get to know each other," or "This person sounds like someone I could grow to like."

Social inclusion conditions

We manipulated participants' feelings of inclusion with the Cyberball inclusion and the Uberball inclusion conditions. The *Cyberball inclusion* condition (*n* = 232) consisted of the 4-player version of the Cyberball inclusion online ball-tossing game where all participants are given approximately the same percentage of throws throughout the game (33%) (Williams et al., 2000).

The *Uberball Inclusion* condition (*n* = 206) is identical to the Cyberball inclusion condition; however, after approximately five throws, the preprogrammed players to the left and atop the participant *only start sending throws to the participant* (and stop sending throws to the player to the right of the participant). The participant can send throws to whomever they wish (left, atop, or right). This condition clearly and overtly indicates to the participant that *they* are the target of preferential social inclusion as they receive about 90% of the throws (Simard and Dandeneau, 2018).

The Uberball and Cyberball inclusion conditions consisted of 50 throws that lasted approximately 5 min and were programmed using Inquisit Web software (Millisecond Software LLC, 2016).

Measures

Anticipated group acceptance

Anticipation of being accepted by the group was measured on a scale designed from items used in the study by Anthony et al. (2007) as well as from other items created for this study (example item: "How likely is it that the others will like you?"). This 9-point scale ranged from *not at all* to *very much* (α = 0.95). This measure was used as a manipulation check, following the ambiguous and positive feedback manipulations.

Fundamental needs

The fundamental needs of belonging, self-esteem, meaningful existence, and control were assessed using a 5-point scale ranging from *not at all* (1) to *extremely* (5; Jamieson et al., 2010). A total mean score was computed (α = 0.94), where a higher score indicates a higher level for each need, that is, more *fulfilled* needs (example items for *belonging*, "I felt I belonged to a group"; *self-esteem*, "I felt liked and worthy"; *meaningful existence*, "I felt important"; and *control*, "I felt powerful"). The overall score (mean of 4 subscales) and the four individual subscales were used as our primary dependent measures.

Perceived relational value

Perceived relational value was assessed using a 7-point scale ranging from *not agree at all* (1) to *very strongly agree* (7; Simard and Dandeneau, 2018). A total mean score was computed ($\alpha=0.96$; example item: “I felt like others value playing with me”). This measure was used as an additional outcome measure.

Fear of negative evaluation

Participants’ fear of negative evaluation was assessed using Carleton et al.’s (2006) 5-point scale ranging from *Not at all characteristic of me* to *Extremely characteristic of me* (Carleton et al., 2006). Higher scores indicate a high fear of negative evaluation ($\alpha=0.95$; example item: “I am frequently afraid of other people noticing my shortcomings”). As was the case in Simard and Dandeneau (2018), this measure was used in our primary moderation analyses.

Other measures

We also took measures of self-esteem (Rosenberg, 1965), rejection sensitivity (Downey and Feldman, 1996), relational security with friends (Stinson et al., 2011), and mood (Kercher, 1992) for exploratory purposes. All measures used in this study (including exploratory measures) are available in Supplemental Materials.¹ In this study, we report all measures, manipulations, and exclusions.

Procedure

Participants first read the description of the study and provided informed consent and demographic information. They also completed the brief version of the Fear of Negative Evaluation Scale (Carleton et al., 2006) and other personality measures (e.g., Rosenberg Self-Esteem Scale and Rejection Sensitivity Scale). Participants then read the same experimental vignette asking them to imagine themselves in a first impression context involving three other people (i.e., the other three players in the Cyberball paradigm). As a result, each participant was required to disclose personal information (e.g., hobbies and employment) and was then asked to assess the same information provided by “others” (the other’s information was in fact pre-scripted). Participants were then randomly assigned to one of the four experimental groups where they first received feedback (e.g., positive or ambiguous), completed the measure of anticipation of their social acceptance of the group, and then completed either the Uberball or Cyberball social inclusion conditions. Finally, participants completed measures of fundamental needs, relational value, relational security with friends, and mood and were debriefed and thanked for participating.

Analyses

As per recommendations, we report item-level missing values by scale and the participant’s maximum number of missing items by scale (Parent, 2013). Fear of negative evaluation had 0.59% missing data

points (with no participant with more than three missing items); anticipation: 0.40% missing (max two missing items); relational value: 0.40% missing (max one missing item); and fundamental needs: 0.56% missing (max five missing items). Visual inspection of the missing data revealed no specific patterns. Little’s test confirmed this interpretation by failing to reject the null hypothesis that the missing data were missing completely at random. As per best practices (van Ginkel et al., 2020), we imputed item-level missing values (before calculating the scales’ means) via the *missForest* package (Stekhoven and Bühlmann, 2012; Stekhoven, 2022). To ensure optimal normal distribution of the data, we identified and applied optimal normalizing transformations (one of Box-Cox or Yeo-Johnson) via the *bestNormalize* package (Peterson and Cavanaugh, 2020; Peterson, 2021). We used Welch *t*-tests per recommendations (Delacre et al., 2017). The transformed data satisfactorily met all the univariate and model-based assumptions, and there were no outliers based on three median absolute deviations (Leys et al., 2013; Thériault et al., 2023a). We report raw descriptive statistics (before transformations) of all relevant variables in Table 1.

We performed all statistical analyses in R version 4.2.0 (R Core Team, 2022) using the following additional packages: *visdat* (visualizing missing data; Tierney, 2017), *nanian* (Little’s MCAR test; Tierney et al., 2021), *pwr* (power analyses; Champely, 2020), *lmSupport*, *bootES*, and *effectsize* (effect sizes and bootstrapped confidence intervals; Kirby and Gerlanc, 2013; Curtin, 2018; Ben-Shachar et al., 2020, 2022), *interaction* (moderations and figure; Long, 2019), *psych* (internal reliability analyses; Revelle, 2018), *dplyr* (data manipulation; Wickham et al., 2021), *ggplot2* (Wickham, 2016), *rcompanion* (Mangiafico, 2020), *ggsignif* (Ahlmann-Eltze, 2019), *ggrepel* (Slowikowski et al., 2018), and *ggpubr* (Kassambara, 2019) for figures, as well as report (Makowski et al., 2022) and *rempsyc* (Thériault, 2023) for convenience functions. The data and analysis scripts are available on the Open Science Framework at <https://osf.io/cm3gz/>.

Results

A manipulation check *t* test revealed a statistically significant effect between the ambiguous and positive feedback groups on anticipation of social acceptance ($M_{\text{Ambiguous}} = 6.57$, $M_{\text{Positive}} = 7.18$; difference = 0.62, 95% CI $[-0.89, -0.34]$),² $t(427.69) = -4.78$, $p < 0.001$; (Cohen’s $d = -0.46$, 95% CI $[-0.65, -0.27]$), suggesting that the feedback manipulation created different levels of anticipated social acceptance.

Replication analyses

The first analyses consisted of the same analyses reported by Simard and Dandeneau (2018) to see whether (a) participants in the Uberball condition (compared to the Cyberball inclusion condition) showed higher levels of fundamental need fulfillment and perceived

¹ Available on the Open Science Framework at <https://osf.io/cm3gz/>.

² Square brackets represent 95% confidence intervals throughout this manuscript.

TABLE 1 Descriptive statistics.

Variable	Mean	SD	IQR	Min	Max	Skewness	Kurtosis	<i>n</i>	Missing
Age	39.02	12.08	17.00	19.00	73.00	0.73	−0.19	436	2
Fear of negative evaluation	2.85	1.06	1.58	1.00	5.00	0.13	−0.86	438	0
Anticipation	6.86	1.49	2.03	1.25	9.00	−0.71	0.41	438	0
Needs	3.78	0.75	1.05	1.05	5.00	−0.72	0.42	438	0
Need to belong	3.93	0.84	1.05	1.00	5.00	−0.86	0.51	438	0
Need for self-esteem	3.88	0.85	1.00	1.20	5.00	−0.73	0.30	438	0
Need for meaningful existence	4.08	0.83	1.00	1.00	5.00	−1.16	0.90	438	0
Need for control	3.23	0.84	1.00	1.00	5.00	−0.19	−0.03	438	0
Relational value	5.12	1.52	2.00	1.00	7.00	−0.76	−0.16	438	0

relational value and (b) a moderation of fear of negative evaluation between inclusion condition and fundamental needs.

Regarding result (a), the Uberball condition does lead to higher fulfillment of fundamental needs (overall needs and individual needs) and perceived relational value than Cyberball inclusion, as in previous research and with comparable effect sizes (Table 2; Figure 1).

Regarding results (b), a critical difference between Simard and Dandeneau (2018) studies and the current study is that participants in the present study underwent a positive/ambiguous feedback manipulation *before* completing the Uberball/Cyberball inclusion conditions. The fear of negative evaluation by condition interaction on fundamental need fulfillment was not significant ($\beta=0.08$, $t(434)=0.93$, $p=0.354$, $sr^2=0.00$ [0.00, 0.01]).³ Visual assessment of the data revealed that all participants, regardless of levels of fear of negative evaluation and feedback group, seemed to have benefited from the Uberball condition relative to the Cyberball inclusion condition. This discrepancy with Simard and Dandeneau (2018) is not totally unexpected, however, given that in our study, participants received social feedback beforehand, which could have changed the effect that the fear of negative evaluation \times Uberball condition interaction has on fundamental needs. The next section addresses this point by demonstrating a three-way interaction between fear of negative evaluation, social feedback condition, and inclusion condition.

Primary analyses

Our main hypotheses tested the two-way “feedback \times condition” and the three-way “feedback \times condition \times fear of negative evaluation” interactions on fundamental needs as the dependent variable. We used

general linear and simple linear moderation models to examine these hypotheses.

First, in contrast to our hypotheses, the two-way interaction “feedback \times condition” was not significant (Table 3). As predicted, the “feedback \times condition \times fear of negative evaluation” interaction term significantly predicted fundamental needs (Table 3). However, the nature of the interaction differs from our predictions. To decompose this complex three-way interaction, we tested a two-way interaction for each of the ambiguous feedback and positive feedback conditions separately. As suggested by Figure 2, the two-way interaction between inclusion condition and fear of negative evaluation is significant only in the positive feedback condition ($\beta=0.36$, $t(208)=2.83$, $p=0.005$, $sr^2=0.03$ [0.00, 0.07]) but not in the ambiguous feedback condition ($\beta=-0.16$, $t(222)=-1.20$, $p=0.233$, $sr^2=0.01$ [0.00, 0.02]).

To further explore the interaction, we conducted simple slope analyses for each feedback condition separately (with $+1/-1$ SD; Aiken and West, 1991; Hayes, 2018). In the *ambiguous* feedback analyses, there was a significant condition effect (Cyberball inclusion condition vs. Uberball condition) on fundamental needs for those with low ($\beta=0.26$, $t(430)=2.90$, $p=0.004$, $sr^2=0.02$ [0.00, 0.04]) and mean levels of fear of negative evaluation ($\beta=0.19$, $t(430)=2.95$, $p=0.003$, $sr^2=0.02$ [0.00, 0.04]) but not for those with high levels of fear of negative evaluation ($\beta=0.11$, $t(430)=1.21$, $p=0.228$, $sr^2=0.00$ [0.00, 0.01]). In other words, for participants at the mean and low levels of fear of negative evaluation, those in the Uberball condition reported significantly higher levels of fundamental need fulfillment than their counterparts in the Cyberball inclusion condition.

For those having received *positive* feedback, the condition term predicted fundamental needs for those at mean levels ($\beta=0.17$, $t(430)=2.63$, $p=0.009$, $sr^2=0.01$ [0.00, 0.03]) and high levels of fear of negative evaluation ($\beta=0.35$, $t(430)=3.72$, $p<0.001$, $sr^2=0.03$ [0.00, 0.06]) and not for those with low levels of fear of negative evaluation ($\beta=-0.01$, $t(430)=-0.12$, $p=0.905$, $sr^2=0.00$ [0.00, 0.00]). In other words, for participants at the mean and high levels of fear of negative evaluation, those in the Uberball condition reported significantly higher levels of fundamental need fulfillment than those in the Cyberball inclusion condition.

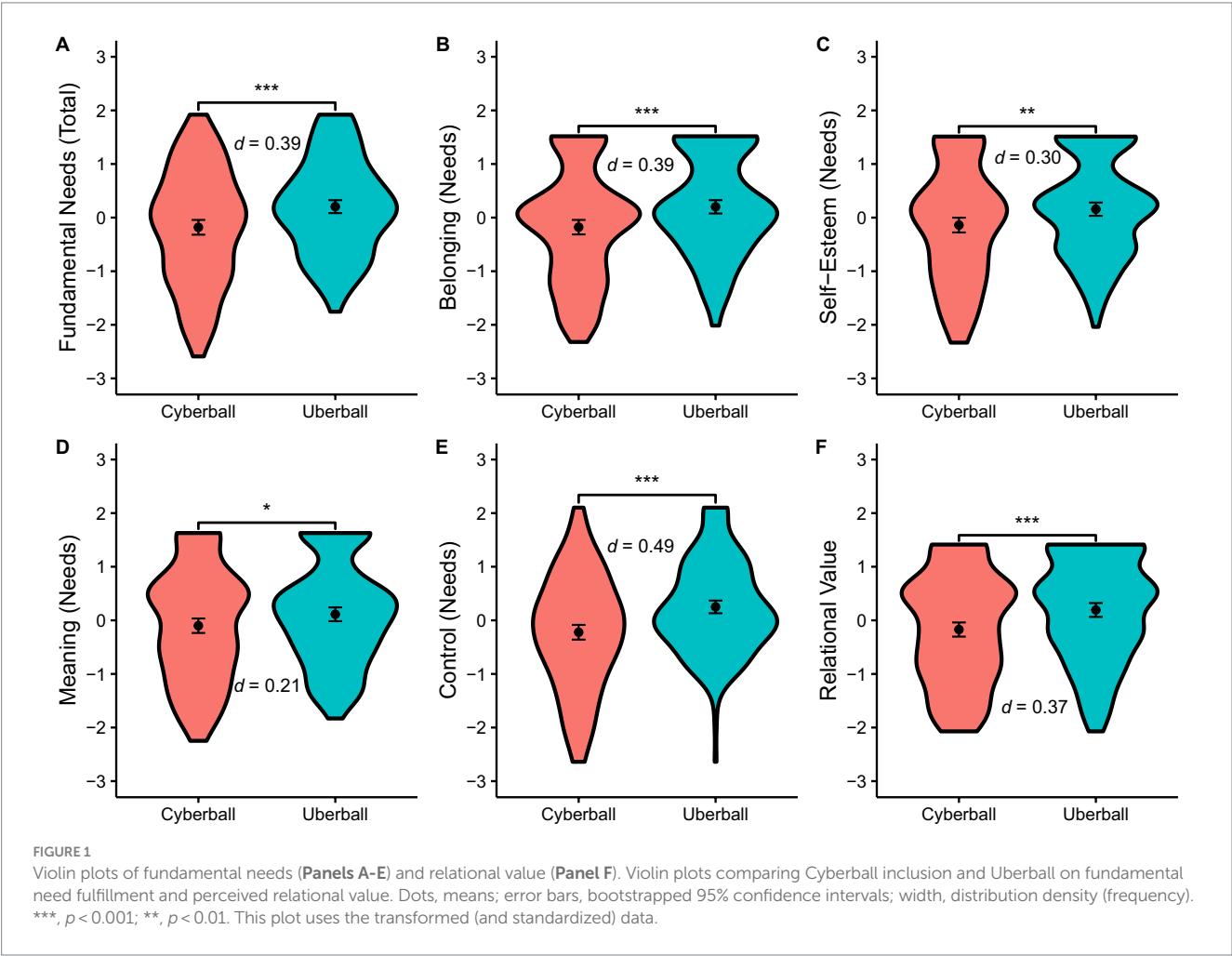
We also tested the “feedback \times condition \times fear of negative evaluation” interaction for each of the individual fundamental needs.

³ We report the semi-partial correlation squared (sr^2) and its 95% confidence interval as an index of the effect size. The sr^2 allows us to quantify the unique contribution (proportion of variance explained) of an independent variable on the dependent variable, over and above the other variables in the model. The sr^2 is often considered a better indicator of the practical relevance of a variable.

TABLE 2 Results of pairwise comparisons (Cyberball inclusion vs. Uberball) on fundamental needs and relational value.

Dependent variable	Subdimension	<i>t</i>	<i>df</i>	<i>p</i>	<i>d</i>	95% CI
Fundamental needs	Total Needs	4.14	433.60	<0.001	0.39	[0.20, 0.58]
	Belonging	4.07	435.78	<0.001	0.39	[0.20, 0.58]
	Self-Esteem	3.16	434.95	0.002	0.30	[0.11, 0.49]
	Meaning	2.28	435.92	0.023	0.22	[0.03, 0.40]
	Control	5.14	432.33	<0.001	0.49	[0.30, 0.68]
Relational value	...	3.89	435.37	<0.001	0.37	[0.18, 0.56]

d, Cohen's *d*; CI, confidence interval. The transformed (and standardized) data were used in the analyses reported in this table. Shaded/bolded areas represent statistically significant rows.



The three-way interaction term significantly predicted *belongingness* ($\beta = 0.44$, $t(430) = 2.38$, $p = 0.018$, $sr^2 = 0.01$ [0.00, 0.03]), *self-esteem* ($\beta = 0.58$, $t(430) = 3.19$, $p = 0.002$, $sr^2 = 0.02$ [0.00, 0.04]), and *meaningful existence* ($\beta = 0.60$, $t(430) = 3.25$, $p = 0.001$, $sr^2 = 0.02$ [0.00, 0.04]) but was not significant for *control* ($\beta = 0.30$, $t(430) = 1.63$, $p = 0.103$, $sr^2 = 0.01$ [0.00, 0.02]).

Discussion

The central objective of this research was to further understand the effects of the Uberball condition on fulfilling fundamental needs after providing either ambiguous or positive feedback to participants.

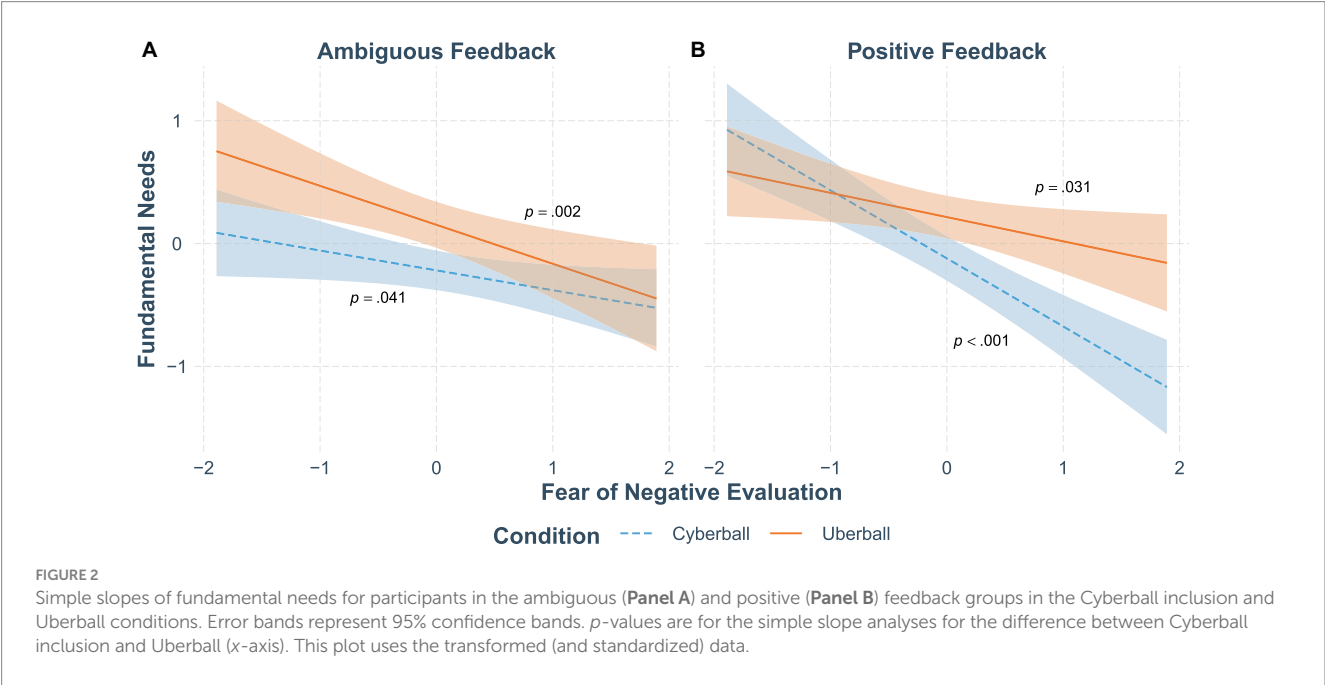
Two main conclusions stem from the current study. First, preferential inclusion (Uberball condition) increases fundamental need fulfillment and relational value significantly more than ordinary inclusion (Cyberball inclusion condition). Second, whereas socially anxious individuals (with a high fear of negative evaluation) generally report a lower satisfaction of fundamental needs, the combination of receiving positive social feedback followed by experiencing ordinary inclusion (Cyberball inclusion condition) greatly exacerbates this tendency.

The first conclusion stems from the results showing that overall, participants who were the target of preferential inclusion (Uberball condition) reported higher levels of fundamental need fulfillment and perceived relational value than those who took part in an ordinary

TABLE 3 Results of multiple regression analyses.

Dependent variable	Predictor	df	β	t	p	sr^2	95% CI
Fundamental needs	Feedback	430	0.10	0.79	0.430	<0.00	[0.00, 0.01]
	Condition	430	0.37	2.95	0.003	0.02	[0.00, 0.04]
	Fear of negative evaluation	430	−0.16	−2.05	0.041	0.01	[0.00, 0.02]
	Feedback × Condition	430	−0.03	−0.19	0.847	<0.00	[0.00, 0.00]
	Feedback × Fear of negative evaluation	430	−0.39	−3.29	0.001	0.02	[0.00, 0.05]
	Condition × Fear of negative evaluation	430	−0.16	−1.21	0.226	<0.00	[0.00, 0.01]
	Feedback × Condition × Fear of negative evaluation	430	0.51	2.83	0.005	0.02	[0.00, 0.04]

β , standardized regression coefficient; sr^2 , semi-partial correlation squared; feedback, social feedback (ambiguous vs. positive); condition, inclusion condition (Cyberball inclusion vs. Uberball); transformed (and standardized) data were used in the analyses reported here. Shaded/bolded areas represent statistically significant rows.



“social participation” task (Cyberball inclusion condition). This result conceptually replicates and extends [Simard and Dandeneau \(2018\)](#) by showing the additional effects on perceived relational value—an important mediating element of one’s feelings of personal self-esteem and self-worth ([Leary, 2005](#)).

Our second conclusion stems from the results of a three-way interaction between feedback condition, inclusion condition, and level of social insecurity showing that the expected negative relationship between fear of negative evaluation and fundamental need fulfillment is considerably stronger after receiving positive social feedback followed by experiencing ordinary inclusion (Cyberball inclusion condition). Interestingly, the effect was significant for the same three individual needs as in previous research: belongingness, self-esteem, and meaningful existence, and it was not significant for the control subscale ([Simard and Dandeneau, 2018](#)). Next, we explore this three-way interaction in more detail.

Unmet expectations

[Figure 2](#) suggests that in the ambiguous feedback condition, Uberball relates to higher fundamental need fulfillment relative to Cyberball inclusion for people with low or average levels of social insecurity (as confirmed by the simple slopes). In the positive feedback condition, both inclusion conditions relate to high fundamental need fulfillment in socially secure individuals, but for socially insecure individuals, Cyberball inclusion leads to lower levels of fundamental need fulfillment than the Uberball condition.

Accordingly, it seems that for those in the Cyberball inclusion condition, one’s level of social insecurity influences one’s emotional responses to receiving positive or ambiguous social feedback. Specifically, relative to ambiguous feedback, positive feedback appears to reduce fundamental need fulfillment in people with high social insecurity and to increase it in people with low social insecurity.

We also know from our results that positive feedback led to higher anticipation of social acceptance relative to ambiguous feedback (a medium effect-sized difference). Thus, one interpretation of these results is that for socially insecure people, positive feedback may raise their social expectations of future social situations but that these expectations lead to disappointment when they are “merely included” in the group as opposed to being a highly valued member as in the Uberball condition.⁴ Although many would have their expectations unmet, socially anxious individuals may be particularly sensitive to it, highlighting the importance of expectation violations for this group of people (Wesselmann et al., 2017).

According to the temporal need-threat model of ostracism, detecting ostracism requires only the slightest representation of ostracism, and over-detection of ostracism likely serves an evolutionary purpose (Williams, 2009). However, some are more sensitive, hypervigilant, and overactive to social ostracism. Social exclusion makes people interpret neutral information as hostile (DeWall et al., 2009), and this tendency may be accentuated in socially insecure people. Although everyone tends to react negatively to negative feedback, socially hypersensitive people, for example, also tend to respond negatively to ambiguous feedback or even simply to the *absence* of positive feedback (Cikara and Girgus, 2010; Yang and Girgus, 2018). Because socially insecure individuals acutely fear negative social appraisals, they may interpret ordinary social inclusion negatively to confirm their chronic fears, à la self-fulfilling prophecy (Stinson et al., 2009, 2011). For example, for people with borderline personality disorder, being socially included through the Cyberball inclusion condition is not enough as they still feel rejected unless they experience extreme inclusion through a variant of the Uberball condition termed overinclusion (De Panfilis et al., 2015). Whereas healthy controls experienced as much rejection-related emotions, anxiety, and sadness during social participation (Cyberball inclusion) than during overinclusion, people with borderline personality disorder experienced substantially more rejection-related emotions, anxiety, and sadness after “mere inclusion/social participation” than after overinclusion. Given that people with borderline personality disorder typically have a higher fear of negative evaluation (Weinbrecht et al., 2020), it is possible that there is a similar dynamic at play in the current results—the “mere inclusion/social participation” in Cyberball inclusion simply did not live up to the social expectations created by positive feedback manipulation.

Socially secure people, on the other hand, may benefit from positive feedback relative to ambiguous feedback even when they are not preferentially included perhaps because they are better able to separate the social feedback component from the group's behavior.

These individuals probably have their fundamental needs already fulfilled and therefore are not actively trying to restore their needs, making them content even when their social value is not heightened (Hales and Williams, 2021).

Finally, the Uberball condition, interestingly, seems to eradicate the expectations contingencies. Whether participants receive positive or ambiguous social feedback seems to make little difference on the slope of fear of negative evaluation. Consistent with findings with borderline personality disorder and overinclusion (De Panfilis et al., 2015; Hales and Williams, 2021), the Uberball condition's effect may come from the preferential inclusion they experience matching their positive expectations following positive feedback or eliminating doubt of one's social value after ambiguous feedback.

Limitations

This study carries a few limitations. First, there are known limitations to online samples from MTurk, CloudResearch, and the like (e.g., Aruguete et al., 2019). Second, the social feedback consisted of written conversation scripts, which may lack ecological validity and the “realness” of social interactions. Future research would benefit from replicating the current findings using more ecologically valid social interactions (e.g., confederates). Third, because we did not have a “no feedback” group (i.e., a group that did not receive any feedback) and a “no social interaction/inclusion” group (i.e., a group that completed a neutral task alone, as in Simard and Dandeneau, 2018), it is difficult to say whether participating in any social participation task (i.e., Cyberball inclusion or Uberball conditions) is better than *not* participating in a social participation task at all (i.e., completing a task alone). Thus, although the current data allow us to suggest general conclusions, we can only speculate as to the nature of the specific dynamics at play.

Conclusion

This study adds to the evidence suggesting that social participation and preferential social inclusion constitute separate processes that lead to distinct psychological outcomes (e.g., fundamental needs). It also suggests that the social context under which social inclusion is experienced may influence one's emotional response to this social inclusion, especially for socially insecure individuals. In particular, socially insecure individuals may be motivated to restore fundamental needs by building positive expectations following initial positive feedback but end up even more disappointed when reality does not live up to their expectations. Ultimately, the Uberball condition constitutes a timely addition to the social scientist's toolbox for further exploring the dynamics of social inclusion.

Data availability statement

The data, analysis scripts, and supplemental materials for this study are available on the Open Science Framework at: <https://osf.io/cm3g3z/>.

⁴ A mediation analysis revealed that anticipation of social acceptance partly mediates (28%) the relationship between fear of negative evaluation and fundamental needs, b (for the indirect effect) = -0.09 [-0.13 , -0.04], $p < 0.001$. Another mediation analysis suggests that anticipation of social acceptance also partly mediates the relationship between *feedback* and fundamental needs, b (for the indirect effect) = 0.21 [0.12 , 0.31], $p < 0.001$. Essentially, while positive feedback leads to higher anticipation of social acceptance, anticipation leads to higher fundamental needs (however, a negative direct effect prevents the total effect from reaching significance).

Ethics statement

The studies involving humans were approved by the Comité institutionnel d'éthique de la recherche avec des êtres humains (CIEREH) at Université du Québec à Montréal (UQAM). The studies were conducted in accordance with the local legislation and institutional requirements. Participants first read the description of the study before providing their informed consent to participate.

Author contributions

RT: Data curation, Formal analysis, Investigation, Software, Visualization, Writing – original draft, Writing – review & editing. FD-C: Conceptualization, Data curation, Investigation, Methodology, Project administration, Writing – original draft. SD: Conceptualization, Funding acquisition, Investigation, Methodology, Project administration, Resources, Supervision, Writing – original draft, Writing – review & editing.

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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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Examining social anxiety and dual aspects of social comparison orientation: the moderating role of self-evaluation of social skills

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Introduction: Social comparison orientation comprises ability comparison, which entails superior and inferior ratings; and opinion comparison, which does not include such ratings. Previous research on negative emotions and the social rank theory of social anxiety indicates that social anxiety is positively associated with ability comparison. This is particularly true of individuals with a stronger sense of inferiority (e.g., lower self-evaluation of their social skills). Nevertheless, the relationship between the two aspects of social comparison orientation and social anxiety remains unclear.

Methods: Two hundred thirty-eight individuals ($M_{age} = 40.53 \pm 9.78$ years, 50.4% men) participated in an online cross-sectional survey questionnaire.

Results: Social anxiety was positively correlated with ability comparison but not opinion comparison. The relationship between social anxiety in situations observed by others and ability comparison was stronger for individuals with lower (vs. higher) self-rated social skills.

Discussion: This study showed that the two types of social comparison are differentially related to social anxiety. The findings support the social rank theory of social anxiety, which states that social comparisons involving superior and inferior ratings lead to social anxiety owing to the perception of one's inferiority. Making such social comparisons can result in heightened social anxiety, particularly for individuals with low self-evaluations of social skills. The results indicate the importance of these social comparisons in the emergence and persistence of social anxiety. Furthermore, the potential of interventions based on mindfulness, compassion, social media, and video feedback in mitigating the negative effects of such social comparisons is discussed.

KEYWORDS

self-evaluation of social skills, social anxiety, social comparison, social comparison orientation, social rank theory of social anxiety, social skills

1 Introduction

People compare themselves with others in various situations, often resulting in emotional consequences (Festinger, 1954). Social comparison orientation is the tendency to compare oneself with others regarding abilities, ideas, and so on. It has two components: ability comparison and opinion comparison (Gibbons and Buunk, 1999). Ability comparison

refers to social comparisons based on ability and is made to ascertain an individual's superiority or competence. Conversely, opinion comparison involves evaluating opinions and ideas, focusing on the opinions and feelings an individual should adopt. Ability comparison is grounded in a competitive mindset, while this might not be the case for opinion comparison (Ozimek and Bierhoff, 2020; Liu et al., 2021).

Between the two factors, only ability comparison is associated with negative emotions such as depression, envy (Park and Baek, 2018), risk-taking (Liu et al., 2021), low self-esteem (Ozimek and Bierhoff, 2020), and social maladjustment (Miao et al., 2018). The two factors of social comparison orientation could exhibit different and unique relationships with other variables and need to be examined separately (Gerson et al., 2017). However, scant research has examined the relationship between social comparison orientation and social anxiety—anxiety that arises in of social or performance situations that may attract the attention of others. A few studies reveal that social anxiety positively correlates with overall social comparison orientation (Gregory and Peters, 2017; Jiang and Ngien, 2020). It is possible to argue that those with high social anxiety have an uncertain self-concept (e.g., Stopa et al., 2010); therefore, they make more social comparisons to clarify their self-concept (Gibbons and Buunk, 1999). However, it is unclear how the dual aspects of social comparison orientation (not the overall score of the scale) are associated with social anxiety. Examining how the two aspects of social comparison orientation relate to social anxiety is essential for a more detailed understanding of the association between general social comparison orientation and high social anxiety shown in previous studies. Thus, we focused on the two aspects of social comparison orientation and hypothesized that only ability comparison is associated with higher social anxiety.

The theoretical studies on social anxiety support our hypothesis that social anxiety positively correlates with ability comparison. According to social rank theory (Trower and Gilbert, 1989), those with high social anxiety view others as competitors for resources rather than as friendly collaborators, which is similar to the mindset behind ability comparison. These individuals compare their social ranks and abilities with those of others (i.e., a form of social comparison). These comparisons result in social anxiety when one's social rank is low and perceived as inferior. Previous research supports this model (Hope et al., 1998; Haker et al., 2014; Tone et al., 2019; Parsons et al., 2021), showing that feeling inferior owing to social comparison is associated with social anxiety (Mitchell and Schmidt, 2014; Goodman et al., 2021). This type of social comparison involves an assessment of superiority or inferiority (Allan and Gilbert, 1995). Based on these findings and theories, social anxiety is expected to be positively correlated with ability comparison. In contrast to ability comparison, in opinion comparison, the targets of comparison are considered informants or role models, not competitors (Park and Baek, 2018; Yang et al., 2018). Because this is not how socially anxious individuals perceive the world as assumed in social rank theory, we hypothesized that opinion comparison and social anxiety might be negatively or non-correlated.

Furthermore, if social anxiety is positively associated with ability comparison, it is conceivable that the association could be moderated by some type of ability. As an ability to moderate the association between social anxiety and ability comparison,

we focused on *social skills* and explored its moderating effect. Social skills refer to the skills needed to achieve social goals in various contexts (Mueser and Bellack, 1998). A low self-evaluation of social skills is linked to high anxiety in social situations, including performance contexts (Segrin, 1996; She et al., 2023). Individuals with high social anxiety have cognitive distortions that lead them to underestimate their social skills (Norton and Hope, 2001). Moreover, social anxiety is rooted in beliefs of social incapability and inferiority (Turner et al., 2003). Patients with social anxiety disorder tend to make more social comparisons regarding social skills than healthy controls (Antony et al., 2005). Social skills fall under the category of abilities; thus, making ability comparisons in the context of social skills might have a significant impact on social anxiety. Individuals with a low self-evaluation of social skills and frequent ability comparisons could perceive their social skills as markedly inferior, resulting in a prominent increase in social anxiety. Thus, the relationship between ability comparison and social anxiety could be moderated by self-evaluations of social skills. However, no studies have examined the interaction between self-evaluation of social skills and ability comparison.

In summary, previous research has found that social anxiety positively correlates with overall social comparison orientation. However, it is unclear which of the two components of social comparison orientation is more relevant to social anxiety. The present study hypothesized that social comparison orientation would only be linked to social anxiety for superior and inferior ability comparisons. Furthermore, it was expected that the association between social comparison with superiority and inferiority ratings (i.e., ability comparison) and social anxiety would be stronger for those with lower self-evaluations of social skills. However, it was unclear how self-evaluation of social skills would affect the association between social anxiety and ability comparison. Thus, this study also examined the moderating effect of self-evaluation of social skills on the relationship between ability comparison and social anxiety.

2 Methods

2.1 Participants

A cross-sectional questionnaire survey was conducted. An online crowdsourcing platform (CrowdWorks¹) was used to survey 252 people. The procedure for requesting responses to the questionnaire online is the same as in previous studies such as Jiang and Ngien (2020). To participate in the survey, participants were required to be native speakers of Japanese and at least 18 years old. There were no exclusion criteria. Participants provided demographic data (sex, age, and education) on a page created in Qualtrics² and then completed questionnaires, described below. As the survey was conducted online, the platform ensured that participants could not proceed without completing all values, ensuring that none of the 252 participants

¹ <https://crowdworks.jp/>

² <https://www.qualtrics.com/>

who completed the survey had missing values. From these 252 participants, we excluded participants with the same IP address, extremely short response times [-2 standard deviation (SD)], and those who responded incorrectly to the attention check. The final sample comprised 238 Japanese adults. Regarding sex, 120 were men (50.4%), 117 were women (49.2%), and one refused to disclose this information. The age range was 18–70 years ($M_{age} = 40.53 \pm 9.78$ years). The participants' highest level of education was distributed as follows: 4 participants had completed middle school, 52 had completed high school, 32 had completed junior college or technical college, 138 had a university degree, and 10 had a graduate degree. Two participants preferred not to disclose their highest level of education.

Using G*Power 3.1, a *post hoc* power analysis on the incremental coefficient of determination (R^2) of linear multiple regression analysis was conducted by adding an interaction term (sample size: 238, significance level: .05, power: .80). The analysis revealed that the minimum detectable effect size was $f^2 = 0.03$. Thus, the sample size in the present study was detectable for small to moderate effect sizes and above (Cohen, 1988). The study was approved by the ethical review board of Kyoto University. All participants provided written informed consent before participating.

2.2 Measures

2.2.1 Iowa–Netherlands Comparison Orientation Measure (INCOM)

The INCOM is a commonly used scale that measures people's social comparison orientation. The original version of this scale was developed by Gibbons and Buunk (1999) and has 11 items with two comparison factors: ability comparison (e.g., "I often compare myself with others concerning what I have accomplished in life") and opinion comparison (e.g., "I often like to talk with others about mutual opinions and experiences"). The Japanese version of the INCOM, developed by Toyama (2002), has 10 items with the same factors as the original version. The internal consistency, retest reliability, and construct validity of the Japanese version of the INCOM have been confirmed (Toyama, 2002). Responses range from (1) *strongly disagree* to (5) *strongly agree* for each item. Since the opinion comparison factor had only three items and a rather low alpha coefficient ($\alpha = .67$), the mean inter-item correlation was calculated to confirm the reliability. The value was .41, which is considered good (Clark and Watson, 1995).

2.2.2 Social Phobia Scale (SPS)

The SPS and Social Interaction Anxiety Scale (SIAS; introduced in the next subsection) are commonly used scales measuring different aspects of social anxiety and are often used simultaneously. The SPS assesses the fear of being observed by others (e.g., "I feel awkward and tense if I know people are watching me"). Mattick and Clarke (1998) originally developed the scale with 20 items. The Japanese version was created by Kanai et al. (2004). The internal consistency and criterion-related validity of the Japanese version have been confirmed. Responses range from (0) *not at all true of me* to (4) *extremely true of me* for each item.

2.2.3 Social Interaction Anxiety Scale (SIAS)

The SIAS evaluates fears of interacting in dyads and groups (e.g., "I am tense mixing in a group"). As with the SPS, the original version of this scale was developed by Mattick and Clarke (1998) and translated into Japanese by Kanai et al. (2004), who confirmed its internal consistency and criterion-related validity. The scale has 20 items and responses range from (0) *not at all true of me* to (4) *extremely true of me* for each item.

2.2.4 Social Skills Inventory (SSI)

The SSI is a commonly used scale that measures people's self-evaluation of their social skills. The original version of this scale was developed by Riggio (1986). The Japanese version of the SSI was developed by Kayano (1988), who confirmed its internal consistency and construct validity. Based on previous research (Strahan, 2003), the Social Control Skills subscale (15 items; e.g., "I can fit in with all types of people, young and old, rich and poor"), which assesses the skills to play appropriate roles and present oneself effectively in diverse social situations (Riggio, 1986), was chosen owing to its association with significantly lower self-evaluations among individuals with high social anxiety. Additionally, this subscale seems to be prone to eliciting feelings of superiority or inferiority when compared to others. Responses range from (1) *not at all like me* to (5) *exactly like me* for each item.

2.3 Data analysis

Data analyses were conducted using the R software (v. 4.2.0.). The tests' statistical significance level (α) was set at .05.

First, descriptive statistics were calculated, followed by a correlation analysis. For testing correlation coefficients, variables are assumed to follow a normal distribution. In cases in which the variables did not meet this assumption, we calculated 95% confidence intervals (CIs) for the correlation coefficients using percentile bootstrap with 10,000 resampling iterations (Pek et al., 2018). This approach allows for a robust interval estimation of correlation and regression coefficients even when the normality assumption is not met. Significance was determined if the CI did not include zero.

Subsequently, we performed moderated multiple regression analyses to identify the moderating effects of self-evaluation of social skills on the relationship between ability comparison and social anxiety (the SPS and the SIAS). If the interaction term in the multiple regression model is significant, simple slope analyses were conducted to examine the relationship between ability comparison and social anxiety among individuals with high ($+1$ SD) and low (-1 SD) self-evaluations of social skills (a moderating variable). In addition, although not the primary focus of this study, the moderating effects of self-evaluation of social skills on the relationship between opinion comparison and social anxiety were also examined in an exploratory manner. It is assumed that the residuals are normally distributed in regression analysis. Therefore, if the assumption was not met, the 95% CIs of the regression coefficient were determined by percentile bootstrap with 10,000 resampling iterations; they were considered significant if the CIs did not contain zero (Pek et al., 2018).

TABLE 1 Descriptive statistics, internal consistency (Cronbach's alphas), and correlations among variables.

Variable	<i>M</i>	<i>SD</i>	<i>Sk</i>	<i>Ku</i>	α	1	2	3	4	5
1. INCOM	3.10	0.67	0.00	−0.29	.84					
2. Ability	3.03	0.78	0.02	−0.62	.87	.94***				
						[.92, .95]				
3. Opinion	3.26	0.80	−0.21	−0.61	.67	.63***	.33***			
						[.55, .70]	[.21, .44]			
4. SPS	1.07	0.77	0.94	0.66	.94	.34***	.42***	−.04		
						[.21, .46]	[.31, .54]	[−.16, .10]		
5. SIAS	1.84	0.85	0.21	−0.55	.95	.24***	.37***	−.18**	.75***	
						[.11, .35]	[.25, .47]	[−.30, −.06]	[.66, .84]	
6. SSI	2.73	0.65	0.39	−0.08	.88	−.09	−.22***	.26***	−.55***	−.81***
						[−.21, .04]	[−.34, −.10]	[.14, .37]	[−.67, −.44]	[−.85, −.76]

Sk, Skewness; *Ku*, Kurtosis; INCOM, Iowa–Netherlands Comparison Orientation Measure; Ability, ability comparison factor of the INCOM; Opinion = opinion comparison factor of the INCOM; SPS, Social Phobia Scale; SIAS, Social Interaction Anxiety Scale; SSI, Social Skills Inventory (Social Control subscale). Values in square brackets indicate the 95% confidence interval for each correlation. As the SPS was not normally distributed, confidence intervals for correlation coefficients for the SPS were calculated by the percentile bootstrap method with 10,000 resampling iterations. ** $p < 0.01$, *** $p < 0.001$.

TABLE 2 Testing moderating effect of self-evaluation of social skills on the relationship between ability comparison and social anxiety (the SPS and the SIAS).

IV: SPS					IV: SIAS				
Predictor	β	95%CI		<i>p</i>	Predictor	β	95%CI		<i>p</i>
		<i>LL</i>	<i>UL</i>				<i>LL</i>	<i>UL</i>	
(Intercept)	−0.025	−0.126	0.076	.625	(Intercept)	−0.007	−0.079	0.066	.860
Ability	0.309	0.217	0.396	.000	Ability	0.196	0.122	0.269	.000
SSI	−0.493	−0.589	−0.393	.000	SSI	−0.766	−0.840	−0.692	.000
Ability \times SSI	−0.113	−0.187	−0.029	.011	Ability \times SSI	−0.030	−0.093	0.034	.359

SPS, Social Phobia Scale; SIAS, Social Interaction Anxiety Scale; Ability, ability comparison factor of the INCOM; SSI, Social Skills Inventory (Social Control subscale). Confidence intervals for standardized regression coefficients for the SPS were calculated by the percentile bootstrap method with 10,000 resampling iterations.

3 Results

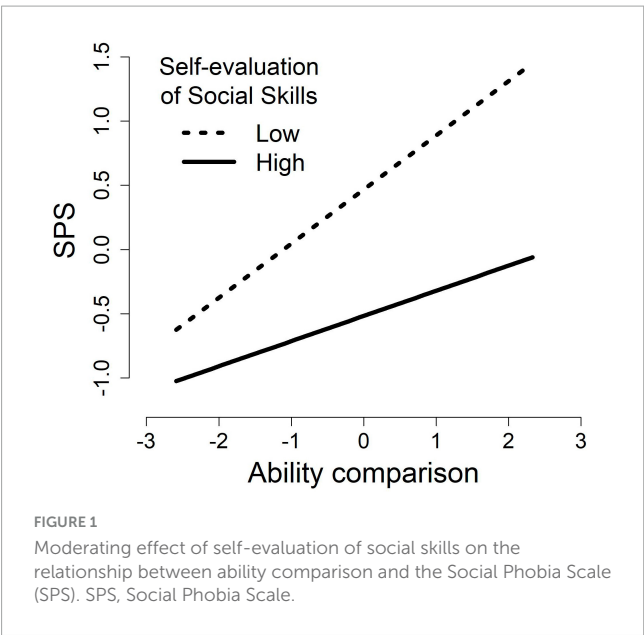
Table 1 shows the descriptive statistics (mean, *SD*, skewness, kurtosis, and Cronbach's alpha) and correlation matrix. Most scales were approximately normally distributed, but the SPS was positively skewed. Therefore, the CIs of the correlation coefficients for the SPS were obtained by the percentile bootstrap method.

A correlational analysis was conducted to examine the relationship between the two factors of social comparison orientation and social anxiety. INCOM total scores showed a weak positive correlation with the SPS and the SIAS. Ability comparison showed a moderate positive correlation with the SPS and the SIAS. Contrastingly, opinion comparison did not show a positive correlation with the SPS and the SIAS.

Moderated multiple regression analyses were performed to examine whether self-evaluation of social skills moderates the relationship between social anxiety and ability comparison (Table 2). As the moderated multiple regression model for the SPS did not appear to have normally distributed residuals, a Kolmogorov–Smirnov test was performed and it was found that the residuals were not normally distributed ($D = 0.09$, $p = .04$). Therefore, 95% CIs for the standardized regression coefficients were obtained by the percentile bootstrap method,

which showed that the interaction was significant ($\beta = -0.11$, 95% CI $[-0.19, -0.03]$). The regression coefficient was significant even when classical tests, rather than bootstrapping, were performed ($\beta = -0.11$, $p = .01$, 95% CI $[-0.20, -0.03]$). Subsequently, a simple slope analysis was conducted to examine the relationship between ability comparison and the SPS among individuals with high (+ 1 *SD*) and low (−1 *SD*) self-evaluations of social skills. Ability comparison and the SPS were positively correlated for low ($\beta = 0.42$, 95% CI $[0.29, 0.54]$) and high ($\beta = 0.20$, 95% CI $[0.09, 0.30]$) self-evaluations of social skills, with a stronger association observed at lower levels of self-evaluation of social skills (Figure 1). Conversely, the moderated multiple regression model for the SIAS did not show a significant interaction ($\beta = -0.03$, $p = .36$, 95% CI $[-0.09, 0.03]$).

Table 3 shows the exploratory results of moderated multiple regression analyses to examine whether self-evaluation of social skills moderates the relationship between social anxiety and opinion comparison. The moderated multiple regression model for the SPS showed significant interaction ($\beta = -0.13$, $p = .01$, 95% CI $[-0.23, -0.03]$). Opinion comparison and the SPS were weakly positively correlated for low ($\beta = 0.23$, $p = .002$, 95% CI $[0.09, 0.36]$) but not for high ($\beta = -0.03$, $p = .73$, 95% CI $[-0.19, 0.13]$) self-evaluations of social skills. Conversely, the moderated multiple



regression model for the SIAS did not show a significant interaction ($\beta = 0.02, p = .70, 95\% \text{ CI } [-0.06, 0.09]$).

4 Discussion

The study showed that of the two social comparison orientations—ability and opinion comparisons—only ability comparison was positively associated with social anxiety. The association between ability comparison and social anxiety was stronger for individuals with lower self-evaluations of social skills and mitigated for those with higher self-evaluations.

First, general social comparison orientation was positively correlated with social anxiety, in line with previous studies (Gregory and Peters, 2017; Jiang and Ngien, 2020). Notably, when considering social comparison orientation by factor, social anxiety demonstrated a positive association exclusively with ability comparison and not with opinion comparison, a distinction not clarified in previous studies. The findings support previous research (Gerson et al., 2017) that discussed the need to consider the two factors of the INCOM separately. Further, this study builds on Park and Baek's (2018) research, which demonstrated a positive association between ability comparison and negative emotions, such as depression

and envy. It extends our understanding regarding the correlation between social anxiety and ability comparison orientation.

The finding that social anxiety was positively correlated only with ability comparison could be difficult to explain solely based on the theory that socially anxious individuals engage in social comparisons to clarify their unclear self-concept (see Gibbons and Buunk, 1999). According to the social rank theory of social anxiety (Trower and Gilbert, 1989), a possible explanation is that compared to their counterparts, those with high social anxiety make more ability comparisons because they view the people around them as competitors. Indeed, competitiveness is linked to ability comparison (Liu et al., 2021): People with high social anxiety tend to view others as competitive (Tone et al., 2019). This view could account for the high ability comparisons among those who are socially anxious. Contrastingly, those who do not view the people around them as competitive and have low ability comparisons could experience less social anxiety because they have fewer occasions to feel inferior compared to their counterparts. Further, opinion comparison was not positively correlated with social anxiety. In opinion comparison, the subject is viewed as an informant or role model (Yang et al., 2018). This friendly attitude differs from the competitive attitude of socially anxious individuals and is not likely associated with social anxiety.

Further, this finding indicates that social anxiety could mediate the link between ability comparison and social maladjustment among university students (Miao et al., 2018). Performance goals, which rely on social comparison, such as ability comparison, are positively associated with anxiety among college students (Liu et al., 2023). When they view others as their competitors and engage in fierce competition, they may also experience mental health problems via, for example, sacrificing sleep (Cao, 2023). Based on these observations, further research is needed on the effects of competitive attitudes, including ability comparison, on people's anxiety and mental health.

Self-evaluations of social skills were negatively correlated with social anxiety. This is consistent with previous studies (Segrin, 1996; She et al., 2023). Notably, the relationship between ability comparison and social anxiety in situations observed by others (as measured by the SPS) was stronger when the self-evaluation of social skills was lower. This finding aligns with Trower and Gilbert (1989), who suggested that perceived low social rank, including poor social skills (Zuroff et al., 2010), contributes

TABLE 3 Testing moderating effect of self-evaluation of social skills on the relationship between opinion comparison and social anxiety (the SPS and the SIAS).

IV: SPS					IV: SIAS				
Predictor	β	95%CI		p	Predictor	β	95%CI		p
		LL	UL				LL	UL	
(Intercept)	0.032	−0.076	0.140	.554	(Intercept)	−0.004	−0.082	0.074	.925
Opinion	0.099	−0.011	0.208	.078	Opinion	0.029	−0.050	0.108	.475
SSI	−0.560	−0.670	−0.450	.000	SSI	−0.816	−0.896	−0.737	.000
Opinion × SSI	−0.126	−0.228	−0.025	.014	Opinion × SSI	0.015	−0.059	0.088	.695

SPS, Social Phobia Scale; SIAS, Social Interaction Anxiety Scale; Opinion, opinion comparison factor of the INCOM; SSI, Social Skills Inventory (Social Control subscale).

to elevated social anxiety levels through social comparisons accompanied by superior and inferior evaluations. These results are also consistent with [Antony et al.'s \(2005\)](#) findings, indicating that social comparisons are particularly prevalent in relation to social skills among patients with social anxiety disorder compared to a healthy group. Individuals who perceive their social skills as inadequate might experience stronger social anxiety, as frequent comparisons could reinforce their sense of inferiority compared to those around them. Interestingly, these effects observed in the SPS were not evident in the SIAS. This suggests that frequent awareness of inferiority regarding social skills affects social anxiety in situations scrutinized by others, such as those associated with the SPS. However, this effect was not strong in cases in which individuals interact with others, such as those related to the SIAS. In scrutinized situations (e.g., public speaking), people may be particularly more likely to be aware of their own and others' social rank than in situations related to the SIAS (e.g., chatting). It is also interesting that, although not the primary focus of this study, the results of the moderated regression analysis for opinion comparison showed a weak positive association between the SPS and opinion comparison only for individuals with low self-evaluations of social skills. Further research on the background mechanism is encouraged.

4.1 Theoretical implications

The two aspects of social comparison orientation were differentially associated with social anxiety. This indicates that higher social comparison orientation among those with higher social anxiety is particularly strong on aspects related to superiority and inferiority, supporting the social rank theory of social anxiety. Furthermore, as in [Gerson et al. \(2017\)](#), our results also suggest that future research dealing with social comparison orientation should distinguish between the two aspects. The results also suggest that for social anxiety, both the perception of one's inferiority as a result of social comparisons and the frequency of social comparisons (i.e., social comparison orientation) should be considered (see [Goodman et al., 2021](#)). Future research should examine variables that mediate the association between these two dimensions and social anxiety (e.g., self-esteem).

4.2 Practical implications

Interventions that reduce the frequency of social comparisons involving superior/inferior ratings could decrease social anxiety. Comparisons involving superiority or inferiority are generally made in a mindless state ([Langer et al., 2010](#)); thus, mindfulness-based interventions could be promising. Compassion-based interventions could also be effective in reducing such comparisons, as the mentality that underlies such comparisons, such as viewing others as one's competitors, is at odds with a mentality of caring for others ([Gilbert, 2015](#)).

Social media and social comparison are deeply interrelated and impact people's mental health. For example, using social

media such as Instagram can lead to social anxiety, and this association is entirely mediated by a general social comparison orientation ([Jiang and Ngien, 2020](#)). The present study extends their research and suggests that the impact of social media use on social anxiety can be minimized by suppressing social comparisons, especially those involving superior/inferior evaluations.

The results also indicate that interventions to enhance the self-evaluations of social skills could potentially mitigate the link between high ability comparison and increased social anxiety. One such effective intervention is video feedback ([Warnock-Parkes et al., 2017](#)), which improves the self-evaluation of social skills for those who underestimate their own abilities in this regard. Interventions such as this can reduce social anxiety related to social comparisons by improving self-evaluations of social skills.

4.3 Limitations

This study reveals novel findings on the relationship between social anxiety, the two factors of social comparison orientation, and self-evaluation of social skills. However, some limitations should be noted. The study was based on a sample of Japanese adults, and the results could differ among people of different nationalities, ages, or clinical groups. Although a relatively diverse age range was represented, the sample did not include those aged younger than 18 years or those older than 70 years. Lastly, owing to the limitations of a cross-sectional design, it would be interesting to explore causal relationships between variables in future research.

5 Conclusion

This study deepens our understanding of the complex dynamics between social anxiety, the two factors of social comparison orientation, and self-evaluation of social skills. The findings indicate avenues for further investigation and the potential for interventions in addressing social anxiety. Future research exploring diverse populations and causal relationships will be important in advancing this field of study and informing potential therapeutic approaches.

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 humans were approved by the ethical review board of Kyoto University. The studies were conducted in accordance with the local legislation and institutional

requirements. The participants provided their written informed consent to participate in this study.

Author contributions

HO: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Software, Visualization, Writing-original draft, Writing-review and editing. MN: Funding acquisition, Supervision, Writing-review and editing.

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Conflict of interest

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Multilayer perceptron modeling for social dysfunction prediction based on general health factors in an Iranian women sample

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In the year 2022, this research conducted an in-person study involving 780 single or widowed women, aged between 20 and 70, falling within the bottom three economic deciles and possessing varying levels of education. All participants held educational qualifications below a high school diploma and were beneficiaries of charitable financial support in Khorasan province, Iran. The study aimed to investigate the predictive factors of social dysfunction in this specific demographic. Data collection spanned a 12-month period throughout 2022, with participants completing the GHQ-28 questionnaire during their visits to the charity office. Clinical in-person interviews were also conducted to gather comprehensive data. Data analysis was carried out using IBM SPSS version 27. The research employed a Multilayer Perceptron (MLP) neural network model, considering an extensive set of input factors and covariates. These factors included cognitive functioning, anxiety, depression, age, and education levels. The MLP model exhibited robust performance, achieving high overall accuracy and sensitivity in identifying cases of high social dysfunction. The findings emphasized the significance of cognitive functioning, anxiety, and depression as pivotal predictors of social dysfunction within this specific demographic, while education and age displayed relatively lower importance. The normalized importance scores provided a relative measure of each covariate's impact on the model's predictions. These results furnish valuable insights for the development of targeted interventions and evidence-based policies aimed at addressing social dysfunction and promoting societal well-being among economically disadvantaged, single or widowed women. Notably, the research underscores the potential of MLP modeling in social science research and suggests avenues for further research and refinement to enhance the model's predictive accuracy, particularly for cases of low social dysfunction.

KEYWORDS

multilayer perceptron, artificial neural network, social dysfunction, anxiety, depression, low-income women

1 Introduction

Psychological well-being is a complex and multi-faceted aspect of human health, with mental disorders exerting a profound and lasting impact on individuals. Recognizing and addressing these disorders effectively is of paramount importance. To this end, the choice of appropriate assessment tools is the initial step in identifying and understanding these problems. One such tool frequently employed by researchers is the questionnaire, tailored to specific methodologies and target groups (1).

Social functioning, a cornerstone of an individual's overall well-being and daily life, encompasses the capacity to form and sustain relationships, adapt to social contexts, and communicate effectively (2, 3). Understanding the intricate domain of social functioning is indispensable. Effective adult functioning hinges on the ability to interpret others' behaviors and respond appropriately, guided by widely accepted norms of social interaction (4). An individual's social functioning is defined by their interactions with their surroundings and their capacity to carry out their role within such contexts (5). Social dysfunction, encompassing a broad spectrum of maladaptive behaviors and impaired interactions, has become a pressing concern in contemporary society. It hampers the functioning of individuals, communities, and societies, leading to a range of adverse consequences (6). This underscores the importance of understanding and addressing social dysfunction as it not only affects individual well-being but also has far-reaching implications for the broader social fabric.

The psychosis spectrum presents three vital components of social ability: social cognition, social interaction, and social functioning. These components are intertwined, with competency in one skill often fostering another. Social cognition, in particular, stands as a linchpin of successful interactions, enabling and reinforcing effective social functioning (7). Understanding of the factors that contribute to social dysfunction is crucial for policymakers, clinicians, and researchers seeking to address these challenges effectively. Research on social dysfunction has revealed its multifaceted nature, influenced by various biological, psychological, and sociocultural factors. Previous studies have highlighted the role of cognitive functioning in shaping social behavior and interactions. Cognitive deficits have been linked to impaired social adaptability and difficulties in understanding and interpreting social cues (8).

Emotional states, particularly anxiety and depression, have also garnered attention in the context of social dysfunction. Individuals experiencing anxiety may withdraw from social interactions due to fear or discomfort, leading to social dysfunction (9). Similarly, depression can contribute to social withdrawal and impaired social functioning, as individuals may struggle with motivation and engagement in social activities. Recognizing the influence of anxiety and depression in predicting social dysfunction is essential for devising interventions that address emotional well-being. A linkage between the presence of social dysfunction in depression and anxiety has long been noted (10, 11).

Major depressive disorder (MDD) is a prevalent psychiatric condition characterized by persistent sadness and a loss of interest or pleasure in daily activities (12). Notably, MDD often leads to profound and pervasive impairments in social functioning, defined as the capacity to fulfill standard social roles (13). Importantly, depression frequently results in the loss or disruption of significant social relationships. Another critical clinical feature of depression is the presence of somatic

symptoms which can be interpreted as the clinical manifestation of psychological issues (14, 15). According to research, women who exhibit a greater extent of physical symptoms are more prone to being diagnosed with depression (16). Although women are known to report higher somatic symptoms, less is known regarding within-group disparities between women of varying education and age.

Depression is one of the most prevalent mental disorders in the 21st century, and it is related to low socioeconomic status (17), poor physical health (18), sleep problems (19), and a drastic suicide risk (20). Annually, an estimated 703,000 individuals commit suicide throughout the world. For every suicide, there are about 20 others who attempt suicide and several more who have serious suicidal ideation (21). Suicide can be prompted by a variety of risk factors such as poor socioeconomic status, financial hardship, and a low educational level (22, 23). It has been observed in older people that prior adverse experiences influence the management of future crises (24), while others argue that these can lead to depression (25), while still, others contend that older people, in particular, should be considered for suicide prevention programs owing to the numerous risk factors that relate to them (26). The gender paradox in suicide is long-established, with women having more suicidal thoughts and attempts than males (27, 28) with a prevalence of suicidal ideation in women. However, the intra-group variation in the prevalence of suicidal ideation in women has not been widely investigated. Furthermore, these social deficits are linked to an array of negative outcomes, including increased mortality rates (29, 30). This intricate web of connections between suicide, social dysfunction, and depression highlights the urgent need for comprehensive approaches to address these interrelated issues. By understanding these relationships, we can develop more effective strategies for suicide prevention and mental health support, especially among at-risk populations.

Although depression is the most prevalent mental disorder, as many as 20 million people were found to have anxiety disorders worldwide.¹ It appears that elderly people have lower prevalence rates of diagnosed anxiety disorders than younger adults (31). However, researchers have discovered a wide range in the prevalence of anxiety disorders during a 12-month period among adults aged 55 and above, ranging from 7 to 12% (32–34). In addition, the prevalence of disorders differs among cultures and living conditions, as well as depending on study design and evaluation methods (35–37). The symptoms of anxiety are more prevalent in low socioeconomic groups (38). It is well recognized that there are differences in mental health across conventional SES variables including income, educational achievement, and other measures of social rank (39). Prins et al. hint of under researched processes in social epidemiology by demonstrating that the effects of class relations on anxiety go beyond those of SES (40). Hence, there are multiple factors related to SES that should be taken into account while investigating anxiety.

In addition to emotional and cognitive factors, sociodemographic characteristics such as education and age have been explored in relation to social dysfunction. Education plays a significant role in social integration and cohesion, with higher educational attainment often associated with improved social adaptability and engagement (41). Age can also influence social functioning, as individuals at

¹ <https://ourworldindata.org/mental-health>

different life stages may face distinct social challenges and opportunities (42). Acknowledging the impact of education and age on social dysfunction can inform targeted interventions tailored to specific age groups. Social dysfunction is a multifaceted phenomenon that affects various aspects of patients' lives, including social interactions, everyday activities, and employment status (43). Vividly, social dysfunction is a multidimensional phenotype that is impacted by a range of socio-demographic factors, such as poor socioeconomic status, as well as psychological disorders/dysfunctions such as depression and anxiety. People's social roles have been found to change with age and can be influenced by psychopathology (44). Social dysfunction is correlated with unemployment, disability and being single (45, 46).

Understanding the complexity of social dysfunction requires considering various factors beyond just emotional and cognitive aspects. Sociodemographic characteristics like education and age have emerged as significant contributors to the dynamics of social dysfunction. Research has shown that education plays a pivotal role in promoting social integration and cohesion, with higher educational attainment often linked to enhanced social adaptability and engagement (41). Additionally, age can exert a profound influence on social functioning, as individuals at different life stages encounter diverse social challenges and opportunities (47). Social dysfunction, a multifaceted phenomenon impacting various facets of patients' lives, encompasses social interactions, everyday activities, and employment status (32). This multidimensional phenotype is further shaped by a range of socio-demographic factors, including poor socioeconomic status, as well as psychological disorders and dysfunctions like depression and anxiety. Moreover, people's social roles undergo transformation with age and can be influenced by psychopathology (44). Notably, social dysfunction exhibits strong correlations with unemployment, disability, and being single, as evidenced by studies such as those conducted by Brown et al. (45) and Rizvi et al. (46).

Machine learning, and specifically Multilayer Perceptron (MLP) modeling, has shown promise in capturing complex relationships and nonlinear dependencies among variables. In social science research, MLP models have been used to predict various social and behavioral outcomes. For instance, Zheng et al. (48) employed an MLP model to predict mental health outcomes, while Lu et al. (49) used MLPs to identify risk factors for social problems. These studies highlight the potential of MLP modeling in social science research, particularly in predicting complex outcomes such as social dysfunction. In recent years, advances in data science and machine learning have opened new avenues for studying complex social phenomena. Among the innovative methodologies, MLP modeling has emerged as a powerful tool for predictive analytics in various domains, including social science research. This study aims to utilize an MLP model to explore the impact of covariates and hidden layers on predicting social dysfunction, offering valuable insights for targeted interventions and policy formulation. The incorporation of covariates into MLP modeling offers an opportunity to gain insights into the impact of various factors on social dysfunction. Covariates encompass independent variables that may influence an individual's behavior and interactions within society. In the context of social dysfunction, covariates could include demographic information, cognitive functioning, emotional states, and socio-economic status, among others. Understanding the relative importance of these covariates can shed light on the underlying mechanisms driving social dysfunction.

Research studies have demonstrated the utility of MLPs in various social science domains, including predicting mental health outcomes (48) and identifying risk factors for social problems (49). MLPs offer the advantage of uncovering hidden patterns and nonlinear associations, allowing researchers to explore complex interactions among covariates and the dependent variable. By utilizing this modeling approach, researchers can potentially develop more accurate and nuanced models for social dysfunction prediction. However, while existing literature has explored the individual impacts of cognitive functioning, emotional states, education, and age on social dysfunction, limited research has investigated their combined influence within an MLP modeling framework. This study seeks to address this gap by employing an MLP model that incorporates hidden layers to capture intricate relationships among these covariates. By doing so, this research aims to provide a nuanced understanding of social dysfunction prediction and identify the most influential factors for targeted interventions and policy development.

In this context, the present study utilizes an MLP model to predict social dysfunction by incorporating a set of covariates, including education, cognitive functioning, anxiety, depression, and age. By analyzing the importance of these covariates in the context of social dysfunction prediction, this research aims to contribute to a deeper understanding of the multifaceted nature of social dysfunction and provide valuable insights for designing targeted interventions and evidence-based policies. In this study we utilized network analysis which assumes that symptoms of disorders trigger one another (50). In the field of psychopathology, a network approach enables the assessment of how specific behaviors or symptoms are interconnected with several other behaviors or symptoms (51). Implementing network analysis allows for investigating how symptoms of disorders link and become mutually reinforcing by analyzing symptoms as a network (52).

In light of the vulnerability experienced by women in low socioeconomic status and the prevalence of employment inequalities, this study was undertaken to address the imperative need for enhanced research and initiatives aimed at safeguarding and enhancing women's mental well-being. The primary objective of this study was to assess disparities in Cognitive functioning, social dysfunction, Anxiety, depression Education levels and age within this demographic, shedding light on the pressing mental health concerns faced by women in low socioeconomic groups.

The primary objective of this study is to assess and analyze the disparities in cognitive functioning, social dysfunction, anxiety, depression, education levels, and age within a specific demographic of women in low socioeconomic groups. By employing Multilayer Perceptron (MLP) modeling and incorporating covariates, we aim to gain a deeper understanding of the multifaceted nature of social dysfunction, identify the most influential factors affecting it, and provide valuable insights for designing targeted interventions and evidence-based policies to enhance the mental well-being of women in low socioeconomic status.

2 Materials and methods

2.1 Study methodology

The multilayer perceptron (MLP) neural network function of IBM SPSS v27 was utilized in this study to minimize errors in prediction.

The architecture of the neural network consisted of three layers: an input layer, a hidden layer that incorporated radially symmetric functions and unsupervised learning to define the hidden neurons, and an output layer with a categorical node. This node was used to calculate the weighted sum of the hidden layer outputs and determine the class index for the input pattern. The researchers experimented with different combinations of nodes in one or two hidden layers to build the model. Neural networks learn from potential correlations between independent (cause criteria) and dependent (effect criteria) variables to create a model, and are able to justify the outcomes by linking predicted values with observed actual values. Neural network systems are more effective in such applications than traditional computing systems that rely on a set of instructions to solve problems.

2.2 Data collection and variables

The study sample consisted of 780 single or widowed women between the ages of 20 and 70, who fell within the bottom three economic deciles and had varying levels of education. All participants had less than a high school diploma and were receiving charitable financial support in Khorasan province, Iran. Data were collected over a 12-month period during the winter to fall of 2022, with participants completing the questionnaire and clinical in-person interview during their visits to the charity office.

2.2.1 Inclusion and exclusion criteria

2.2.1.1 Inclusion criteria

- Single or widowed women.
- Aged between 20 and 70.
- Falling within the bottom three economic deciles.
- Having varying levels of education, all participants having less than a high school diploma.
- Receiving charitable financial support in Khorasan province, Iran.

2.2.1.2 Exclusion criteria

- Any individuals not meeting the above inclusion criteria.

2.3 Ethical statement

Before administering the GHQ-28 questionnaire, the objective of the study was explained to all participants, and their consent was obtained. They were made aware of their right to withdraw from the study at any time without consequence. For those who had difficulty reading the questionnaire due to physical or academic limitations, an assistant read the questions and recorded their responses. This approach ensured that all participants had an equal opportunity to participate in the study, regardless of their literacy level or any other potential barriers to participation.

2.4 Measurements

2.4.1 GHQ 28

The mental health status of the study participants was assessed using the General Health Questionnaire-28 (GHQ-28), a validated

instrument developed by Goldberg and Hillier (53). This questionnaire is designed to comprehensively evaluate various aspects of mental health, consisting of four distinct sub-components: Somatic symptoms (items 1–7), Anxiety/insomnia (items 8–14), Social dysfunction (items 15–21), and Severe depression (items 22–28), each comprising seven items for a total of 28 items. Participants provided responses to these items using a Likert scale ranging from zero to three, with lower scores indicating better mental health. The GHQ-28 demonstrated strong internal consistency (Cronbach's alpha coefficient of 0.9), good split-half reliability (coefficient of 0.89), and moderate test-retest reliability (coefficient of 0.58), indicating its stability over time (54). Factor analysis identified four distinct factors, namely "depression," "psychosocial activity," "anxiety," and "somatic," elucidating the multidimensional nature of the mental health assessment. Furthermore, the study population-specific receiver operating curve (ROC) analysis determined an optimum cutoff score of 19/20, with a sensitivity of 0.83 and specificity of 0.76, facilitating the identification of individuals at higher risk of mental health issues. This brief and practical assessment tool can be completed in approximately 5 min, making it an efficient choice for mental health evaluation in the context of the study.

2.5 The ANN approach

Artificial neural networks (ANNs) are computational methods that simulate animal brain processes in a simplified manner and are widely used to solve complex problems (55). These networks consist of artificial neurons or nodes that act as information processing units. These neurons are organized in layers and connected through synaptic weights or connections. Using this processing style, the neurons can screen and communicate data in a controlled manner to create an analytical model that can classify stored data. ANNs typically consist of three interconnected layers of artificial neurons: the input layer, the hidden layer, and the output layer. Researchers have the option to create one or more hidden layers between the input and output layers. Neurons within the same layer are not interconnected, but each neuron can be connected to a neuron in the next layer.

The first layer, known as the input layer, gathers data about variables from the provided dataset. The hidden layer then processes this data, and the output layer produces the categorical class label or predicts continuous measures. The values in the input layer that connect to the hidden node are multiplied by pre-determined weights, and then all of the results are summed to create a single number. This number is passed as an argument to a nonlinear mathematical function, called the activation function (AF) in ANNs (56). The AF returns an output between 0 and 1 which is the sum of the weighted input values that enter a node. The activation function converts the weighted input of the neuron to its output activation. Artificial neural networks (ANNs) neurons go through two stages: the training stage and the usage stage. During the training stage, the system is taught to predict outputs using datasets with actual inputs and outputs as examples. This supervised learning begins with random weights and adjusts the weights using gradient-based optimization algorithms like back-propagation to solve the problem. The difference between the target output values and the obtained values is calculated using the error function to regulate learning (57). The error function is dependent on the weights, which must be adjusted to minimize the

error. After a dataset of respectable weights has been originated, the neural network model can take an alternative set with unidentified output measures and forecast the corresponding outputs automatically.

2.6 The multilayer perceptron approach

The perceptron-based model is only suitable for linearly identifiable data. In cases where the dataset is non-linear, the multilayer perceptron (MLP) is used instead. The MLP is a neural network with interconnected neuron layers that can incorporate the high non-linearity of the dataset. By using non-linear activation functions, such as the sigmoid function, the MLP is capable of approximating any continuous function at a random minor error by applying complex enough MLPs. The MLP network training procedure is used to minimize an objective function with regard to its criteria, which is connected to the task that the MLP is used for. The feedforward algorithm is used to quickly complete the prediction by an MLP (56).

The back-propagation algorithm (BPA) is widely used to change the ANN weights to lessen the mean squared error between the desired and actual outputs of the network. BPA uses controlled learning in which the neural network is trained using a dataset for which the input, as well as the desired outputs, are known. After the training process, the network weights are identified and then are used to compute the output measures for the original input samples. The gradient method can be used to reduce the objective function $E(\theta)$, which states that the sum of an update for a parameter is negatively proportionate to the gradient at its current value (56, 58–61).

2.6.1 The number of the necessary hidden units

The number of hidden units in an MLP is crucial to achieve a desired approximation level and influences the number of independent values that need to be adjusted in the network parameters. However, determining the necessary number of MLP parameters is not straightforward, especially when the hidden units are distributed across different layers. It is important to find the optimal number of hidden units, and also to define the maximum number of parameters for a given number of hidden units. Typically, one hidden layer is sufficient, but in some cases, two hidden layers may be needed to meet the required number of network constraints. The necessary number of hidden units can be calculated using equations that take into account the input quantity and the desired degree of model fit. Equations are presented to help compute the number of required hidden units and their distribution across one or two hidden layers. The equations consider the number of inputs and the desired degree of fit, and can be used to determine the necessary number of parameters for MLP neural networks. Typically, one hidden layer is enough, but if two hidden layers are needed to meet the required constraints, the equations can help determine the appropriate number of hidden units for each layer (56, 62, 63).

2.7 Network specifications

The predictive model employed in this study is based on the Multilayer Perceptron (MLP) architecture. MLPs are a class of artificial neural networks consisting of interconnected layers of nodes, where

each node performs a weighted sum of inputs and applies an activation function to produce an output. The model architecture includes an Input Layer, two Hidden Layers, and an Output Layer. The Input Layer contains 18 units, representing the covariates and input factors. The two Hidden Layers consist of 8 and 6 units, respectively, and are activated using the hyperbolic tangent activation function. The Output Layer comprises 2 units, representing the binary classification of social dysfunction, and uses the identity activation function. Specifications of MLP artificial neural network have been presented in Table 1.

2.8 Data preprocessing and rescaling

Before feeding the data into the MLP model, standardization was applied to the covariates to ensure a consistent scale and facilitate convergence during training. Standardization centers the data around zero with a standard deviation of one, eliminating potential issues related to varying scales across variables. This step ensures that each covariate contributes equally to the model's predictions and prevents any particular covariate from dominating the learning process (56).

2.9 Model training and error function

Farahani et al. (56) describe that the MLP model was trained using a supervised learning approach, where the model is presented with a labeled dataset and iteratively adjusts its weights and biases to minimize prediction errors. The error function used for training is the Sum of Squares, which calculates the squared difference between the predicted output and the true target value for each data point. The backpropagation algorithm, a common method for training MLPs, is employed to update the model's parameters during each iteration, optimizing the model's performance over time.

2.10 Model evaluation and testing

To evaluate the performance of the MLP model, it was tested on an independent dataset that was not used during training. The testing sample allowed us to assess the model's generalization ability and its ability to make accurate predictions on unseen data. The model's performance was assessed using metrics such as Sum of Squares Error and Percent Incorrect Predictions. Additionally, the classification performance of the model was evaluated using metrics such as sensitivity and specificity to assess its ability to correctly identify cases of high and low social dysfunction.

TABLE 1 Specifications of MLP artificial neural networks used in this research.

Metric	Training phase	Testing phase
Sum of squares error	45.444	24.565
Incorrect prediction rate (%)	11.1	11.9
Accuracy (%)	-	88.9
Sensitivity (high dysfunction)	-	97.7
Sensitivity (low dysfunction)	-	34.2

3 Results

The results of our study utilizing the Multilayer Perceptron (MLP) model demonstrated strong predictive performance in assessing social dysfunction. The demographic characteristics of our study sample are summarized in [Table 2](#), indicating key features of the participants, including their educational levels and age categories. A total of 780 participants were included in the analysis ([Table 3](#)).

The Multilayer Perceptron (MLP) model demonstrated promising performance in predicting social dysfunction based on the input factors and covariates. The model was trained and tested on a sample of data, with the training phase yielding a Sum of Squares Error of 45.444 and an 11.1% rate of incorrect predictions. During the testing phase, the model achieved a Sum of Squares Error of 24.565 and an 11.9% rate of incorrect predictions, indicating its ability to generalize well to unseen data.

The classification performance of the model was evaluated using the testing sample. The results revealed a high overall accuracy of 88.9%. The model exhibited a remarkable ability to correctly predict cases of high social dysfunction, with a sensitivity of 97.7%. However, its performance in identifying cases of low social dysfunction was relatively lower, with a sensitivity of 34.2%. These findings suggest that the MLP model is particularly adept at identifying individuals with high social dysfunction, but further improvements may be necessary to enhance its predictive accuracy for low social dysfunction cases.

An essential aspect of our study was assessing the relative importance of each covariate in predicting social dysfunction. We quantified the importance of cognitive functioning (HYPO), which emerged as the most influential factor, with an importance score of 0.269. Anxiety (ANX) closely followed, with a score of 0.282, indicating its strong predictive value. Depression (DEP) exhibited high predictive importance as well, with a score of 0.274. In comparison, education (EDU) and age played relatively smaller roles, with importance scores of 0.107 and 0.068, respectively. These

importance scores provide a comparative measure within the model, indicating the relative impact of each covariate on social dysfunction prediction. The prominence of cognitive functioning and emotional states underscores the imperative for targeted interventions and support in these domains ([Table 4](#)).

Finally, the study assessed the normalized importance of each covariate, offering insights into their relative contributions to the model's accuracy. Although the contribution of depression (DEP) is higher (97.2%) than that of cognitive functioning (HYPO; 95.2%), it's important to understand that the normalized importance score does not directly translate to absolute influence. The 100% contribution from anxiety (ANX) underscores its critical role in predicting social dysfunction, but this does not necessarily mean it is inherently more influential than other variables. The normalized importance scores for education (EDU) and age, at 37.7 and 24.1%, respectively, indicate that these factors have a comparatively lower impact on the model's predictions when compared to other variables ([Table 2](#)).

The results of the Multilayer Perceptron (MLP) model for social dysfunction prediction are promising, demonstrating its capacity to capture complex relationships and dependencies among covariates. The model showcased high overall accuracy and strong sensitivity in identifying individuals with high social dysfunction. Cognitive functioning (HYPO), depression (DEP) and anxiety (ANX) emerged as the most influential predictors, highlighting their significance in predicting social dysfunction. These findings offer valuable insights for developing targeted interventions and evidence-based policies to address social dysfunction and promote societal well-being ([Figures 1, 2](#)).

To provide a more comprehensive understanding of the implications of our findings, it's essential to discuss how the model's performance aligns with our research objectives. Our study aimed to predict social dysfunction among a specific demographic of women in low socioeconomic status, and the results show the MLP model's promising ability to achieve this goal. The model's high overall accuracy and sensitivity are encouraging, as they indicate that it excels in identifying individuals with high social dysfunction. These findings hold significant promise for practical applications and policy development. By recognizing that cognitive functioning (HYPO), anxiety (ANX), and depression (DEP) are the most influential factors in predicting social dysfunction, we can now tailor interventions and policies to address these critical areas. For instance, targeted support programs for improving cognitive functioning, mental health, and coping with anxiety may be developed to aid individuals experiencing social dysfunction. Policymakers can use these insights to prioritize resources and design evidence-based initiatives. While our MLP model excels in identifying high social dysfunction cases, it's important to

TABLE 2 Normalized importance of covariates.

Covariate	Normalized importance (%)
Cognitive (HYPO)	95.2
Anxiety (ANX)	100.0
Depression (DEP)	97.2
Depression (DEP)	97.2
Education (EDU)	37.7
Age	24.1

TABLE 3 Demographic characteristics of the study sample.

Characteristic	Frequency	Percent
Education		
1 = Primary School	224	28.7
2 = Secondary School	230	29.5
3 = High School	326	41.8
Age		
1 = Over 35 years old	438	56.2
2 = Under 35 years old	342	43.8

TABLE 4 Importance of covariates in predicting social dysfunction.

Rank	Covariate	Importance score
1	Cognitive (HYPO)	0.269
2	Anxiety (ANX)	0.282
3	Depression (DEP)	0.274
4	Education (EDU)	0.107
5	Age	0.068

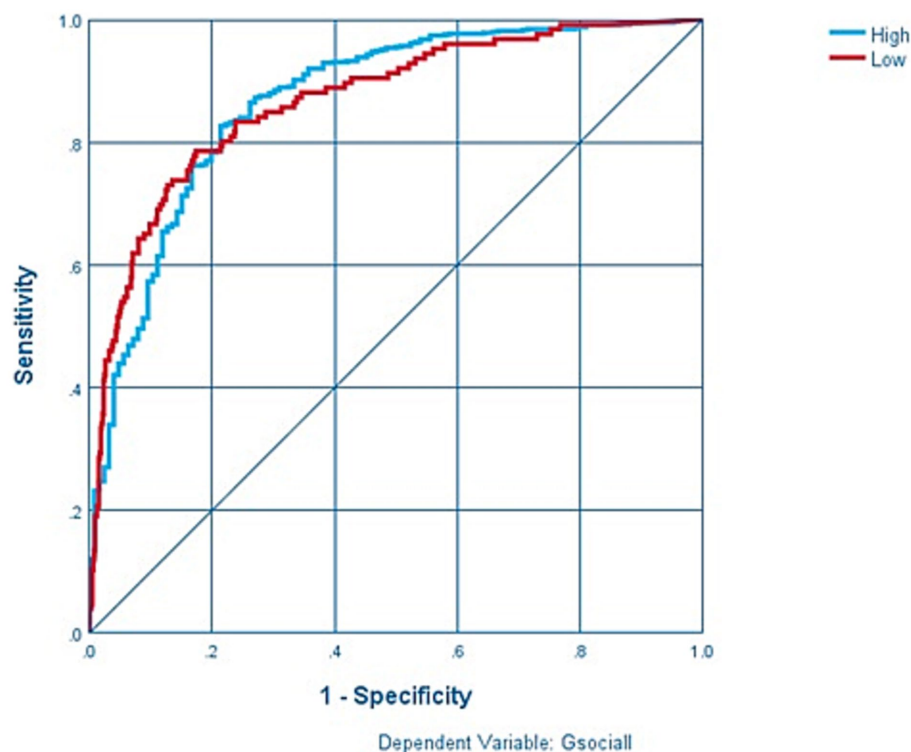


FIGURE 1
Sensitivity and specificity in MLP model.

acknowledge that further improvements are needed to enhance its predictive accuracy for low social dysfunction cases. Understanding the challenges and limitations of the model's performance can guide future research and model refinement efforts. Future studies may focus on refining the model to better capture nuanced variations in social dysfunction among individuals with relatively lower dysfunction levels.

4 Discussion

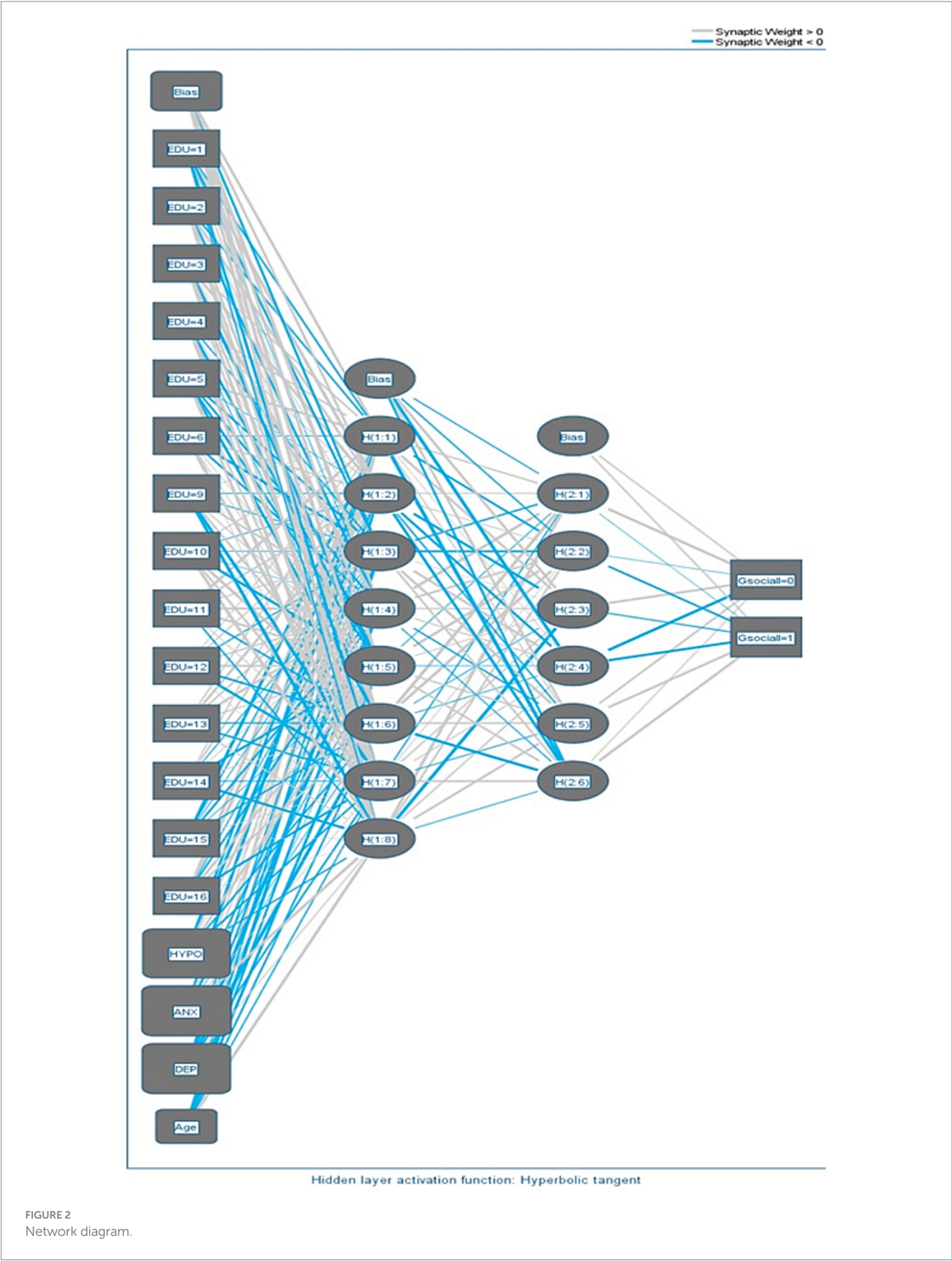
The findings derived from the Multilayer Perceptron (MLP) model, employed to forecast social dysfunction, provide valuable insights into the intricate nuances of this societal concern. The model's remarkable performance, characterized by its elevated overall accuracy and sensitivity in identifying instances of high social dysfunction, underscores its efficacy in discerning the intricate interplay among input variables and covariates. Nevertheless, the comparatively lower sensitivity in detecting cases of low social dysfunction highlights the imperative for further exploration and enhancement of the model's predictive capabilities in this particular domain. One of the remarkable attributes of artificial neural networks is their adaptability, achieved through the fine-tuning of model factors via weight adjustments, allowing for specific function training, as elucidated by Hagan and Dennutu (64). Furthermore, the inherent parallel processing capabilities of artificial neural networks translate into swift classification speeds, as articulated by the same authors. Additionally, they help mitigate the oversimplification of complex relationships, a notable

advantage. These merits underscore the preference for employing this method over traditional statistical techniques such as logistic regression for predictive purposes.

Our study findings, echoing the insights of Farahani et al. (65), underscore the significant role of artificial neural networks in making precise predictions based on various risk factors. Farahani et al.'s (65) research, which achieved an impressive 90.5% accuracy in classifying high and low-risk individuals in predicting suicide tendencies, highlights the potential of these networks in modeling complex, non-linear relationships. In essence, both of these research work underline the potential of artificial neural networks in unraveling complex social phenomena and stress the importance of addressing mental health concerns in interventions for healthier and thriving communities.

The finding that cognitive functioning (HYPO) emerged as an influential predictor of social dysfunction aligns with existing literature on the role of cognitive processes in shaping human behavior and interactions (66). Cognitive functioning encompasses a broad range of mental processes, such as memory, attention, and problem-solving, which play a pivotal role in social functioning and adaptability. The strong impact of cognitive functioning on social dysfunction underscores the significance of cognitive assessments and interventions in mitigating social challenges.

Anxiety and depression were also identified as crucial predictors of social dysfunction. These findings are consistent with research that highlights the association between mental health issues and impaired social interactions (67). Individuals experiencing anxiety or depression may struggle with social interactions, leading to withdrawal and social dysfunction. The MLP model's ability to capture the influence of these



emotional states emphasizes the importance of addressing mental health concerns in interventions aimed at promoting healthy social functioning (45).

Education and age have demonstrated comparatively lower predictive significance in relation to social dysfunction when juxtaposed with cognitive functioning, anxiety, and depression. Nevertheless, their

roles remain substantively meaningful and warrant careful consideration in comprehensive analyses. Education, for instance, has been consistently correlated with heightened social integration and cohesion, often highlighting that individuals with higher educational attainment tend to exhibit superior social adaptability (41). Similarly, age can exert a notable influence on social functioning, with individuals at various life stages grappling with distinct social challenges (47). Recognizing the pivotal roles of education and age in the context of predicting social dysfunction paves the way for tailoring age-appropriate interventions and support systems.

The relative impact of each covariate on the model's predictive accuracy is further underscored by the normalized importance scores. Notably, cognitive functioning and depression exhibit substantial normalized importance, signifying their significant contributions to the model's overall performance. Furthermore, the comprehensive normalized importance attributed to anxiety underscores its pivotal role in precisely predicting social dysfunction. This understanding of the varying importance of covariates enables the prioritization and customization of interventions to effectively target the most influential factors. The current study serves as a compelling testament to the potential of Multilayer Perceptron (MLP) modeling in unraveling intricate social phenomena, such as social dysfunction. The model's capacity to harness hidden layers and capture nonlinear relationships among covariates offers an invaluable tool for deciphering the multifaceted dynamics that underlie social dysfunction. As MLP modeling continues to evolve, it opens up new avenues for the development of refined predictive models and a nuanced comprehension of social behavior, thereby supporting the formulation of evidence-based policies and the implementation of precisely targeted interventions.

In summation, the discussion of the MLP model's outcomes underscores the critical significance of cognitive functioning, anxiety, and depression as major predictors of social dysfunction. These findings accentuate the imperative of addressing mental health concerns and cognitive well-being within interventions aimed at fostering healthy social interactions. Moreover, the acknowledgment of the roles played by education and age provides insights for tailoring interventions tailored to specific age groups and educational backgrounds. The application of MLP modeling in social science research presents a promising avenue toward gaining deeper insights into social dysfunction and the formulation of effective strategies to nurture thriving communities.

4.1 Limitations

1. Sample size and generalizability: one of the primary limitations of this study is the sample size. While the research provides valuable insights into social dysfunction among a specific group of single or widowed women in Iran, the relatively small sample size may limit the generalizability of the findings. Future studies could benefit from larger and more diverse samples, encompassing various demographic groups.
2. Data collection bias: the study relied on self-report data and in-person interviews, which may introduce response and recall biases. Participants might underreport or overreport certain aspects of their experiences due to social desirability or memory limitations. To mitigate this bias, incorporating additional data collection methods, such as observations or ecological momentary assessments, could enhance the accuracy of the findings.
3. Single gender and age group: the study's focus on single or widowed women in Iran within a specific age range might limit the applicability of the findings to a broader population. Future research should aim for more diverse samples to ensure the results can be applied to a wider range of individuals.
4. Neural network complexity: while the MLP model proved effective, it is essential to acknowledge that the model's complexity can be a double-edged sword. Overfitting, where the model performs exceptionally well on the training data but struggles with unseen data, can be a concern. Careful consideration of the model's architecture and ongoing validation with larger datasets can help address this concern.

4.2 Suggestions for future research

1. Diverse and representative samples: future research should endeavor to include more diverse and representative samples, both in terms of demographics and geographical locations. This will allow for a more comprehensive understanding of social dysfunction across different populations.
2. Longitudinal studies: longitudinal studies tracking participants over an extended period can provide a deeper understanding of how social dysfunction evolves over time and the factors that contribute to its persistence or resolution.
3. Incorporate objective measures: combining self-report data with objective measures can help mitigate response bias and provide a more accurate representation of individuals' experiences. For example, using wearable technology to collect real-time data on social interactions can enhance the quality of data.
4. Comparative analyses: conducting comparative analyses between different machine learning models and traditional statistical approaches, such as logistic regression, can offer insights into the strengths and weaknesses of each method. This can help identify which approach is most suitable for specific research questions.
5. Intervention development: building on the insights regarding cognitive functioning, anxiety, depression, and other influential factors, future research can focus on developing and testing targeted interventions to mitigate social dysfunction. These interventions should consider a variety of factors, including cognitive well-being, mental health, education, and age, to promote healthy social interactions.
6. Validation and external testing: it is essential to validate the findings in different cultural and geographical contexts. External testing can confirm the robustness and applicability of the MLP model for predicting social dysfunction in diverse settings.
7. Advanced data collection techniques: leveraging advanced data collection techniques, such as natural language processing for text data or physiological monitoring for stress-related data, can provide a more comprehensive picture of social dysfunction's underlying mechanisms.

5 Conclusion

The present study utilized a Multilayer Perceptron (MLP) model to predict social dysfunction, drawing insights from a comprehensive set of input factors and covariates. The MLP model demonstrated favorable performance in both training and testing phases, highlighting its capability to generalize well to unseen data and make accurate predictions. The high overall accuracy of 88.9% underscores the effectiveness of the MLP model in classifying social dysfunction cases.

An essential aspect of the study was the assessment of covariate importance in predicting social dysfunction. Cognitive functioning (HYPO) emerged as an influential predictor, emphasizing its critical role in shaping social behavior and interactions. Anxiety (ANX) and depression (DEP) also contributed significantly to the model's accuracy. These findings offer valuable insights into the drivers of social dysfunction and call for targeted interventions addressing cognitive functioning and emotional well-being.

The normalized importance scores provided further clarity on the relative contributions of covariates to the model's predictive accuracy. Anxiety (ANX), cognitive functioning (HYPO) and depression (DEP) demonstrated the highest relative importance, indicating their significant impact on the model's performance. Anxiety (ANX), in particular, exhibited a full contribution, indicating its indispensable role in predicting social dysfunction. Education (EDU) and age, though less influential, remain important factors in understanding social dysfunction dynamics.

Overall, the study highlights the potential of MLP modeling in social science research, particularly in predicting social dysfunction. The model's ability to capture complex relationships and nonlinear dependencies among covariates makes it a valuable tool for unraveling the intricate mechanisms underlying social dysfunctions. The findings presented here contribute to a deeper understanding of social dysfunction's multifaceted nature and inform evidence-based interventions and policies aimed at addressing these challenges.

While the MLP model showed robust performance, there is room for further research and refinement. Enhancing the model's sensitivity in identifying low social dysfunction cases could be explored to improve its comprehensive predictive capacity. Additionally, expanding the dataset and incorporating additional relevant covariates may enrich the model's predictive power, providing a more nuanced understanding of social dysfunction dynamics.

In conclusion, the study underscores the significance of Multilayer Perceptron Modeling in social dysfunction prediction, offering valuable insights into the impact of covariates on this complex societal issue. The results have implications for policymakers, clinicians, and researchers seeking to address social dysfunction and promote healthier and more harmonious communities.

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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 humans were approved by Tarbiat Modares University, Tehran, Iran. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study. Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

Author contributions

SB: Writing – original draft. ST: Writing – original draft. HF: Methodology, Writing – original draft, Writing – review & editing. PW: Methodology, Writing – review & editing. ER: Writing – original draft.

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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.

The reviewer MB declared a past collaboration with the authors to the handling editor.

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Can dialectical behavior therapy skills group treat social anxiety disorder? A brief integrative review

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The purposes of this brief integrative review are to identify and critically evaluate recent work in the area of Dialectical Behavior Therapy-Skills Group (DBT-SG) for Social Anxiety Disorder (SAD) with suicidal ideation (SI) and to suggest further how DBT-based skills may be applied to cognitive maintenance factors of SAD. Accordingly, we first evaluate the relevance of DBT in treating SI in other disorders. Second, we evaluate the relationship between SI and SAD, providing considerations for the complexity of comorbid disorders and presentations. Finally, we extend this knowledge to discuss considerations for the use of DBT-SG skills to target specific etiological and maintenance elements of SAD, with a focus on four themes (interpersonal effectiveness, mindfulness, emotion regulation, and distress tolerance). Overall, we conclude that DBT-SG may prove beneficial in reducing SI and symptoms in SAD that impact social and emotional functioning.

KEYWORDS

social anxiety, dialectical behavior therapy (DBT), social anxiety (SA), interpersonal effectiveness, distress tolerance, emotion regulation (ER), mindfulness

Introduction

Social Anxiety Disorder (SAD) is a chronic and impairing disorder marked by a fear of one or more social or performance situations ([American Psychiatric Association, 2013](#)). SAD remains among the most common anxiety disorders, with an estimated current and lifetime prevalence of 7.1% and 12.1%, respectively ([Kessler et al., 2005](#)). SAD also has high rates of comorbidities, with 69 to 81% of affected individuals experiencing comorbid mental health conditions [i.e., major depression disorder (MDD), bipolar disorders, panic disorder, specific phobias, generalized anxiety disorder (GAD), alcohol use disorders, etc.; ([Schneier et al., 1992](#); [Magee et al., 1996](#); [Weiller et al., 1996](#); [Lecrubier, 1998](#); [Kessler et al., 1999](#); [Mennin et al., 2000](#); [Kessler et al., 2005](#); [Koyuncu et al., 2019](#))]. These comorbidities exacerbate symptom severity and contribute to poorer outcomes, including significant treatment resistance and decreased overall functioning ([Koyuncu et al., 2019](#)). SAD is further associated with increased reports of suicidal ideation (SI) and attempts when compared to other anxiety disorders ([Sareen et al., 2005](#); [Cougle et al., 2009](#); [De La Vega et al., 2018](#)). Furthermore, SI and attempts in SAD are more pronounced in incidence and severity, irrespective of comorbid depression ([Herres et al., 2019](#)). Previous research has noted comorbid diagnoses within this population exacerbate suicidal behaviors, thus underscoring the urgent need for new treatment avenues to address this pernicious aspect

of the disorder (Weiller et al., 1996; Sareen et al., 2005; De La Vega et al., 2018; Koyuncu et al., 2019).

Currently, front-line treatments for SAD include Cognitive Behavioral Therapy (CBT), which is recognized as the most effective and widely recommended form of intervention (Gordon et al., 2014). Nevertheless, prior work suggests SAD is the anxiety disorder that is *least* responsive to CBT, as defined by remarkably modest remission rates, with up to 51% of cases remaining symptomatic following treatment completion (Juster and Heimberg, 1995; Springer et al., 2018). CBT's limited success rates highlight that current "gold-standard" interventions may not engage core etiological and maintenance factors of SAD. Therefore, there is a pressing need to identify alternative intervention methods that may also target under-appreciated mechanisms of the disorder. Dialectical Behavior Therapy-Skills Group (DBT-SG) has demonstrated promise as a treatment for psychiatric disorders characterized by complex comorbidities and suicidal ideation and behaviors (Valentine et al., 2015). However, there have been no systematic considerations of DBT-SG for SAD or the extent to which hypothesized mechanisms of the disorder may fit this particular treatment approach. Accordingly, this brief review highlights a theoretical rationale for applying DBT-SG for SAD and considers the evidence for potential mechanisms by which this intervention may influence SAD course and severity.

Dialectical behavioral therapy (DBT) was first developed as an intervention for Borderline Personality Disorder [BPD; (Linehan, 1993)] and has also been used successfully in non-BPD populations (Valentine et al., 2015). "Full-model" DBT involves several components including individual therapy, group skills training, telephone consultation, therapist consultation, and team meetings (Linehan, 1993). However, research has documented that implementing DBT in community settings faces challenges like staff training, turnover, and financial constraints in seeking and sustaining services (Swenson et al., 2002; Carmel et al., 2014). Perhaps as a result, research has increasingly focused on implementing DBT Skills Group (DBT-SG) as a stand-alone treatment (Valentine et al., 2015). DBT-SG is led by two trained clinicians who meet with the group weekly and follow a protocol emphasizing four core skills: mindfulness, distress tolerance (DT), emotion regulation (ER), and interpersonal effectiveness (Linehan, 2014). Group meetings focus on covering assigned topics related to one of the four skills, followed by a discussion of the weekly homework (Linehan, 2014). These components address the core dialectic in DBT of *acceptance* and *change* while concurrently allowing the individual to pursue life values even while in psychological distress. Importantly, meta-analyses of DBT-SG studies highlight its efficacy as a stand-alone treatment in treating a variety of mental health concerns such as depression and other mood disorders, oppositional defiant disorder, eating disorders, attention-deficit hyperactivity disorder, BPD, with implementation in variety of clinical settings, such as prisons or medium security settings, community or psychology department clinics, and via telehealth (Valentine et al., 2015; Zalewski et al., 2021; Bean et al., 2022; Landes et al., 2022). DBT-SG effectively reduced suicidal behaviors and sustained that improvement over time while addressing comorbid disorders and symptoms (Sambrook et al., 2007; Soler et al., 2009; Long et al., 2011; Decker et al., 2019). Further, research found DBT-SG is similarly as effective to "full-model" DBT at reducing suicidal behaviors and non-suicidal self-injurious behaviors and reducing anxiety (Linehan et al., 2015).

Suicidality and comorbidity in social anxiety disorder

The increased experience of suicidal ideation in SAD represents a potentially promising rationale and justification for considering the use of DBT-SG in this population (Sareen et al., 2005; Cougle et al., 2009; De La Vega et al., 2018). Research highlights individuals with SAD endorse SI, with 16% of individuals with SAD reporting SI in the previous month and 18% reporting a history of suicide attempts (Cougle et al., 2009; Bomyea et al., 2013). Moreover, Weiller et al. (1996), found SI worsens with comorbid diagnoses in this community. Their study revealed 8.5% of individuals with SAD had a history of SI, compared to 41.3% of those with comorbid SAD. Additional research found this relationship persisted after social anxiety symptoms were in remission and no longer met diagnostic criteria (Kessler et al., 1999). Researchers theorize this relationship stems from a lack of belongingness and perceived burdensomeness that those with SAD often experience, which are interpersonal factors associated with a higher suicide risk (Davidson et al., 2011; Silva et al., 2015; Chu et al., 2016; Buckner et al., 2017; Duffy et al., 2020). This association is thought to increase self-perceived social burden among those with SAD, leading to the belief that others would be "better off" without them (Duffy et al., 2020). Critically, DBT-SG has demonstrated effectiveness in reducing suicidal behaviors and sustaining that improvement over time (Decker et al., 2019). For example, Decker et al. (2019) investigated the application of DBT-SG for Veterans with suicidal ideation and found improvements in suicidal risk, SI, and a sustained improvement at a 3-month follow-up. Thus, DBT-SG offers a promising approach to address the under-appreciated risk of SI among those with SAD and could provide a more proactive approach in treating SI than other standardized treatments for SAD. In addition to the potential direct effect of DBT-SG on SI, extant research highlights the effectiveness of DBT-SG in addressing comorbid disorders, which may indirectly reduce suicidal behaviors and sustain improvement over time (Sambrook et al., 2007; Soler et al., 2009; Long et al., 2011; Decker et al., 2019). Available data suggest 69–81% of individuals with SAD endorse diagnostic criteria for another mental health diagnosis, which include other anxiety disorders (e.g., GAD or panic disorder), substance abuse disorders, and obsessive-compulsive or mood disorders, such as MDD (Schneier et al., 1992; Magee et al., 1996; Weiller et al., 1996; Lecrubier, 1998; Kessler et al., 1999; Mennin et al., 2000; Kessler et al., 2005; Koyuncu et al., 2019). A study by Soler et al. (2009) found secondary depression improved when implementing DBT-SG in a sample of individuals with BPD. These findings highlight DBT-SG's utility in treating primary and secondary diagnoses; an aspect of DBT-SG that may be beneficial for treating SAD when considering the increased rate of comorbidities within this population.

Social anxiety and dialectical behavior therapy - skills group

Another vital aspect of DBT is the four overarching themes within which these mechanisms exist and are actively practiced. A central point within this review is that DBT-SG may engage etiological and maintenance elements of SAD despite a lack of direct tests assessing the implementation of DBT-SG within this population. For example,

cognitive maintenance factors of SAD that have received consistent empirical support include high social standards, perceived poor social skills, poorly defined social goals, lack of perceived control, negative self-perception, heightened self-focused attention, post-event rumination and avoidance, and safety behaviors (Clark and Wells, 1995; Hofmann, 2007).

Interpersonal effectiveness skills

Regarding social standards, individuals with SAD frequently report believing they must achieve a high level of competency while concurrently underestimating their social abilities to meet that standard (Hofmann, 2007). Paradoxically, current research does not support the presence of social skills deficits in SAD but instead highlights that social performance abilities play a minimal role in many anxiety disorders (Clark and Arkowitz, 1975; Halford and Foddy, 1982; Rapee and Lim, 1992; Stopa and Clark, 1993). There is greater consensus regarding the importance of perceived social skills insofar as individuals with SAD appraise their social skills more negatively (Alden and Wallace, 1991; Rapee and Lim, 1992; Stopa and Clark, 1993). Alden and Wallace (1991) had socially anxious individuals rate themselves within a social interaction and found that socially anxious individuals demonstrated a negative bias in their performance and underestimated their social skill. Research has noted SAD treatment can boost how individuals perceive their performance, despite no objective improvements in performance (Newman et al., 1994). This discrepancy between the perceived social standard and perceived social abilities may result in a negative self-appraisal and a negative self-perception (Hofmann, 2007). Lastly, SAD can result in difficulty in setting, defining, and achieving social goals (Newman et al., 1994; Heinrichs and Hofmann, 2001; Hiemisch et al., 2002).

The interpersonal effectiveness skills in DBT-SG can target perceived deficits in social functioning and could address three core factors of SAD: high social standards and their ability to reach that standard, perceived poor social skills, and poorly defined social goals. This skill aims to maintain and improve relationships while maintaining self-respect (Linehan, 2014). This skill could help adjust their social standards and improve their goal-setting difficulties while helping them gain confidence in their social abilities and, as a byproduct, improve their negative self-perceptions and perceived lack of control. Notably, reviews on social skills emphasized that social skills training alone is ineffective in improving social skills in SAD (Ponniah and Hollon, 2008). However, the combination of the skills in DBT-SG for this population can more efficiently address the core aspects of the disorder.

Mindfulness skills

Individuals with SAD utilize selective information processing, resulting in heightened self-focused attention. For example, social threats may lead to increased self-focused attention, detailed self-monitoring, and observation (Hirsch et al., 2003). SAD can also result in a lack of perceived control over adverse emotional and bodily reaction (Rapee and Lim, 1992; Zalewski et al., 2021), leading them to the perceived uncontrollability of emotional responses in social situations (Cloitre et al., 1992; Leung and Heimberg, 1996;

Hofmann, 2007). Several skills within DBT-SG can concurrently address these factors, such as mindfulness, ER, and DT skills.

Mindfulness is a core DBT-SG skill that entails observing, describing, and participating fully in one's actions and experiences in a non-judgmental manner with a focus on effective behavior (Linehan, 1993). As previously noted, there are currently no studies regarding the application of DBT-SG for SAD. However, several mindfulness-based interventions, such as Mindfulness-Based Stress Reduction and Mindfulness-Based Cognitive Therapy, can provide support for this component of DBT-SG as they have been efficacious in decreasing negative emotions and SAD symptom severity (Goldin et al., 2013; Strege et al., 2018). Within these interventions, the main objectives emphasize observing thoughts, emotions, and physical sensations in the present moment and critically doing so without judgment. Mindfulness is thought to target negative ruminative thought processes within SAD that, over time, may lead to behavioral avoidance of social situations. In turn, these can unlink the experience of social interaction from its typically reinforcing outcomes (Klemanski et al., 2017; Richey et al., 2019). Extant research highlights increases in mindfulness lead to increased executive and attentional control and as mindfulness skills improve so does the ability to control and direct attention (Lynch et al., 2006). Therefore, mindfulness could address the lack of perceived control and circumvent the heightened self-focused attention within SAD. These mindfulness skills in DBT-SG could engage SAD symptoms through the exact mechanisms of other mindfulness-based therapies.

Emotion regulation (ER) skills

Several models of SAD emphasize the role of difficulties in ER, mainly decreased emotional awareness, emotional hyper-reactivity, and difficulty regulating the emotional experience (Clark and Wells, 1995; Rapee and Heimberg, 1997; Clark and McManus, 2002; Goldin et al., 2009). Individuals with SAD commonly employ two ER strategies: expressive suppression (ES) and cognitive reappraisal (CR). ES involves inhibiting outward emotional expression, potentially leading to the suppression of both positive and negative emotions and resulting in anhedonia (Erwin et al., 2003; Turk et al., 2005; Spokas and Heimberg, 2009; Watson and Naragon-Gainey, 2010; Werner and Gross, 2010). CR involves reframing one's perspective to diminish or intensify emotional impact, thus altering the interpretation of the situation (Gross, 2002). While typically effective in reducing negative emotions, in SAD, this strategy is less successful, as individuals often doubt their ability to employ it effectively (Werner et al., 2011). The inability to regulate emotions before, during, and after a social interaction can contribute to anxiety, avoidance and impact social functioning (Erickson et al., 2014). Due to this difficulty in ER, evidence-based interventions for SAD should include an ER component.

ER skills within DBT-SG aim to improve emotional modulation and control, with the recognition that no one is ever in complete emotional control (Linehan, 1993). A key strategy is opposite action, which entails determining whether an emotion is justified, being exposed to the anxiety-inducing cue, and replacing the behavior elicited with new responses (Linehan, 1993). These skills broaden the cognitive response to the emotional experience and aid in changing perception of the emotional experience (Lynch et al., 2006).

Improvements in ER skills can address several etiologic and maintenance factors within SAD, such as negative self-perception and lack of perceived control that will lessen by increasing self-esteem and a sense of control over emotional responses (Cloitre et al., 1992; Fernandes et al., 2022).

Distress tolerance (DT) skills

DT pertains to the assessment and consequences of experiencing negative emotions. Individuals with SAD have lower DT which is associated with a heightened reactivity to stress, anxiety and distress (Keough et al., 2010). Moreover, this suggests ineffective coping mechanisms and results in concerted attempts to avoid negative emotions entirely. For example, Keough et al. (2010) theorized low DT might lead to perceiving anxiety symptoms as uncontrollable and intensify the reliance on avoidance and safety behaviors. Notably, low DT impacts treatment outcomes, as per Katz et al. (2017) who reported it predicted increased SAD symptom severity in therapy. This underscores the importance of addressing DT in treatment.

DT Skills in the DBT- SG focus on addressing two skills: crisis survival skills (i.e., tolerating painful events, urges, and emotions) and reality acceptance skills [i.e., minimize suffering by embracing a life different from their ideal (Linehan, 1993)]. These skills facilitate an improvement in conscious control over attentional processes, emotional and rational thinking integration, and a sense of unity with themselves (Linehan, 1993; Lynch et al., 2006). In SAD, this distress can intensify emotional reactions to social situations, resulting in hyperreactivity to negative emotions. Moreover, SAD can distort time perception, due to self-focused attention and post-event rumination, causing time to seem to pass slowly (Bar-Haim et al., 2010; Gross and Jazaieri, 2014). Lynch and colleagues (Lynch et al., 2006) found DBT may increase perceived control, reduce self-focused attention and improve control over attentional processes, fostering a sense of ownership and behavioral acceptance in individuals with SAD. Moreover, this skill fosters a radical acceptance of the current situation which could improve the negative self-perception within SAD.

Combining skills in DBT-SG to address interrelated factors

Two final interrelated factors that maintain SAD are avoidance and safety behaviors (i.e., behaviors intended to reduce or hide anxiety) and post-event rumination [i.e., thoroughly reviewing social interactions, emphasizing anxiety and self-doubt (Clark and Wells, 1995; Heinrichs and Hofmann, 2001)]. Avoidance and safety behaviors disrupt social interactions by diverting attention to props or items during stressful social situations for temporary comfort (Clark and Wells, 1995; Heinrichs and Hofmann, 2001). These constructs produce a positive feedback loop that sustains social anxiety by preventing exposure despite repeated successful social encounters (Wells et al., 1995). Post-event rumination contributes to a negative self-perception, leading to anticipatory processing, which reinforces anxiety through past failures (Clark and Wells, 1995; Clark, 2001; Hofmann, 2007). Mindfulness skills could address these factors by changing emotion-linked automatic responses and fear, allowing individuals to acquire

new responses (Lynch et al., 2006), and, thus, disrupting avoidance and safety behaviors. Moreover, as new automatic responses arise and individuals perceive themselves non-judgmentally, post-event rumination could improve, and the negative perception of themselves and their social skills could improve.

Similarly, ER skills interfere with the reliance on avoidance and safety behaviors by allowing people to engage in more effective behaviors that break down the association between the emotionally evocative stimulus and the unjustified emotional response (Gross, 1998). As the negative self-perception and lack of perceived control lessen due to the increased self-esteem and sense of control (Cloitre et al., 1992; Fernandes et al., 2022), this would lessen an individual's need to engage in post-event rumination, especially if they are confident in their sense of control over the situation and in their behavior.

Interpersonal effectiveness would peripherally address these factors because, as high social standards, perceived poor social skills, and poorly defined social goals improve, so would the negative self-perception and lack of perceived control. Subsequently, the post-event rumination and the need for avoidance and safety behaviors would decrease. DT skills can address avoidance and safety behaviors by providing individuals with skills to tolerate anxiety without behavioral avoidance. Moreover, DT enhances control over attentional processes, allowing individuals with SAD to gain a sense of ownership and acceptance over their behavior and facilitating a detachment from the post-event rumination since individuals would feel less of a need to engage in that behavior when they can tolerate the interactions.

Conclusion

SAD is a debilitating disorder that remains resistant to cognitive-behavioral treatment, leaving those impacted by the disorder with prolonged impairment in various aspects of day-to-day functioning. Specific characteristics of SAD that require particular consideration during treatment include its high comorbidity rate with other anxiety and mood disorders and pronounced SI. Within this review, we characterized DBT-SG as a potentially promising intervention for SAD with considerations for complex, comorbid disorders and maintenance factors that contribute to SI. This brief integrative review was motivated by the limited research on the use of DBT-SG in SAD, and focuses on the connecting the mechanisms of action in DBT-SG to the known mechanisms of psychopathology genesis and maintenance in SAD. We propose that, given the identification of SI in SAD in current research, DBT principles may also prove promising for this disorder. Given complications outlined in current research regarding the challenging nature of implementing DBT in community settings, we suggest that DBT-SG may be more suitable for SAD. Furthermore, elements of SAD that further perpetuate symptoms of the disorder, such as avoidance and difficulties with emotion expression, may be well addressed utilizing the four themes of DBT-SG: interpersonal effectiveness, mindfulness, ER and DT. Limitations of the current field include not only scarcity of social anxiety populations included in intervention work that utilizes DBT principles but also scarcity of treatment consideration of SI in SAD. This limits conclusions regarding differences in response to treatment based on severity of symptoms and complex presentations.

Limitations of the current review should thus be considered in light of the general limitations noted in the literature. Specifically, this review explored the themes within DBT-SG and their potential impact on SAD. However, discussions comparing these considerations for a range of SAD severity and in those with and without SI are limited due to the nature of the existing literature. Furthermore, this review primarily focused on adults with SAD. Therefore, discussion on the influence of DBT-SG may not be generalizable to other developmental periods in which SI may be pronounced (e.g., adolescence or late-life).

We propose the implementation of DBT-SG for SAD may prove beneficial in reducing SI and specific cognitive maintenance factors of the disorder, including but not limited to high social standards, perceived poor social skills, poorly defined social goals, lack of perceived control, negative self-perception, heightened self-focused attention, post-event rumination and avoidance, and safety behaviors. In addition to considering how these symptoms may be treated within each theme of DBT-SG, combining skills from multiple themes may prove useful in tackling complex symptoms. In light of the findings outlined here, future research may consider the direct impact of DBT-SG on SAD symptoms and maintenance, with specific considerations for measuring and monitoring SI.

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Associations between olfactory reference disorder and social phobia – results of an internet-based study

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Despite the similar clinical features of Olfactory Reference Disorder (ORD) and Social Phobia (SP), or studies showing elevated comorbidity of the two disorders, and the conceptualization of ORD as a form of SP in the East Asian culture, to our knowledge, the relationship between ORD and SP has not been investigated. This study examined the association of ORD according to the 11th revision of the International Classification of Diseases (ICD-11) and SP in 225 German university / college students who completed self-ratings with regard to socio-demographic data and symptoms of SP and ORD within an anonymous internet-based survey. Symptoms of SP were assessed with the Social Phobia Inventory (SPIN). Symptoms of ORD according to the ICD-11 were assessed with the Olfactory Reference Disorder Questionnaire (ORDQ), developed for this study. In our sample, 86.6% of the participants who met the self-rated features for ORD also met the self-rated criteria for current SP. ORD severity scores were significantly related to SP. Participants with and without self-reported ORD differed significantly in their SP total scores. SP severity was also significantly correlated with poorer insight of ORD-related beliefs, greater ORD-related avoidance of intimate relationships and higher levels of shame and fear of rejection due to body odor. These preliminary findings indicate that ORD could be closely related to SP and highlight the need for future research on the relationship of ORD and SP in order to gain a better understanding of the development, maintenance, treatment and classification of ORD.

KEYWORDS

olfactory reference disorder, ICD-11, social phobia, social anxiety disorder, avoidance, insight, shame

1 Introduction

Olfactory reference disorder (ORD) is a distressing and impairing condition characterized by a persistent preoccupation with the belief that one is emitting a foul or offensive body odor or breath that is usually not perceptible to others (World Health Organization, 2019). Research studies examining the prevalence of ORD in university students suggest that the disorder is relatively common - estimates of its prevalence vary between 2.1 and 5.5% (Kasahara and Kenji, 1971; Zhou et al., 2018; Reuter et al., 2023). However, a systematic examination of its prevalence in the general population is lacking. Indeed, empirical research on ORD is scarce and most findings on this disorder are limited to case reports or case series with only a few

subjects. However, the suffering of those affected (e.g., Feusner et al., 2010; Prazeres et al., 2010; Greenberg et al., 2016) underscores the importance of investigations into the disorder.

Recently, ORD has been included as a new diagnosis in the category of obsessive-compulsive and related disorders in the 11th revision of the International Classification of Diseases (ICD-11) (World Health Organization, 2019). However, although ORD has now been assigned as being part of the obsessive-compulsive disorder (OCD), its classification is still a matter of debate. There are similarities to OCD inasmuch as individuals with ORD perform repetitive behaviors and are preoccupied with permanent thoughts about their odor. Moreover, OCD is a common comorbid disorder of ORD which further supports their overlap. Specifically, comorbidity rates of 25–50% have been reported in clinical samples consisting of 20 (Phillips and Menard, 2011) and 14 (Prazeres et al., 2010) patients with diagnosed ORD. Based on case reports, similarities of the two conditions are also evident in their pharmacological and psychotherapeutic treatment responses (e.g., Stein et al., 1998; Phillips and Castle, 2007; Martin-Pichora and Antony, 2011). However, individuals with OCD are usually aware of the exaggeration and senselessness of their actions or fears (Eisen et al., 2004; Schulte et al., 2020), whereas this does not seem to be the case with the majority of those affected by ORD since insight is poorer in ORD (previous studies report percentages of 57–90%; Begum and McKenna, 2011; Phillips and Menard, 2011; Zhou et al., 2018) than in OCD (percentages of 2% are reported; Eisen et al., 2004; Phillips et al., 2007). In addition, the prevalence of ideas of reference is higher in individuals with ORD as compared to OCD (Kozak and Foa, 1994; Feusner et al., 2010; Phillips and Menard, 2011; Greenberg et al., 2016) and, though data are limited, research suggests the higher co-occurrence of social phobia (SP) and major depressive disorder in ORD (Prazeres et al., 2010; Phillips and Menard, 2011) compared to OCD (Denys et al., 2004; Torresan et al., 2013; Lochner et al., 2014).

Apart from OCD, clinical observations and available data show an overlap of ORD with features of SP. For instance, fears of negative evaluation and rejection as well as social avoidance also seem to be present among those affected with ORD (Phillips and Menard, 2011; Veale and Matsunaga, 2014; Greenberg et al., 2016). Greenberg et al. (2016) found that most (80%) of their 253 subjects with ORD reported that they feared that their odor could offend others. Moreover, in their sample of 38 persons with diagnosed ORD who went through qualitative interviews, Schmidt et al. (2022) found that it seems to be predominantly social situations that trigger ORD symptoms. Thereby, the literature suggests that individuals affected by ORD fear being rejected or humiliated by others because of their smell, that social situations are endured with the use of safety behaviors similar to SP, and that similar feelings to those in SP, namely shame and anxiety, arise in social situations if these cannot be avoided (Pryse-Phillips, 1971; Liebowitz et al., 1985; Feusner et al., 2010; Stein et al., 2016; Sweet et al., 2021; Schmidt et al., 2022). Another similar

feature in the psychopathology of ORD with SP appears to be the awareness of self-referent information. ORD is characterized by an excessive self-consciousness about the perceived odor (World Health Organization, 2019). Such a consciousness of the self is also found in SP where those affected divert their attention to excessive self-monitoring in social situations (Clark and Wells, 1995). This self-focused attention in SP has been proposed to be an important maintaining factor of the disorder (Clark and Wells, 1995). In addition, SP has been found to be a common comorbid disorder in patients with ORD, and this supports a possible relationship between the two disorders. In their patient sample, Phillips and Menard (2011) found that 65% of their 20 patients had a lifetime diagnosis of SP while 60% had a current SP. Due to such a high occurrence of SP, the authors suggested that patients with ORD should also be carefully assessed for SP (Phillips and Menard, 2011). Similarly, in their assessment of 106 OCD patients and 65 SP patients, Lochner and Stein (2014) found a higher prevalence of ORD in SP than in OCD patients.

Indeed, the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) even refers to the proximity of SP and ORD, although ORD has not been defined as a separate diagnosis within it. Specifically, ORD is described in the DSM-5 under “*Jikoshu-kyofu*,” a condition in the Japanese diagnostic system defined as the fear of having an offensive body odor (American Psychiatric Association, 2013). “*Jikoshu-kyofu*” is a variant form of the culturally bound syndrome “*taijin kyofusho*,” a disorder of interpersonal fear and a type of SP in Eastern cultures (Kleinknecht et al., 1997; American Psychiatric Association, 2013).

In light of the previous findings and the conceptualization of ORD in the East Asian culture which suggest a link between ORD and SP, it is surprising, and apparently due to the aforementioned blatant lack of studies, that this relationship has not been empirically investigated. There are only a few studies that have assessed just single symptoms of SP among individuals with ORD, while there is one report from Phillips and Menard (2011) that has assessed solely the comorbidity of SP in their 20 patients with ORD. In addition, it is worth mentioning that due to a lack of standardized diagnostic criteria before the ICD-11, ORD was assessed using different diagnostic criteria in earlier studies.

Therefore, the present study examined the association of ICD-11 ORD and SP in university students, a convenient, nonclinical sample. To our knowledge, this is the first investigation to examine correlates of SP in participants reporting ORD according to the ICD-11. Based on the literature and our clinical experience, we hypothesized that ORD severity would be positively associated with SP and that higher levels of SP would be related to poorer insight (delusionality) of ORD-related beliefs, greater ORD-related avoidance of intimate relationships and higher levels of shame and fear of rejection due to body odor.

2 Methods

2.1 Sampling and procedure

The data used in this study are part of a larger research assessment focusing on epidemiological aspects and correlates of ORD (see also Reuter et al., 2023) which was completed through an anonymous internet-based survey using the survey tool provided by

Abbreviations: DSM-5, Diagnostic and Statistical Manual of Mental Disorders (5th edition); GU, Goethe University; ICD-11, International Classification of Diseases (11th revision); M, Mean; OCD, Obsessive-compulsive Disorder; ORD, Olfactory Reference Disorder; ORDQ, Olfactory Reference Disorder Questionnaire; SD, Standard Deviation; SP, Social Phobia; SPIN, Social Phobia Inventory; TU, Technische Universität; WHO, World Health Organization.

SoSci Survey (Leiner, 2019). We decided to conduct an anonymous online survey since ORD is accompanied by shame and avoidance of social contacts (e.g., Phillips and Menard, 2011; Schmidt et al., 2022). An anonymous online survey therefore seemed favorable to reach as many severely affected people as possible who might not reveal their worries in personal contact out of shame. Inclusion criteria comprised being aged 18 years or older and being a student at a university or college. Participants were recruited by an advertisement redirecting readers to the survey. The advertisement was placed on the websites, social media platforms and campus e-mail newsletters of the Goethe-University (GU) Frankfurt, the Technische Universität (TU) Braunschweig and adjoining universities and colleges between December 2021 and May 2022 (until a sufficient sample size was reached). Potential participants were invited to an anonymous online survey which would take between about 5 and 30 min to complete, depending on the response behavior (the assessment was shortened for participants who reported no symptoms of ORD [score = 0, “not at all”] as assessed via the first five items of the *Olfactory Reference Disorder Questionnaire* [ORDQ, see 2.2.2] which was presented at the beginning of the assessment. If no ORD symptoms were reported, the remaining questionnaires, following the ORDQ, were dropped). It was stated that the results of the study might help to improve the care of people suffering from an extreme preoccupation with the belief of emitting a foul or offensive body odor. In order to increase participation, we provided an incentive by raffling two €500 online shopping gift cards upon the completion of the assessment. Participants were informed about all aspects of the study in order to make an informed decision about participation, including information about the aim, procedure, scope, possible risks of the study, data protection and that they were free to withdraw from the study at any time without giving reasons. Informed consent was presented on a cover page before starting the survey; only if the participants consented to participate were they directed to the survey. The study was approved by the ethics committee of the Medical Faculty of Goethe-University Frankfurt and by the ethics committee of Technische Universität Braunschweig.

2.2 Measures

The measures were administered in German.

2.2.1 Socio-demographic data

We assessed age, sex, relationship status, level of education and bodily diseases that may cause malodor (hyperhidrosis, trimethylaminuria, gastroesophageal reflux disease, achalasia, irritable bowel syndrome, periodontitis, or extreme tooth decay, as well as tumors in the mouth, throat, nose, or gullet).

2.2.2 Olfactory reference disorder questionnaire (ORDQ)

The ORDQ is a 16-item self-report measure assessing the ICD-11's essential features of ORD (persistent preoccupation, self-consciousness, repetitive and/or avoidance behaviors, distress and/or impairment) over the past three months; we had to develop this as such since there was no existing questionnaire assessing ORD according to the ICD-11. Furthermore, the current version of ICD-11

does not specify a minimum duration to diagnose ORD. Therefore, since we assumed that one cannot consider “persistent” symptoms as being less than three months' duration and to ensure as high a reliability as possible, we decided, after also consulting three international experts on ORD, on a three-month history of ORD symptoms. Each item is rated on a 5-point Likert scale (“0” = not at all, “1” = a little, “2” = moderate, “3” = severe, “4” = extremely).

The first four items of the questionnaire can be used as screening items since they assess the essential features of ICD-11 ORD as described above (1: “I am persistently preoccupied about the fact that I emit, or could emit, a foul or offensive body odor or breath,” 2: “I am excessively self-conscious about my body odor or breath,” 3: “Due to the concern about my body odor or breath, I carry out repeated, excessive behaviors (e.g., I repeatedly check my body odor or repeatedly ask other people about my smell, repeatedly apply perfume or deodorant, I shower several times a day) or avoid (social) situations or activities,” and 4: “I suffer from the concern about my body odor or breath or am impaired in my life”).

Insight into ORD beliefs is assessed by the fifth item of the ORDQ (“I am absolutely convinced that one or more parts of my body (e.g., mouth, hands, feet, chest, genital area,...) exude an unpleasant smell, although other people have assured me that this is not the case”). The insight of the participants was measured in this study with this item.

The remaining 11 subitems ask in-depth questions. The total score of ORD symptom severity is obtained by summing up the scores of items 1–16, resulting in a score range from 0 to 64. In the present study, participants with a score greater than or equal to 2 on all four screening items (1–4) were considered to have a probable diagnosis of ORD. Internal consistency (Cronbach's alpha) of the total scale for the present sample was 0.92 and for the first four screening items was 0.85.

2.2.3 ORD-related avoidance of intimacy, shame, and fear of rejection

Shame and fear of rejection as well as the avoidance of intimate relationships due to one's body odor were assessed by two additional items to the ORDQ. Both features are often described in the literature as symptoms of ORD (e.g., Feusner et al., 2010; Greenberg et al., 2016), but are not included in the ICD-11 description of ORD.

2.2.4 Social phobia inventory (SPIN)

Social phobia was assessed by the German version of the SPIN (Connor et al., 2000; Stangier and Steffens, 2002). This consists of 17 items evaluating fear, avoidance and physiological discomfort in the previous week. Items are rated on a 5-point Likert scale (“0” = not at all, to “4” = extremely). The total score ranges from 0 to 68. A cut-off score ≥ 25 in the German version has been proposed to suggest a social anxiety disorder (Sosic et al., 2008). The SPIN has shown good psychometric properties (Sosic et al., 2008). Internal consistency (Cronbach's alpha) in the present study was 0.94 (Connor et al., 2000).

2.2.5 Data analysis

Analyses were run using IBM SPSS version 28 (SPSS Inc., Chicago, United States). Pearson product-moment correlation coefficients examined the relationship between ORS and SP total symptom severity. Spearman's rank correlation examined the relationship between the remaining selected variables. Between-group differences were conducted using non-parametric Mann-Whitney U-tests.

Results were evaluated using 95% confidence intervals (CIs). The significance threshold for all analyses was set at $p < 0.05$. Missing values were avoided in advance by using the forced choice format.

3 Results

3.1 Sample description

A total of 440 students accessed the survey; of these, 404 participants gave informed consent. A total of 275 participants completed the survey of whom 15 participants screened positive for self-reported ORD (five participants were excluded since they reported a medical condition that might account for malodor; for a detailed description on the prevalence estimation see Reuter et al., 2023). Since 50 participants skipped all of the questionnaires due to the complete lack of ORD symptoms being recorded in the ORDQ at the beginning of the assessment (see 2.1), the final sample consisted of 225 participants who completed the questionnaires. The majority ($n = 177$ [78.7%]) of the participants were female. The mean age was 24.76 years \pm 5.28 (age range = 18–65 years). Regarding their relationship status, the majority ($n = 88$ [39.1%]) were single. Table 1 provides a detailed description of the participants' socio-demographic information.

3.2 Associations between ORD with variables of interest

The means and standard deviations for the SP and ORD variables are presented in Table 2. We examined the associations of ORD with SP, delusional, avoidance of intimate relationships and the feelings of shame and fear of rejection. As predicted, the ORD total symptom severity was significantly positively related to SP total symptom severity ($r = 0.53$, $p < 0.001$). Of the 15 participants who met the self-rated features for ORD, nearly all had clinically significant social phobia scores: 86.6% ($n = 13$) had a SPIN score ≥ 25 , indicating a current SP. In addition, the SP total scores in the SPIN of the

participants with self-reported ORD ($M = 32.46$, $SD = 11.84$, 95% CI: 25.91–39.02) and without self-reported ORD ($M = 18.71$, $SD = 14.17$, 95% CI: 16.79–20.64) differed significantly according to the Mann–Whitney U -test ($U = 715.00$, $Z = -3.53$, $p < 0.001$).

As expected, SP severity was significantly positively correlated with delusional conviction ($r = 0.40$, $p < 0.001$), avoidance of intimate relationships due to malodor concerns ($r = 0.31$, $p < 0.001$), and the feelings of shame and fear of rejection due to body odor ($r = 0.32$, $p < 0.001$).

4 Discussion

The results suggest high rates of SP in individuals with ORD. In our sample, 86.6% of the participants who met the self-rated features for ORD also met the self-rated criteria for a current SP. This finding is consistent with previous research reporting elevated rates of SP in individuals suffering from ORD (Phillips and Menard, 2011) and shows that ORD and SP co-occur. The high rate of co-occurrence (as well as the clear phenomenological overlap) may indicate that both conditions might share underlying factors. However, future research is needed to investigate this hypothesis. At the moment, too little is known about the epidemiology as well as the factors of the origin and maintenance of ORD to make predictions. Although currently classified as an obsessive-compulsive disorder, the comorbidity rates of OCD in ORD seem to be lower: co-occurrence rates of between 25% (Phillips and Menard, 2011) and 50% (Prazeres et al., 2010) have been reported. However, given the few available studies on ORD, future research investigating the comorbidity rates of SP and OCD in ORD, in particular using clinical interviews, is needed. In addition, the findings of a higher comorbidity of SP compared to OCD in ORD leaves the question unanswered of whether ORD is more strongly associated with SP compared to OCD or whether this is due to the generally higher prevalence of SP compared to OCD (e.g., Bebbington, 1998; Stangier, 2016).

The ORD severity scores were significantly related to SP as measured by the SPIN. The association with SP determined in this study indicates that social anxiety may be related to olfactory concerns which, in turn may cause or aggravate concerns about social acceptance. In addition, the SPIN mean score of 32.46 ($SD = 11.84$) for the participants who met the self-reported features for ORD was approximately three standard deviations above the mean of 14.56 ($SD = 9.36$) for the nonclinical control group reported for the German version of the scale (Sosic et al., 2008); this indicates a higher magnitude of fear, avoidance and physiological symptoms of SP in ORD relative to nonclinical samples. Our finding of a significant difference in the SPIN total scores between participants with and without probable ORD supports this assumption. However, at the same time it is clear that our results require confirmation from further research. Due to the cross-sectional design, we are not able to determine causality. In addition, we did not investigate whether other conditions could have influenced the relationship between ORD and SP. In future studies, possible confounding variables should be assessed.

As anticipated, SP severity was significantly associated with greater ORD-related avoidance of intimate relationships and higher levels of shame and fear of rejection due to body odor. This finding is

TABLE 1 Socio-demographic characteristics of the total sample ($n = 225$) and the ORD group ($n = 15$).

	Total sample n (%)	ORD group n (%)
<i>Gender</i>		
Female	177 (78.7)	12 (80.0)
Male	45 (20.0)	2 (13.3)
Diverse	3 (1.3)	1 (6.7)
<i>Relationship status</i>		
Single	88 (39.1)	8 (53.3)
Partnership, living together	50 (22.2)	3 (20.0)
Partnership, living apart	72 (32.0)	2 (13.3)
Married, living together	11 (4.0)	2 (13.3)
Married, living apart	3 (1.3)	0
Divorced	1 (0.4)	0
Age (years)	M (SD) 24.76 (5.28)	M (SD) 24.2 (5.36)

M, Mean; SD, Standard deviation.

TABLE 2 Range, means, and standard deviations of the SP and ORD total scores.

	ORD group				Non-ORD group			
	<i>n</i>	Range	<i>M</i> (95% CI)	<i>SD</i>	<i>n</i>	Range	<i>M</i> (95% CI)	<i>SD</i>
SPIN	15	10–57	32.46 (25.9–39.02)	11.83	210	0–58	18.71 (16.79–20.64)	14.16
ORDQ	15	13–45	29.60 (24.16–35.03)	9.81	260	0–55	8.49 (7.41–9.57)	8.84

The sample sizes differ because 50 participants who did not report ORD symptoms in the ORDQ skipped all the following questionnaires, including the SPIN. *M*, Mean; *SD*, Standard Deviation; *CI*, Confidence Interval; SPIN, Social Phobia Inventory; ORDQ, Olfactory Reference Disorder Questionnaire.

consistent with previous studies showing an overlap of the central features between SP and ORD (e.g., Phillips and Menard, 2011) and underscores the social aspect of olfactory concerns. Indeed, in light of our results and previous findings, there is much indication that both conditions share, as a central aspect, an excessive concern about the negative evaluation of others. In any event, future research investigating cognitive factors underlying ORD as well as shared mechanisms underlying ORD and SP are warranted. In this regard, a worthwhile research question could be what role do safety behaviors and self-focus play in the maintenance of ORD. As mentioned above, both are features of the disorder. In their prominent cognitive model of social phobia, Clark and Wells (1995) proposed that safety behaviors and self-focused attention are important maintaining factors in SP. The cognitive therapy of SP (Clark and Wells, 1995; Wells, 1997) based on their model focuses on a change in these two factors (e.g., shifting the attentional focus, dismissing safety behaviors) and has proven to be effective (e.g., Clark et al., 2003). If self-focused attention and safety behaviors are also key maintaining factors in ORD, the cognitive therapy of SP could possibly also be effective in the treatment of ORD.

Likewise, as hypothesized, we found that poor insight in ORD was significantly related to the SP severity scores. Poor insight is a prominent feature of ORD since the individuals affected are often convinced that their perceived body odor is real and has a physical rather than a psychological reason (Begum and McKenna, 2011; Phillips and Menard, 2011; Zhou et al., 2018). However, studies show that there is a range of different insight levels (e.g., Phillips and Menard, 2011; Greenberg et al., 2016). Moreover, in their review of case reports on ORD, Begum and McKenna (2011) report that the level of insight can also fluctuate within patients. This coincides with our clinical impression that the convictions of patients with ORD often fluctuate between obsessional thoughts, overvalued ideas or referential thinking, with some beliefs reaching a delusional quality. The relationship between poor insight and SP in our study could be explained by the overlap between delusional conviction and overvalued ideas or ideas of reference (Watzke and Schwenke, 2014) which are a common feature of SP (e.g., Konermann and Zaudig, 2003). However, further research is required to elucidate the relationship between poor insight in ORD and SP.

Our findings, demonstrating a significant association between ORD severity and SP, as well as a high comorbidity between ORD and SP, are consistent with previous studies linking ORD to features of social phobia (e.g., Phillips and Menard, 2011; Veale and Matsunaga, 2014; Schmidt et al., 2022) and indicate that the Eastern conceptualization of ORD as a type of SP deserves attention in Western research. Doubtless to say, our results are preliminary. Further research using large samples representative for the general population and especially with the use of clinical interviews to assess

diagnoses is needed to investigate the relationship between ORD and SP, including their common features and shared etiologic factors. With our results, no statement can be made about whether ORD could be a subtype of SP or not. To determine this, large epidemiological studies would be necessary in which the psychopathology, comorbidity, genetic underpinnings and familial aggregation of ORD and SP are investigated. In any case, our findings suggest that this further research into the association of the two conditions could be valuable to clarify the classification of ORD.

The strength of our study is that, to our knowledge, for the first time the relationship between ORD and SP has been directly examined. Moreover, we report data on ICD-11 ORD while previous studies captured ORD with different criteria due to the absence of standardized diagnostic categorization. However, there are also significant limitations in our study. Firstly, even though one has better access to severely affected individuals by using an anonymous online survey, since ORD is accompanied by much shame (Pryse-Phillips, 1971; Stein et al., 1998), our data, therefore, relies purely on these self-ratings. Without an in-person clinical interview, no information about the diagnostic status with regard to ORD or SP can be obtained (e.g., regarding ORD, we could not determine whether there was an actual body odor or whether comorbid psychopathology may have influenced or explained the ORD symptoms). Secondly, since our sample consisted mostly of women, the results may not be generalizable to men affected by ORD. Furthermore, the generalizability of our results is limited by the fact that our sample consisted of university students. Therefore, our results are not representative for the general population. In addition, there could have been selection effects in the recruitment of the participants. Finally, although the internal consistency of the ORDQ was good (for the four screening items) to excellent (total scale), the instrument still needs to be evaluated. With regard to the validity of the ORDQ, the correlation with the SPIN suggests that discriminant validity could be given. However, against the background of the limitations of the online survey and the only small number of cases of the participants with self-reported ORD, no valid statements can be made about the psychometric properties of the instrument. Currently, there are no evaluated instruments to assess ORD and, to our knowledge, there are no other available instruments assessing ORD according to the ICD-11. Future research on ORD would benefit from the development and evaluation of instruments to assess ORD.

5 Conclusion

To our knowledge, this is the first study that has directly examined the relationship between ORD and SP. In our sample of university students, we found a significant positive association between

self-reported SP and self-reported ORD and a high comorbidity (86.6%) of self-reported SP in individuals reporting ICD-11 ORD. Higher levels of SP were related to a poorer insight of ORD-related beliefs, greater ORD-related avoidance of intimate relationships and higher levels of shame and fear of rejection due to body odor.

In Western research, ORD has so far been mainly compared to OCD and ultimately conceptualized as an OCD spectrum disorder in the ICD-11. However, the findings of this study indicate that ORD could also be closely related to SP. If this is confirmed by future studies, treatment concepts that have proven to be successful in the treatment of SP could also be effective in the treatment of ORD.

Although preliminary, our results have implications for clinical practice, and suggest that additional research on the relationship of ORD and SP, including their possible interplay or shared etiologic factors, could be of value in order to gain a better understanding of the development, maintenance, classification and treatment of ORD.

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 humans were approved by Ethics Committee of the Medical Faculty of Goethe-University Frankfurt, Germany and the Ethics Committee of Technische Universität Braunschweig, Germany. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their online informed consent to participate in this study.

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Author contributions

JR, RS, and AG contributed to the study concept and design. JR originated the idea for this manuscript, conducted the study, collected the data and performed the statistical analysis and interpretation of data, coordinated and wrote the first draft of the manuscript. RS and AG critically revised the draft of the manuscript. All authors contributed to the article 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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