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Influencing factors of adherence to sustainable diets: a systematic review of behavioral theories

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This systematic review aims to identify factors influencing adherence to a sustainable diet based on behavioral theories. We searched four databases, including PubMed, Web of Science, Scopus, and Science Direct, for observational studies assessing sustainable food consumption according to the Theory of Planned Behavior (TPB), the Theory of Reasoned Action (TRA), and the Social Cognitive Theory (SCT) up to December 01, 2023. Additionally, the reference lists of original studies were screened, and 12 papers were analyzed. In identifying triggers for consumers' behavioral changes, we found that improving food choice skills is a valuable strategy to enhance an individual's perceived control and ability to adopt sustainable eating behaviors. The most recurrent predictors for sustainable food choices were attitudes, Perceived Behavioral Control, subjective norms, experience, and personal factors. This study provides valuable insights into the factors influencing consumer behavior and offers opportunities to promote sustainable food choices.

KEYWORDS

theory of planned behavior, sustainable diet, nutrition, food consumption, systematic review

1 Introduction

Food stands as one of the most crucial determinants of human health, with global disease burdens heavily influenced by dietary factors (Afshin et al., 2019; Aguirre Sánchez et al., 2021). The increasing population and prevailing dietary trends, such as the consumption of meat and processed foods, contribute to escalating greenhouse gas emissions, environmental pollution, and the depletion of ecosystems (Willett et al., 2019). To address non-communicable diseases and combat climate change, a crucial focus is placed on promoting sustainable diets while understanding consumer behavior and acceptance (Hawkes and Popkin, 2015).

Sustainable diets, as defined by the Food and Agriculture Organization (FAO), are characterized by low environmental impact, healthiness, safety, nutrition, preservation of biodiversity, optimal use of natural resources, cultural acceptability, economic fairness, affordability, and contributions to food and nutrition security, fostering a productive life for all generations (Burlingame and Dernini, 2010; Biasini et al., 2021; Whitmee et al., 2015). The EAT-Lancet Commission has introduced the concept of a "safe operating space" for the food system, which defines scientifically established boundaries within which the global food system can function sustainably. This framework aims to promote a stable Earth system and

improve global health by minimizing the negative environmental impact of food production and consumption (Willett et al., 2019). Behavioral and educational interventions are deemed crucial at all levels of society to facilitate the transition to sustainable diets (Biasini et al., 2021). Consequently, adopting healthy and sustainable dietary behaviors with minimized adverse environmental impacts necessitates a comprehensive understanding of various aspects of adoption (Aguirre Sánchez et al., 2021; Messerli et al., 2019a).

In the context of promoting sustainable diets and addressing the environmental and health challenges, applying social-psychological models is a valuable strategy for identifying and understanding the cognitive constructs that influence dietary behavior. Cognitive constructs that are associated with dietary behaviors can be recognized by using social-psychological models (Biasini et al., 2021). Different theoretical models including the Theory of Reasoned Action (TRA) (Fishbein et al., 1975), the Theory of Planned Behavior (TPB) (Ajzen, 1991), and the Social Cognitive Theory (SCT) (Bandura and Walters, 1977) could investigate and indicate adherence to sustainable diet behavior. TRA suggests that a person's behavior can be predicted by their attitudes toward that behavior, primarily through the influence of their behavioral intention. It emphasizes that attitudes specific to the behavior in question are crucial. Additionally, the theory posits that a person's intention to perform a behavior, which ultimately determines if they will do it, is shaped by social pressures or "subjective norms" stemming from their perception of what others will think about them performing that behavior (Al-Suqri and Al-Kharusi, 2015). TPB is one of the psycho-social and behavior theories, that may be related to dietary behavior, which can result in different associations between food choices and certain eating behaviors (McDermott et al., 2015). TPB identifies four key factors influencing human behavior: normative beliefs (perceptions of social acceptability), behavioral beliefs (evaluations of expected outcomes), control beliefs (confidence and perceived barriers), and external influences (social interactions and media). TPB is valuable for designing evidence-based interventions and health behavior changes (Fishbein and Ajzen, 2011), involving the modification of attitudes, subjective norms, and perceived control by targeting influential beliefs. In dietary contexts, TPB can help shape attitudes, social expectations, and confidence regarding specific food choices and eating behaviors to promote healthier habits (Fishbein and Ajzen, 2010; Brouwer and Mosack, 2015; Wang, 2018). Similarly, according to SCT, behavior results from an interdependent interaction between factors related to the subject, behavior, and environment. Moreover, the environment can also be modified by individuals according to their preferences. Key SCT concepts include outcome expectations (beliefs about behavior outcomes), self-regulation (goal-setting, monitoring, and structuring the environment), observational learning (learning from others), and self-efficacy (belief in one's ability to perform a behavior) (Glanz et al., 2008).

Sustainable dietary behaviors are shaped by a wide range of factors, such as personal preferences, societal pressures, and environmental limitations. The interplay between these elements creates significant challenges in designing interventions that successfully encourage sustainable eating habits (Chen and Antonelli, 2020). Emphasizing theoretical models offers a more effective approach for developing interventions that address the diverse dimensions of eating behavior, fostering both health and sustainability (Prestwich et al., 2015). For instance, TPB has been widely utilized in dietary interventions to promote healthier eating by targeting attitudes, perceived behavioral control, and subjective norms, with studies demonstrating its utility in enhancing sustainable food practices (Wang, 2018). Similarly, TRA has been applied to assess the influence of attitudes and social pressures on food consumption behaviors, offering insights into behavioral intentions that align with sustainability goals (Al Mamun et al., 2024). Furthermore, interventions informed by SCT have successfully leveraged self-efficacy and observational learning to encourage healthier dietary behaviors while reducing environmental impacts (Martin et al., 2018). The focus on theoretical models is crucial for developing interventions that address the broad factors influencing eating behavior, promoting both health and sustainability. Behavioral approaches are essential to investigate the benefits of adopting healthier, more sustainable eating habits, particularly those that minimize negative environmental impacts (Willett et al., 2019; Messerli et al., 2019b). Consequently, the objective of this systematic review is to identify the primary factors driving behavioral change toward choosing a sustainable diet based on the theoretical frameworks of TRA, TPB, or SCT. Additionally, this systematic review offers valuable recommendations for identifying behavioral approaches and developing the necessary strategies to transition towards more sustainable diets.

2 Materials and methods

2.1 Search strategy and selected articles

Following the Guidelines for Systematic Reviews and Meta-Analyses (PRISMA), we conducted a systematic review. A comprehensive search was carried out in four databases, namely PubMed, Scopus, Web of Science, and Science Direct. The same search strategy was applied across all electronic databases, and the literature search was extended to include records published by December 1, 2023. Articles were considered in English. The merging of Mesh and non-MESH terms were as follows: ("Sustainable di-et*" OR "sustainable food consumption" OR "sustainable nutrit*" OR "sustainable food") AND ("theory of planned behavio*" OR "TPB" OR "theory of reasoned action" OR "TRA" OR "planned behavio*" OR "social cognitive theory" OR "reasoned action"). To prevent missing any related studies, we also hand-searched all reference lists of eligible studies and related reviews.

We included original, peer-reviewed studies that met the following eligibility criteria: (Afshin et al., 2019) studies that both included "behavioral outcome measures based on TPB, or TRA, or SCT," AND examined "factors associated with a sustainable diet." This means that the studies had to evaluate behavioral outcomes such as attitudes, intentions, subjective norms, and perceived behavioral control (PBC) using these theoretical frameworks, and also exploring factors related to sustainable dietary behaviors. For TPB studies, we required a minimum of correlations between the following outcomes: PBC, intention, and behavior. For TRA studies, we required correlations between attitudes and subjective norms with intention, as well as between intention and behavior. We also included studies published in English.

This methodological decision was made to ensure that studies provided sufficient data to evaluate the predictive relationships between the core constructs of these theories. These correlations are essential for testing the validity of the theoretical models in explaining

or predicting sustainable dietary behaviors. By "a minimum of correlations," we refer to the requirement that at least one measurable statistical association must be reported between the specified theoretical constructs (e.g., between PBC and behavior, or between intention and behavior). This criterion was set to ensure that included studies provided quantitative evidence of the theoretical relationships rather than just descriptive or qualitative accounts. We excluded studies with the following conditions: (Afshin et al., 2019) editorials, reviews, commentary letters (Aguirre Sánchez et al., 2021) qualitative studies (Willett et al., 2019) conference abstracts, or presentations or other studies without English full text, (Hawkes and Popkin, 2015) duplicate publications, and (Burlingame and Dernini, 2010) studies without TPB, TRA, and SCT, and (Biasini et al., 2021) multi-country studies.

Initially, articles based on the titles and abstracts of the retrieved references were independently screened by two researchers. A chief investigator was also present to resolve any disagreements. Full-text evaluation and data extraction were performed on those that met the inclusion criteria. Studies without an English full text and those that were not peer-reviewed were excluded. The protocol of this study was recorded in PROSPERO (record number: CRD42023483795).

2.2 Data extraction

The data extraction process involved multiple steps to ensure accuracy and consistency. Initially, all manuscripts meeting the eligibility criteria were identified and organized using EndNote software. Then, the relevant data for each manuscript were systematically extracted and recorded in Excel software. For each article included in the review, the following data were recorded: author(s), year of publication, country, study population (details about the study participants, including sample size, age range or average age, and gender distribution), study design, applied theoretical model(s) (the behavioral theory or theories used in the study, such as TPB, TRA, and SCT), type of measurement (Range of the Likert scale), items measured (type of theoretical model variable), and key results.

Two independent reviewers conducted the data extraction process to minimize bias and errors, with discrepancies resolved through discussion or consultation with a third reviewer.

2.3 Quality assessment

Quality Assessment: Validated quality assessment tools were used to evaluate the studies included in this systematic review, specifically the Guidelines for Evaluating Prevalence Studies (Boyle, 1998). This tool was chosen because it provides a comprehensive framework for assessing the quality of observational studies, especially those evaluating the prevalence of specific behaviors or conditions, such as adherence to sustainable diets. This tool assesses selection bias, measurement bias, and analysis bias in seven items: (Afshin et al., 2019) clearly defining the target population; (Aguirre Sánchez et al., 2021) sampling representative of potential respondents; (Willett et al., 2019) achieving an adequate response rate; (Hawkes and Popkin, 2015) using standardized data collection methods; (Burlingame and Dernini, 2010) employing reliable survey instruments; (Biasini et al., 2021) using valid survey instruments; and (Whitmee et al., 2015) analyzing the data appropriately. The total quality score varied between 0 and 7, based on "Yes" (scored 1) or "No" (scored 0) answers (Supplementary Table S1). Two authors (S.R.S., and S.F.F) independently assessed all studies selected for this systematic review. To address any disagreements in their assessments, a third author was involved. Among the studies reviewed, four discrepancies were identified and resolved through discussion. For instances where consensus was not initially achieved, the third author provided an independent judgment to finalize decisions. This process ensured a thorough and consistent evaluation of study quality in accordance with the predefined criteria.

3 Results

3.1 Quality assessment and limitations of included studies

The quality assessment of the 12 included studies showed that five were high quality (scoring 7/7), five studies were moderate quality (scoring 5–6/7), and two were lower quality (scoring 4/7). Key limitations across studies included unclear target population definitions, non-representative samples, inadequate response rates, and inconsistent data collection methods all of which could affect the generalizability and reliability of findings.

3.2 Studies' characteristics and the variables

In the primary search, a total of 189 articles were identified. Ultimately, 12 studies met all inclusion criteria and were incorporated into the present review. The figure illustrates the search process in the PRISMA flow diagram (see Figure 1).

Table 1 provides a summary of the included studies. The majority of the reviewed studies were conducted in Europe (n = 5), followed by Asia (n = 4), Africa (n = 1), and Australia (n = 1), without including multi-country studies. Four studies applied either the original or an adapted version of TPB (Elhoushy, 2020; Salleh et al., 2022; Vermeir and Verbeke, 2008; Vassallo et al., 2016), while six papers referred to a combination of behavioral models and environmental and psychological variables (Betzler et al., 2022; Ukenna and Ayodele, 2019; Hsu et al., 2020; Weber et al., 2020; Alam et al., 2020; Dowd and Burke, 2013; Alagarsamy et al., 2021). Both TPB and Protection Motivation Theory (PMT) were used together in one paper (Eker et al., 2019). Due to the broadening of the sustainability concept, most of the reviewed studies examined factors affecting sustainable food consumption (Salleh et al., 2022; Vermeir and Verbeke, 2008; Betzler et al., 2022; Weber et al., 2020; Alam et al., 2020), sustainable food choices (Elhoushy, 2020; Vassallo et al., 2016; Hsu et al., 2020; Dowd and Burke, 2013; Alagarsamy et al., 2021), with one paper addressing the triggers of a widespread shift towards sustainable diets (Eker et al., 2019), and another focusing on sustainable street food patronage in a developing economy (Ukenna and Ayodele, 2019). Overall, within the TPB model framework, attitude (Elhoushy, 2020; Vermeir and Verbeke, 2008; Vassallo et al., 2016; Ukenna and Ayodele, 2019; Weber et al., 2020; Alam et al., 2020; Dowd and Burke, 2013; Alagarsamy et al., 2021) and PBC (Elhoushy, 2020; Vermeir and Verbeke, 2008;

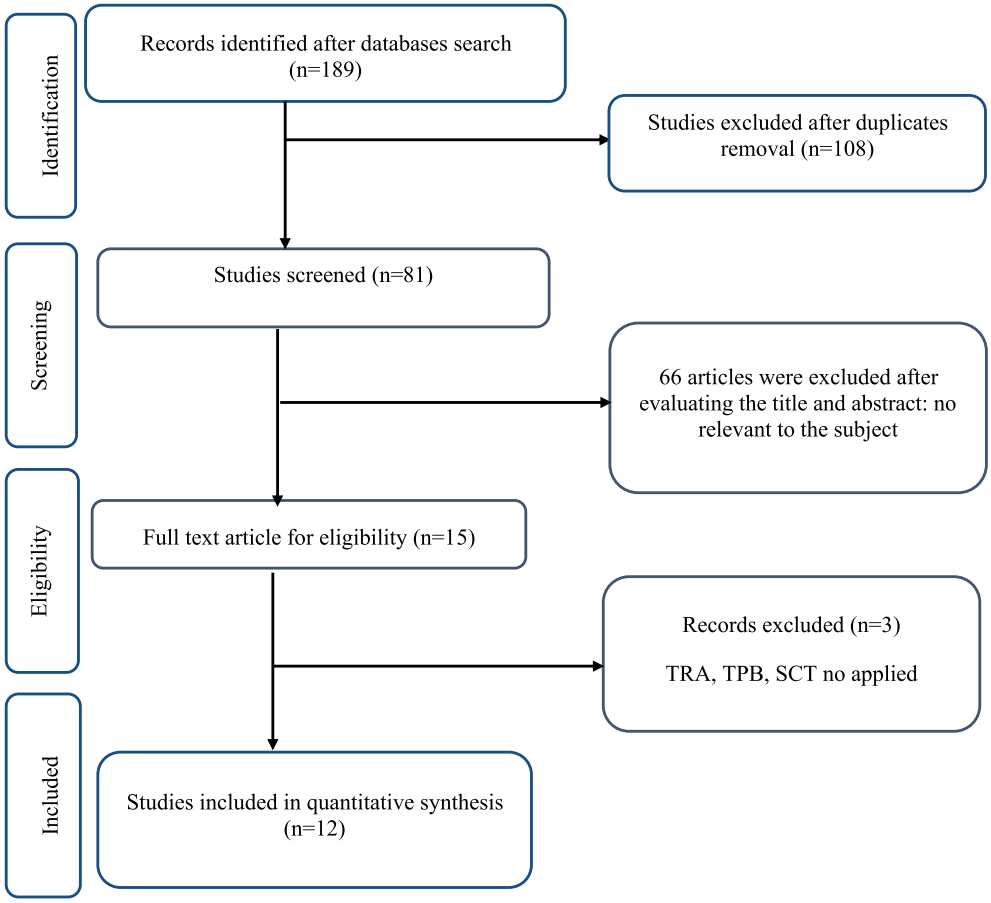

FIGURE 1
Flowchart of study selection for inclusion trials in the systematic review.

Vassallo et al., 2016; Ukenna and Ayodele, 2019; Hsu et al., 2020; Weber et al., 2020; Alam et al., 2020; Dowd and Burke, 2013; Eker et al., 2019) were more frequent predictors of consumers' intentions compared to other variables related to sustainable diets. Subsequently, subjective norms (Vassallo et al., 2016; Ukenna and Ayodele, 2019; Hsu et al., 2020; Weber et al., 2020; Alam et al., 2020; Dowd and Burke, 2013; Eker et al., 2019), additional constructs such as experience (Salleh et al., 2022; Vassallo et al., 2016; Ukenna and Ayodele, 2019), personal norm (Elhoushy, 2020; Betzler et al., 2022), knowledge (Hsu et al., 2020), awareness (Betzler et al., 2022), and green consumption values (Alagarsamy et al., 2021) were identified as variables related to a sustainable diet. In the following sections, the results assess the effect of each construct on a sustainable diet, separately.

3.3 Attitude

Of the 12 studies applying the TPB model, 10 research described attitude as a predictor of adopting a more sustainable diet (Elhoushy, 2020; Vermeir and Verbeke, 2008; Vassallo et al., 2016; Ukenna and Ayodele, 2019; Weber et al., 2020; Alam et al., 2020; Dowd and Burke, 2013; Alagarsamy et al., 2021). Attitude towards the behavioral intention refers to a favorable or unfavorable evaluation of a behavior (Ajzen, 1991). Elhoushy (2020) reported that attitudes positively affect the intention to choose sustainable food in restaurants. Dowd (Dowd and Burke, 2013) revealed that attitude is one of the strongest predictors of intention to purchase sustainably sourced food. Moreover, according to the results of another study, across all national territories of Italy there was positive attitudes toward buying the sustainable food product (Vassallo et al., 2016). In another investigation, a positive attitude towards the intention of buying sustainable dairy products consumption named Le Fermier products was a great trigger for encouraging the consumption of sustainable foods (Vermeir and Verbeke, 2008). Alagarsamy et al. (2021) indicated that consumers' attitudes toward sustainable food logistics can directly or indirectly impact their intention to make green purchases and their environmentally conscious behavior toward food products, such as choosing products with minimal environmental impact or those produced through eco-friendly practices (Alagarsamy et al., 2021). One study reported that attitude and perception have a positive impact on the intention of consumers to consume sustainable food (Alam et al., 2020). In a separate study, attitudes, specifically consumers' positive evaluations of sustainable street foods (SSF) regarding their health benefits, environmental impact, and quality, significantly impacted consumer preferences for SSF. These favorable attitudes were shown to raise customers' intention to patronize SSF vendors by 19.9%. Additionally, subjective norms—social influences encouraging SSF support—and perceived behavioral control, such as ease of accessing SSF, increased support for vendors by 13.6 and 8.9%,

TABLE 1 Articles included in the review sustainable diet preference based on the theory of planned behavior: a systematic review.

	Author, Year, Country	Population	Age (Mean or range)	Sample Size	Design	Items measuring	Measurement	Assessment	Key results; To have a significant association with ...
1	Hayatul Safrah Salleh. et al. /2022/ Malaysia	Adult Malaysian consumers	Consumers aged 18 and above Male (*n* = 134. 29.6%) Female (*n* = 318, 70.4%)	452	Self-administered survey	Consumer Behavior, Behavioral Intention, Experience	A 5-point Likert scale (from 1 = Strongly disagree to 5 strongly agree)	Sustainable food consumption	Intrinsic experience (such as feeling happy, confident, and healthy)
2	Subburaj Alagarsamy et al./2021/India	Adult population	18–35 years Male (*n* = 164. 58%) Female (*n* = 120. 42%)	284	Online questionnaire	Willingness Attitude, Behavioural Consistency, Green consumption value, Value and Green consumer behaviour.	Likert-type scale (1 = strongly disagree; 5 = strongly agree)	Pre-purchase sustainable logistics of food products	Green consumption values, Consumer attitudes towards
3	Shirin Betzler. et al./ 2021/ German	German adult	Range (18–65) Study1: Male (*n* = 55), Female (*n* = 46) Study2: Male (*n* = 151), Female (*n* = 153)	Study1:101 Study1:304	Online panel	TPB variables [a] Problem awareness, Guilt, Pride, Awareness of consequences, Ascription of responsibility, Food consumption	A 5-point Likert scale of agreement	Sustainable food consumption	Attitude, Problem awareness, Personal norm, and Emotional factors (guilt and pride)
4	Sayed Elhoushy / 2020/ Egypt	Egyptian consumers	18–70 years Male (*n* = 237 38.9%) Female (*n* = 372 61.1%)	609	A web-based survey A paper-based survey	TPB variables [a] Activism	A 7-point Likert scale (from 1 = "strongly disagree," and 7 = "strongly agree")	Consumers' sustainable food choices	Attitudes, PBC [b], Personal norms, and Activism
5	Alina Weber et al./2020/ Germany	Student biology teachers	18–33 69% female, 64% BA students	270	Self-administered questionnaire	Attitude, SN [C], PBC [b] Environmental (Egoistic, Altruistic, Biospheric concern) Psychological (Nature Relatedness) Variables	Intention to eat sustainably: a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree) Attitudes toward sustainable nutrition: a 7-point scale Subjective norm: a 7-point Likert scale (1 = very likely, 7 = very unlikely) Perceived behavioral control: a 7-point Likert scale (1 = very likely, 7 = very unlikely) Environmental concern: 5-point Likert scale (1 = not important, 5 = important)	Eat sustainable diets	Attitude, SN [C], PBC [b], Nature relatedness, Altruistic concern

(Continued)

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TABLE 1 (Continued)

	Author, Year, Country	Population	Age (Mean or range)	Sample Size	Design	Items measuring	Measurement	Assessment	Key results; To have a significant association with ...
6	Syed Shah Alam/ 2020/ Malaysia	Malaysian adults	Above 20 years Male (*n* = 101.45.9%) Female (*n* = 119. 54.1%)	220	Self-administered questionnaire	Attitude, SN [C], Perceive availability, Perceived effectiveness, Perceived Value, Intention, Actual Behavior	A 6-point Likert-scale (from "1 = strongly disagree" to "6 = strongly agree")	Sustainable food consumption	Attitude, PBC [b], SN [C], Perceived value, Perceive availability, Perceived effectiveness
7	Stephen I et al./ 2019/ Nigeria	Adults in Nigeria	-	437	Self-administered questionnaire	Attitude, PBC [b], SN [C], Past behavior, Actual patronage, Patronage intention.	A 5-point Likert-scale (from disagree to strongly agree)	Sustainable food consumption	Attitudes, PBC [b], SN [C], Experience
8	Sibel Eker et al./2019/–	-	-	-	-	Protection Motivation Theory (severity of a threat, coping appraisal) And Attitude, PBC [b] or self-efficacy, SN [C], and intentions	-	Refers to modelling the drivers of a widespread shift to sustainable diets	PBC [b], SN [C], Self-efficacy
9	Shin-Yun Hsu et al./2016/ Taiwan	Taiwanese citizens	Consumers aged 18 and above male (53.2%) and female (46.8%)	300	Online communities	Family and friend support, Health, Price, Knowledge, Interest	A 5-point Likert scale	Purchasing sustainable food	Family and friend support, Health, and Knowledge
10	Marco Vassallo et al./2016/ Italy	Italian consumers	Over 18 years of age	3,000	Self-administered questionnaire	Attitude, SN [C], PBC [b], intention, and Past behaviour	A 7-point Likert- scales and A 9-point scale	Sustainable food consumption	Attitude, SN[C], PBC [b], Experience
11	Kylie Dowd et al./2012/Australia	Australian grocery buyers	19–80 years Male (*n* = 28. 20%) Female (*n* = 109. 80%)	137	Online questionnaire	Attitude, SN [C],PBC [b], Behavioural intention, Positive moral attitude, Ethical self-identity Food Choice Questionnaire (FCQ): health, mood, convenience, sensory appeal, natural content, price, weight, familiarity, ecological welfare, political values, religion	Positive moral attitude: A 7-point scales from 1 = disagree to 7 = agree Ethical self-identity: a seven-point scale from 1 = disagree to 7 = agree Motivations for food purchases: a seven-point scale, where 1 = unimportant and 7 = important.	Purchasing sustainably sourced food	Attitude, SN [C], PBC [b], Ethical self-identity, Health and Ethical values
12	Iris Vermeir et al./2007/Belgium	Educated young adults	Age group 19–22 years	456	Self-administered questionnaires	Attitude, SN [C], Perceived consumer effectiveness, Perceived availability, Confidence, Human value	A 7-point Likert scale (from 1 = 'not important at all' to 7 = 'extremely important')	Purchase sustainable dairy products	Attitudes, PBC [b], Confidence, Human value

a TPB variable: attitudes, perceived behavioral control, personal norms, subjective norms, and intention. b PBC: perceived behavioral control. C SN: subjective or social norms.

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respectively (Ukenna and Ayodele, 2019). Moreover, based on another report, attitude was identified as the strongest factor influencing biology teachers' intention to eat sustainably (Weber et al., 2020). In general, sustainable nutrition is linked to the Sustainable Development Goals (SDGs) (Rieckmann, 2017), and the role of teachers training has been proven in promoting the SDGs (Walshe, 2008). Accordingly, all teachers and learners will acquire sufficient competencies through education to achieve the SDGs by 2030 (Rieckmann, 2017). For example, it is an essential part of the German biology curriculum (Fiebelkorn and Menzel, 2013). Additionally, education directly contributes to solving global environmental problems, promoting sustainability, and fostering the transformation toward sustainable nutrition (Anastacio, 2020).

In this context, some studies have demonstrated that attitudes might influence teaching motivation, teaching behavior (Büssing et al., 2018; Blazar and Kraft, 2017; Ruzek et al., 2015), and the integration of Education for Sustainable Development contexts, such as teaching sustainable nutrition in biology (Büssing et al., 2018). Furthermore, with the addition of environmental psychological variables, altruistic concern and nature-relatedness -defined as an individual's emotional connection to and appreciation for the natural environment- are positively correlated with sustainable eating attitudes (Weber et al., 2020). Nature-relatedness predicts behaviors that support sustainability and the environment, such as purchasing sustainable products (Howell et al., 2011; Nisbet et al., 2011), as well as the intention to eat sustainably (Rieckmann and Holz, 2017). Altruistic individuals consider the broader impact of environmental changes on others, influencing their sustainable food choices based on perceived collective costs and benefits (Schultz et al., 2005).

3.4 Knowledge and awareness

Two papers demonstrated knowledge (Hsu et al., 2020) and awareness (Betzler et al., 2022) as predictors of adopting a sustainable diet. To measure knowledge about sustainable food, studies often use surveys or questionnaires that assess participants' understanding of sustainability issues, such as the environmental impact of food choices, ethical sourcing, and the importance of reducing waste. One study indicates that the knowledge levels of individuals affect their interest in a subject and are important determinants of behavior (Hung et al., 2016). Sustainable consumption is supported by knowledge and awareness, two factors that have proven to be crucial over the years (Uddin and Khan, 2018; Heo and Muralidharan, 2019). In the study conducted by Hsu et al. (2020), it was indicated that having at least a moderate level of knowledge about sustainable food increases individuals' interest in purchasing sustainable food. One article reported that sustainable consumption is influenced by general problem awareness (PA) related to sustainability challenges, such as environmental degradation or resource depletion. This awareness significantly predicts sustainable food consumption (Betzler et al., 2022). Additionally, 'sustainable status' refers to the degree to which consumption practices align with sustainability goals, such as reducing environmental impact or supporting ethical food production.

3.5 Perceived behavioral control (PBC)

Nine of the 12 studies using the TPB model indicated that PBC is a predictor of adopting a more sustainable diet (Elhoushy, 2020; Vermeir and Verbeke, 2008; Vassallo et al., 2016; Ukenna and Ayodele, 2019; Hsu et al., 2020; Weber et al., 2020; Alam et al., 2020; Dowd and Burke, 2013; Eker et al., 2019). Perceived availability refers to whether consumers see sustainable products as easy to access, while perceived effectiveness refers to how positive or negative they think their actions are (Ajzen, 1991). The results demonstrated that the intention to choose sustainable food at restaurants was positively impacted by PBC (Elhoushy, 2020), as well as the intention to purchase sustainably sourced food (Dowd and Burke, 2013). According to another study in Italy, PBC had a significant impact on purchasing sustainable food products across the nation. Approximately 27% bought such products regularly, while 69% did so at least occasionally (Vassallo et al., 2016). Moreover, one study confirmed that higher PBC positively affects customers' intention to support sustainable street food vendors, increasing it by 10.2% with each 1-unit increase in PBC (Ukenna and Ayodele, 2019). A follow-up study, health incentives-defined as the perceived health benefits associated with adopting sustainable diets-were examined along with price acceptability as factors influencing interest in sustainable diets. Price acceptability had no impact, while health incentives effectively predicted interest (Hsu et al., 2020). In one study, two factors, perceived consumer effectiveness (PCE) and perceived availability, were identified as influencing sustainable dairy product consumption intention positively, along with PBC (Vermeir and Verbeke, 2008). Similarly, research has shown that factors like PBC (Weber et al., 2020), the availability of sustainable food, and perceived consumer effectiveness (Alam et al., 2020) significantly influence individuals' intentions to choose sustainable food. In this context, "intention" refers to a person's planned behavior, and "sustainable food" refers to environmentally responsible, ethically sourced food choices that promote long-term sustainability. Research indicates that self-efficacy, particularly among females, is a key driver of significant dietary changes and strongly influences both the intention and actual behavior of shifting diets (Eker et al., 2019).

3.6 Personal norms

Among the 12 reviewed studies, personal norms as predictors of sustainable diets were described in two studies (Elhoushy, 2020; Betzler et al., 2022). Personal norms reflect an individual's internal feelings about moral obligations and judgments, encompassing the difference between right and wrong (Stern et al., 1999). For instance, individuals are more likely to opt for sustainable dining if they anticipate achieving desired personal outcomes (e.g., health, approval from others). A study found that personal norms positively influenced the intention to choose sustainable restaurant food (Elhoushy, 2020). A further study reported that personal norms were the strongest predictor of sustainable food consumption (Betzler et al., 2022).

3.7 Subjective norms

Subjective norms as predictors of sustainable diets were indicated in seven papers (Vassallo et al., 2016; Ukenna and Ayodele, 2019; Hsu et al., 2020; Weber et al., 2020; Alam et al., 2020; Dowd and Burke, 2013; Eker et al., 2019). Subjective or social norms refer to perceived social pressure that motivates a particular behavior (or does not motivate a particular behavior). In general, an individual's behavioral

intentions are influenced by the opinions and expectations of their social environment (Ajzen, 1991; Vogt and Dirk, 2007). Ukenna and Ayodele (2019) concluded that subjective norms are a key predictor of consumers' intention to patronize sustainable street food and organic food. This implies that when subjective norm increases by 1 unit, customers' intention to patronize sustainable street food marketers will ultimately go up by 90.5%. Hsu et al. (2020) study modified the subjective norm to focus on family and friend support, finding that such support is a strong predictor of interest in buying sustainable food. Other studies also confirmed the significance of subjective norms in sustainable food consumption (Dowd and Burke, 2013; Ham et al., 2015; Al-Swidi et al., 2014). Considering subsequent research in Italy, 'important people' and 'friends' were significant predictors of sustainable food product choices. Notably, 'friends' exerted strong social pressure across Italy, while 'important people' had no significant impact (Vassallo et al., 2016). The results of other studies indicated that subjectivity (Weber et al., 2020) and social norms (Vermeir and Verbeke, 2008; Alam et al., 2020) have a significant effect on the intention to consume sustainable food. The study found that social norms are the key factor driving widespread dietary changes. In the analytical model used, which considered various influencing factors like attitudes and perceived control, shifts in dietary behavior were most strongly impacted by social norms (Eker et al., 2019). The study found that three factors from the Value-Belief-Norm (VBN) theory—ascribed responsibility (AR), awareness of consequences (AC), and personal norm (PN)—are significantly linked to sustainable food consumption. Ascribed responsibility refers to an individual's sense of duty to address environmental or social issues. Awareness of consequences is the understanding of the negative impact one's actions can have on the environment. Personal norm reflects a person's internalized values and ethical obligations. All three factors encourage individuals to choose sustainable food options (Betzler et al., 2022).

3.8 Additional constructs

This section explores additional factors influencing sustainable food choices, beyond traditional behavioral predictors. Key constructs such as experience, activism, perceived value, ethical self-identity, emotional factors, confidence, and values were identified as significant in shaping consumers' decisions. The section highlights the gap between intention and behavior, noting that factors like past experiences and emotional motivations can bridge this gap. By incorporating these factors, the manuscript aims to provide a more comprehensive understanding of sustainable diet choices and suggest practical interventions for promoting them.

Given the studies assessed in the present review, three studies described additional constructs such as experience (Salleh et al., 2022; Vassallo et al., 2016; Ukenna and Ayodele, 2019), and five research described activism (Elhoushy, 2020), perceived value (Alam et al., 2020), ethical self-identity (Dowd and Burke, 2013), emotional factors (Betzler et al., 2022), confidence and values (Vermeir and Verbeke, 2008), and green consumption values (Alagarsamy et al., 2021); as predictors of adopting a more sustainable diet.

There is an important gap between behavioral intention and the behavior associated with the intention, despite intentions being good predictors of behavior. For example, 47% of individuals with high intentions failed to perform their intended behavior (Sheeran, 2002). Ting et al. (2019) concluded that a consumer's previous experience and involvement in choosing the food considerably affected the decisions of that consumer in their general discrimination behavior towards food. The results showed that the interaction between intrinsic experiences and intentions moderated behavior toward functional foods. Consumers are motivated by feeling healthy, confident, and happy to adopt healthy eating habits (Salleh et al., 2022). At the national level in Italy, past behavior was the most influential predictor of sustainable food choices. Overcoming perceived barriers was strongly driven by past experience in purchasing sustainable food products, indicating its role in shaping future sustainable diets (Vassallo et al., 2016). Additional research reported that sustainable street food marketers' past behavior has no significant impact on customers' intention to patronize them (Ukenna and Ayodele, 2019).

The results of one study demonstrated the incorporation of activism as an additional predictor of sustainable food choices (Elhoushy, 2020). According to Elhoushy and Jang (2019), the theoretical framework suggests that activism is an attitude that reflects individuals' engagement in the public good as well as their perceived value of doing so. Hence, the more people consider sustainable food choices as self-relevant (related to their current objectives), the more likely they are to choose such products. Another study found that perceived value has a significant impact on the intention to consume sustainable food (Alam et al., 2020). The perceived value of a good or service is determined by how consumers evaluate it with regard to the net benefit they receive and is an important antecedent of buying intention (Bolton and Drew, 1991; Patterson and Spreng, 1997). Additionally, ethical self-identity was statistically significant, and the consumption of sustainably sourced food is directly related to the intention to purchase (Dowd and Burke, 2013). Self-identity refers to the identification of people's roles and how they perceive themselves in society. It is suggested that the stronger a person's role identification, the more self-identity will influence their behavior (Armitage and Conner, 1999). The authors argued that concern about ethical issues contributes to one's sense of ethical identity, which may have just as much influence on consumer behavior as price or other self-interested factors (Shaw et al., 2000). Sustainable food consumption is positively related to emotional factors, such as guilt and pride (Betzler et al., 2022). A study found that confidence is directly related to the intention to purchase sustainable dairy products (Le Fermier), with individuals who had higher confidence showing more positive attitudes, stronger social norms, and greater PCE. Additionally, consumers with traditional values were more likely to purchase sustainable products, while those seeking power were less likely to do so (Vermeir and Verbeke, 2008).

4 Discussion

This systematic review, based on constructs of the theory of planned behavior, indicates factors affecting sustainable diet behavior, a diet that is nutritionally adequate, environmentally friendly, affordable, and culturally acceptable (Johnston et al., 2014; Donati et al., 2016). The results of the 12 revised papers showed the related factors associated with adherence to a sustainable food diet, focusing mainly on attitudes, PBC, subjective norms, experience, and personal factors, respectively. Moreover, when constructs such as experience,

activism, perceived value, ethical self-identity, emotional factors, confidence, and values are included in different socio-cognitive models, they significantly enhance the explanation of the variance in individuals' intentions—meaning the degree to which these factors account for differences in people's intentions to adopt sustainable dietary behaviors. Consistent with previous researchers' conclusions, Shin et al. (2018), Kim et al. (2016), and Jang et al. (2015) show that when TPB is enhanced with factors like personal values, moral beliefs, and perceptions of environmental impact, it can better capture the diversity of factors that drive consumers' intentions to adopt sustainable dietary practices. The extended TPB model goes beyond the traditional TPB constructs—attitude, subjective norm, and perceived behavioral control—by incorporating additional factors such as emotional influences, values, past experiences, personal moral norms, and perceived quality. These enhancements address the complexity of sustainability-related behaviors and have been shown to improve predictive accuracy. Studies supporting this conclusion demonstrate that the TPB and its extensions effectively account for diverse psychological and social influences on behaviors like sustainable food choices.

This study highlighted attitudes as one of the most important predictors of adherence to a sustainable diet. Attitudes are the main predictor of behavioral intentions (Bissonnette and Contento, 2001). Accordingly, Persson (2013) emphasized the unavoidable role of attitudes in sustainable food consumption, noting that individuals' attitudes, perceptions, and beliefs strongly influence their choices. Positive or negative attitudes toward food production significantly shape these cues. However, the concept of sustainable food remains unfamiliar to many, posing challenges to accepting new ideas and forming beliefs necessary to change current behaviors (Habermas, 2015). While a positive attitude is essential for encouraging sustainable consumption, it is not sufficient alone, as other factors also impact decision-making (Vermeir and Verbeke, 2008). Knowledge is another key factor, as a higher level of understanding about sustainability increases interest in sustainable diets and influences decision-making and behavior. Educating individuals about unsustainable consumption patterns emerges as a critical strategy for promoting behavior change. Environmental education, in particular, contributes not only to knowledge acquisition but also to the development of values that challenge unsustainable practices. This dual effect of education—enhancing knowledge and cultivating values—can empower individuals to align their attitudes and actions more effectively. The findings suggest that integrating targeted educational initiatives into sustainability programs can address the gap between intention and action, fostering meaningful changes in sustainable food choices. By focusing on improving awareness, building values, and addressing knowledge deficits, education serves as a transformative tool to promote attitudes and behaviors aligned with sustainable dietary practices.

Similarly, in the majority of the reviewed studies, PBC also had a considerable influence on the intention to choose sustainable food, and a positive association was shown between consumer effectiveness and the intention to consume sustainable foods. Consumers might be more inclined to preserve food if they are aware of their role in modifying certain cues of intention (Conner and Sparks, 2005; Arvola et al., 2008). Based on Arvola et al. (2008), awareness of their roles enables them to promote sustainable food consumption more effectively. At the same time, consumer behavior is more influenced by perceived availability, which refers to the extent to which individuals perceive sustainable food options as accessible and easy to obtain. This factor appears to have a stronger impact on behavior than consumer effectiveness, which denotes the belief that individual consumption choices can contribute to broader sustainability goals. The interplay between these factors suggests that perceived availability may play a pivotal role in shaping consumer decisions. These observations are supported by studies (Cummins et al., 2005; Giskes et al., 2007; Roberts, 1996) that when consumers find a particular product easier to find, they may consider purchasing it. This could change their behavior regarding how they consume certain products and how they perceive them, eventually altering their mindsets and perceptions. Furthermore, consumers' perception of effectiveness influences how they consume food products. In other words, consumers' attitudes are likely to be altered and manipulated when they perceive their role as effective in sustainable consumption.

This study highlights that social norms positively influence adherence to sustainable diets, as they provide individuals with a sense of social validation and shared responsibility. Social norms, which represent the collective beliefs and practices within a community, play a pivotal role in shaping food choices (Stern et al., 1999). Hence these norms can differ across age groups due to varying cultural and generational influences. For instance, younger generations may embrace sustainable food consumption as part of a growing environmental movement, while older generations might be guided by traditional values that align with sustainable practices (Cruwys et al., 2015). These findings emphasize the importance of fostering awareness of the social and environmental consequences of dietary choices and promoting a sense of communal accountability to activate moral obligations and encourage sustainable consumption.

This systematic review indicates that personal norms can significantly influence adherence to a sustainable diet. Interestingly, the nature of sustainable consumption includes rationality, morality, and altruism. Personal norms play an important role as predictors of pro-environmental behaviors in choosing sustainable diets, and when individuals are triggered by personal norms, they may decide to behave sustainably (Kim et al., 2013). The findings indicate that personal norms, driven by values and ethical identity, play a crucial role in shaping responsibility toward environmental and societal well-being. Strengthening awareness of the ethical aspects of food choices can enhance personal norms, promoting sustainable consumption.

Interestingly, this study found evidence that past experience and behavior are significant predictors of intention and actions related to sustainable diet adherence, commonly referred to as 'patronage behavior.' In this context, 'patronage behavior' refers to individuals' repeated and intentional purchasing of sustainable food products. Past experience with purchasing and consuming sustainable products helps consumers overcome perceived barriers to adopting sustainable diets and habits over time. In this direction, Yi-Man (2011) found out that patronage intention is positively influenced by the past behavior frequency. The most frequently reported factor influencing sustainable food purchasing behavior is past experience with buying sustainably produced foods (Robinson and Smith, 2002; Ajzen, 2011; Smith et al., 2007) In particular, it is crucial that the buying experience for sustainable products is perceived as excellent, especially in terms of product quality. Consumers expect that sustainable food products should meet or exceed the quality standards of conventional products. Additionally, trust in the effectiveness of sustainably produced

products is an important factor, with consumers needing assurance that the products are indeed produced in a way that benefits the environment and society (Thøgersen and Ölander, 2006).

The present review study reveals the impact of activism on the intention to adopt sustainable diets. Activism refers to a distinct type of environmental attitude or mindset toward adopting a sustainable diet. As a result of these findings, the importance of environmental motives in promoting sustainability is highlighted, further supporting the role of environmental attitudes in driving sustainability development (Elhoushy & Jang, 2019; Sheth et al., 2011). Additionally, individuals' choices in other contexts are influenced by how they behave sustainably in one context (Lanzini and Thøgersen, 2014; Margetts and Kashima, 2017). However, in the past, activism has been conceptualized as participation in other activities (e.g., at-home recycling) rather than as a distinctive attitude.

This result confirms that perceived value can enhance adherence to sustainable diets. Consumers' behavior in the sustainable food market is greatly influenced by perceived values (Grunert et al., 2014). Some studies argue that consumer perceptions about the intention to consume food are strongly influenced by perceived values (Eggert and Ulaga, 2002; Tam, 2004). This result also confirms that ethical self-identity can enhance adherence to sustainable diets. As Shaw et al. noted, individuals who see themselves as ethical or environmentally conscious are more likely to perceive their sustainable actions as both meaningful and achievable (Shaw et al., 2000). The interaction between perceived value and ethical self-identity highlights their complementary roles in promoting sustainable diets. Perceived value motivates behavior by emphasizing practical and ethical benefits, while ethical self-identity fosters psychological commitment. Together, they address both cognitive and emotional aspects of decision-making, making consumers with strong ethical identities and high perceived value more likely to adopt sustainable diets. To enhance adherence, sustainability interventions should combine promoting tangible benefits with fostering ethical responsibility through educational campaigns and marketing strategies, bridging the intention-action gap and encouraging lasting behavior change.

The results of reviewed studies demonstrate that consumers with different confidence levels are influenced by a variety of factors to determine their behavioral intentions, and social norms differ between customers with high and low confidence levels. Consumers with low confidence are less influenced by social norms than consumers with high confidence. Consumers who are less confident about the sustainability of a product consider their attitudes, perceived availability, and PCE beliefs, whereas highly confident consumers are also concerned about social norms (Vermeir and Verbeke, 2008). Jager et al. (2000) concluded that low confidence may lead to social processing if there is no knowledge of the product's availability and need-satisfying ability. Social processing refers to the tendency of individuals to rely on external social influences, such as the opinions and support of friends and family, to form their perceptions and decisions. We understand that social processors (in this case, those who believe that the product is sustainable) tend to follow social norms with the support of friends and family since they also readily believe the claims made about the product, as it is unknown.

Finally, studies have shown that traditional consumers tend to buy sustainable products, while power seekers are less inclined because they do not care about promoting behaviors that will not lead to power. For example, high universalists are individuals who prioritize the broader consequences of their actions on the environment and are motivated to protect it. They tend to choose sustainable products based on their internal values and beliefs about the environment. In contrast, low universalists may purchase sustainable products not primarily for their own internal satisfaction but to meet the expectations or needs of others, such as social pressures or moral obligations. Thus, due to external factors, availability is the least important factor for both groups (Vermeir and Verbeke, 2008). The differences in sustainable consumption behaviors stem from the alignment between consumers' core values and sustainability principles. High universalists, motivated by internal ethical values, show consistent sustainable behavior, while power seekers' self-interest reduces their engagement. Availability is less influential for both groups, highlighting the need to address deeper motivations. Tailored interventions, such as reinforcing ethical values for high universalists and leveraging social norms for low universalists, can effectively promote sustainable consumption across diverse consumer groups.

The methods used in these studies, such as surveys and questionnaires, were essential in understanding how individuals align their dietary behaviors with sustainable principles. These tools quantified behaviors and provided objective data on how closely participants' actions matched sustainable consumption goals. They helped identify factors influencing sustainable food choices, such as availability, barriers, and individual experiences, as well as the impact of activism, moral obligation, and ethical self-identity. The methods also revealed how attitudes, personal values, and emotional factors like guilt and pride influence sustainable eating behaviors, offering a comprehensive view of the motivators and barriers in adopting sustainable diets.

4.1 Strengths and limitation

A notable strength of the study is its comprehensive approach, encompassing various constructs and models related to sustainable dietary behavior. Like other studies, this research has limitations. The first limitation arises from the use of self-report tools in data collection, introducing potential biases into the findings. The second limitation is the limited exploration of additional constructs, such as experience, activism, perceived value, ethical self-identity, emotional factors, confidence, and values, which have been identified in some studies as influencing sustainable food choices. These constructs were not consistently studied across all reviewed papers, possibly due to differences in research focus, sample populations, and study scope. The third limitation stems from a lack of geographic diversity in the reviewed studies. The majority of the research was conducted in Europe, potentially limiting the generalizability of the findings to a global context.

5 Conclusion

A sustainable consumption pattern is crucial for achieving sustainable development in our world today. Hence, there is an essential need to identify factors that can significantly influence changing individual consumption behavior. This review study identified intentions and behaviors toward adherence to sustainable food based on the TPB, influenced by the following components and constructs. Accordingly, these reviewed studies pinpoint that attitudes,

PBC, subjective norms, experience, personal factors, and additional constructs including activism, perceived value, ethical self-identity, emotional factors, confidence, and values are all important determinants for sustainable food choices. Additionally, it is shown that improving skills related to sustainable decision-making, such as enhancing awareness of sustainable food options, increasing knowledge of environmental impacts, and developing the ability to critically evaluate sustainability claims, can strengthen an individual's perceived control and capacity to make informed, sustainable food choices. These skills are essential for adopting and maintaining sustainable eating behaviors. Future research should employ experimental interventions targeting key constructs like attitudes, perceived control, and subjective norms to promote sustainable dietary behavior. Longitudinal studies tracking sustainable food choices can provide insights into the long-term sustainability of behavior change and identify the key factors that influence individuals' ongoing commitment to making sustainable food choices. Research should inform culturally tailored policies and interventions to bridge the knowledge-attitude-action gap and promote sustainable dietary behaviors broadly.

Data availability statement

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

Author contributions

SF: Conceptualization, Formal analysis, Investigation, Methodology, Writing – original draft, Writing – review & editing. HT: Methodology, Writing – review & editing. MK: Methodology, Writing – review & editing. HD: Writing – review & editing. NR: Writing – review & editing. SS: Conceptualization, Methodology, Project administration, 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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Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fsufs.2025.1465622/full#supplementary-material

References

Afshin, A., Sur, P. J., Fay, K. A., Cornaby, L., Ferrara, G., Salama, J. S., et al. (2019). Health effects of dietary risks in 195 countries, 1990–2017: a systematic analysis for the global burden of disease study 2017. *Lancet* 393, 1958–1972. doi: 10.1016/S0140-6736(19)30041-8

Aguirre Sánchez, L., Roa-Díaz, Z. M., Gamba, M., Grisotto, G., Moreno Londoño, A. M., Mantilla-Uribe, B. P., et al. (2021). What influences the sustainable food consumption Behaviours of university students? A systematic review. *Int. J. Public Health* 66:149. doi: 10.3389/ijph.2021.1604149

Ajzen, I. (1991). The theory of planned behaviour. *Organ. Behav. Hum. Decis. Process.* 50, 179–211. doi: 10.1016/0749-5978(91)90020-T

Ajzen, I. (2011). The theory of planned behaviour: Reactions and reflections. *Psychol. Health* 26, 1113–1127. doi: 10.1080/08870446.2011.613995

Al Mamun, A., Ma, Y., Reza, M. N. H., Ahmad, J., Wan, H. W. M. H., and Lili, Z. (2024). Predicting attitude and intention to reduce food waste using the environmental values-beliefs-norms model and the theory of planned behavior. *Food Qual. Prefer.* 120:105247. doi: 10.1016/j.foodqual.2024.105247

Alagarsamy, S., Mehrolia, S., and Mathew, S. (2021). How green consumption value affects green consumer behaviour: the mediating role of consumer attitudes towards sustainable food logistics practices. *Vision* 25, 65–76. doi: 10.1177/0972262920977986

Alam, S. S., Ahmad, M., Ho, Y.-H., Omar, N. A., and Lin, C.-Y. (2020). Applying an extended theory of planned behavior to sustainable food consumption. *Sustain. For.* 12:8394. doi: 10.3390/su12208394

Al-Suqri, M. N., and Al-Kharusi, R. M. (2015). Ajzen and Fishbein's theory of reasoned action (Tra). *Information Seeking Behavior and Technology Adoption: Theories and Trends*. IGI Global, 188–204.

Al-Swidi, A., Mohammed Rafiul Huque, S., Haroon Hafeez, M., and Shariff, N. M. (2014). The role of subjective norms in theory of planned behavior in the context of organic food consumption. *Br. Food J.* 116, 1561–1580. doi: 10.1108/BFJ-05-2013-0105

Anastacio, M. R. Proposals for teacher training in the face of the challenge of educating for sustainable development: beyond epistemologies and methodologies. Universities and sustainable communities: Meeting the goals of the agenda 2030 (2020).

Armitage, C. J., and Conner, M. (1999). Predictive validity of the theory of planned behaviour: the role of questionnaire format and social desirability. *J. Community Appl. Soc. Psychol.* 9, 261–272. doi: 10.1002/(SICI)1099-1298(199907/08)9:4<261::AID-CASP503>3.0.CO;2-5

Arvola, A., Vassallo, M., Dean, M., Lampila, P., Saba, A., Lähteenmäki, L., et al. (2008). Predicting intentions to purchase organic food: the role of affective and moral attitudes in the theory of planned behaviour. *Appetite* 50, 443–454. doi: 10.1016/j.appet.2007.09.010

Bandura, A., and Walters, R. H. (1977). Social learning theory. New York City: Englewood cliffs Prentice Hall.

Betzler, S., Kempen, R., and Mueller, K. (2022). Predicting sustainable consumption behavior: knowledge-based, value-based, emotional and rational influences on Mobile phone, food and fashion consumption. *Int. J. Sustain. Dev. World Ecol.* 29, 125–138. doi: 10.1080/13504509.2021.1930272

Biasini, B., Rosi, A., Giopp, F., Turgut, R., Scazzina, F., and Menozzi, D. (2021). Understanding, promoting and predicting sustainable diets: a systematic review. *Trends Food Sci. Technol.* 111, 191–207. doi: 10.1016/j.tifs.2021.02.062

Bissonnette, M. M., and Contento, I. R. (2001). Adolescents' perspectives and food choice behaviors in terms of the environmental impacts of food production practices: application of a psychosocial model. *J. Nutr. Educ.* 33, 72–82. doi: 10.1016/S1499-4046(06)60170-X

Blazar, D., and Kraft, M. A. (2017). Teacher and teaching effects on students' attitudes and behaviors. *Educ. Eval. Policy Anal.* 39, 146–170. doi: 10.3102/0162373716670260

Bolton, R. N., and Drew, J. H. (1991). A multistage model of Customers' assessments of service quality and value. *J. Consum. Res.* 17, 375–384. doi: 10.1086/208564

Boyle, M. H. (1998). Guidelines for evaluating prevalence studies. *Evid. Based Ment. Health* 1, 37–39. doi: 10.1136/ebmh.1.2.37

Brouwer, A. M., and Mosack, K. E. (2015). Expanding the theory of planned behavior to predict healthy eating behaviors: exploring a healthy eater identity. *Nutr. Food Sci* 45, 39–53. doi: 10.1108/NFS-06-2014-0055

Burlingame, B., and Dernini, S. Sustainable diets and biodiversity. Rome, Italy. (2010).

Büssing, A. G., Schleper, M., and Menzel, S. (2018). Do pre-service teachers dance with wolves? Subject-specific teacher professional development in a recent biodiversity conservation issue. *Sustain. For.* 11:47. doi: 10.3390/su11010047

Chen, P.-J., and Antonelli, M. (2020). Conceptual models of food choice: influential factors related to foods, individual differences, and society. *Food Secur.* 9:1898. doi: 10.3390/foods9121898

Conner, M., and Sparks, P. (2005). Theory of planned behaviour and health behaviour. *Predict. Health Behav.* 2, 121–162.

Cruwys, T., Bevelander, K. E., and Hermans, R. C. (2015). Social modeling of eating: a review of when and why social influence affects food intake and choice. *Appetite* 86, 3–18. doi: 10.1016/j.appet.2014.08.035

Cummins, S., Petticrew, M., Higgins, C., Findlay, A., and Sparks, L. (2005). Large scale food retailing as an intervention for diet and health: quasi-experimental evaluation of a natural experiment. *J. Epidemiol. Community Health* 59, 1035–1040. doi: 10.1136/jech.2004.029843

Donati, M., Menozzi, D., Zighetti, C., Rosi, A., Zinetti, A., and Scazzina, F. (2016). Towards a sustainable diet combining economic, environmental and nutritional objectives. *Appetite* 106, 48–57. doi: 10.1016/j.appet.2016.02.151

Dowd, K., and Burke, K. J. (2013). The influence of ethical values and food choice motivations on intentions to purchase sustainably sourced foods. *Appetite* 69, 137–144. doi: 10.1016/j.appet.2013.05.024

Eggert, A., and Ulaga, W. (2002). Customer perceived value: a substitute for satisfaction in business markets? *J. Bus. Ind. Mark.* 17, 107–118. doi: 10.1108/08858620210419754

Eker, S., Reese, G., and Obersteiner, M. (2019). Modelling the drivers of a widespread shift to sustainable diets. *Nat. Sustain.* 2, 725–735. doi: 10.1038/s41893-019-0331-1

Elhoushy, S. (2020). Consumers' sustainable food choices: antecedents and motivational imbalance. *Int. J. Hosp. Manag.* 89:102554. doi: 10.1016/j.ijhm.2020.102554

Elhoushy, S., and Jang, S., editors. Factors affecting Consumers' sustainable behaviour formation: a multi-stage model. 25th Asia Pacific Tourism Association Annual Conference Da Nang City, Vietnam; (2019).

Fiebelkorn, F., and Menzel, S. (2013). Student teachers' understanding of the terminology, distribution, and loss of biodiversity: perspectives from a biodiversity hotspot and an industrialized country. *Res. Sci. Educ.* 43, 1593–1615. doi: 10.1007/s11165-012-9323-0

Fishbein, M., and Ajzen, I. (2010). Predicting and changing behavior.

Fishbein, M., and Ajzen, I. (2011). Predicting and changing behavior: The reasoned action approach. New York, USA and London, UK: Psychology press.

Fishbein, M., Ajzen, I., and Belief, A. (1975). Intention and behavior: An introduction to theory and research. Reading, MA: Addison-Wesley.

Giskes, K., Van Lenthe, F. J., Brug, J., Mackenbach, J., and Turrell, G. (2007). Socioeconomic inequalities in food purchasing: the contribution of respondent-perceived and actual (objectively measured) Price and availability of foods. *Prev. Med.* 45, 41–48. doi: 10.1016/j.ypmed.2007.04.007

Glanz, K., Rimer, B. K., and Viswanath, K. (2008). Health behavior and health education: Theory, research, and practice. eds. K. Glanz, B. K. Rimer and K. Viswanath New York, USA, and London, UK: John Wiley & Sons.

Grunert, K. G., Hieke, S., and Wills, J. (2014). Sustainability labels on food products: consumer motivation understanding and use. *Food Policy* 44, 177–189. doi: 10.1016/j.foodpol.2013.12.001

Habermas, J. (2015). Knowledge and human interests. Hoboken, New Jersey, USA: John Wiley & Sons.

Ham, M., Jeger, M., and Frajman, I. A. (2015). The role of subjective norms in forming the intention to purchase green food. *Econ. Res.* 28, 738–748. doi: 10.1080/1331677X.2015.1083875

Hawkes, C., and Popkin, B. M. (2015). Can the sustainable development goals reduce the burden of nutrition-related non-communicable diseases without truly addressing major food system reforms? *BMC Med.* 13, 1–3. doi: 10.1186/s12916-015-0383-7

Heo, J., and Muralidharan, S. (2019). What triggers young millennials to purchase eco-friendly products?: the interrelationships among knowledge, perceived consumer effectiveness, and environmental concern. *J. Mark. Commun.* 25, 421–437. doi: 10.1080/13527266.2017.1303623

Howell, A. J., Dopko, R. L., Passmore, H.-A., and Buro, K. (2011). Nature connectedness: associations with well-being and mindfulness. *Personal. Individ. Differ.* 51, 166–171. doi: 10.1016/j.paid.2011.03.037

Hsu, S. Y., Wang, H. C., Ho, J. L., and Chen, H. C. (2020). Exploring consumers' interest in choosing sustainable food. *Front. Psychol.* 11:489. doi: 10.3389/fpsyg.2020.00489

Hung, Y., de Kok, T. M., and Verbeke, W. (2016). Consumer attitude and purchase intention towards processed meat products with natural compounds and a reduced level of nitrite. *Meat Sci.* 121, 119–126. doi: 10.1016/j.meatsci.2016.06.002

Jager, W., Janssen, M. A., De Vries, H., De Greef, J., and Vlek, C. (2000). Behaviour in commons dilemmas: Homo Economicus and Homo Psychologicus in an ecological-economic model. *Ecol. Econ.* 35, 357–379. doi: 10.1016/S0921-8009(00)00220-2

Jang, S. Y., Chung, J. Y., and Kim, Y. G. (2015). Effects of environmentally friendly perceptions on Customers' intentions to visit environmentally friendly restaurants: an extended theory of planned behavior. *Asia Pac. J. Tour. Res.* 20, 599–618. doi: 10.1080/10941665.2014.923923

Johnston, J. L., Fanzo, J. C., and Cogill, B. (2014). Understanding sustainable diets: a descriptive analysis of the determinants and processes that influence diets and their impact on health, food security, and environmental sustainability. *Adv. Nutr.* 5, 418–429. doi: 10.3945/an.113.005553

Kim, Y. J., Njite, D., and Hancer, M. (2013). Anticipated emotion in consumers' intentions to select eco-friendly restaurants: augmenting the theory of planned behavior. *Int. J. Hosp. Manag.* 34, 255–262. doi: 10.1016/j.ijhm.2013.04.004

Kim, S. Y., Yoon, J., and Choi, I. (2016). What matters to promote consumers' intention to patronize sustainable business-and-industry (B&I) food services? *Br. Food J.* 118, 2710–2731. doi: 10.1108/BFJ-02-2016-0050

Lanzini, P., and Thøgersen, J. (2014). Behavioural spillover in the environmental domain: an intervention study. *J. Environ. Psychol.* 40, 381–390. doi: 10.1016/j.jenvp.2014.09.006

Margetts, E. A., and Kashima, Y. (2017). Spillover between pro-environmental Behaviours: the role of resources and perceived similarity. *J. Environ. Psychol.* 49, 30–42. doi: 10.1016/j.jenvp.2016.07.005

Martin, C. A., Rivera, D. E., Hekler, E. B., Riley, W. T., Buman, M. P., Adams, M. A., et al. (2018). Development of a control-oriented model of social cognitive theory for optimized Mhealth behavioral interventions. *IEEE Trans. Control Syst. Technol.* 28, 331–346. doi: 10.1109/tcst.2018.2873538

McDermott, M. S., Oliver, M., Simnadis, T., Beck, E., Coltman, T., Iverson, D., et al. (2015). The theory of planned behaviour and dietary patterns: a systematic review and Meta-analysis. *Prev. Med.* 81, 150–156. doi: 10.1016/j.ypmed.2015.08.020

Messerli, P., Murniningtyas, E., Eloundou-Enyegue, P., Foli, E. G., Furman, E., Glassman, A., et al. Global sustainable development report 2019: The future is now–science for achieving sustainable development. (2019a). New York, USA.

Messerli, P., Murniningtyas, E., Eloundou-Enyegue, P., Foli, E., Furman, E., Glassman, A., et al. (2019b). Independent Group of Scientists Appointed by the secretary-general. *Glob. Sustain. Dev. Rep.* Hoboken, New Jersey, USA.

Nisbet, E. K., Zelenski, J. M., and Murphy, S. A. (2011). Happiness is in our nature: exploring nature relatedness as a contributor to subjective well-being. *J. Happiness Stud.* 12, 303–322. doi: 10.1007/s10902-010-9197-7

Patterson, P. G., and Spreng, R. A. (1997). Modelling the relationship between perceived value, satisfaction and repurchase intentions in a business-to-business, services context: an empirical examination. *Int. J. Serv. Ind. Manag.* 8, 414–434. doi: 10.1108/09564239710189835

Persson, A. Determinants of sustainable food consumption-moving consumers down the path of sustainability by understanding their behavior. Gothenburg, Sweden. (2013).

Prestwich, A., Webb, T. L., and Conner, M. (2015). Using theory to develop and test interventions to promote changes in health behaviour: evidence, issues, and recommendations. *Curr. Opin. Psychol.* 5, 1–5. doi: 10.1016/j.copsyc.2015.02.011

Rieckmann, M. (2017). Education for sustainable development goals: Learning objectives. Cham, Switzerland: Unesco Publishing.

Rieckmann, M., and Holz, V. (2017). Verankerung Von Bildung Für Nachhaltige Entwicklung in Der Lehrerbildung in Deutschland. *ZEP* 2018, 4–10. doi: 10.31244/zep.2018.02.02

Roberts, J. A. (1996). Green consumers in the 1990s: profile and implications for advertising. *J. Bus. Res.* 36, 217–231. doi: 10.1016/0148-2963(95)00150-6

Robinson, R., and Smith, C. (2002). Psychosocial and demographic variables associated with consumer intention to purchase sustainably produced foods as defined by the Midwest food Alliance. *J. Nutr. Educ. Behav.* 34, 316–325. doi: 10.1016/S1499-4046(06)60114-0

Ruzek, E. A., Domina, T., Conley, A. M., Duncan, G. J., and Karabenick, S. A. (2015). Using value-added models to measure teacher effects on students' motivation and achievement. *J. Early Adolesc.* 35, 852–882. doi: 10.1177/0272431614525260

Salleh, H. S., Mat, N. H. N., Mohamed, W. N., Arzaman, A. F. M., Samsuddin, N. S., and Ahnual, N. K. (2022). Moderating effect of experience on the intention-behavioral relationship towards sustainable food consumption. *ABAC J.* 42, 142–159. doi: 10.14456/abacj.2022.40

Schultz, P. W., Gouveia, V. V., Cameron, L. D., Tankha, G., Schmuck, P., and Franěk, M. (2005). Values and their relationship to environmental concern and conservation behavior. *J. Cross-Cult. Psychol.* 36, 457–475. doi: 10.1177/0022022105275962

Shaw, D., Shiu, E., and Clarke, I. (2000). The contribution of ethical obligation and self-identity to the theory of planned behaviour: an exploration of ethical consumers. *J. Mark. Manag.* 16, 879–894. doi: 10.1362/026725700784683672

Sheeran, P. (2002). Intention—behavior relations: a conceptual and empirical review. *Eur. Rev. Soc. Psychol.* 12, 1–36. doi: 10.1080/14792772143000003

Sheth, J. N., Sethia, N. K., and Srinivas, S. (2011). Mindful consumption: a customer-centric approach to sustainability. *J. Acad. Mark. Sci.* 39, 21–39. doi: 10.1007/s11747-010-0216-3

Shin, Y. H., Im, J., Jung, S. E., and Severt, K. (2018). The theory of planned behavior and the norm activation model approach to consumer behavior regarding organic menus. *Int. J. Hosp. Manag.* 69, 21–29. doi: 10.1016/j.ijhm.2017.10.011

Smith, J. R., Terry, D. J., Manstead, A. S., Louis, W. R., Kotterman, D., and Wolfs, J. (2007). Interaction effects in the theory of planned behavior: the interplay of self-identity and past behavior. *J. Appl. Soc. Psychol.* 37, 2726–2750. doi: 10.1111/j.1559-1816.2007.00278.x

Stern, P. C., Dietz, T., Abel, T., Guagnano, G. A., and Kalof, L. (1999). A value-Belief-norm theory of support for social movements: the case of environmentalism. *Hum. Ecol. Rev.* 6, 81–97.

Tam, J. L. (2004). Customer satisfaction, service quality and perceived value: an integrative model. *J. Mark. Manag.* 20, 897–917. doi: 10.1362/0267257041838719

Thøgersen, J., and Ölander, F. (2006). The dynamic interaction of personal norms and environment-friendly buying behavior: a panel study 1. *J. Appl. Soc. Psychol.* 36, 1758–1780. doi: 10.1111/j.0021-9029.2006.00080.x

Ting, H., Fam, K.-S., Hwa, J. C. J., Richard, J. E., and Xing, N. (2019). Ethnic food consumption intention at the touring destination: the national and regional perspectives using multi-group analysis. *Tour. Manag.* 71, 518–529. doi: 10.1016/j.tourman.2018.11.001

Uddin, S. F., and Khan, M. N. (2018). Young Consumer's green purchasing behavior: opportunities for green marketing. *J. Glob. Mark.* 31, 270–281. doi: 10.1080/08911762.2017.1407982

Ukenna, S. I., and Ayodele, A. A. (2019). Applying the extended theory of planned behavior to predict sustainable street food patronage in a developing economy. *J. Food Prod. Mark.* 25, 404–434. doi: 10.1080/10454446.2019.1572561

Vassallo, M., Scalvedi, M. L., and Saba, A. (2016). Investigating psychosocial determinants in influencing sustainable food consumption in Italy. *Int. J. Consum. Stud.* 40, 422–434. doi: 10.1111/ijcs.12268

Vermeir, I., and Verbeke, W. (2008). Sustainable food consumption among young adults in Belgium: theory of planned behaviour and the role of confidence and values. *Ecol. Econ.* 64, 542–553. doi: 10.1016/j.ecolecon.2007.03.007

Vogt, H., and Dirk, K. (2007). The book Theorien in der biologiedidaktischen Forschung. eds. H. Vogt and K. Dirk Berlin, Heidelberg: Springer.

Walshe, N. (2008). Understanding students' conceptions of sustainability. *Environ. Educ. Res.* 14, 537–558. doi: 10.1080/13504620802345958

Wang, F. (2018). Predicting healthy eating behavior: Examination of attitude, subjective norms, and perceived behavioral control factors. Columbus, Ohio, USA: Bowling Green State University.

Weber, A., Büssing, A. G., Jarzyna, R., and Fiebelkorn, F. (2020). Do German student biology teachers intend to eat sustainably? Extending the theory of planned behavior with nature relatedness and environmental concern. *Sustain. For.* 12:4909. doi: 10.3390/su12124909

Whitmee, S., Haines, A., Beyrer, C., Boltz, F., Capon, A. G., de Souza Dias, B. F., et al. (2015). Safeguarding human health in the Anthropocene epoch: report of the Rockefeller Foundation–lancet commission on planetary health. *Lancet* 386, 1973–2028. doi: 10.1016/S0140-6736(15)60901-1

Willett, W., Rockström, J., Loken, B., Springmann, M., Lang, T., Vermeulen, S., et al. (2019). Food in the Anthropocene: the EAT–lancet commission on healthy diets from sustainable food systems. *Lancet* 393, 447–492. doi: 10.1016/S0140-6736(18)31788-4

Yi-Man, T. (2011). Applying the extended theory of planned behavior to predict the intention of visiting a green hotel. *Afr. J. Bus. Manag.* 5, 7579–7587. doi: 10.5897/AJBM11.684