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RESEARCH ARTICLE

Toward An Integrative Model of Healthy Dietary Behaviors: A Meta-Analysis Approaches

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ABSTRACT

The objective of this study was to develop a research framework for understanding healthy eating behavior. This framework incorporated multiple factors that influence healthy eating, including self-determined motivations (SDMs) and emotional responses as antecedents; attitudes toward a healthy diet (AT); subjective norms of a healthy diet (SN); and perceived behavioral control (PBC) toward a healthy diet as mediators; and gender, age, and education as moderators. Employing meta-analysis, we systematically synthesized data from a diverse range of previous empirical studies published between 1985 and 2024. A total of 281 primary studies, encompassing a sample size of 155,220, were analyzed, aggregating effect sizes for each hypothesis. The results of the study illustrated that the factors of self-determined motivations and emotional responses significantly influence AT, SN, and PBC, facilitating healthy diet behavior intention (HBI) and healthy diet behavior (HDB). Additionally, being a woman with a college-level education and aged older than 40 years have a more pronounced influence on the link between attitude and healthy behavior intention than men with an undergraduate education and aged younger than 40 years. This pattern is also observed for the link between perceived behavior control and healthy behavior intention. Overall, this study provided a comprehensive assessment of the relationship between two antecedents, three mediators and three moderators on intentions toward healthy dietary behavior. In the context of global climate change and limited resources, with a growing emphasis on healthy diets, the findings of this study offer crucial insights for developing effective interventions to promote healthy eating habits. The outcomes of this research have significant implications for the development of interventions that effectively encourage healthy dietary practices.

INTRODUCTION

The field of health behavior, particularly the freedom to choose a healthy lifestyle, has received considerable attention in the Western literature. However, there is a notable scarcity of nuanced exploration of healthy eating as a regulatory motive (Cena & Calder, 2020; Hagger & Chatzisarantis, 2009; Pelletier et al., 2004). Research has highlighted the difficulties faced by individuals when endeavoring to embrace and maintain long-term healthy eating behaviors (Ntoumanis et al., 2021). This study highlights the gradual increase in the recognition and importance of nutritious food. This development could encourage the adoption of healthier eating patterns (Pelletier et al., 2004). However, research, such as the study performed by Ng et al. (2012), warns against the uncontrolled and excessive consumption of nutritious food, highlighting the possible negative impacts on health.

Maintaining a desired behavior for a specific reason is crucial for sustaining healthy eating habits (Szakaly & Peto, 2018; Zhang et al., 2019). This recurrent phenomenon is important considering that unhealthy eating is a significant risk factor for various health issues (Pelletier et al., 2004; Roman et al., 2021). The prevention of these health concerns through the adoption of a healthy lifestyle, especially one that regulates healthy eating behaviors, prompts an essential question: how can individuals be effectively supported in addressing and maintaining healthy eating behaviors? This question has become a focal point in the realm of subjective health perceptions and is closely intertwined with actual health status (Szakaly & Peto, 2018). To gain a more profound understanding of the challenges associated with preparing and sustaining healthy eating habits, it is imperative to delve into the literature. A comprehensive analysis of the current findings on healthy eating behaviors, encompassing the role of motivating variables and moderators of healthy diet intentions, is paramount (McCarthy et al., 2017).

Previous consumer behavior studies are normally based on idea behavior that is directly provoked by rational and conscious intentions, which are influenced by beliefs and attitudes about one's values and control possibilities and the judgments of important others (Conne, 1998; Zong & Guo, 2022). Nevertheless, in the real world, most of our behaviors may be associated with an intuitive, nonrational nature that is related to affective or emotional responses.

Thus, in understanding the intricate interplay between psychological constructs and healthy eating behaviors, a multifaceted theoretical approach is essential for comprehensive insight. Two prominent approaches are adopted in this study. First, self-determination theory (SDT; Deci & Ryan (2012)) and the theory of planned behavior (TPB; Ajzen, 1991) offer invaluable perspectives on motivational factors shaping individuals' attitudes, subjective norms, and perceived behavioral control toward healthy eating. SDT emphasizes intrinsic and extrinsic motivations, positing that individuals are driven by a fundamental need for autonomy, competence, and relatedness (Ryan & Deci, 2017). Applying SDT to healthy eating; intrinsic motivations, such as the desire for vitality; and extrinsic motivations, such as societal pressure or health directives, significantly influence attitudes toward healthy eating, subjective norms regarding societal expectations, and perceived control over one's dietary choices. Complementing SDT, the TPB underscores the role of attitudes, subjective norms, and perceived behavioral control as determinants of behavioral intentions and subsequent actions (Chatzisarantis & Biddle, 1998; Hasbullah et al., 2016; Verstuyf et al., 2012). Within the context of healthy eating, the TPB elucidates how individuals' beliefs about the outcomes of adopting a healthy diet, societal norms surrounding dietary habits, and perceived ability to make healthier choices collectively shape intentions and behaviors. Taken together, SDT and the TPB offer robust frameworks for understanding the rational motivations underpinning healthy eating attitudes, norms, and behavioral control.

However, a comprehensive understanding of healthy eating behaviors necessitates consideration of emotional responses and hedonic consumption (Firth et al., 2020). The hedonic consumption model elucidates how individuals' emotional experiences, such as pleasure, satisfaction, or emotional responses, influence their attitudes, norms, and perceived control regarding dietary choice (Hirschman & Holbrook, 1982). Emotional responses play a pivotal role in shaping individuals' perceptions of healthy eating, as positive emotions associated with consuming nutritious foods can reinforce healthy eating attitudes and behaviors, while negative emotions may deter them (Ljubičić et al., 2023).

Given that previous studies regarding healthy eating behaviors tend to focus on the cognitive aspect of decision-making style, this study intends to develop a multifaceted framework to explain this phenomenon. By integrating STD, the TPB, and the hedonic consumption model, we propose a two-dimensional lens to explore the intricate dynamics of healthy eating behaviors (Firth et al., 2020). This integrated approach recognizes the complex interplay between motivational factors, cognitive

processes, and emotional responses in shaping individuals' intentions and actions toward healthy eating. Moreover, endorsing this multiple approach underscores the richness and comprehensiveness of theoretical development in elucidating the multifaceted nature of healthy eating behaviors. Through this holistic perspective, we aim to provide insights that can inform interventions and strategies aimed at promoting healthier dietary habits and improving public health outcomes (Firth et al., 2020; Nystrand & Olsen, 2020; Seow et al., 2022).

This study primarily focused on healthy eating behavior; with this focus, the role of exercise was excluded from this study and subject to further validation. The inclusion of emotional responses acknowledges the importance of affective states in shaping individuals' behaviors and decision-making processes related to well-being, specifically in the context of dietary choices (Alexander et al., 2021). By examining how emotional responses interact with cognitive processes in the context of healthy eating behavior, our research seeks to uncover the underlying mechanisms driving individuals' choices and behaviors.

A proposed solution involves the development of a comprehensive model of healthy eating behavior, encompassing antecedents, mediators, and moderators. Key antecedents, such as the factors of self-determined motivations (SDMs) and emotional response (ER), are identified as potential direct influencers of healthy eating behavior intention (HBI). Additionally, these antecedents also exert indirect effects on HBI through the mediating effects of healthy eating attitudes (ATs), healthy eating subjective norms (SNs), and healthy eating perceived behavioral control (PBC). This article aims to provide a consolidated overview of the research on the interconnections between healthy eating intentions, perceived behavioral control, and attitudes and subjective standards related to healthy eating.

The specific objectives of this study include the following:

1. Identifying the impact of self-determined motivations (SDM) and emotional responses on healthy diet behavior intention.
2. The influence of self-determined motivations and emotional responses on TPB factors were verified as mediators (including healthy diet attitude, healthy diet subject norms, and healthy diet perceived behavioral control), and the effects of these mediators on healthy diet behavior were assessed.
3. Investigating the influence of healthy diet behavior intention on actual healthy diet behavior.
4. The moderating effect of demographic variables (such as sex, age, and education) on the influence of the mediators on health diet behavior was also examined.

In conclusion, by delving into these objectives and expanding the scope of research on healthy eating behaviors, this study aspires to contribute valuable insights into effective strategies for promoting and maintaining healthy dietary habits. The multidimensional approach, which incorporates antecedents, mediators, and moderators, offers a holistic

understand the complexities surrounding healthy eating behaviors.

LITERATURE REVIEW

Self-determined motivation (SDM) and self-determination theory (SDT)

In the realm of human motivation, self-determination theory (SDT) is a psychological framework that delves into the core psychological needs of autonomy, competence, and relatedness. This theory, widely applied in diverse fields, particularly health, uniquely acknowledges autonomy as an essential human need (Ng et al., 2012). Expanding on SDT, Deci and Ryan (1985) emphasize the importance of comprehending motivation, behavioral substitution, and surrogate regulation beyond self-determination theory, particularly in the context of fostering healthy eating behaviors.

Exploring the underpinnings of self-determined motivation (SDM) reveals that individuals regulate their eating behaviors based on a spectrum of health-related factors (Bavaresco et al., 2020). Notably, self-determined motivations emerge as pivotal influencers, fostering a shift toward healthier dietary habits. This literature review underscores the integral role of SDT and SDM in understanding the complex dynamics of human motivation, providing a nuanced perspective essential for promoting healthier lifestyles, particularly in the realm of dietary choices.

Theory of Planned Behavior (TPB)

The theory of planned behavior (TPB), defined by Ajzen (1991, 2020), serves as a widely accepted framework for exploring the intricate connections among attitudes, beliefs, intentions, and behavior. This theory spans diverse domains, demonstrating its utility in comprehending and predicting human behavior in realms such as health, environment, and consumer behavior. Conne (1998) emphasized the efficacy of the TPB in decoding various facets, including goal achievement, such as healthy behavioral intentions and behaviors aligned with those goals (e.g., healthy diet). The study also delves into nuanced considerations of individual differences, such as state versus orientation. Additionally, the formulation of implementation intentions within the TPB framework emerges as a promising avenue for future exploration.

Digging deeper into the TPB's application underscores consumer behavior as a focal point, representing one of the most scrutinized contexts in research and a prevalent social psychological explanation (Ulker-Demirel & Ciftci, 2020). Notably, within this application, behavioral intention becomes a significant trade-off, delicately balancing attitude prediction and outcome prediction. This nuanced understanding not only contributes to comprehending decision-making processes in consumer behavior but also suggests fruitful avenues for further research within the TPB framework.

The Dual-Process Theory

The dual-process model, encompassing System 1 (intuitive, automatic processing) and System 2 (deliberative, controlled processing), elucidates the intricacies of human decision-making, notably in dietary contexts (Kahneman, 2011). System 1 operates swiftly and is guided by heuristics, emotions, and environmental cues, driving automatic responses such as food cravings (Brown et al., 2021; Kahneman, 2011). Conversely, System 2 engages in slower, conscious processes involving logical reasoning and consideration of long-term consequences, such as evaluating nutritional information (Kahneman, 2011). These two systems interact dynamically; System 1 often influences behavior preemptively, while System 2 can exert deliberate control under specific circumstances (Evans & Stanovich, 2013). In healthy eating, decisions result from a blend of heuristics and emotional responses (System 1) and conscious evaluations (System 2), necessitating interventions that address both aspects (Hofmann et al., 2008). By integrating insights from both systems, researchers can better comprehend dietary decision-making mechanisms, facilitating the development of effective interventions targeting rational and emotional processes. This holistic approach acknowledges the multifaceted nature of dietary behaviors, emphasizing the importance of considering cognitive, emotional, and environmental factors (Evans & Stanovich, 2013; Hofmann et al., 2008; Kahneman, 2011).

Emotional response

Emotions have a significant impact on food choices, as shown by people's inclination to find comfort in foods during times of stress or melancholy (Ljubičić et al., 2023). Emotional eating refers to the desire for meals in consumers' favorites. Scholars have extensively studied the influence of MBSR on dietary patterns and health outcomes (Betancourt-Núñez et al., 2022). Furthermore, emotions have a significant effect not only on the choice of food but also on wider eating patterns and consumption behaviors. As a result, they have a dramatic impact on total dietary intake and nutritional well-being (Gibson, 2006; Lattimore, 2020). A thorough understanding of the complex relationship between

emotional and rational dietary behaviors is crucial for developing effective treatments to promote better eating habits and enhance overall health outcomes (Firth et al., 2020). Studies have shown that emotions may enhance the precision of TPB models, particularly the significance of good emotions in forecasting the inclination to buy food (Martini et al., 2024). Havermans and Jansen (2007) argue that positive emotional responses seem to arise from sensory gratification and the anticipation of eating, possibly accompanied by a reduction in hunger. On the other hand, emotions may stem from favorable thoughts associated with eating (Havermans & Jansen, 2007; Lowe et al., 2009; Macht & Dettmer, 2006). Individuals experiencing good emotional states, such as enjoyment or satisfaction, are more likely to choose healthier foods and have improved self-control (Redden & Haws, 2013). Furthermore, some research have shown that the practice of emotion regulation is crucial for maintaining psychological well-being and may be accomplished via the use of several tactics (Tamir et al., 2023).

Healthy Dietary Behaviors

Healthy dietary behaviors originate from the intention to promote health, aligning closely with the theory of planned behavior (TPB), which posits intention as the immediate precursor to behavior. According to the TPB, intention encompasses motivational factors influencing behavior, and individuals, given sufficient control, enact their intentions when opportunities arise (Krishna, 2012). This phenomenon is evident in the study by McCarthy et al. (2017), where daily food behaviors stemmed from routine activities, carrying potential health consequences. Acknowledging the impact of routine smoking on health-related behaviors, the development of healthy dietary behaviors has emerged as a remedy for this issue. Addressing the intricate interplay between healthy and problematic eating behaviors, as explored by Guertin et al. (2020), becomes imperative. Utilizing healthy eating behaviors as a lens to investigate motivational dynamics offers a strategic approach to unravel the complexities surrounding individuals' food choices, thereby promoting overall well-being.

Hypothesis Development

The Effect of Self-Determined Motivation on Attitudes toward Healthy Diets, Healthy Diet Subjective Norms, Perceived Behavioral Control and Healthy Behavior Intentions (HBIs)

According to SDT, individuals' motivation to engage in dietary behaviors can promote attitudes, social norms and behavioral control toward healthy eating and sustained engagement in the healthy dietary process. Verplanken and Faes (1999) noted that a healthy diet is essential for the prevention and management of various chronic diseases. Thus, self-motivation is an important factor in adopting and maintaining healthy eating behaviors (Szakaly & Peto, 2018; Verplanken & Faes, 1999). This paper presents a systematic review of the literature on the effect of self-determined motivation (SDM) on healthy diet attitudes (AT), subjective norms of healthy diet (SN), and perceived behavioral control (PBC). These findings, in particular, indicate that interventions aimed at increasing self-determined motivation may be effective at promoting healthy dietary habits (Conner et al., 2002; Ryan & Deci, 2000; Verplanken & Faes, 1999). Furthermore, several studies emphasize the importance of self-determined motivation in promoting healthy eating behavior by indicating the influence of self-determined motivation on attitudes toward healthy eating, subjective norms of healthy eating, and behavioral control perception (McCarthy et al., 2017; Ryan & Deci, 2020).

Studies have shown that self-determination motivations play a significant role in motivational processes, intention formation, and behavioral development. Based on these study results, motivations (such as self-efficacy) can be assessed to provide socially designed food environments that promote healthy eating and to perform modifications that can favorably change people's healthy dietary behaviors (Willmott et al., 2021). Mullan et al. (2021) indicated that integrating habitual and

self-determined motivation may help improve the intention–behavior aspects of these health behaviors. Based on the above discussions, the following hypotheses are developed:

Hypothesis H1: SDM is positively related to AT.

Hypothesis H2: SDM is positively related to SN.

Hypothesis H3: SDM is positively related to PBC.

Hypothesis H4: The SDM is positively related to HBI.

The Effect of Emotional Response on Self-Determined Motivation, Attitudes toward Healthy Diet, Healthy Diet Subjective Norms, Perceived Behavioral Control and Healthy Behavior Intentions (HBIs)

Recognition of the intricate relationships between emotional reactions and a variety of health-related actions has recently garnered increasing attention. A critical behavior that significantly impacts overall health and the prevention of diseases is the observance of a nutritious diet. Examining the effect of emotional responses on self-determined motivation (SDM), attitudes (ATs), subjective norms (SNs), perceived behavioral control (PBC), and healthy behavioral intentions (HBIs), among other psychological factors that define healthy eating behaviors, has become a critical issue. Previous research has emphasized the significant impact of emotional responses on individuals' motivations for various behaviors (Fredrickson, 2001; Smith et al., 1993; Köster, 2009). Based on this investigation, we hypothesize that people who experience strong emotional reactions exhibit greater self-determined motivation to establish and maintain healthy eating habits. Ares et al. (2015) argued that consumers' perception of well-being in a food context may involve a holistic evaluation of the product and then doing the overall liking or healthfulness score for their choice. The effects of healthy food on well-being may be strongly related to physical health, pleasure, and emotional responses. Thus, emotional responses toward specific foods become critical to consumers' decision-making. Consistent with research highlighting the significant influence of emotions in shaping attitudes toward health-related activities (Cameron & Leventhal, 2003; Carbonneau et al., 2021). American Psychological Association (2011, November 1) Moreover, the convergence of academic, social, and family demands may create a mentally burdensome environment, leading to the formation of harmful eating habits in children and adolescents that last into adulthood (Richards et al., 2021). Thus, it is of utmost importance to foster healthy dietary habits through a comprehensive family upbringing. We also expect that individuals with stronger and more positive emotional responses will have more favorable views. People with strong emotional responses tend to perceive better dietary standards in their social circles and, in turn, increase compliance with these standards. Recognizing the complexity of emotional states (Ljubičić et al., 2023), previous research has shown that emotional responses may strongly influence an individual's motivation for certain activities (Fredrickson, 2001; Smith et al., 1993;). Therefore, it is hypothesized that people with strong emotional responses would have higher levels of self-motivation when adopting and maintaining a healthy diet.

Furthermore, research in the field of health psychology repeatedly demonstrates that emotions play a substantial role in shaping individuals' attitudes toward activities connected to health (Cameron & Leventhal, 2003). Thus, we suggest that individuals who experience more positive emotional responses are more inclined to follow a better diet. In addition, taking into account the significant influence of social influence and norms on food choices (Gallin et al., 2023; Løvoll et al., 2017), we anticipate that individuals with stronger emotional responses will perceive healthier eating habits as the standard within their social circle, thereby adhering more closely to these norms. Social influence and norms have a significant impact on people's food preferences (Mead et al., 2014). Based on the interpersonal nature of emotions, people who have greater emotional reactions may see better nutritional standards within their social circles, leading to an increased commitment to these standards.

Emotional states have an impact on how people perceive their control over their conduct. These emotions may either help or hinder individuals' perceived capacity to participate in certain acts (Fredrickson, 2001; Arribas-Galarraga et al., 2017). Therefore, it is postulated that individuals who experience more favorable emotional reactions would have a greater perception of their capacity to adhere to a healthy diet. Therefore, it is postulated that individuals who experience more favorable emotional reactions may sense a greater level of control over their capacity to maintain a healthy diet. Behavioral intentions are close predictors of actual behavior enactment (Ajzen, 1991). Based on the motivating aspect of emotions, people who have intense emotional reactions are expected to be more likely to adopt good food habits. Based on the above discussions, the following hypotheses are developed:

Hypothesis H5: ER is positively related to SDM.

Hypothesis H6: ER is positively related to AT.

Hypothesis H7: ER is positively related to SN.

Hypothesis H8: ER is positively related to PBC

Hypothesis H9: ER is positively related to HBI

The effects of Social Norms on Personal Attitudes and Perceived Behavioral Control

Chan and Hagger (2012) argued that autonomous motivation can influence behavioral intention through the mediation of attitude (AT), subjective norms (SNs), and perceived behavioral control (PBC). Grønhøj et al. (2013) argue that attitude and perceived behavioral control are the key variables in predicting behavioral intention. Previous studies have indicated that social norms, personal attitudes and perceived control over behaviors are important factors influencing the adoption and maintenance of healthy lifestyles. Interventions to change social norms, personal attitudes and perceived behavioral regulation may be effective in promoting appropriate dietary habits (Chan & Hagger, 2012; Conner et al., 2002; Ntoumanis et al., 2021). Therefore, the following hypotheses are developed:

Hypothesis 10: SN is positively related to AT.

Hypothesis 11: SNs are positively related to PBC.

The Effects of Healthy Diet Attitudes Toward Healthy Diet Subjective Norms and Healthy Diet Perceived Behavioral Control on Healthy Behavior Intentions

Healthy eating habits are shown to have numerous physical and mental health benefits. Adopting and maintaining healthy eating intentions and habits are influenced by attitudes, subjective norms, and perceived behavioral control (Nystrand & Olsen, 2020; Verplanken & Faes, 1999; Chatzisarantis & Biddle 1998). Adriaanse et al. (2011) indicate that boosting intentions are more successful in encouraging good eating habits than discouraging lousy eating habits. Perceived behavioral control and attitude are found to be the most important contributing factors to behavioral intentions (Pena-Garcia et al., 2020), both of which are found to be beneficial and useful when following a healthy diet (Grønhøj et al., 2013; Hagger et al., 2022; Inoue et al. 2015). According to Baldwin et al. (2022), perceived competence, self-determined motivation, and habit automaticity affect the quality of adult diets. To encourage healthy eating habits, the structure of eating behaviors and the assessment of their contribution to enhancing diet quality are used. Based on the above discussion, the following hypotheses are developed:

Hypothesis 12: AT is positively related to HBI.

Hypothesis 13: SN is positively related to HBI.

Hypothesis 14: PBC is positively related to HBI.

The Effect of Healthy Diet Behavior Intentions (HBI) on Healthy Dietary Behavior (HDB)

According to Verplanken & Faes (1999), the intentions made can be successful in establishing healthier eating habits. Faes (2011) further contends that the impact of the intention to change healthy eating behaviors is expressed through the intention to continue engaging in healthy eating behaviors (Gardner et al., 2011). Thus, according to Ouellette & Wood (1998), past behaviors (including attitudes and subjective norms) help generate intentions, and intentions further guide behaviors. Gaube et al. (2019) proposed that the positive relationship between risk perception and health-related behavioral variables (a combination of intention and actual behavior) is strongly enhanced. Therefore, Webb and Sheeran (2006) and Gardner et al. (2011) identify the consistency of modifying intentions and actions and aid in the conversion of intentions into action by encouraging the stability of intentions and the establishment of implementation intentions. Specifically, the effectiveness of executing intentions in promoting healthy eating habits and motivating health-related activities is confirmed in the literature (Adriaanse et al., 2011).

Based on the above discussions, the following hypotheses are developed:

Hypothesis 15: HBI is positively related to HDB.

Moderating Effects of Demographic Variables

According to Claudia et al. (2019), Gundala et al. (2022) and Wu (2022), studies on demographic variables enable the differentiation of important associations between various individuals, particularly those associated with healthy dietary behaviors. Gundala et al. (2022) use the gender of an interviewee as a moderating variable to investigate the associations between attitudes and intentions. They concluded that gender moderates the associations between attitude and purchase intention, indicating that males and females interact differently. Carfora et al. (2022) also demonstrated that gender significantly influences eating behavior and healthy eating practices in terms of attitudes, perceived behavioral control, and subjective norms to intentions. Hasbullah et al. (2016) investigate the effects of age on attitudes and subjective norms in business, which is especially useful for market segmentation and positioning. Based on the age of the respondents, Claudia et al. (2019) concluded that premeditated behavior mediates the relationship between attitudes and hiring intentions. Age is a significant factor in building selection based on attitudes, subjective norms, and perceived behavioral control according to an interdisciplinary study (Bavaresco et al., 2020). Thus, Claudia et al. (2019) demonstrated that age moderates the association between attitudes and total healthy eating intentions as well as the association between attitudes, social norms, and perceived control and healthy eating intentions. A hypothetical derivation of the moderating effect of age is developed. On the other hand, Wu (2022) examines the moderating role of educational status and concludes that education level negatively moderates the relationship between subjective norms and intention among individuals with chronic diseases. According to Nystrand & Olsen (2020), consumer attitudes and intentions regarding the consumption of functional food products and education are crucial factors. A separate study conducted by Jun et al. (2014) focused on the influence of health values on the selection of healthy foods in restaurants and concluded that education has a greater impact on consumers' intentions to purchase healthy food.

On the basis of the results of previous studies, a suitable starting point is provided for hypothesizing the moderating effects of demographic variables (e.g.), gender, age, and education:

Hypothesis 16: Gender, age, and educational level can moderate the relationship between attitudes toward a healthy diet (AT) and healthy behavioral intentions (HBI).

Hypothesis 17: Gender, age, and educational level can serve as moderators of the relationship between healthy dietary subjective norms (SNs) and healthy behavioral intentions (HBIs).

Hypothesis 18: Gender, age, and educational level can serve as moderators of the relationship between perceived behavioral control (PBC) and healthy behavior intentions (HBI).

Based on the above discussions, the research framework of this study is shown in Figure 1.

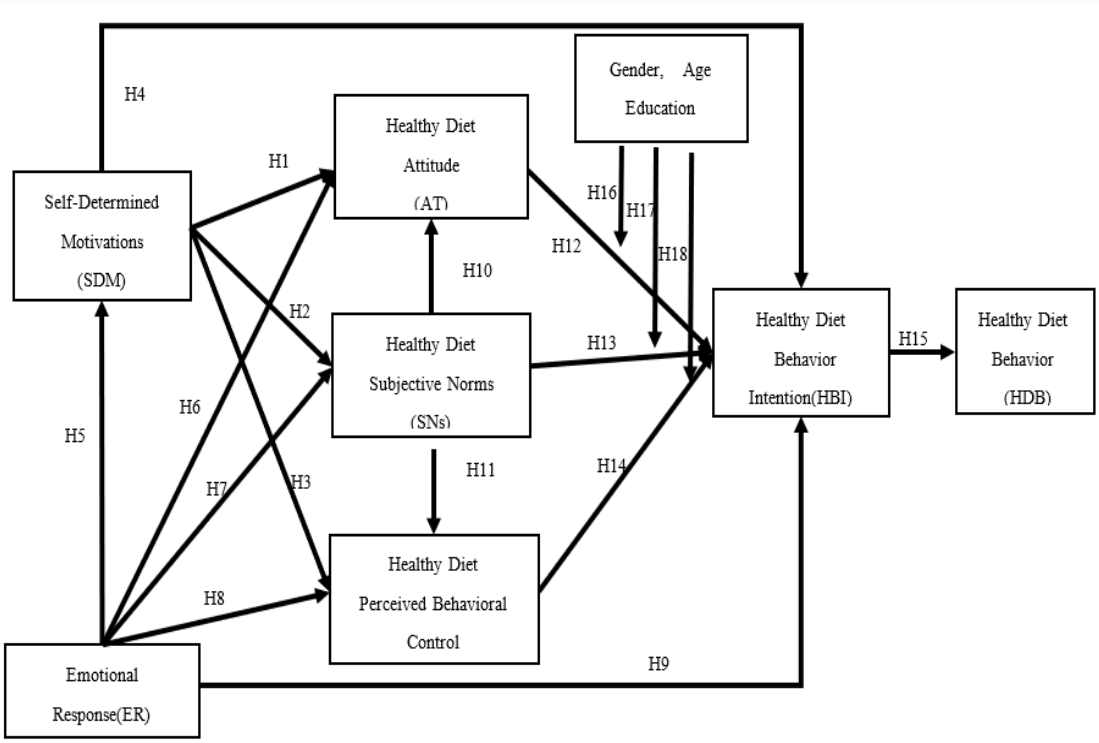

Figure 1 The conceptual framework

METHOD

Scientific knowledge is built on the cumulative findings from prior research within a domain, where individual studies act as building blocks (Rowley & Paul, 2021; Paul & Barari, 2022). Meta-analysis is adopted in this study to systematically collect, review, and synthesize findings from multiple quantitative studies related to healthy dietary behavior. While traditional literature reviews enable readers to gain a deep understanding of the literature and help identify research gaps in a specific research domain, meta-analysis systematically and statistically integrates previous findings to provide a state-of-the-art view of current knowledge in this domain (Borenstein et al., 2021). Conducting a meta-analysis on healthy dietary behavior is crucial for several reasons. First, by combining data from multiple studies, meta-analysis increased the statistical power and robustness of findings, helping to resolve inconsistencies and conflicting results in the exciting literature. This comprehensive synthesis can identify key factors and/or moderators influencing healthy dietary behaviors, offering clearer insights for both scholars and practitioners (Julian et al., 2019). Second, meta-analysis can highlight areas where research is lacking, thereby identifying gaps and guiding future efforts. Third, by providing a more accurate and reliable picture of the relationships and variables affecting dietary behaviors, meta-analysis encourages feather development and innovation in its importance in the research domain (Paul & Barari, 2022). Thus, instead of conducting a systematic literature review, the study conducts a meta-analysis to enhance the generalizability of findings across different populations, settings, and contexts.

Our meta-analysis was conducted utilizing the Comprehensive Meta-Analysis (CMA) tool, a publication supported by the National Institutes of Health in the United States (Borenstein, 2022). CMA was used to conduct a comprehensive analysis of our research hypotheses by analyzing the distribution of the effect sizes and performing meta-regressions. This instrument facilitates accurate navigation across the complex network of study results, providing significant insights into the intricacies of our data. The rigorous evaluation of publication bias offered a perspective to examine the strength and dependability of our results. In essence, the visualizations generated at a high resolution by the CMA functioned as potent instruments, augmenting the lucidity and communicative influence of our investigation.

Inclusion criteria

This study aims to develop a research framework for healthy eating behavior from an individual perspective, integrating various psychological theories. The study incorporates the Self-Determination Theory (SDT), Dual-Process Theory, Experiential Consumption Model, Theory of Planned Behavior, Health Belief Model, and Social Cognitive Theory to create a comprehensive framework for understanding healthy eating behavior from the user's perspective. We developed and expanded our search strategy to include a broader range of databases: PsycINFO, PubMed, Taylor & Francis Group, Google Scholar, ResearchGate, JSTOR, ScienceDirect, and SAGE.

Specifically, the results of the included studies focus on eight key constructs: self-determined motivation, emotional response, healthy diet attitude, healthy diet subjective norms, healthy diet perceived behavioral control, healthy diet behavior intentions, healthy diet behavior, and demographic variables. These constructs were chosen for their conceptual relevance and their importance in capturing a comprehensive range of motivational factors, behavioral intentions, and cognitive and affective processes related to healthy dieting. Our data synthesis included empirical studies published between 1985 and 2024 to ensure broad coverage of relevant literature. We employed a rigorous screening process to identify eligible studies for inclusion in the meta-analysis. Initially, a comprehensive search across the aforementioned databases yielded a total of 330 studies. To be included in this research, studies had to meet the following criteria. Empirical and quantitative research includes hypothesis testing, reporting of sample size, and statistical reporting of either a correlation coefficient or a standardized regression coefficient, with one-time estimates used for studies with multiple time points.

After applying these criteria, 49 studies that did not meet the eligibility requirements were excluded, resulting in a final dataset of 281 primary studies, collectively representing a sample size of 155,220 participants. This extensive dataset allows us to capture a wide range of relevant studies, ensuring that our findings are robust and generalizable across different populations, settings, and contexts.

Meta-analytic strategy

Hunter (1994) employs a meta-analysis approach to identify effect sizes for statistical artifacts. Observed correlations are often used to compute the sampling error variance of a correlation, but in a meta-analysis, the means of the observed correlations are utilized. By combining data from multiple studies, a meta-analysis can increase the statistical power, which provides a more precise estimate of the effect size. Meta-analysis can also be used to assess the general abilities of findings in different research settings. Furthermore, meta-analyses adopt the heterogeneity indicator (Q) to verify whether the variances are due to true effects or sampling errors. The aim of the meta-analytic approach is to investigate confidence intervals, magnitudes, and correlations of the effect size of a link with greater accuracy. Meta-analysis has an array of advantages over individual studies or narrative reviews. The sample size was increased by combining data from many studies, enhancing the statistical power of the results (Borenstein et al., 2009). Meta-analysis provides a more precise estimate of the impact magnitude while ensuring transparency and avoiding bias by combining data

from multiple trials via a methodical and predetermined approach that includes a comprehensive search for relevant papers, selection criteria, and data extraction (Aertsens et al., 2009; Higgins, 2019). When several studies provide contradictory results, a meta-analysis can assist in resolving these discrepancies by synthesizing the information. Furthermore, systematic reviews incorporate data from many populations and situations, providing a more comprehensive picture of the study topic (Sutton, 2000). Meta-analysis not only allows researchers to look into sources of variation and determine how certain factors affect overall effect size (O'Connor & Sargeant, 2014) but also provides a numerical summary of effect sizes that make it easy to understand and compare different studies. It also helps find and eliminate publication bias, which provides a more complete and fair picture of the evidence (Higgins, 2019). Overall, meta-analysis is a strong and comprehensive method for combining data from several investigations. It provides a complete and quantitative overview of pertinent facts, leading to more robust findings and directing evidence-based decision-making (Borenstein et al., 2009).

Analytical techniques

The correlation coefficient (r) was used as the primary effect size in the present study, and standardized regression coefficients (β) were converted to r for further analysis. After collecting and analyzing all of the necessary correlation coefficients (r), the researchers calculated the 95% confidence interval (CI) to evaluate the statistical significance of each effect size. When the 95% CI did not include 0, the effect magnitude was considered to be statistically significant (Hartung & Knapp, 2001). Q-statistics were used to examine the homogeneity of the effect size distribution. The Q value must be greater than the chi-square (χ^2) value with a degree of freedom equal to (n-1), where n is the number of investigations. This finding lends significance to the homogeneity null hypothesis. If the homogeneity of the null hypothesis is rejected, variance heterogeneity will exist. In other words, variations in effect size may occur apart from sampling. A substantial Q-statistic indicates that the observed impact is diverse and that modifiers are needed to explain more of the variation in the results. The z test devised by Hough & Hall (1994) was subsequently used to assess the statistical significance of between-group differences.

Variable coding

If previous research produces impact sizes at multiple levels for a given construct, this study produces a single impact size. Because each of the selected papers presented demographic information about the participants differently, three generic characteristics of each sample were coded as potential moderators: gender (male/female), age (under/over 40), and education (below undergraduate/above graduate). To ensure accuracy, each of the selected papers was independently coded by two members of the coding team, which included the first author and a PhD student with expertise in the subject. Prior to coding, the team reviewed the coding strategy and addressed any concerns. Table 1 shows the list of previous studies included in this meta-analysis.

Table 1: Previous studies included in this meta-analysis

Studies Alphabetically by Source and Codes for HypothesesTests[a,b]	
Al-Jubari (2019) 57, (SN-AT, SN-PBC, AT-BI, SN-HBI, PBC-HBI)	Lovoll et al. (2017) 11, (ER-SDM)
Arribas-Galarraga et al.(2017) 36, (ER-SDM)	MacFarlane & Woolfson, (2013) 61, (HBI-HDB)
Ayres et al. (2011) 16, (ER-AT)	Martini et al. (2024) 5, (ER-AT,ER-SN ,ER-PBC,ER-HBI)
Bavaresco et al. (2020) 9, (AT-HBI, SN-HBI, PBC-HBI)	McDonough & Crocker, (2007) 43, (ER-SDM)
Berki-Kiss & Menrad, (2022) 60, (ER-SN, ER-PBC, ER-HBI)	Mohiyeddini et al. (2009) 53, (AT-HBI, SN-HBI, PBC-HBI)
Brouwer & Mosack (2015) 46, (AT-HBI)	Mohiyeddini et al. (2009) 53,(ER-AT,ER-SN,ER-PBC,ER-HBI)

Brug et al. (2006) 40, (SN-AT, SN-PBC, AT-HBI, SN-HBI, PBC-HBI, HBI-HDB) Carfora et al. (2022) 49, (ER-SDM, ER-AT, ER-SN, ER-PBC) Carfora et al. (2022) 49, (SDM-AT, SDM-PBC, SN-AT, SN-PBC, SDM-HBI, PBC-HBI) Carrera et al. (2012) 59, (ER-HBI) Carrus et al. (2008) 34, (ER-SDM, ER-AT, ER-SN, ER-PBC, ER-HBI) Chan & Hagger (2012) 42, (SDM-AT, SDM-SN, SDM-PBC, SN-AT, SN-PBC, AT-HBI, SN-HBI, PBC-HBI, SDM-HBI) Chan et al. (2020) 53, (SDM-AT, SDM-SN, SDM-PBC) Chatzisarantis (1998) 17, (AT-HBI, SN-HBI) Chung et al., (2017) 4, (SDM-AT, SDM-SN, SDM-PBC, AT-HBI, SN-HBI, PBC-HBI, SDM-HBI, HBI-HDB) Conner et al. (2002) 21, (HBI-HDB) Cox et al. (2009) 55, (ER-SDM) Cuesta-Valiño et al., (2020) 26, (ER-AT) De Bruijn et al. (2007) 51, (SN-AT, SN-PBC, AT-HBI, SN-HBI, PBC-HBI) de Bruijn et al. (2009) 1, (SN-AT, SN-PBC, AT-HBI, SN-HBI, PBC-HBI) de Bruijn, (2010) 2, (SN-AT, SN-PBC, AT-HBI, SN-HBI, PBC-HBI) Faes (2011) 17, (SN-AT, SN-PBC, AT-HBI, SN-HBI, PBC-HBI, HBI-HDB) Freivogel & V, (2020) 26, (HBI-HDB) Gan et al. (2023) 26, (SDM-HBI) Grønhøj et al. (2013) 24, (SN-AT, AT-HBI, SN-HBI, PBC-HBI) Hagger et al. (2005) 33, (HBI-HDB) Hagger et al. (2019) 3, (HBI-HDB) Jun et al. (2014) 28, (AT-HBI) Lee et al. (2010) 41, (ER-HBI) Lnoue et al. (2015) 30, (SDM-AT)	Moons & De Pelsmacker (2012) 37,(ER-AT,ER-HBI) Mouratidis & Michou (2011) 15, (ER-SDM) Mullan et al. (2021) 6, (SDM-HBI, HBI-HDB) Nieves-Pavón et al. (2024) 10, (ER-AT,ER-SN,ER-PBC) Nystrand & Olsen (2020) 19, (AT-HBI, PBC-HBI) Otaibi (2018) 18, (SN-AT, SN-PBC, AT-HBI, SN-HBI, PBC-HBI, HBI-HDB) Pena-García et al. (2020) 20, (AT-HBI, SN-HBI, PBC-HBI) Psouni et al. (2016) 50, (HBI-HDB) Rapaport & Orbell (2000) 51, (ER-SDM, ER-AT, ER-SN, ER-PBC, ER-HBI) Reizer et al. (2019) 38, (ER-SDM) Rhodes & Courneya, (2005) 53, (SN-AT, SN-PBC, AT-HBI, SN-HBI, PBC-HBI, HBI-HDB) Russell et al. (2017) 56, (AT-HBI, SN-HBI, PBC-HBI) Su et al. (2014) 32, (ER-HBI) Swaim et al. (2014) 31, (SN-AT, SN-PBC, AT-HBI, PBC-HBI, HBI-HDB) Taylor et al. (2016) 52 , (ER-AT, ER-SN, ER-PBC, ER-HBI) Thompson et al. (1994) 3, (SDM-SN, AT-HBI, SN-HBI) Turner et al. (2010) 2, (ER-HBI) Vandercammen et al. (2014) 48, (ER-SDM) Wang et al. (2018) 14, (ER-AT, ER-SN, ER-PBC, ER-HBI) Wang, (2011) 53, (ER-AT, ER-SN, ER-PBC, ER-HBI, AT-HBI, SN-HBI, PBC-HBI, HBI-HDB) Willmott et al. (2021) 4, (SDM-AT, SDM-PBC, SDM-HBI) Xie et al. (2013) 50, (ER-AT, ER-SN, ER-PBC, ER-HBI)

Studies listed alphabetically by source and hypothesis test codes[a,b]

[a]Codes in parentheses: emotional response (ER), self-determined motivation (SDM), healthy diet attitude (AT), healthy diet subjective norms (SN), healthy diet perceived behavioral control (PBC), healthy diet behavior intentions (HBI), and healthy diet behavior (HDB)

[b]The journals are footnoted in alphabetical order

(1)American Journal of Preventive Medicine (2) Appetite (3) Appl Psychol Health Well Being (4) BMC Public Health (5) British Food Journal (6) British Journal of Health Psychology (7) British Journal Soc Psychol (8) British Journal of Nutrition (9) Building and Environment (10) Cities (11) Cogent Psychology (12) Curr Opin Psychol(13) Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity (14) Energy Policy (10) (15) Educational Psychology (16) European Journal of Personality (17) European Journal of Social Psychology (18) Food and Nutrition Sciences (19) Food Quality and Preference (20) Heliyon (21) Health Psychology (22) Health Psychology Review

(23) Health Education (24) In Handbook of theories of social psychology (25) In Perceived Safety (26) International Journal of Environmental Research and Public Health (27) International Review of Sport and Exercise Psychology (28) International Journal of Hospitality Management (29) Journal of Nutrition Education and Behavior (30) Journal of Applied Sport Psychology (26) (31) Journal of Business Ethics (32)Journal of China Tourism Research (33) Journal of Educational Psychology (34) Journal of Environmental Psychology (35) Journal of Functional Foods (36) Journal of Human Sport & Exercise (37) Journal of Marketing Management (38) Journal of Managerial Psychology (39) Journal of Research in Personality (40) Journal of Nutrition Education and Behavior (41) Journal of Travel Research (42) Journal of Science and Medicine in Sport (43) Journal of Sport and Exercise Psychology (44) Motivation and Emotion (45) Nutrients (46) Nutrition & Food Science (47) Organizational Behavior and Human Decision Processes (48) PLoS One (38) (49) Public Health Nutrition (50) Psychology (51)Psychology & Health(52) Psychology & Marketing (53) Psychology of Sport and Exercise (54) Psychology & Marketing (55) Research Quarterly for Exercise and Sport (56) Resources, Conservation & Recycling (57) SAGE Open(58) Teaching and Teacher Education(59) Scandinavian Journal of Psychology(60) Sustainable Production and Consumption.

RESULTS

The outcomes of the main effects

The first 15 hypotheses in this investigation are shown in Table 2. The examination of hypotheses on the impact of self-determined motivation (SDM) on several aspects associated with healthy eating patterns produces convincing results. Hypothesis H1, which suggested a positive correlation between SDM and attitude toward a healthy diet (AT), was validated by a significant correlation coefficient ($r = 0.458$, 95% CI [0.247, 0.627], $p<0.000$). These findings indicate that individuals who have a stronger internal drive are more likely to have positive views about adopting a nutritious diet. Similarly, a significant correlation coefficient ($r=0.313$, 95% CI [0.088, 0.508], $p<0.000$) supports Hypothesis H2, which predicts a positive association between SDM and healthy diet subjective norms (SNs). This result suggested that people motivated by internal factors tend to perceive stronger social pressure in favor of a healthy diet. Furthermore, the study findings support Hypothesis H3, which proposes a positive connection between SDM and perceived behavioral control (PBC). The results revealed a statistically significant positive correlation ($r = 0.359$, 95% CI [0.229, 0.476], $p<0.000$). These findings indicate that individuals who have higher degrees of self-determined motivation feel more in control of their capacity to adhere to a healthy diet. Moreover, Hypothesis H4, which suggested a direct association between SDM and healthy behavior intentions (HBI), was confirmed with a statistically significant correlation coefficient ($r = 0.474$, 95% CI [0.296, 0.260], $p<0.000$). This finding emphasizes the crucial influence of internal motivations on individuals' intentions to adopt and maintain healthy dietary behaviors. The strength of these results is confirmed by the statistically significant effect size metrics, demonstrating fundamental differences in the influence of SDM across people.

Additionally, all the Q values exceeded χ^2, indicating heterogeneity in the variance of effect size for H1, H2, H3, and H4 and suggesting genuine variations in the impact of SDM across individuals. Furthermore, all I^2 values exceeded 75%, implying substantial differences in the actual effects under examination and highlighting the significant variability in the actual effects being studied. These results emphasize the need to acknowledge and nurture the inherent motivations that drive people's actions to successfully encourage better lifestyles and food choices. By targeting intrinsic motivations, treatments and tactics designed to encourage nutritious eating habits may be customized to accommodate the varied requirements and motivations of people, therefore fostering health and well-being.

Table 2: Results of the meta-analysis of the main effects

Effect size and 95% Confidence											
Variable			n	k	Interval			Heterogeneity			
Hyp.	Independent	Dependent			r	LCI	UCI	p value	χ^2	Q	I^2
H1	SDM	AT	7795	6	0.458	0.247	0.627	0.000***	11.07	426.958	98.829
H2	SDM	SN	7164	5	0.313	0.088	0.508	0.000***	9.488	272.352	98.531
H3	SDM	PBC	7468	5	0.359	0.229	0.476	0.000***	9.488	107.911	96.293
H4	SDM	HBI	3721	6	0.474	0.296	0.620	0.000***	11.07	169.122	97.044
H5	ER	SDM	4486	11	0.372	0.271	0.465	0.000***	18.31	117.762	91.508
H6	ER	AT	9881	16	0.369	0.207	0.511	0.000***	25.00	1120.76	98.662
H7	ER	SNs	6564	13	0.293	0.111	0.456	0.000***	21.03	676.094	98.225
H8	ER	PBC	6564	13	0.291	0.178	0.397	0.000***	21.03	264.299	95.460
H9	ER	HBI	8562	17	0.38	0.285	0.468	0.000***	26.30	374.267	95.725
H10	SN	AT	7340	13	0.235	0.176	0.292	0.000***	21.03	77.731	84.562
H11	SN	PBC	7340	13	0.185	0.085	0.282	0.000***	21.03	222.298	94.602
H12	AT	HBI	8946	23	0.498	0.418	0.569	0.000***	33.92	494.404	95.550
H13	SN	HBI	6703	19	0.237	0.181	0.293	0.000***	28.87	103.552	82.617
H14	PBC	HBI	7362	19	0.433	0.324	0.531	0.000***	28.87	546.187	96.704
H15	HBI	HDB	5134	14	0.433	0.307	0.544	0.000***	22.36	347.946	96.264

Notes: emotional response (ER), self-determined motivation (SDM), healthy diet attitude (AT), healthy diet subjective norms (SN), healthy diet perceived behavioral control (PBC), healthy diet behavior intentions (HBI), healthy diet behavior (HDB)

Furthermore, the present meta-analysis examined the correlation between self-determined motivation (SDM) and emotional response (ER) with regard to healthy dietary behaviors. The findings revealed noteworthy positive associations between ER and SDM, AT, SN, and PBC. The first finding suggested that individuals who feel emotionally charged are more inclined to demonstrate intrinsic motivation in their pursuit of incorporating healthy dietary practices (r=0.371, 95% CI [0.315, 0.426], p<0.000, Q(576.123)> χ^2=21.03, I^2=97.416%). By building upon the SDT, our study offers evidence that emotional responses play a crucial role in influencing self-determined motivations to engage in healthy dietary practices. The substantial positive correlation observed between self-determined motivation (SDM) and emotional response (ER) highlights the criticality of incorporating emotional elements into efforts to encourage long-term participation in healthy dietary practices; Ryan & Deci (2000) support Hypothesis H5. Additionally, in accordance with SDT, the second finding indicates that internal motivation, influenced by emotions, greatly facilitates the modification of behavior, particularly in relation to food habits. People who experience good feelings, such pleasure or happiness, are more likely to fully understand and accept the importance of these healthy dietary habits. Our research revealed a significant and positive correlation (r=0.422, 95% CI [0.354, 0.484], p<0.000, Q(734.283)> χ^2=21.03, I^2=97.131%) between an individual's emotional state and his or her attitude toward maintaining a healthy diet. This highlights the influence of emotional reactions on individuals' attitudes and beliefs about the adoption and maintenance of healthy dietary practices, thereby providing support for Hypothesis H6. This discovery underscores the need to include emotional variables in treatments aimed at promoting positive attitudes toward healthy food choices. This aligns with prior research on health behavior and attitudes conducted by Ajzen and Fishbein (1975).

Moreover, the significant positive relationship between emotional response and healthy diet subjective norms (r=0.293, 95% CI [0.111, 0.456], p<0.000, Q(676.094)> χ^2=21.03, I^2=98.225%) suggested that individuals experiencing heightened emotional responses are more likely to perceive social pressure and expectations regarding healthy dietary behaviors, aligning with Hypothesis H7 and underscoring socioemotional influences on individuals' perceptions of normative behaviors related to diet. Furthermore, research on emotional behavior and perceived control by Bandura (1997) supports our finding of a strong positive correlation between emotional response and perceived behavioral control (r=0.291, 95% CI [0.178, 0.397], p<0.000, Q(264.299)> χ^2=21.03, I^2=95.46%), emphasizing the influence of emotional states on people' confidence in their capacity to manage their food choices and behaviors. This study corroborates Hypothesis H8 and underscores the need to address emotional variables in therapies designed to improve people's perceived control over their food behaviors.

In addition, research on health behavior intentions conducted by Ajzen (1991) confirmed our discovery of a strong positive correlation between emotional response and healthy behavior intentions (r=0.38, 95% CI [0.285, 0.468], p<0.000, Q(374.267)> χ^2=26.30, I^2=95.725%), emphasizing the impact of emotional reactions on people's motivation to adopt good eating habits. This discovery offers empirical evidence in favor of Hypothesis H9 and emphasizes the influence of emotional elements on people's intentions and motivations to adopt and sustain good eating habits.

Furthermore, subjective norms regarding a healthy diet had a significant impact on consumers' attitudes toward a healthy diet (r=0.235, 95% CI [0.176, 0.292], p<0.000; Q(77.731)> χ^2=21.03; I^2=84.562%); perceived behavioral control (r=0.185, 95% CI [0.085, 0.282], p<0.000; Q(222.298)> χ^2=21.03, I^2=94.602%); and health behavioral intentions (r=0.237, 95% CI [0.181, 0.293], p<0.000; Q(103.552)> χ^2=28.87, I^2=82.617%). Consequently, Hypotheses H10, H11, and H13 are supported by these findings. The results suggest that subjective norms related to a healthy diet play a pivotal role in enhancing consumers' attitudes, perceived behavioral control, and behavioral intentions, emphasizing their critical contribution to promoting healthier choices. These findings are consistent with prior research grounded in Ajzen's (1991) TPB, SN, and PBC toward a healthy diet. When consumers believe that their significant others (e.g., family, friends, society) value and endorse a healthy diet, it positively influences their attitude toward a healthy diet, intentions toward a healthy diet, and perceived behavioral control. Drawing from social cognitive theory (SCT) by Bandura (1986), when consumers perceive their significant others as successfully practicing a healthy diet, their self-efficacy and positive intentions increase. This, in turn, leads to increased adherence to a healthy diet. Additionally, if consumers perceive that their social network supports and encourages a healthy diet, their belief in their ability to control dietary choices strengthens, consequently elevating their perceived behavioral control.

Furthermore, consumers' healthy dietary behavioral intentions are significantly influenced by their attitude toward a healthy diet (r=0.498, 95% CI [0.418, 0.569], p<0.000; Q(494.404)> χ^2 (33.92); I^2=95.55%) and perceived behavioral control (r=0.433, 95% CI [0.324, 0.531], p<0.000; Q(546.187)> χ^2 (28.87), I^2=96.704%). Consequently, Hypotheses H12 and H14 find support in the data. Similarly, the health belief model (Rosenstock, 1974) explains that consumers who perceive themselves to be at risk of health problems or consider health to be of significant importance tend to harbor stronger intentions to adopt a healthy diet. In line with these perspectives, self-determination theory (Deci & Ryan, 1980) asserts that self-determined motivations significantly influence behavioral intentions toward healthy diet behaviors. Overall, the combination of attitudes toward a healthy diet, perceived behavioral control, health perceptions, and self-determined incentives all serve as influential elements that increase consumers' intentions to adopt a healthy diet. These results are consistent with previous research, especially in relation to Ajzen's (1991) TPB. According to this idea, individuals who are more inclined to adopt a healthy diet are more likely to have resolute intentions to practice good eating habits.

TPB provides additional evidence that having high levels of self-assurance and mastery of food choices play significant roles in developing strong intentions to embrace a nutritious diet. These views might contribute to their feelings of independence and connection with others. This leads to an augmentation of customers' self-determined motivations (Ryan & Deci, 2000). The TPB provides supportive evidence for the correlation between the intention to participate in healthy activities and the eventual adoption of healthy behavior (r = 0.433, 95% CI [0.307, 0.544], p<0.000, Q (347.946) > χ^2 (22.36), I^2 = 96.264%). Consequently, H15 has been substantiated with supporting evidence. Consumers' intentions to engage in health-promoting behaviors provide a unique framework for maintaining a healthy diet.

Meta-analysis results of moderator effects (H16) (H17) (H18)

To determine the moderating effect in a meta-analysis, the z test, a method developed by Hunter et al. (1990), was applied by assessing the statistical distinctions of influence on specific links between groups. As shown in Table 3, there was no significant difference in the moderating influence of demographic variables on the interplay between attitudes toward a healthy diet and behavioral intentions, including across gender groups (male: r=0.480, female: r=0.505, Z<1.96, P>0.05), age groups (less than 40 years: r=0.496, higher than 40 years: r=0.504, Z<1.96, P>0.05), and education groups (below college degree: r= 0.455, above college degree: r=0.568, Z<1.96, P>0.05). These outcomes suggest that gender does not significantly alter the association between attitudes toward a healthy diet and the intention to engage in corresponding behaviors. Moreover, when evaluating the moderating impact of demographic variables on the association between subjective norms and healthy diet-related behavioral intentions, significant differences in gender and education were found. Specifically, males (r=0.368) and females (r=0.356) exhibited a statistically significant difference, surpassing the threshold of Z>1.96 (P<0.05). Furthermore, an intriguing pattern emerged in terms of educational categories, revealing notable distinctions: below a college degree (r=0.202) and above a college degree (r=0.237) showed statistical significance, exceeding Z>1.96 (P<0.05). Conversely, age groups yielded no significant differences, with correlations of r=0.343 for those under 40 years and r=0.384 for those over 40 years (Z<1.96, P>0.05). When we shifted the focus to the moderating influence of demographic variables on the connection between perceived behavioral control and healthy diet-related behavioral intentions, no significant disparities were found across gender groups (male: r=0.272; female: r=0.427, Z<1.96, P>0.05); age brackets (less than 40 years: r=0.409; higher than 40 years: r=0.304, Z<1.96, P>0.05); or educational divisions (below college degree: r=0.418; above college degree: r=0.623, Z<1.96, P>0.05). These findings emphasize the intricate connections between demographic factors and the interaction between perceived behavioral control and healthy dietary intentions to adopt a healthy diet, emphasizing the complex nature of these linkages.

Table 3: Meta-analysis results of moderator effects (H16, H17, H18)

Hyp.	Variable		n	k	Effect size and 95% Confidence Interval			Heterogeneity				Significant difference
	Independent	Dependent			r	LCI	UCI	p value	χ^2	Q	I^2	
H16	AT	HBI										
Gender												N
Male			1551	4	0.480	0.185	0.695	0.000***	7.815	121.293	97.527	

	Female		5673	10	0.505	0.319	0.654	0.000***	16.919	592.874	98.482
	Age										N
	Less than 40		4463	10	0.496	0.309	0.646	0.000***	16.919	437.786	97.944
	Higher than 40		2749	4	0.504	0.242	0.697	0.000***	7.815	180.552	98.338
	Education background										N
	Under college		1322	5	0.455	0.215	0.644	0.000***	9.488	90.587	95.584
	college		5817	9	0.568	0.384	0.709	0.000***	15.507	621.470	98.713
H17	SN	HBI									
	Gender										Y
	Male		1036	3	0.368	0.111	0.579	0.000***	5.991	34.395	94.185
	Female		1959	7	0.356	0.066	0.591	0.000***	12.592	270.134	97.779
	Age										N
	Less than 40		2583	7	0.343	0.089	0.554	0.000***	12.592	278.942	97.849
	Higher than 40		336	3	0.384	0.036	0.649	0.000***	5.991	23.462	91.476
	Education background										Y
	Under college		1085	3	0.202	0.134	0.269	0.000***	5.991	2.613	23.494
	college		2391	7	0.237	0.083	0.379	0.000***	12.592	86.426	63.058
H18	PBC	HBI									
	Gender										N
	Male		1539	4	0.272	0.093	0.434	0.000***	7.815	36.299	91.735
	Female		4126	6	0.421	0.271	0.550	0.000***	11.07	129.168	96.129
	Age										N
	Less than 40		4584	7	0.409	0.284	0.519	0.000***	12.592	125.063	95.202
	Higher than 40		2843	3	0.304	0.124	0.465	0.000***	5.991	33.998	94.117
	Education background										N
	Under college		1036	3	0.418	0.110	0.653	0.000***	5.991	51.312	96.102
	college		5097	7	0.623	0.495	0.724	0.000***	12.592	240.376	97.504

Notes: Healthy diet attitude (AT), healthy diet subjective norms (SN), healthy diet perceived behavioral control (PBC), healthy diet behavior intentions (HBI)

CONCLUSIONS AND SUGGESTIONS

CONCLUSIONS

Several noteworthy conclusions emerge from the results of this study. First, self-determined motivations, encompassing autonomy, competence, and relatedness, exert a significant influence on consumers' attitudes toward a healthy diet, healthy diet subjective norms, and perceived behavioral control. These findings align with prior research; for instance, Teixeira et al. (2012) argue that self-determined motivations correlate with a more positive attitude toward a healthy diet, as perceived stress tends to result in unhealthy eating. Similarly, Verstuyf et al. (2012) contended that motivational dynamics play a role in shaping consumers' eating habits.

Moreover, these results corroborate previous research indicating the impact of self-determined motivation on theory of planned behavior (TPB) factors. Intrinsic and extrinsic motivations are associated with a sense of autonomy and internalization of norms, inspiring consumers to serve as positive role models and foster positive subjective norms (Goldberg, 2017; Markland, 1999). Research has shown that people's confidence in their ability to maintain a healthy diet positively influences their eating behaviors (Prestwich et al., 2014). Additionally, the study's findings suggest a potential mediating mechanism for the impact of healthy eating behavior intentions on outcomes, warranting consideration in future research.

Moreover, as argued by Hagger et al. (2006), a sense of self-determined motivation positively influences consumers' perceived behavior control, fostering a feeling of empowerment and capability in performing the behavior. Verstuyf et al. (2012) highlighted that higher self-determined motivations lead consumers to believe in their ability to control their eating habits and make healthy choices. Confirming this, Rhodes et al. (2004) noted that individuals with stronger self-determined motivations exhibit greater confidence in overcoming barriers and obstacles, enhancing perceived behavioral control.

Furthermore, the study results showed that emotional responses also play an important role in shaping consumers' motivations, attitudes, subjective norms, and perceived behavioral control toward healthy dietary habits. These results are in line with those of previous studies. Bandura (1997) suggested that emotional states can often be associated with a higher level of intrinsic motivation. A positive emotional mode may foster supportive social environments that further influence consumers' adherence to healthy eating norms. Emotions such as confidence and empowerment may enhance consumers' beliefs about the ability to control the healthiest choices. Lattimore et al. (2020) argue that an emotional eating tendency is associated with perceived behavioral control. Mercader-Rubio et al. (2023) argue that individuals with different levels of emotion regulation skills are more likely to exhibit intrinsic motivation and positive behavioral intentions toward healthy eating, underscoring the inference of emotional responses to motivation and behavioral intention factors. These study results contribute to our understanding of the influence of emotional responses and healthy eating behaviors.

ACADEMIC IMPLICATIONS

This research investigates the complex relationships between self-determined motives, emotional responses, and psychological variables that impact healthy behavioral intentions and behaviors. It utilizes self-determination theory, the theory of planned behaviors, the health belief model and social cognitive theory. The results have significant academic consequences that might influence the field of psychology and research on health behavior.

We firmly believe that by focusing on individual perceptions of healthy eating behavior, this study can significantly contribute to academicians and professionals in the following ways :

1. This study integrates Self-Determination Theory, Theory of Planned Behavior, and Experental Consumption Model to provide a comprehensive understanding of healthy eating behaviors, bridging motivational factors, cognitive processes, and emotional responses.
2. This research emphasizes the crucial role of emotional responses in shaping healthy eating behaviors, examining how positive and negative emotions influence dietary choices, contributing to a deeper understanding of eating behavior.
3. This research identifies key motivational antecedents, such as self-determined motivations and emotional responses, that influence healthy eating behavior intentions, enabling targeted interventions for promoting healthier dietary habits.
4. This study investigates the mediating role of self-determined motivations and emotional responses in the relationship between TPB factors and healthy eating intentions, highlighting the influence of these two mediators.
5. This study provides valuable insights for health interventions, suggesting that integrating emotional and cognitive aspects can enhance the effectiveness of healthy eating programs.
6. This study enhances understanding of health perception and risk communication, enabling effective strategies to motivate healthier eating habits by emphasizing long-term benefits and reducing perceived barriers.

MANAGEMENT IMPLICATIONS

From a managerial perspective, recognizing the impact of emotional responses and self-determined motivations on psychological determinants related to healthy eating behavior holds implications for promoting wellness initiatives within organizations. Managers can create a supportive environment that features positive emotional experiences and intrinsic motivations for making healthier dietary choices among employees. By integrating emotional and cognitive considerations into firms' policies and practices, managers can play a pivotal role in promoting healthier lifestyles and improving overall employee well-being.

Understanding the impact of self-determined incentives, societal norms, attitudes toward a healthy diet, perceived behaviors, and health perceptions on healthy behavioral intentions is crucial from a management perspective. These implications hold significance for organizations, politicians, and practitioners involved in promoting healthy behaviors. The following key management implications emerge:

1. Employee Motivation and Engagement: Managers can foster a supportive work environment by comprehending self-determined motivations. Providing opportunities for employees to engage in healthy behaviors aligned with their values and interests enhances motivation and overall engagement.

2. Organizational Culture and Norms: Establishing a health-conscious culture is paramount. Managers play a pivotal role in shaping norms that encourage and reinforce healthy behaviors through the implementation of policies, wellness challenges, and supportive networks.

3. Health Promotion and Education: Effective campaigns should take into account employees' attitudes toward a healthy diet. Communicating the benefits of a healthy diet, dispelling misconceptions, and providing credible information contribute to promoting healthier eating intentions.

4. Behavior Modeling and Reinforcement: Managers should lead by example and reinforce desired behaviors. Demonstrating healthy practices and acknowledging employees who exhibit them not only sets a positive precedent but also encourages others to follow suit.

5. Health Perception and Risk Communication: Providing accurate information about health status and the risks associated with an unhealthy diet is vital. Managers should communicate the potential

benefits of a healthy diet, influencing employees' perceptions and motivating them to align their intentions with better health outcomes.

6. Environmental Support: Managers can facilitate healthy behaviors by offering environmental support. This includes making healthy food options easily accessible, promoting mindful eating practices, and creating a physical environment that encourages and supports healthy choices.

Considering these implications empowers organizations and managers to promote healthy behavioral intentions, resulting in improved employee health, increased productivity, and a positive organizational culture centered around wellness.

LIMITATIONS AND FUTURE RESEARCH DIRECTIONS

This research has inherent limitations that warrant careful consideration. First, while the impact of healthy dietary behaviors has garnered attention, the number of studies testing specific hypotheses remains relatively small, despite the increasing overall volume of related research. Although meta-analysis, as suggested by Raju (1991), is a valuable method, its application is not without significant constraints. We acknowledge that our research framework does not address certain issues that may be highly relevant to the domain of healthy dieting, especially from a psychological perspective. These omissions are noted as limitations of this paper, and we encourage future research to validate and extend our findings in these areas.

First and foremost, the presence of heterogeneity across studies, encompassing variations in study design, participants, interventions, and outcomes, poses a challenge to the generalizability of findings. Second, the potential for publication bias introduces the risk of distorting overall effect size estimates, potentially leading to an overestimation of effects. Third, the quality of the included studies is different than that of the meta-analysis results; methodological flaws or biases within the studies may compromise the reliability of the findings. Fourth, meta-analyses offer group-level estimates, potentially obscuring vital variations at the individual level, a pitfall known as the ecological fallacy.

Moreover, issues such as data availability, selection bias, and the challenge of establishing causality in observational studies contribute to the limitations of meta-analysis. It is crucial to recognize that meta-analyses are bound by the variables for which sufficient data are available, rendering them a summary of the most frequently studied influencing factors, as noted by Borenstein (2009). Future studies should explore alternative theoretical frameworks to identify additional determinants. This avenue of research can offer a more comprehensive understanding of the complexities surrounding healthy dietary behaviors, addressing the limitations posed by the current research landscape.

Finally, meta-analysis is a powerful statistical technique used to synthesize and analyze data from multiple studies on a particular topic. Its strength lies in its ability to provide a comprehensive overview of the research findings across different studies, increasing statistical power and generalizability. By pooling data from multiple studies, meta-analyses can increase the sample size, which enhances the statistical power. This allows for more precise estimates of effect sizes and greater confidence in the findings. However, if the studies included in the meta-analysis exhibit substantial heterogeneity in terms of participant characteristics, interventions, outcome measures, or study designs, this can lead to variability in effect sizes across studies. As a result, the correlation between studies may be low, indicating inconsistency in the findings. Variations in study methodologies, such as sampling techniques, measurement instruments, or analytical approaches, can also contribute to differences in effect sizes across studies. These methodological differences may lead to low correlations between the studies included in the meta-analysis. Borenstein et al. (2010) argued that correlations higher than 0.5 can be considered relatively strong, while correlations below 0.3 may be viewed as weak. Among the 15 research hypotheses, only three of these correlations were lower than 0.3. Thus, this issue should be regarded as one of the limitations of a study.

DECLARATIONS

1. Ethical Approval (Consent to Participate and Consent for Publication):

Ethical considerations played a pivotal role in the execution of this study. Given that this research exclusively utilized data from previously published and publicly available sources, no new data were collected from human subjects. Consequently, ethical approval was not needed for this meta-analysis.

The researchers closely adhered to the highest ethical standards throughout the entire research process. The study ensured transparency and impartiality in terms of the data collection and synthesis, aiming for an accurate representation and interpretation of the findings. The intellectual property rights and ethical guidelines of the included studies were duly respected, with proper citation and referencing of all sources employed.

This study poses no risk to the privacy or confidentiality of any human subjects because it is based solely on the analysis of literature and previously published data. The authors affirm their commitment to upholding academic integrity and ethical conduct in all aspects of the study.

2. Funding:

This study did not receive any external funding.

3. Availability of Data and Materials:

The datasets used in this study, drawn from previously published and publicly available sources, are accessible upon request. For inquiries regarding data access, please contact the corresponding author, Mr. Yo-Yu Liu, at liuyoyu@gmail.com.

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