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Impact of vegetarian restaurant experiences on pro-environmental eating behaviors: a sustainable tourism perspective

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Introduction: The rapid rise of vegetarian tourism mirrors the global expansion of the plant-based food market. Despite this trend, limited research has explored how vegetarian restaurants influence consumers' pro-environmental behaviors through sensory experiences and the dissemination of green knowledge.

Methods: Guided by the Stimulus–Organism–Response (SOR) framework, this study developed and empirically tested a conceptual model linking sensory perception, perceived green knowledge, green mindfulness, eco-reflection, and environmentally friendly dietary behavior. A mixed-methods approach was adopted, combining qualitative exploration with a quantitative survey conducted among 615 diners at vegetarian restaurants in Shanghai.

Results: Structural equation modeling results indicated that sensory experience and perceived green knowledge significantly enhanced green mindfulness and eco-reflection, which in turn promoted environmentally friendly dietary behavior. Both direct and indirect pathways were significant, confirming the mediating roles of green mindfulness and eco-reflection within the SOR framework.

Discussion: These findings deepen theoretical understanding of sustainable consumption mechanisms in vegetarian dining contexts by identifying sensory and cognitive routes that foster pro-environmental dietary behavior. Practically, the results offer insights for vegetarian restaurant managers on designing sensory environments and educational strategies that encourage mindful eating and reduce food waste.

KEYWORDS

vegetarian restaurant, pro-environmental behavior, sensory experience, green knowledge, green mindfulness, eco-reflection, sustainable consumption, Stimulus–Organism–Response (SOR) model

1 Introduction

The rapid growth of vegetarian tourism reflects the significant expansion of the global plant-based food market, which is projected to reach USD 77.8 billion by 2025, indicating a notable rise in vegan practices and sustainable consumption patterns (Statista, 2023; Niederle and Schubert, 2020). This trend has contributed to the increasing popularity of vegetarian restaurants among tourists (Garnett et al., 2019). However, despite the industry's expansion, food waste remains a prevalent issue in the restaurant sector, and vegetarian restaurants are not exempt from this challenge; in

some cases, the problem is even more severe (Zeineddine et al., 2021). Meanwhile, a plant-based diet is considered environmentally beneficial due to its potential to reduce greenhouse gas emissions from livestock (Kim et al., 2020). Many vegetarian restaurants also promote organic and locally produced foods, offering consumers more environmentally friendly choices. Vegetarianism can help reduce the environmental damage caused by factory farming (Leighton, 2021). Plant-based foods served in vegetarian restaurants are beneficial to health, and healthy eating patterns help reduce the demand for medical resources, indirectly benefiting the environment (Violi et al., 2023). Therefore, investigating how and to what extent diners' environmentally friendly behaviors can be stimulated is of critical environmental and societal significance.

Although vegetarian restaurants offer environmentally friendly dining options, they often face challenges, particularly in delivering rich sensory experiences and effectively communicating environmental knowledge (Choi et al., 2022). The concepts of green mindfulness and eco-reflection are essential for vegetarian restaurants to provide immersive sensory perceptions and effectively convey environmental information (Banerjee et al., 2023). Green mindfulness emphasizes customers' awareness of the environmental impact of their choices, while eco-reflection involves thoughtful consideration of the benefits of vegetarian options (Abdollahzadeh, 2021). Both concepts contribute to shaping the dining experience and enhancing diners' environmental consciousness, potentially encouraging more sustainable consumer behaviors. Despite the increasing number of vegetarian restaurants, the extent to which sensory perception enhances green awareness and eco-reflection remains an area requiring further research (Parkin and Attwood, 2022). To address this issue, vegetarian restaurants should innovate their service and marketing strategies to educate and inspire diners about the environmental consequences of their choices while providing enjoyable meals. Tackling these challenges is crucial for the long-term success of vegetarian restaurants, as it relates both to their commercial viability and their authentic contribution to environmental sustainability. By enriching sensory experiences and improving the communication of environmental knowledge, vegetarian restaurants can better meet diners' preferences while promoting broader adoption of eco-friendly eating habits.

In the context of sustainable consumption, eco-friendly dietary practices have been extensively studied in tourism research (Vermeir et al., 2020; Galchenko et al., 2025). Sensory information plays a significant role in influencing tourists' behaviors (Alyahya and McLean, 2022; Agapito et al., 2017). However, research on sensory perception within vegetarian restaurants remains limited. There is a notable lack of comprehensive studies on the sensory cognition of green mindfulness and eco-reflection in the food service industry, as well as their impact on environmentally friendly eating behaviors and sustainability (Shishan et al., 2021). This study aims to address this gap by examining how vegetarian restaurants can enhance diners' experiences and promote eco-friendly behaviors through improved sensory perception and the dissemination of green knowledge. Specifically, this study will (1) investigate sensory perceptions and perceived green knowledge in vegetarian restaurants using both qualitative and quantitative methods, (2) analyze the effects of these attributes on green mindfulness and eco-reflection, and (3) evaluate how green mindfulness and eco-reflection influence environmentally friendly eating behaviors.

The conceptual model integrates sensory experiences at vegetarian restaurants, perceived knowledge of environmental issues, and their effects on green mindfulness and eco-reflection, ultimately influencing green dietary choices. This research is grounded in environmental psychology, consumer behavior, and sustainable development theory, incorporating the Stimulus-Organism-Response (SOR) framework to comprehensively examine how vegetarian restaurants can enhance customers' sensory experiences to promote eco-friendly eating habits (Spangenberg et al., 1997). By applying these theories and conducting empirical research, the study aims to provide specific strategies for vegetarian restaurants to reduce food waste and maximize environmental benefits, while also expanding the theoretical framework linking vegetarian restaurant operations with environmental conservation. The practical outcome of this research focuses on increasing the environmental benefits of vegetarian restaurants and minimizing food waste, whereas its theoretical contribution advances scholarly understanding of integrating vegetarian restaurant growth with sustainable practices.

2 Literature review

2.1 SOR theory

The Stimulus-Organism-Response (SOR) theory, developed by Mehrabian and Russell (1974), analyzes human behavior through three core elements: stimulus (external environmental cues), organism (internal cognitive-emotional processes), and response (behavioral outcomes). Originally applied in psychological studies, the framework has been widely adapted in consumer behavior and environmental psychology to explore how environmental stimuli shape emotional and cognitive reactions, and ultimately behaviors (Bitner, 1992; Eroglu et al., 2003). For instance, in hospitality research, SOR has been used to examine how restaurant atmospherics (stimulus) influence customer satisfaction (organism) and loyalty (response) (Ma and Chang, 2022; Muskat et al., 2019).

However, critical gaps remain in the application of SOR to sustainability-focused dining contexts—particularly vegetarian restaurants. First, existing SOR studies in hospitality primarily target general restaurants or hotels, with limited attention to vegetarian establishments, which serve as key venues for sustainable consumption (Badu-Baiden et al., 2024). For example, Badu-Baiden et al. (2024) applied SOR to vegan restaurants but focused on “attribute-benefit-value-intention” linkages, neglecting the role of pro-environmental behavioral outcomes (e.g., food waste reduction). Second, the “organism” component in most SOR models is limited to basic emotions (e.g., satisfaction) or general cognition, lacking context-specific psychological constructs like green mindfulness and eco-reflection that are critical to sustainable behavior (Kim and Jeon, 2024). Third, few studies integrate cultural contextual factors into SOR—such as the religious and cultural associations of vegetarianism in Chinese cities like Shanghai—even though cultural cues can amplify the impact of stimuli on organismic processes (Li et al., 2021).

Few studies consider cultural factors—such as temple tourism in Shanghai—that influence vegetarian consumption in China. Li et al. (2021) explore Chinese vegan tours but do not examine restaurant experiences, while Gvion (2023) focuses on Israeli vegan restaurants. This paper constructs a second-order structural equation model based

on the SOR theory to address this gap. The SOR framework is rarely applied to vegetarian restaurants, and its “organism” variables often lack green psychological constructs, such as mindfulness. [Badu-Baiden et al. \(2024\)](#) apply SOR to vegan restaurants but omit pro-environmental behavior; [Ma and Chang \(2022\)](#) use SOR in green restaurants but concentrate on satisfaction. [da Silva \(2024\)](#) applies the SOR model to the vegan industry but focuses on storytelling marketing.

This study addresses existing gaps by expanding the Stimulus-Organism-Response (SOR) framework to the context of vegetarian restaurants. Specifically, we define “stimulus” as sensory perceptions (e.g., restaurant ambiance, food presentation) and perceived green knowledge (e.g., environmental benefits of plant-based diets); “organism” as green mindfulness (awareness of environmental consequences) and eco-reflection (deliberation on the ecological value of vegetarianism); and “response” as environmentally friendly dietary behaviors (e.g., reducing food waste). This adaptation aligns with recent calls to refine the SOR framework for sustainability research by incorporating context-specific variables ([Fakfare and Wattanacharoensil, 2023](#)).

2.2 Vegetarian restaurant sensory perceptions

Vegetarian restaurants are increasingly recognized as more than just dietary venues—they represent lifestyle choices and social values, especially among middle-class consumers in East Asia who associate vegetarianism with health consciousness and social responsibility ([Gvion, 2023](#); [Liu et al., 2015](#)). Despite this, public adoption of plant-based diets remains limited ([Curtain and Grafenauer, 2019](#); [Dedehayir et al., 2022](#)), making vegetarian restaurants crucial for promoting sustainable consumption patterns through sensory experiences ([Kurz, 2018](#)).

Sensory perceptions—including visual (e.g., interior design), auditory (e.g., background music), olfactory (e.g., fresh ingredients), tactile (e.g., tableware texture), and gustatory (e.g., food flavor) cues—are well-established drivers of customer experience in restaurants ([Rašan et al., 2022](#); [Ryu and Han, 2011](#)). For instance, [Cho et al. \(2020\)](#) found that sensory marketing, such as pairing classical music with red plateware, enhanced customers’ evaluations of food quality. Similarly, [Chang and Cheng \(2023\)](#) demonstrated that the sensory design of cartoon-themed restaurants increased customer loyalty. However, these studies primarily focus on satisfaction or loyalty rather than pro-environmental behavior—a significant oversight for vegetarian restaurants, which emphasize sustainability ([Choi et al., 2022](#)).

Green mindfulness and eco-reflection help bridge this gap. Green mindfulness, defined as non-judgmental awareness of environmental consequences ([Schultz and Ryan, 2015](#)), is enhanced by sensory experiences. For example, the natural decor of a vegetarian restaurant (a visual stimulus) can prompt customers to reflect on their environmental impact ([Amel et al., 2009](#)). Eco-reflection, on the other hand, involves deep consideration of vegetarianism’s ecological benefits ([Li et al., 2021](#)). Sensory cues such as fresh, locally sourced ingredients (olfactory and gustatory stimuli) can reinforce this reflection by making abstract environmental values more tangible ([Parkin and Attwood, 2022](#)). Despite this, few studies have explicitly

linked sensory perceptions in vegetarian restaurants to these psychological constructs ([Parkin and Attwood, 2022](#)).

However, previous studies ([Thampanichwat et al., 2023](#)) have suggested that certain sensory elements can enhance green mindfulness. Therefore, in this paper, we incorporate a sensory scale to demonstrate the influence of sensory experiences on green mindfulness within a vegetarian context. Furthermore, [Green’s \(2016\)](#) research indicates that specific sensory elements can facilitate reflection. Building on these findings, this article aims to expand existing theories by demonstrating the impact of sensory factors on green mindfulness in a vegetarian setting. Based on this, the following assumptions are proposed.

Hypothesis 1: The sensory perception of vegetarian restaurants has a significant positive effect on green mindfulness.

Hypothesis 2: The sensory perception of vegetarian restaurants has a significantly positive impact on eco-reflection.

2.3 Perceived green knowledge

Perceived green knowledge refers to individuals’ awareness and understanding of environmental protection, particularly concerning the ecological benefits of products or services ([Maniatis, 2016](#)). It is categorized into two types: abstract knowledge, which involves personal interpretations of environmental issues, and concrete knowledge, which consists of factual information about practices such as plant-based diets ([Schahn and Holzer, 1990](#)). For consumers, green knowledge is a crucial predictor of pro-environmental decisions, as it reduces uncertainty regarding the impact of their choices ([Jaiswal and Kant, 2018](#)).

Green knowledge significantly influences green mindfulness: individuals with greater environmental awareness are more likely to maintain focus on their environmental actions ([Ericson et al., 2014](#)). For example, [Liu et al. \(2020\)](#) found that consumers who understood the carbon footprint of meat production (concrete green knowledge) were more mindful when choosing plant-based options. Similarly, green knowledge promotes eco-reflection by deepening understanding of environmental issues, encouraging individuals to connect daily choices (e.g., dining) with long-term sustainability ([Li et al., 2021](#)). In tourism contexts, travelers with green knowledge often use new experiences (e.g., dining at a vegetarian restaurant) to reflect on their lifestyle and adopt sustainable habits ([Osikominu and Bocken, 2020](#)).

Notably, vegetarian restaurants serve as unique venues for conveying environmental knowledge, as they can highlight the benefits of plant-based diets through menus, staff interactions, and decor ([Gvion, 2023](#)). However, existing research seldom explores how this knowledge interacts with green mindfulness and eco-reflection within vegetarian settings ([Banerjee et al., 2023](#)), resulting in:

Hypothesis 3: Perceived green knowledge has a significant positive impact on green mindfulness.

Hypothesis 4: Perceived green knowledge has a significant positive impact on eco-reflection.

2.4 Environmentally friendly dietary behavior

Environmentally friendly dietary behavior focuses on reducing the ecological impact of food consumption, including minimizing waste, reducing greenhouse gas emissions, and protecting biodiversity (Kim et al., 2020). Plant-based diets are a cornerstone of this behavior, as meat and dairy production contributes significantly to environmental pollution—adopting a vegetarian diet can reduce these emissions by up to 50% (Sabaté and Soret, 2014). In tourism, dining experiences often act as catalysts for such behavior, as travelers are more open to new practices (Nosrati et al., 2023).

Green mindfulness promotes environmentally friendly dietary behavior by enhancing self-awareness of the link between eating choices and the environment (Amel et al., 2009). For example, mindful consumers are more likely to avoid overordering (reducing waste) because they actively consider the environmental consequences (Remar et al., 2022). Mindfulness also strengthens commitment to sustainable actions by fostering empathy for environmental issues (Sajjad and Shahbaz, 2020).

Eco-reflection, meanwhile, is a prerequisite for sustained pro-environmental behavior. In tourism, reflective participation in activities like vegetarian dining helps visitors internalize environmental values and translate them into actions (Ballantyne et al., 2011). For instance, Lee et al. (2023) found that wildlife tourists who reflected on their impact were more likely to adopt eco-friendly eating habits post-trip. Without reflection, individuals may lack the motivation to act on their environmental awareness (Kollmuss and Agyeman, 2002).

Despite the established roles of mindfulness and reflection, few studies have tested their combined impact on environmentally friendly dietary behavior in vegetarian restaurants (Thiermann and Sheate, 2022). Chang and Cheng (2023) link sensory cues to loyalty; Jaiswal and Kant (2018) link green knowledge to decisions—but no integration. da Silva (2024) links storytelling credibility to brand trust

and perceived quality, and identifies the two as necessary conditions for purchase intention; Thampanichwat et al. (2023) links natural sensory elements in architecture to green mindfulness—but no integration of “sensory/green cognitive stimuli and green psychological mechanisms in vegetarian restaurant scenarios.” Based on the above theory:

Hypothesis 5: Green mindfulness has a significant positive impact on environmentally friendly dietary behavior.

Hypothesis 6: Eco-reflection has a significant positive impact on environmentally friendly dietary behavior.

Theoretical Novelty: This study expands the Stimulus-Organism-Response (SOR) framework by incorporating green mindfulness and eco-reflection as “organism” variables, and environmentally friendly dietary behavior as the gap in sustainability-focused SOR applications (Fakfare and Wattanacharoensil, 2023). *Mechanistic Novelty:* It integrates sensory perceptions (sensory stimuli) and green knowledge (cognitive stimuli) to explain how these factors jointly influence behavior through green psychological constructs, contrasting with prior studies that examine these variables in isolation (Parkin and Attwood, 2022). *Contextual Novelty:* The research focuses on vegetarian restaurants in Shanghai, where temple tourism (Ju, 2014) provides a unique cultural context for vegetarianism, thus addressing the lack of region-specific studies in China (Li et al., 2021) (see Figure 1).

3 Methodology

3.1 Research site

There are three main reasons for selecting Shanghai as the research site. First, Shanghai is a municipality with a long and rich

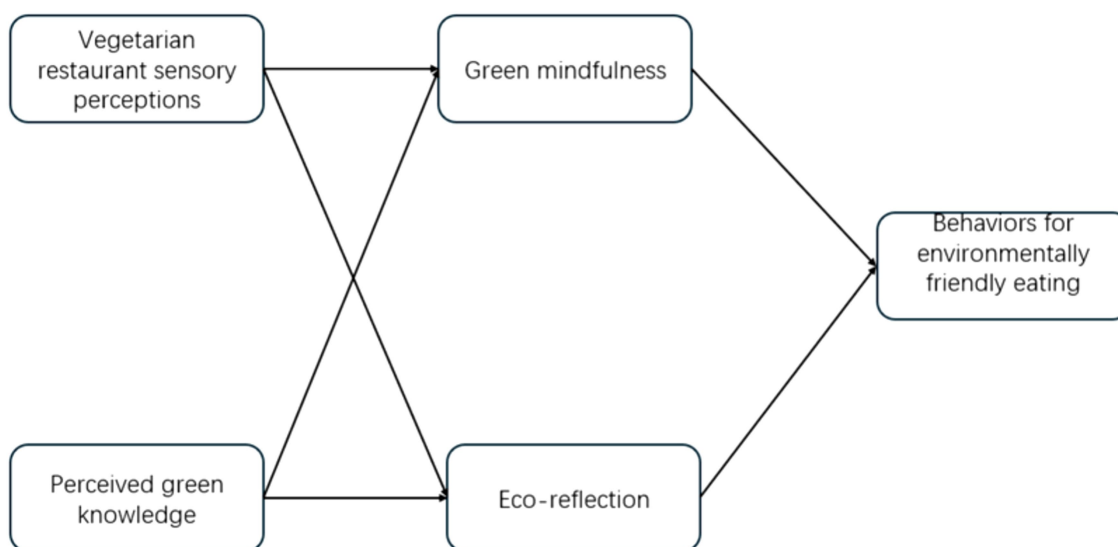


FIGURE 1
Model assumptions.

history. In ancient times, it served as an important fishing port, salt production area, and trade hub. Today, it stands as a major center of China's economy, finance, trade, shipping, and commerce. Since the 20th century, Shanghai has emerged as the most significant economic center in China and one of the largest cities in Asia. With its distinctive Shanghai cuisine, comfortable environment, and numerous tourist attractions, the city attracts both domestic and international visitors. During the 2024 National Day holiday, the total number of tourists reached 18.6225 million. The city's popularity among tourists has significantly contributed to the rapid development of its catering industry. Shanghai is also one of the earliest destinations in China for vegetarian dining. It hosts a wide variety of vegetarian restaurants, many of which have a long history and unique characteristics, such as Jing'an Temple Vegetarian Noodle House, Yiye Yitian Dizang Tea Vegetarian Hotpot, Dacai Wujie, and the Humanitarian Vegetarian Happy Village.

3.2 Scale design

A three-part survey was designed for this study. The first part included a screening question: "How would you describe your regular diet?" The second part consisted of five key constructs: sensory perception of vegetarian restaurants, perceived green knowledge, green mindfulness, eco-reflection, and environmentally friendly dietary behavior. The third part gathered demographic information, including age, gender, education level, and monthly income.

Based on existing literature, these constructs were slightly adapted to better fit the context of vegetarian restaurant settings. Sensory perception of vegetarian restaurants was measured following the work of [Chang and Cheng \(2023\)](#), with items such as "The vegetarian restaurant has an aesthetically pleasing environment" and "I enjoy the music in the vegetarian restaurant." The scale developed by Tan and Teng was adopted to measure perceived green knowledge, including items like "Vegetarian restaurants contribute to environmental protection" and "I understand the balance between livelihood and environmental conservation." Green mindfulness was assessed using four items from Dharmesti's scale (e.g., "When leaving the vegetarian restaurant, I make sure to turn off the power"). Eco-reflection was measured using three items adapted from Park (e.g., "I am able to reflect deeply on topics I care about"). Environmentally friendly dietary behavior was measured following the approach of [Kim et al. \(2020\)](#) (e.g., "When dining in restaurants, I minimize waste by reducing food waste"). All items across these constructs were evaluated using a 7-point Likert scale, ranging from 1 (strongly disagree) to 7 (strongly agree). A complete list of items is provided in [Appendix A](#).

The original questionnaire was translated from English. To ensure respondents' comprehension, the items were first translated into Chinese by the authors and then reviewed by three professional translators. To improve clarity and readability, the translated items were further examined by five master's students and three doctoral students. Prior to the main data collection, a pilot study was conducted to validate the questionnaire's reliability and effectiveness, and to ensure the comprehensibility of all items. This study adopted purposive sampling, a non-probability sampling method. In October 2024, a total of 55 valid responses were collected in Shanghai during

the pilot phase. The statistical analysis indicated satisfactory reliability and validity of the questionnaire (Cronbach's $\alpha > 0.70$).

In November 2024, a preliminary field investigation was conducted in collaboration with staff at ten vegetarian restaurants in Shanghai. These restaurants were representative vegetarian establishments, offering exclusively plant-based food and beverages. Three researchers participated in the fieldwork and visited each restaurant to explain the purpose of the study to customers. After their meals and payment, between 60 and 66 customers at each location were invited to complete the survey. Among the 625 returned questionnaires, three were excluded due to abnormal responses and seven due to missing data, resulting in a total of 615 valid responses. The overall response rate was 98.4%.

This study employed SPSS v.26 and SmartPLS 4.0 for data analysis. SPSS v.26 was used for descriptive statistics and preliminary data processing. First, demographic characteristics were summarized through descriptive analysis. Second, exploratory factor analysis (EFA) was conducted to identify the underlying structure of the proposed constructs. Third, confirmatory factor analysis (CFA) was performed to ensure the reliability and validity of the constructs. Finally, structural equation modeling (SEM) was used to examine the direct effects among variables.

4 Discussion

4.1 Sample analysis

The demographic profile of respondents shows that female participants (54.0%) slightly outnumbered male participants (46.0%). The majority were aged 18–25 (48.0%), followed by those aged 26–30 (22.8%), with only a small proportion over 60 years old (4.4%). Regarding educational background, most respondents held a bachelor's degree (47.6%), while a small percentage had completed education at junior high school or below (5.2%), and the smallest proportion held a postgraduate degree (5.0%). The most common monthly income bracket was below 3,000 RMB (47.8%), whereas only 9.4% reported earning more than 10,000 RMB per month. In terms of dietary type, non-vegetarians were the most prevalent (50.2%), followed by flexitarians (29.3%) and vegetarians (10.9%). Detailed information is provided in [Appendix B](#).

To validate the viability of the second-order model structure, this study employed exploratory factor analysis (EFA) using principal component extraction and varimax rotation ([Hair et al., 2019](#)). Initially, five subdimensions were identified within the sensory perception aspect of vegetarian restaurants. The EFA results indicated that all factor loadings exceeded 0.50, and

TABLE 1 Discriminant validity.

Item	BFEFE	ER	GM	PGK	VRS
BFEFE	0.811				
ER	0.617	0.832			
GM	0.664	0.572	0.835		
PGK	0.492	0.584	0.547	0.780	
VRS	0.507	0.523	0.688	0.527	0.802

Tolerance > 10.

eigenvalues were greater than 1.0. Collectively, these dimensions accounted for 59.48% of the total variance. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was 0.963, and Bartlett's test of sphericity produced a p -value of 0.000, confirming the model structure's suitability and reliability.

Additionally, the skewness and kurtosis of the data were analyzed to assess normality (Hair et al., 2019). As shown in Table 1, the absolute values of skewness were all below 3, and those of kurtosis were all under 10, indicating that each variable met the criteria for a normal distribution. Further details can be found in Appendix C.

4.2 EFA and measurement refinement

To assess the reliability of the model structure, the second-order structure was independently evaluated. Exploratory factor analysis (EFA) was conducted using principal component extraction and varimax rotation to validate the second-order model structure (Hair et al., 2019). This analysis identified five subdimensions within the sensory perception construct of vegetarian restaurants. The EFA results showed that all factor loadings exceeded 0.50, and all eigenvalues were greater than 1.0. Collectively, these dimensions accounted for 55.72% of the total variance. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was 0.940, and Bartlett's test of sphericity was significant ($p < 0.001$), confirming the reliability of the model structure.

4.3 Measurement model analysis and CFA

Confirmatory factor analysis (CFA) was performed to evaluate the reliability and validity of the measurement model. Table 1 illustrates that the factor loadings (FL) and average variance extracted (AVE) for each second-order construct surpassed the suggested minimum of 0.5 (Hair et al., 2019), thereby confirming convergent validity. Additionally, both

Cronbach's alpha (α) and composite reliability (CR) values were greater than 0.7, demonstrating satisfactory internal consistency.

The model fit indices also demonstrated an acceptable fit to the data: $\chi^2/df = 2.897$, $p = 0.000$; CFI = 0.910; NFI = 0.868; SRMR = 0.130; RMSEA = 0.056. These results are presented in Tables 2, 3. Additionally, the FL, CR, and AVE values for both the first-order and second-order models met recommended thresholds, indicating acceptable levels of reliability and validity.

By comparison, discriminant validity was assessed by examining the square root of the average variance extracted (AVE) for each construct and comparing it to the correlations between constructs (Table 1). The bolded diagonal elements represent the square roots of the AVEs. As shown, the square root of each construct's AVE exceeds its correlations with other constructs, indicating adequate discriminant validity.

In this study, common method bias was verified using Variance Inflation Factor (VIF), and the maximum VIF value was 1.486, which is far less than the criterion of 3.3. Therefore, common method bias does not exist.

As shown in Table 4, the R^2 value for GM is 0.520, indicating that 52% of the variance is explained, and the Q^2 value is 0.359, which is greater than 0, demonstrating good predictive relevance. The R^2 value for ER is 0.405, explaining 40.5% of the variance, with a corresponding Q^2 value of 0.277, also greater than 0, indicating good predictive relevance. For BFEFE, the R^2 value is 0.525, indicating that 52.5% of the variance is explained, and the Q^2 value is 0.343, again greater than 0, suggesting strong predictive capability.

4.4 Hypothesis testing and mediation effect analysis

As shown in Table 5 and Figure 2, all path coefficients are greater than 0.2, and all p -values are less than 0.001, indicating that all

TABLE 2 Measurement model.

Item	FL	Cronbach's α	CR	AVE
SIG1	0.830	0.793	0.879	0.707
SIG2	0.836			
SIG3	0.857			
SM1	0.853	0.816	0.890	0.730
SM2	0.862			
SM3	0.849			
SO1	0.827	0.803	0.884	0.718
SO2	0.854			
SO3	0.860			
TA1	0.844	0.772	0.868	0.687
TA2	0.815			
TA3	0.827			
TO1	0.869	0.836	0.902	0.754
TO2	0.870			
TO3	0.866			

$N = 615$. Standardized factor loadings > 0.70 ; Cronbach's $\alpha > 0.80$; Composite reliability > 0.70 ; Average variance extracted > 0.50 (SIG, Sight; SM, Smell; SO, Sound; TA, Taste; TO, Touch).

TABLE 3 Reliability and validity analysis of first-order and second-order models.

Variable	Item	Factor loading	Cronbach's alpha	CR	AVE
BFEFE	BFEFE1	0.816	0.870	0.906	0.658
	BFEFE2	0.822			
	BFEFE3	0.820			
	BFEFE4	0.799			
	BFEFE5	0.799			
ER	ER1	0.830	0.777	0.871	0.692
	ER2	0.827			
	ER3	0.838			
GM	GM1	0.825	0.856	0.902	0.698
	GM2	0.834			
	GM3	0.831			
	GM4	0.851			
PGK	PGK1	0.804	0.893	0.916	0.608
	PGK2	0.753			
	PGK3	0.781			
	PGK4	0.767			
	PGK5	0.788			
	PGK6	0.799			
	PGK7	0.767			

Item	Second-order CFA	FL	Cronbach's α	CR	AVE
VRS	SIG	0.859	0.951	0.900	0.643
	SM	0.859			
	SO	0.859			
	TA	0.859			
	TO	0.859			

$N = 615$. Standardized factor loadings > 0.70 ; Cronbach's $\alpha > 0.80$; Composite reliability > 0.70 ; Average variance extracted > 0.50 (VRS, Vegetarian Restaurant Sensory Perception; PGK, Perceived Green Knowledge; GM, Green Mindfulness; ER, Eco-Reflection; BFEFE, Behavior of Following Environmentally Friendly Eating).

TABLE 4 R-square and Q-square values.

Variables	R-square	Q-square
GM	0.520	0.359
ER	0.405	0.277
BFEFE	0.525	0.343

$R^2 > 0.33$ indicates acceptable explanatory power; $Q^2 > 0$ indicates predictive relevance.

hypotheses are supported. Moreover, none of the 95% confidence intervals include zero, suggesting that all mediation effects are statistically significant.

5 Conclusion and discussion

As vegetarianism and sustainable consumption continue to grow, the importance of veganism for destination management organizations and various industries is becoming increasingly evident, drawing significant scholarly attention to tourists' attitudes toward veganism (Gomez et al., 2018; Niederle and Schubert, 2020). Consistent with these studies, our research emphasizes that tourists' sensory

experiences in vegetarian restaurants and their perceived environmental knowledge are crucial factors influencing eco-friendly eating behaviors. This aligns with earlier research indicating that dining experiences often serve as catalysts for broader lifestyle changes, especially when linked to sustainability (Nosrati et al., 2023).

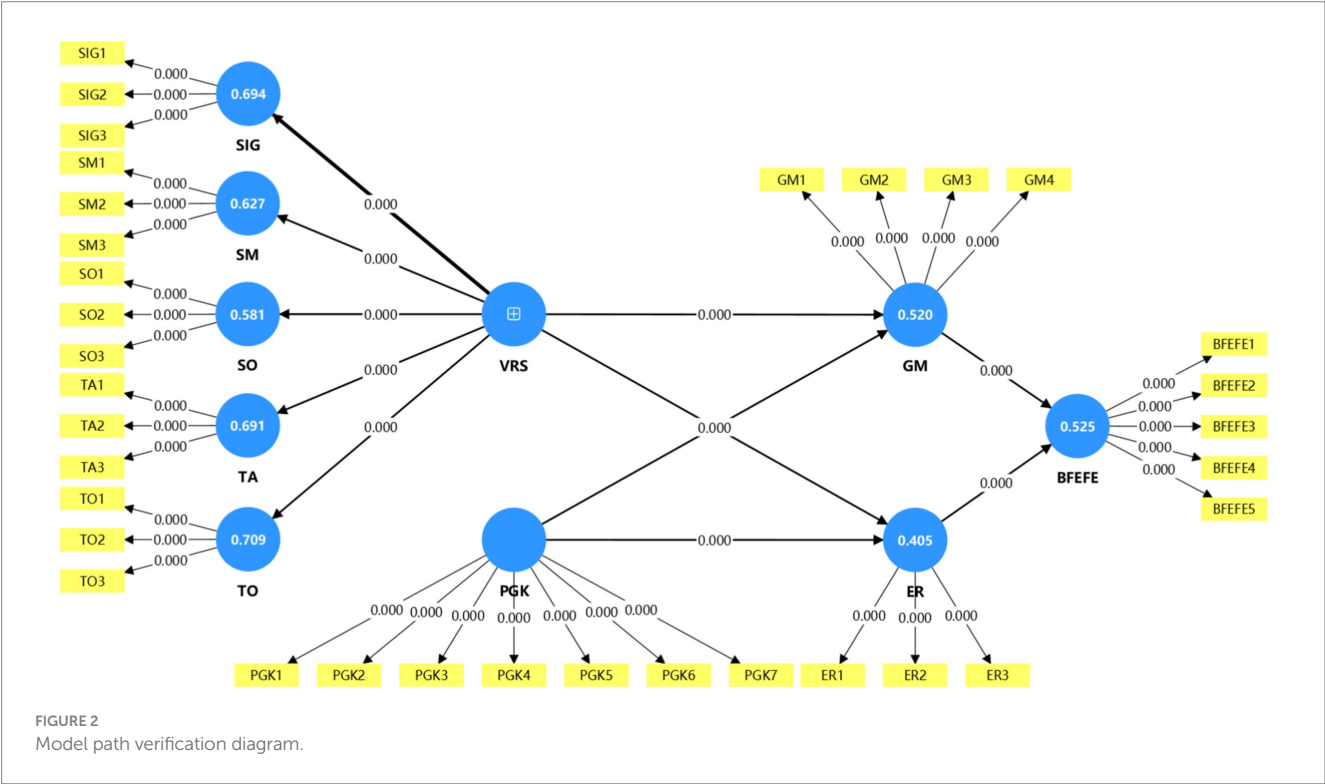
Our findings indicate that adopting veganism not only benefits physical health but also supports environmental conservation, reinforcing current perspectives that plant-based diets function as both a personal health strategy and an expression of ecological responsibility (Harvard Health Publishing, 2024). Notably, sensory experiences in vegetarian restaurants were shown to enhance tourists' environmental awareness and eco-reflection, thereby influencing their environmentally friendly dining choices. This supports Ahn's (2024)

TABLE 5 Path and mediation testing.

Path	Path Coefficient (β)	STDEV	t	p	Result
VRS -> GM	0.553	0.038	14.647	0.000	Supported
PGK -> GM	0.256	0.036	7.161	0.000	Supported
PGK -> ER	0.427	0.045	9.520	0.000	Supported
VRS -> ER	0.297	0.047	6.270	0.000	Supported
GM -> BFEFE	0.463	0.038	12.310	0.000	Supported
ER -> BFEFE	0.353	0.038	9.400	0.000	Supported

Path	Effect	STDEV	t	p	95%CI	
					Lower	Upper
PGK -> GM -> BFEFE	0.118	0.019	6.071	0.000	0.083	0.159
PGK -> ER -> BFEFE	0.151	0.024	6.294	0.000	0.108	0.201
VRS -> GM -> BFEFE	0.256	0.027	9.319	0.000	0.203	0.310
VRS -> ER -> BFEFE	0.105	0.019	5.401	0.000	0.068	0.143
PGK -> GM -> BFEFE	0.118	0.019	6.071	0.000	0.083	0.159

$p < 0.001$ indicates high statistical significance; path coefficient > 0 indicates a positive effect; path coefficient > 0.2 suggests theoretical significance; confidence intervals that do not include zero indicate the presence of a mediation effect.



research, which highlights mindfulness as a mediator between knowledge and behavior, and further expands on it by providing empirical evidence demonstrating how sensory experiences combined with environmental knowledge strengthen eco-reflection.

The situation in Shanghai provides additional insight. The simultaneous promotion of temple tourism during the research period (Ju, 2014) created a cultural environment that fostered awareness of vegetarian habits and vegan principles. This suggests that integrating cultural and religious tourism can encourage environmentally friendly

behaviors. While previous studies primarily focused on motivations such as health or status (Lin et al., 2021), our findings emphasize the significance of culturally rooted experiences, indicating that veganism in tourism is influenced not only by personal motivations but also by socio-cultural contexts.

Interestingly, even tourists who hold a less favorable view of vegetarian restaurants are still indirectly influenced through processes such as green mindfulness and eco-reflection. This suggests that the impact of dining experiences on environmentally friendly behaviors is not

straightforward but operates through indirect cognitive and emotional pathways. Similar patterns have been observed in research on sustainable tourism decisions, where experiential shortcomings are offset by deeper reflective thinking (Wong et al., 2022). Therefore, vegetarian restaurants might intentionally promote eco-reflection to compensate for any deficiencies in sensory appeal or the information they provide.

In conclusion, this research confirms that sensory experiences and perceived green knowledge in vegetarian restaurants positively influence tourists' green mindfulness and eco-reflection, which, in turn, promote environmentally friendly eating behaviors. Beyond providing statistical evidence, the results deepen our understanding of how environmental values are internalized within dining settings and highlight vegetarian restaurants as important micro-environments where ecological awareness is both expressed and practiced.

6 Theoretical implications

This study's theoretical contribution lies in applying the Stimulus–Organism–Response (SOR) framework to investigate customer behavioral intentions in vegetarian restaurants (Badu-Baiden et al., 2024). Although the SOR theory has been extensively used in hospitality research to analyze emotional and cognitive reactions (Ma and Chang, 2022), its application in sustainability-focused dining settings remains limited. By demonstrating that sensory experiences combined with green knowledge promote mindfulness and eco-reflection, this research advances the theory in two key ways.

First, this study expands the SOR framework by highlighting the mediating roles of green mindfulness and eco-reflection. While earlier research often viewed sensory stimuli as having a direct impact on satisfaction or loyalty, our findings indicate that the pathway to eco-friendly behavior is more nuanced and involves reflective psychological processes (Ahn, 2024; Wong et al., 2022). Second, by focusing on a vegetarian dining context, the study emphasizes how culturally specific dining environments—such as temple tourism in Shanghai—strengthen the SOR process. This suggests that external cultural factors can enhance internal organismic responses, thereby broadening the explanatory power of the SOR model.

Overall, these findings contribute to the expanding body of research on sustainable dining and tourism by demonstrating that eco-reflection and mindfulness are not merely incidental outcomes of dining experiences but are fundamental mechanisms driving pro-environmental behavior.

6.1 Practical implications

From a managerial perspective, this study highlights several practical strategies for vegetarian restaurants and the broader sustainable dining industry. Consistent with Kim and Jeon (2024), establishments should enhance the multi-sensory dining environment—utilizing interior design, scents, and fresh food presentations—to foster positive sensory experiences. However, beyond visual and sensory appeal, the research emphasizes integrating sensory design with communication about environmental knowledge. For example, menus could highlight ecological benefits, ingredient origins, or food miles, thereby connecting sensory pleasure with environmental awareness.

Additionally, prioritizing staff training is essential to enable employees to effectively communicate the ecological and health benefits of veganism. Previous studies show that when staff personally embrace plant-based values, they are better able to meet customer expectations (Bertella, 2018). Thus, employees can serve not only as service providers but also as advocates for sustainability. Vegetarian restaurants should also explore partnerships with cultural organizations, such as temples or eco-tourism groups, to situate dining experiences within broader cultural sustainability narratives.

Lastly, by fostering an environment of environmental awareness, vegetarian restaurants can compensate for limitations in sensory variety or menu options. This approach not only enhances customer satisfaction but also cultivates lasting loyalty among eco-conscious patrons, supporting both sustainability goals and business success.

6.2 Limitations and future directions

Although this study offers valuable insights, it has several limitations that warrant further investigation. First, the model was developed in Shanghai, a large city with strong cultural and religious ties to vegetarianism, which may limit its applicability in other contexts (Mou et al., 2020). Future research should apply the framework in smaller cities or international settings to assess cultural differences.

Second, the study focused exclusively on local tourists and excluded international visitors. Given that cultural backgrounds influence perceptions of food and sustainability, comparative research involving diverse visitor groups could provide a deeper understanding of how vegetarian dining affects environmentally friendly behaviors.

Third, the study did not differentiate between various types of vegetarian restaurants, such as budget buffets, religious venues, or gourmet establishments. Categorizing these types could reveal nuanced relationships among sensory experiences, knowledge, and eco-reflection. Additionally, future research should expand the model by incorporating factors such as lifestyle preferences, food safety concerns, and menu innovation. For example, the impact of eco-reflection on long-term behavioral change could be examined, and cross-cultural comparisons might determine whether green mindfulness operates similarly in collectivist versus individualist cultures. These efforts would not only strengthen the theoretical framework but also offer practical guidance for professionals seeking to develop tailored strategies for sustainable dining.

Data availability statement

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

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. Written informed consent from the

[patients/participants or patients/participants legal guardian/next of kin] was not required to participate in this study in accordance with the national legislation and the institutional requirements.

Author contributions

YW: Methodology, Conceptualization, Writing – review & editing, Writing – original draft. XZ: Visualization, Software, Data curation, Writing – original draft, Writing – review & editing. BS: Formal analysis, Writing – review & editing, Investigation, Resources.

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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.2025.1658177/full#supplementary-material>

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