

Pathways to green food purchases: exploring the nexus of attitudes, habits and lifestyles using SEM and NCA

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Abstract

Purpose – Green food consumption offers a promising avenue for reducing the negative environmental impacts of the food sector. However, the challenge lies in reshaping food-related behaviors that are deeply embedded in habits and lifestyles. This study explored how attitudes, purchasing habits and food-related lifestyle characteristics influence the intention to purchase green food products.

Design/methodology/approach – This study utilized a representative survey of 475 residents from Budapest, Hungary. Data were gathered through a structured questionnaire adapted from established literature. The analysis was conducted using partial least squares structural equation modeling (PLS-SEM) and necessary condition analysis (NCA).

Findings – The findings of this study revealed that attitudes, green habits and food-related lifestyle characteristics positively influence green food purchase intentions. Among these factors, green habits emerged as the most influential, while food innovation had the least impact. Furthermore, the necessary condition analysis (NCA) identified attitude as the sole necessary condition, albeit with a low-to-moderate effect size.

Originality/value – These findings hold significant implications for policymakers and managers, who can leverage this information to foster green food purchase intentions. By gaining deeper insights into the characteristics of their target markets and employing tailored communication strategies, they can more effectively promote sustainable consumption behaviors.

Keywords Green food, Purchase intention, Buying habits, Food innovativeness, Environmental responsibility, Structural equation modeling, Necessary condition analysis

Paper type Research paper

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1. Introduction

Global food production and consumption are currently unsustainable, contributing to climate change, depleting natural resources, and causing various ecological issues (Garrett, 2013). In particular, the consumption of meat, processed foods, and dairy products poses a significant burden on the environment (Notarnicola *et al.*, 2017). Additionally, rising consumption levels counteract the benefits of transitioning to cleaner production methods (Clark, 2007), leading to high resource use and greenhouse gas emissions (Tubello *et al.*, 2021). Addressing consumer food choices is, therefore, essential for mitigating environmental degradation. One strategy to reduce the negative impacts of food consumption is to promote green food purchasing behaviors (Liu *et al.*, 2012). Thus, understanding the factors that shape consumers' food purchasing decisions is crucial for supporting this transition (Ahmad, 2010).

This study examines the antecedents of green food purchasing behavior, focusing on consumers in Budapest, Hungary. While Hungarian consumers often show a preference for traditional food products, the country also exhibits trends similar to those observed in Europe and other developed nations. As a result, our findings offer insights that extend beyond Hungary's borders.

Similarly to most countries, the wasteful use of resources is present in Hungarian households manifesting in large quantities of food waste. Regarding their choices, Hungarian consumers often prefer local food products driven by economic, social, and environmental benefits. This ethnocentrism is also seen in other European countries, where local products are often preferred for the perceived quality and support of local economies (Garai-Fodor and Popovics, 2022, 2023). Health is a significant concern for Hungarian consumers, similar to trends observed across Europe. However, there is often a gap between the importance placed on health and actual consumer behavior, which is a common issue in many European countries as well (Papp *et al.*, 1996).

Moreover, globalization, digitalization, and economic and health crises (such as the COVID-19 pandemic) have influenced Hungarian food purchasing preferences, as in other European countries. These factors also contribute to consumer ethnocentrism and preferences for domestic products (Garai-Fodor and Popovics, 2022).

Green consumption in general encompasses consumer decisions that result in low environmental damage, reduced levels of pollution and resource use, and minimized negative social impacts without compromising current needs (Liobikienė and Bernatienė, 2017). The growing preference for green products is evident in a recent global survey by Simon-Kucher and Partners (2021), which showed that one-third of respondents considered sustainability to be a significant purchase criterion.

More specifically, green food consumption has been identified to include purchasing organic food products, consuming local and regional food, preferring fresh vegetables and fruits to processed food, and reducing meat consumption (Brons and Oosterveer, 2017).

Green food consumption is expected to become a significant part of future food consumption owing to the increasing environmental awareness of the population (Ashaolu and Ashaolu, 2020). Certain growth trends are already evident across various categories of green food products. Precooked plant-based foods are gaining popularity because they are practical, convenient, healthy, and beneficial to the environment (Chang *et al.*, 2021). The alternative protein market also shows a growing tendency, which demands meat substitutes such as plant-based burgers (Li *et al.*, 2023). Likewise, organic food is popular among green consumers, as it is produced using environmentally sustainable practices (Rashid and Lone, 2023) and is also recognized as beneficial for health (Rizzo *et al.*, 2020). The rapid growth in organic food market has been observed since the COVID-19 pandemic (Chaturvedi *et al.*, 2024). Based on these facts, it is inferred that green food market has potential for future growth. Additionally, there has been a noticeable increase in the popularity of green food due to the advent of digital media. In particular, social media has emerged as a significant influencer in forming consumers' intentions towards green food choices (Armutcu *et al.*, 2024).

However, a significant gap between attitudes towards the environment and actual environmental behavior still exists. This is evident from ElHaffar *et al.* (2020), who reviewed 58 articles addressing what they refer to as the green gap phenomenon and defined it as “the

inconsistency between what the individual says regarding his/her growing concern about the environmental problems and what he/she does in terms of actions, behaviors, and contributions to lessen the consequences of these problems.”

Their overall conclusion, based on the reviewed articles, is that the green gap cannot be resolved in the short term; thus, it should be extensively researched, especially in light of its continuous evolution.

They identified two primary research streams to address the attitude-intention-behavior gap in green consumption: namely rational and behavioral insight approaches. Based on the recommendations of this review, the current study incorporates rational aspects by using the Theory of Planned Behavior and adds behavioral factors such as habits and lifestyle.

Studying the determinants of an important aspect of green food consumption, namely green food purchase intention, can assist policymakers and marketers in influencing consumers’ food-buying decisions. The literature points out that attitude is an important determinant of behavioral intention, which, in turn, influences purchase behavior (Ajzen, 1991; Fishbein and Ajzen, 1980). However, later evidence has revealed mixed results regarding the attitude-intention relationship (Aguirre Sánchez *et al.*, 2021), suggesting a gap between positive attitude and actual behavior (Nguyen *et al.*, 2019; Park and Lin, 2020; Yamoah and Acquaye, 2019). Hence, there is a need to critically assess the necessity of attitude as a determinant of green consumer behavior and explore behavioral factors, such as habits and lifestyle, which can contribute to explaining the complex nature of green food purchase decisions (Aydin and Yildirim, 2021; Ghazali *et al.*, 2018; Xiao *et al.*, 2022).

In food decisions, consumers have low involvement, and their behavior is often guided by habits. Various scholars have highlighted that habits often guide food choices, leading to unplanned and automatic behavior (Ajzen, 2002; Honkanen *et al.*, 2005; Rebar *et al.*, 2018; Verplanken, 2006). The role of food habits has implications for policymakers and marketing managers in formulating behavioral interventions. However, strength of habits is not equally pertinent in all types of food purchase decisions (Daunfeldt *et al.*, 2012). Therefore, it is important to understand the role of habits in explaining specific food purchase intentions such as green food purchase intentions.

Similarly, lifestyle has been shown to be positively related to sustainable consumption (Mataracı and Kurtuluş, 2020; Tang *et al.*, 2020). In the food context, Brunsø *et al.* (2021) proposed the core aspects of food-related lifestyles, such as food innovativeness and food-related environmental responsibility. In this study, these core dimensions (food innovativeness and food-related environmental responsibility) were used to understand green food purchase intentions. Food innovativeness is relevant to green food purchase behavior because green food consumption involves the adoption of unusual or unconventional food items, including meat alternatives, plant-based proteins (Bakhsh *et al.*, 2021), and organic food products (Zarei and Maleki, 2018). A recent study highlighted food innovativeness as a key factor affecting organic food purchases (Persaud and Schillo, 2017) and seaweed consumption behavior (Govaerts and Olsen, 2022). Moreover, it has been shown that consumers’ sense of environmental responsibility is a basic and significant psychological determinant of pro-environmental behavior (Hines *et al.*, 1987), which can also be expressed in consumer food purchase decisions. This factor, however, has not been assessed often in green food research to date.

Based on the literature review and the identified research gap, the primary purpose of this study is to answer two research questions: first, whether attitude, habits, and psychological and lifestyle characteristics affect green food purchase intention and second, which of these factors are necessary to develop green food purchase intentions.

Our study contributes to the literature on green food consumption in three ways. First, while attitudes are often assessed regarding green food purchasing behavior, we added habits, food innovativeness and food related environmental responsibility to our model, which have rarely been addressed before in this context. Second, we used a combination of two methods, namely Structural Equation Modeling (SEM) and Necessary Condition Analysis (NCA) to increase the reliability of our results. Third, using a large, representative sample, our research revealed

the characteristics of the residents of a large European capital, namely Budapest, Hungary, with regard to their green food purchase intentions.

The remainder of this paper is organized as follows. In the following section, we introduce the relevant literature and develop our conceptual framework. Our research methods are detailed in the third section, while the results are presented in section four, which is followed by the discussion and implications of the results and a presentation of conclusions and recommendations for future research.

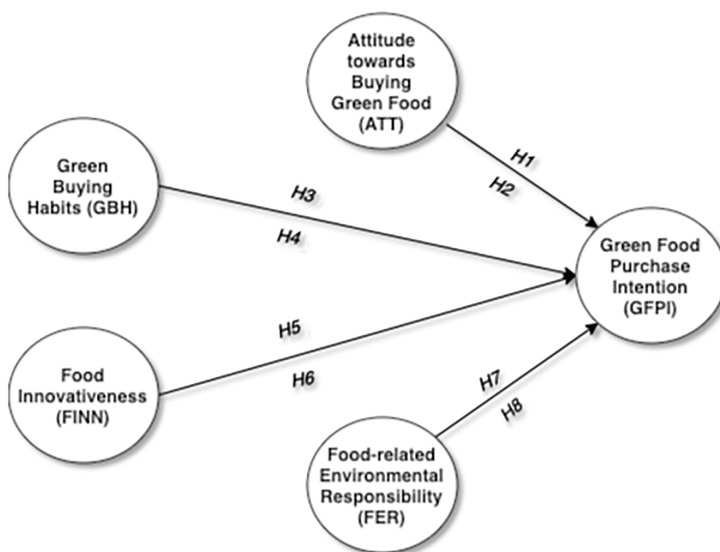
2. Literature review and conceptual framework

Over the past decade, several studies have investigated the characteristics of sustainable food-related behaviors such as preference for meat alternatives, choice of sustainable diet, purchase of organic food products, and purchase of green food. These studies attempted to empirically analyze the critical factors affecting these behaviors, such as contextual variables (Nguyen *et al.*, 2021; Stranieri *et al.*, 2017a), individual demographic characteristics (Stranieri *et al.*, 2017), personality traits (Pucci *et al.*, 2021) beliefs, attitudes, environmental values (Shen and Chen, 2020), digital media (Chaturvedi *et al.*, 2024), and health consciousness (Qi and Ploeger, 2021). Moreover, the study of Qi *et al.* (2020) highlighted the influence of situational factors, particularly COVID-19 pandemic, on increase in preference for green food.

Despite a growing number of studies on green food-related behavior, the relationship between attitude and intention remains equivocal (ElHaffar *et al.*, 2020). Moreover, little attention has been paid to examining other factors, such as buying habits, consumer food innovativeness, and environmental responsibility in the food context. An assessment of these concepts can lead to a better understanding of green food purchase behavior; thus, we propose the conceptual framework presented in Figure 1.

2.1 Attitude towards green food purchase (ATT)

According to Ajzen (1991), attitude is “the degree to which a person has a favorable or unfavorable evaluation or appraisal of a behavior.” Recent research on green food behavior has highlighted the importance of attitude in explaining the intention to behave in a certain way



Source(s): Authors' own work

Figure 1. Conceptual framework

(Alagarsamy *et al.*, 2021; He *et al.*, 2019; Nguyen *et al.*, 2021). A significant attitude-intention relationship has been observed in specific food contexts, such as vegetable burgers (Shen and Chen, 2020), minimally processed vegetables (Stranieri *et al.*, 2017), reduced meat consumption (Lentz *et al.*, 2018), and organic food purchases (Zarei and Maleki, 2018). However, other researchers came to different conclusions. For instance, Chen *et al.* (2014) found a weak-to-moderate relationship between attitude and organic food purchase intention, which was further moderated by gender. Moreover, Naz *et al.* (2020) found a nonsignificant attitude-intention relationship among university students in Hungary. A research gap remains regarding the relationship between attitude towards a behavior and the intention to buy green food. To address this gap, we propose the following hypotheses:

- H1. Attitude towards green food purchase positively affects green food purchase intention.
- H2. A positive attitude towards green food purchase is a necessary condition for the formation of green food purchase intention.

2.2 Green buying habits (GBH)

Verplanken (2006) described habits as repeated behaviors equated with automaticity, which is attributed to limited awareness, uncontrollability, and unintentionality (Verplanken and Orbell, 2003). Verplanken and Orbell (2003) introduced the Self-Reporting Habit Index (SRHI) to measure habit constructs, while Gardner (2012) suggested using the Self-Reported Behavioral Automaticity Index (SRBAI) to assess the automaticity aspect of habits. In this study, we utilized the SRBAI to infer green food buying behavioral automaticity as a green food buying habit.

The habit construct has been added to attitude-behavior relationships in various studies. For instance, Aboelmaged (2021) examined e-waste recycling behavior and concluded that habits can offer a more robust explanation of such behavior than attitudes. Moreover, Ghazali *et al.* (2018) found a positive relationship between green habits and green purchase behavior. Despite these studies, there has been limited research focusing on habits in the context of green food. Therefore, this study proposes the following hypotheses:

- H3. Green buying habits positively affect consumer green food purchase intentions.
- H4. Green buying habits are necessary for green food purchase intention.

2.3 Food-related lifestyle

The Food-related Lifestyle (FRL) concept has been used in numerous studies to segment food consumers and explain food-relevant behaviors. This concept aims to comprehend consumers' diverse views of food in their daily lives. Brunsø *et al.* (2021) recently introduced the abridged dimensions of FRL, such as food innovativeness and food responsibility (food-related environmental responsibility). These two dimensions are relevant to green food consumption and hence were included in our study.

2.3.1 Food innovativeness (FINN). According to Jan-Benedict (1999), consumer innovativeness refers to "the tendency to purchase a new and different product or brand instead of sticking with the existing preferences and consumption patterns." When examining the context of green food, consumer innovativeness becomes relevant as it serves as an important internal factor affecting the intention to consume new products (Persaud and Schillo, 2017). Such a consumer trait is a domain-specific innovation that relates to a specific product context or situation. This study considers food innovativeness and determines it as the set of activities indicating propensity to adopt new foods (Govaerts and Olsen, 2022), recipes, cuisines, and dishes.

Consumer innovativeness has been shown to play a positive role in adoption of organic food (Li *et al.*, 2021), enhancing the intention to consume unique green food type types like seaweed (Govaerts and Olsen, 2022), and willingness to pay for fair-trade food (Konuk, 2019). Studies have measured innovativeness concept using the aspects of need for innovation, enjoyment, preference for nature (Huotilainen *et al.*, 2006), and social innovativeness (Li *et al.*, 2021). These literature findings suggest that consumers with high innovativeness are willing to embrace sustainable foods.

However, the literature most often focuses on organic food, but it does not address the influence of food innovativeness on green food purchase across the full spectrum of green food choices. Therefore, this study seeks to address this knowledge gap by examining the impact of food innovativeness on intention to purchase green food in general. The findings provide valuable insights into the factors affecting consumers' intention to purchase a range of green food choices. Therefore, this study proposes the following hypotheses:

H5. Food innovativeness positively affects green food purchase intention.

H6. Food innovativeness is a necessary condition for green food purchase intention.

2.3.2 Food-related environmental responsibility (FER). According to Stone and Montgomery (1995), environmental responsibility is an expressed innate state wherein an individual intends to act in favor of environmental preservation and ensures that their own activities do not generate adverse effects on the environment. The concept of environmental responsibility comprises several dimensions, including awareness of environmental issues, concern for protecting the environment, willingness or intention to act in support of the environment, and adoption of various eco-friendly behaviors (Stone *et al.*, 1995). This study specifically addresses consumer environmental responsibility, termed food-related environmental responsibility, in the context of food consumption.

The concept of environmental responsibility has been recognized as a significant factor influencing consumers' pro-environmental behaviors (Zheng *et al.*, 2021). For instance, Yue *et al.* (2020a) shown that consumers with higher environmental responsibility are more likely to consume green products. A similar relationship has been found regarding specific green food consumption options, where studies have shown that environmental responsibility has a positive impact on buying organic food (Nasir and Karakaya, 2014), green chicken (Minbashrazgah *et al.*, 2017), and the intention to purchase genetically modified food (Akbari *et al.*, 2023).

While extensive research has been conducted on environmental responsibility and green purchases in general, there has been limited focus on exploring the role of consumer environmental responsibility in the purchase of green food. Moreover, many of these studies have focused predominantly on organic food consumption, whereas other types of green food (such as meat alternatives, odd-shaped food, plant-based products, etc.) remain underexplored. Thus, this study proposes the following hypotheses:

H7. Consumers food-related environmental responsibility positively affects green food purchase intention.

H8. Consumer food-related environmental responsibility is a necessary condition for green food purchase intention.

3. Research methods

In this study, a survey method was applied to collect data from residents of Budapest, Hungary, via telephone interviews conducted between November and December 2021, following the CATI (Computer-Assisted Telephone Interviewing) method, which allowed for standardized questioning and real-time data entry to minimize errors and ensure high data quality.

Budapest was selected because it is the largest city in the country comprising of 17% of the country’s total population (Hungarian Central Statistical Office^{*2}). The responses were captured using a structured questionnaire consisting of sociodemographic and structural variables.

To develop the structured questionnaire, questions were adopted from previous surveys identified during the literature review. To assess attitudes towards green food purchases, we adopted five questions from [Ghazali et al. \(2018\)](#) and [Al Mamun et al. \(2018\)](#). Three items for measuring green habits were drawn from the automaticity dimension of the Self-Reported Behavioral Automaticity Index (SRBAI) ([Rebar et al., 2018](#)). Consumers food innovativeness and food-related environmental responsibility were measured using validated scales based on [Brunso et al. \(2021\)](#) study. Finally, the purchase intention measurement was based on the scale proposed by [Han et al. \(2009\)](#).

The questionnaire was tested by four colleagues who did not participate in the research in order to ensure clarity and accuracy. Feedback from these pilot sessions led to modifications in a number of items before finalizing and programming the questionnaire.

At the beginning of the telephone interviews, respondents were briefly informed about the different types of green food behavior. They were then asked to rate their own green food purchases during the last six months on a five-point Likert scale. In addition to questions about demographic data, participants were asked to rate their level of agreement or disagreement with statements regarding the constructs given in [Appendix 1](#) (1 = strongly disagree to 5 = strongly agree).

Altogether 500 questionnaires were collected. During data preparation, we eliminated statistical outliers with extreme values and deleted responses of non-committed respondents who provided the same responses to all questions relating to the constructs. After cleaning the database, 475 valid responses were retained for detailed analysis. The sample was representative of age, sex, and residence across 23 districts of Budapest. [Table 1](#) provides the sociodemographic characteristics of the survey participants.

After assessing Common Method Variance we used the Smart-PLS 4.0 application to conduct partial least squares structural equation modeling (PLS-SEM), which is used to describe structural models and predict the key determinants of the dependent variable ([Ahmed et al., 2020](#); [Hair et al., 2011](#)). The data analysis was performed in two steps. In the first step,

Table 1. Sociodemographic characteristics of the sample (N = 475)

		Frequency	Percentage
Gender	Male	213	45
	Female	262	55
Age	16–25	32	7
	26–35	100	21
	36–45	97	20
	46–55	60	13
	56–65	64	13
	Above 65	122	26
Education	Elementary School	15	3
	Secondary School	273	57
	College or bachelor’s degree	79	17
	University or master’s degree	100	21
	Postgraduate training (doctorate)	8	2
Household Income per capita*	Under €125	12	3
	125 to 500 €	205	47
	500 to 1,000 €	169	39
	Above 1,000 €	49	11

Note(s): *Hungarian HUF to Euro average exchange rate, 2022, Central European Bank

Source(s): Authors’ own work

the relationships between construct indicators and their corresponding latent variables were assessed (measurement model), including reliability (internal consistency, individual items) and validity (convergent and discriminant). Second, the structural relationships between the dependent and independent variables were tested (Hair *et al.*, 2014). Additionally, necessary condition analysis (NCA) was applied to empirically assess the necessity of independent variables in the prediction of green food purchase intention.

4. Results

Most respondents agreed with the statement that they had made green food purchases in the last six months prior to the survey (rated 4.2 on a 5-point Likert scale).

To analyze the differences in green food purchases across respondent groups by age, education, and household income, one-way ANOVA was conducted using SPSS 26. The F-statistics results indicated *p*-values above the threshold of 0.05, hence, it can be concluded that there were no statistically significant differences in purchase intention among these groups of respondents.

4.1 Common method variance

Common method variance (CMV) is used to describe systematic error variances in the data that result from the same source or a shared source of measurement across multiple variables, which inflates the relationship between the constructs (Richardson *et al.*, 2009). The current study employed two approaches to assess CMV: a) Harman's single-factor test and b) the post-hoc technique of lateral collinearity assessment (LCA).

Harman's single-factor test uses factor analysis to analyze unrotated factor solutions, aiming to reveal any covariance among variables that can be explained by one or more factors (Tehseen *et al.*, 2017). In our study, the results revealed that more than one factor was present in the data, explaining 64.9% of the variance. Moreover, the first factor (34.1%) explanation of the variance falls below the 50% threshold (Podsakoff *et al.*, 2003). Hence, Harman's test indicated that CMV was not a significant concern in this study. However, this approach has been criticized for its insensitivity (Schwarz *et al.*, 2017).

To further investigate CMV, we conducted a post hoc test known as lateral collinearity assessment (LCA). In this approach, a dummy latent variable that can take random values is introduced into the conceptual model and the remaining latent variables are used as predictors of the dummy variables (Kock, 2017). To generate random values for the dummy variables, we used the RND() command in Microsoft Excel raw data file. Subsequently, the same data using dummy variables were loaded into the Smart-PLS 4 software application, and a new model was created. The results of the inner and outer models indicated less than the 3.3 threshold of VIF values (Kock, 2017). Hence, it can be inferred that the model is unaffected by common method bias.

4.2 Measurement model assessment

In this study, the observed variables were designed to function as reflective measures representing the same underlying latent construct. These measures were adopted from the literature, with each latent construct comprising of various indicators conveying a single dimension. In social sciences, constructs such as intention, personality traits, and attitudes are often deemed reflective measures (Hair *et al.*, 2021).

The validity and reliability values are listed in Table 2. Individual item (indicator) reliability was assessed using factor loadings (see Appendix 1). Overall, the loadings are between 0.73 and 0.9, with two items (AT4 and FER3) falling slightly below the recommended cut-off value of 0.708 (Carmines and Zeller, 1979; Hair *et al.*, 2014). However, according to Hair *et al.* (2021), values above 0.5 are considered appropriate in the social sciences. Benitez *et al.* (2020) suggested accepting these values when other validity and reliability measurements met the required criteria.

Construct	Alpha	CR (rho_c)	AVE	HTMT-matrix				Fornell-Larcker criterion				GFPI
				ATT	GBH	FINN	FER	ATT	GBH	FINN	FER	
Attitude towards buying green food (ATT)	0.82	0.87	0.58					0.762				
Green buying habits (GBHs)	0.78	0.87	0.69	0.55				0.466	0.833			
Food innovativeness (FINN)	0.89	0.92	0.7	0.11	0.19			0.097	0.148	0.838		
Food-related Environmental Responsibility (FER)	0.83	0.88	0.59	0.635	0.756	0.216		0.532	0.621	0.183	0.769	
Green food purchase intention (GFPI)	0.86	0.91	0.78	0.702	0.786	0.266	0.73	0.597	0.663	0.234	0.624	0.883

Note(s): Alpha = Cronbach's alpha, CR = composite reliability, AVE = average variance extracted, HTMT = heterotrait-monotrait

Source(s): Authors' own work

The values of both alpha and composite reliability were above the 0.7 minimum cut-off value, indicating strong internal consistency reliability of all constructs used in the model. The reported value of average variance extracted (AVE) surpassed the 0.5 value (Fornell and Larcker, 1981) and was lower than the composite reliability. These empirical results confirm the convergent validity of the measurement model.

The study utilized the Fornell and Larcker (1981) and Heterotrait-monotrait HTMT (Henseler *et al.*, 2015) criteria to assess discriminant validity. The Fornell-Larcker criterion assessment results (Table 2) show the squared root of the AVE values for each construct. These values were compared with the correlations of the corresponding constructs. The results confirmed that all the constructs met the Fornell & Larker criteria. Moreover, the HTMT criterion results indicated that all values were less than 0.85. Values below this threshold indicate that the constructs are significantly different from one another. Consequently, discriminant validity is not a concern in our measurement model.

4.3 Structural model assessment

In order to answer our first research question, we assessed the structural model. Ramayah *et al.* (2017) suggest using the R^2 value for the model goodness measure. The value of R^2 (0.586) indicates that the independent variables explain 58% of the variance in green food purchase intention. According to the bootstrap results (see Table 3), attitude ($\beta = 0.3$), green buying habits ($\beta = 0.37$), food innovativeness ($\beta = 0.11$), and food-related environmental responsibility ($\beta = 0.21$) have a positive relationship with green food purchase intention (GFPI). The results were considered significant at $p = 0.001$.

Additionally, multicollinearity among the indicators was assessed using variance inflation factor (VIF) values. The VIF value of each indicator (see Appendix 1) used in the model was less than 5, which is the recommended maximum value (Hair *et al.*, 2011). Therefore, multicollinearity does not affect the analysis.

4.4 Necessary condition analysis

Necessary condition analysis (NCA) was used to address the second research question. NCA is complementary to other statistical methods and allows to test whether attitude, green buying habits, food innovativeness, and food-related environmental responsibility are necessary conditions of green food purchase intention. Necessary implies that the absence of an independent variable affects the presence of a dependent variable. This approach involves identifying the empty space in the scatter plot and calculating the effect size (d) by assessing the size of the empty space relative to the non-empty area (Dul, 2016).

The value of attitude (CE-FDH $d = 0.161$) was greater than 0.1 at a significance level of $p < 0.05$. Thus, Hypothesis 2 (H2) is supported. By contrast, the other constructs do not meet the criteria ($d \geq 0.1$), leading us to conclude that Hypotheses H4, H6, and H8 are not supported.

Table 3. Results of the structural model

Hypothesis		Std. Beta	Std. error	<i>t</i> value	Decision
H1	Attitude → GFPI	0.299	0.037	8.135*	Supported
H3	Green Buying Habits (GBH) → GFPI	0.375	0.042	8.880*	Supported
H5	Food Innovativeness (FINN) → GFPI	0.113	0.031	3.617*	Supported
H7	Food-related Environmental Responsibility (FER) → GFPI	0.212	0.045	4.650*	Supported

Note(s): This table provides the structural model results derived using Smart-PLS 4.0. The R-squared value was 0.586 and the sample size was 475. The “*” sign indicates a significance level of 0.001

Source(s): Authors’ own work

Further analysis of the effect size shows that attitude ($0.1 > d < 0.3$) falls in the range of moderate effects. In summary, attitude was the only necessary condition for the dependent variable. A detailed evaluation of the constructs is provided in the bottleneck table and scatterplots (see [Appendix 2](#)).

5. Discussion of results

The primary purpose of this study was to explore the effects of attitudes, green buying habits, consumer food innovativeness, and consumer food-related environmental responsibility on green food purchase intention among consumers in Budapest, Hungary.

The results showed that attitude positively affects green food purchase intention, which confirms [Hypothesis 1](#) of this research. This is in line with the results of [Alagarsamy et al. \(2021\)](#), [He et al. \(2019\)](#), and [Nguyen et al. \(2021\)](#), who suggest that consumers are more willing to buy green food when they have positive feelings towards green food and consider the environmental aspects of their consumption. Moreover, the results of NCA, which confirm [Hypothesis 2](#), support the necessity of attitude towards intentions to buy green food and suggest that the absence of a positive attitude may result in a lack of consumer intention to buy environmentally friendly food products.

The confirmation of [Hypothesis 3](#) provides evidence that green habits have a positive effect on green food purchase intention. Similar results have been found in previous studies related to e-waste recycling behavior ([Aboelmaged, 2021](#)) and food purchases in general ([Huang et al., 2020](#)). Interestingly, green habits exhibited the highest beta value and predictability for purchase intention among the independent variables. Necessary Condition Analysis, however, did not find habits necessary for green food purchase intention; thus, we decline [Hypothesis 4](#). These findings indicate that purchasing green food involves both cognitive (attitude) and habitual decision-making processes. While we found that habit had a slightly stronger influence on the green food decision process, it was not a necessary condition. This implies that even those who have not made a habit of buying green food yet can become more sustainable food consumers in the future.

Our empirical evidence shows that consumers' food innovativeness also positively affects green food purchase intention, which supports [Hypothesis 5](#) and suggests that consumers with high food innovativeness are more willing to purchase green food products. These findings support previous work, which indicates that innovativeness leads to the adoption of organic food ([Li et al., 2021](#)), buying intention towards online green products ([Chauhan et al., 2021](#)), and purchasing functional food ([Bekoglu et al., 2016](#)). Although food innovativeness is not a necessary condition for green food purchase intention (and thus we decline [Hypothesis 6](#)) we can further encourage consumers who exhibit high innovativeness to buy organic food ([Zarei and Maleki, 2018](#)), meat alternatives ([Bakhsh et al., 2021](#)), and new plant-based recipes. Consumers with food innovativeness rely on information when purchasing, hence, increasing the availability of knowledge regarding green food to consumers may lead to more conscious purchasing decisions.

Furthermore, the literature has noted that consumer aspiration towards environmental responsibility leads to pro-environmental behavior ([Stone and Montgomery, 1995](#); [Yue et al., 2020b](#)). This is supported by our results for [Hypothesis H7](#), which indicate that consumer food responsibility has a positive effect on consumers' intention to purchase green food. Comparing our results with those in the literature, we find agreement with previous research on green buying ([Zheng et al., 2021](#)), green consumption behavior ([Yue et al., 2020b](#)), and willingness to behave in an environmentally responsible manner ([Martínez García de Leaniz et al., 2018](#)). From a green food perspective, our results suggest that environmental responsibility has the smallest effect on green food purchase intention among the considered factors, but a higher level of food-related environmental responsibility still prompts consumers to plan green-food purchases. However, it is not a necessary condition and thus, we decline [Hypothesis 8](#).

6. Implications of the research

Our study represents an attempt to contribute to the literature on green food consumption by providing insights into the factors that influence purchase intentions and their necessary conditions. Our results have both theoretical and practical implications.

6.1 Theoretical implications

Unlike conventional SEM results that primarily measure the strength of relationships, NCA helps to distinguish between critical and complementary predictors, an approach that has been underutilized in green food research.

Attitudes towards green purchases have already been examined before, however, previous results show a mixed picture (Aguirre Sánchez *et al.*, 2021). Our current results reinforce those previous efforts, which found that attitude has a positive effect on the intention to buy green food (Shen and Chen, 2020; Stranieri *et al.*, 2017). The robustness of our result is strengthened by the outcome of Necessary Condition Analysis, which suggests that a positive attitude not only facilitates green food buying intentions but is also a necessary condition of such intentions. NCA also found that while all examined factors have a positive effect on green food purchasing intentions, attitude is the only necessary condition. This means that without a positive attitude toward green food consumption, other factors such as habits and environmental responsibility may be insufficient in driving purchase intention. This finding extends the ongoing discussion on the attitude-intention-behavior gap (ElHaffar *et al.*, 2020) by pointing at the importance of attitudes when external incentives are minimal, or consumers lack sufficient information on sustainable food options.

Moreover, based on the literature (Aydin and Yildirim, 2021; Ghazali *et al.*, 2018; Xiao *et al.*, 2022), our research addresses the attitude-intention gap by incorporating green buying habits and lifestyle factors in the conceptual framework. Under this framework, the strength of habits helps evaluate the role of daily routines in green food decisions, while lifestyle factors (food innovativeness and food-related environmental responsibility) assist in defining consumer characteristics associated with the intention to purchase green food.

Our results regarding the role of habits align with dual-process theories of decision-making (Kahneman, 2011), which distinguish between automatic (habitual) and deliberative (attitude-based) behaviors. While green food purchasing may begin as a deliberate decision shaped by attitude, frequent exposure and positive experiences could facilitate the transition into habitual behavior. Future research should explore whether food innovativeness moderates the formation of green consumption habits and whether it can help bridge the attitude-behavior gap.

Our results support previous research, which has shown that food-related innovativeness and food-related environmental responsibility affect green food purchase intention. However, while previous literature has predominantly focused on organic food and left other green food types underexplored, this study explored the role of these factors beyond the organic food domain, thus generalizing previous results. Our study also contributes to the explanation of the attitude-intention gap in general by using a cognitive framework combined with a behavioral perspective. Existing literature heavily relies on the notion that consumer decisions are based on rational and conscious thought processes, such as attitude towards buying green food, which affects intention; however, the literature does not pay sufficient attention to the behavioral perspective, for example, the role of buying habits. From this perspective, our study aimed at recognizing the role of buying habits, i.e. routine and automatic performance of a behavior in consumer choices (Ajzen, 2002; Honkanen *et al.*, 2005; Rebar *et al.*, 2018; Verplanken, 2006). This extension enriches the scope of the traditional attitude-intention framework and aims to signify a multidimensional approach.

Finally, by selecting the residents of Budapest, Hungary as the focus, this study also contributes to the limited literature on green food consumption in the Central and Eastern European region. Our results provide an understanding of local consumers' motivations to consume green food.

6.2 Practical implications

Policymakers striving for a more sustainable food sector along with businesses within the food value chain offering green food options may find our results beneficial in several ways.

In the context of the circular economy, this study contributes to the discourse by focusing on consumption patterns – one of the core elements of the circular economy. Green food consumption supports circularity by reducing overall consumption, minimizing waste, utilizing by-products, improving resource efficiency, and encouraging the adoption of socially sustainable food choices.

Our results show that consumers' positive attitudes have a crucial role in shaping green food purchase intentions and thus the implementation of circular food systems. Consequently, endorsing positive feelings and highlighting the environmental benefits of green food products through easy to understand messages is an important option to promote green food consumption (Alam *et al.*, 2020). Businesses may engage in various types of marketing campaigns to promote green products while policy makers may concentrate on education from a young age. However, forming attitudes in large populations is a slow process, which requires careful consideration of environmental, cultural, and economic factors.

Our findings indicate that both food innovativeness and environmental responsibility positively influence green food consumption, thereby promoting a more circular food sector. However, food innovativeness and environmental responsibility can be understood within the broader framework of the circular economy as well. For instance, consumers may adopt innovative approaches to source food locally or rely on their sense of environmental responsibility to seek out packaging-free alternatives.

Future research should explore how messages promoting circular consumer behavior influence green food purchase intentions and vice versa. Integrating circular economy principles into marketing strategies could help shift consumer perceptions from individual responsibility toward systemic impact, potentially fostering greater engagement.

In the context of social media's increasing role in consumer culture, digital platforms play a crucial role in shaping attitudes toward sustainability. Studies indicate that eco-influencers and online food communities significantly affect green consumption behaviors (Armutcu *et al.*, 2024). Since consumers, especially younger generations, rely heavily on digital sources for food-related decisions, future research should explore how digital engagement moderates the relationship between attitude, habits, food innovativeness and green food purchase intention (e.g. while influencers may change attitudes, they often generate short-lived fads, which may not turn into regular behavior and habits). A better understanding of the role of social media can help policymakers and businesses leverage this trend and to develop interactive sustainability campaigns and influencer partnerships to enhance green food adoption.

Our study also points at the importance of buying habits. Habits are characterized by automatic responses made with minimum deliberate thinking, which can result in repetitive purchase behavior. Therefore, developing and implementing behavioral interventions and public campaigns aimed at shifting consumers' buying habits from purchasing conventional to green food items is an important tool for businesses and policymakers alike (Best and Papies, 2017). Our research also demonstrated that while habits have an effect on intentions, they are not necessary to develop green food purchase intentions, which means that non-habitual food buyers may also engage in green food purchase behavior. Yet, differentiating food products with regard to the frequency and method of purchasing by consumers may improve the effectiveness of interventions.

Building on discussions regarding behavioral intervention, the literature offers various approaches, which can establish green buying habits. Nudging presents managers and policymakers a way to shift consumer habits in a subtle way by altering or manipulating the decision-making environment (Verplanken and Whitmarsh, 2021), while gamification encourages the performance of a particular behavior and its transition to a habit based on information diffusion and competition among peers (Reeves *et al.*, 2015). However, the effectiveness of these interventions in the long term varies and requires further investigation.

7. Limitations and further research directions

The current study has several limitations. First, it is limited to residents of Budapest and our sample is not representative of other cities in Hungary or those living outside of the country. While Budapest residents share many similarities with consumers of developed countries such as high quantities of food waste and a preference for local food varieties, still, further studies should explore other regions of the world and other social groups to gain a more comprehensive picture of consumer behavior and aid local and regional policies with regard to green food consumption.

Second, our study did not measure actual buying behavior or expenditure on specific types of food. Based on previous studies (Alagarsamy *et al.*, 2021; Zarei and Maleki, 2018), we assume that purchase intention influences the variance in actual green food purchase behavior. To better understand actual behavior, future studies should include actual green food purchasing and consumption behavior and analyze different green food types. Moreover, even green food purchase intention and behavior may not result in an actual reduction of ecological impact (see, e.g. the behavior-impact gap introduced by Csutora (2012), which also prompts attention and further exploration.

Green food purchasing behavior possesses several distinct characteristics that set it apart from other forms of green purchasing behavior. Unlike other types of purchases, food buying is primarily driven by the need to meet basic necessities, making it an unavoidable activity for individuals who are not self-sufficient in food production. Additionally, food purchasing is a routine activity, though not everyone participates directly (e.g. specific family members may assume this responsibility). These unique factors limit the generalizability of our findings to other types of green purchasing behavior, highlighting the need for similar studies in other specific domains.

Finally, some recent trends were not reflected in our research model, such as the role of influencers in the digital arena through social media or peer-driven green behaviors, which are gaining increasing importance regarding consumer choices. These aspects can be incorporated in future research to gain a better understanding of green food consumption behavior.

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Further reading

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Appendix 1

Questionnaire

Green food is environmentally friendly food that uses less chemicals and produced in a way that reduces negative environmental impact. Organic food, plant-based food products, seasonal and regional vegetables and fruits, and less meat and product with less packaging are examples of green food.

Answer the following questions using the following categories: Strongly disagree = 1, Disagree = 2, Neutral = 3, Agree = 4, Strongly agree = 5.

Table A1. Question items, variance inflation factor (VIF), and factor loadings

Code	Description	Factor loadings	Variance inflation factor
<i>Attitude</i>			
AT1	You like the idea of purchasing green food	0.75	1.68
AT2	You think that purchasing green food is favorable	0.81	2.03
AT3	Your feelings about purchasing green food are positive	0.84	2
AT4	Using Green food is necessary to mitigate global warming	0.67	1.39
AT5	Between green and conventional food, you prefer green one	0.73	1.42
<i>Green Food Purchase Intention (GFPI)</i>			
GFPI1	I am willing to buy green food while shopping	0.85	1.89
GFPI2	I plan to buy green food	0.89	2.44
GFPI3	I will make an effort to buy green food	0.9	2.36
<i>Green Buying Habits (GBH)</i>			
GBH1	Buying environmentally friendly food is natural for me	0.88	1.67
GBH2	I buy environmentally friendly food automatically	0.79	1.6
GBH3	Without thinking, I choose the environmentally friendly option when buying food	0.83	1.62
<i>Food Innovativeness (FINN)</i>			
FINN1	I like to try new food that I have never tasted before	0.82	2.28
FINN2	I love to try recipes from different countries	0.85	2.55
FINN3	Recipes and articles on food from other culinary traditions encourage me to experiment in the kitchen	0.87	3
FINN4	I like to try out new recipes	0.85	2.59
FINN5	I look for ways to prepare unusual meals	0.8	2.08
<i>Food-related Environmental Responsibility (FER)</i>			
FER1	I try to choose food produced with minimal impact on the environment	0.8	1.82
FER2	I am concerned about the conditions under which the food I buy is produced	0.73	1.63
FER3	It is important to understand the environmental impact of our eating habits	0.67	1.35
FER4	I try to choose food that is produced in a sustainable way	0.85	2.17
FER5	I try to buy organically produced food if possible	0.79	1.68

Source(s): Authors' own work

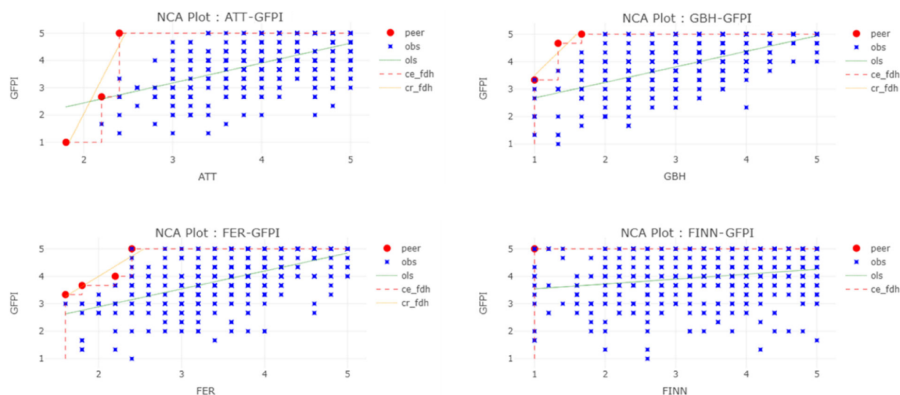
Table B1. NCA bottlenecks and effect sizes

Bottleneck GFPI	ATT	GBH	FINN	FER
0%	NN	NN	NN	NN
10%	12.5	NN	NN	NN
20%	12.5	NN	NN	NN
30%	12.5	NN	NN	NN
40%	12.5	NN	NN	NN
50%	18.7	NN	NN	NN
60%	18.7	8.3	NN	5.9
70%	18.7	8.3	NN	17.6
80%	18.7	8.3	NN	23.5
90%	18.7	8.3	NN	23.5
100%	18.7	16.7	NN	23.5
CE-FDH	0.161*	0.041*	0*	0.078*
Slope	6.31	n/a	1.833	2.5

Note(s): Accuracy and fit of NCA Effect sizes are 100%. * $p < 0.05$; NN = not necessary; CE-FDH = ceiling envelopment-free disposal hull for green food purchase intention

Source(s): Authors' own work

NCA Scatterplots and ceiling lines



Note(s): Peer = Outlier cases constructing ceiling line, obs = observation, ols = ordinary least squares, ce_fdh = ceiling envelope free disposal hull, cr_fdh = ceiling regression free disposal hull

Source(s): Authors' work

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