NOVA IMS Information Management School

MDDM

Master's Degree Program in
Data-Driven Marketing

THE ROLE OF HEALTH AND ENVIRONMENTAL CONSCIOUSNESS IN SHAPING FOOD CHOICES IN GROCERY SHOPPING

Exploring the Moderating Effect of Digital and Physical Landscapes

Catarina Maria Pires dos Santos Vítor

Master Thesis
presented as partial requirement for obtaining a Master's Degree in Data-Driven Marketing

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by

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Master Thesis presented as partial requirement for obtaining the Master's degree in Data-Driven Marketing, with a specialization in Digital Marketing and Analytics

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July, 2024

STATEMENT OF INTEGRITY

I hereby declare having conducted this academic work with integrity. I confirm that I have not used plagiarism, any form of undue use of information or falsification of results along the process leading to its elaboration. I further declare that I have fully acknowledged the Rules of Conduct and Code of Honor from the NOVA Information Management School.

[Lisbon, 8th July 2024]

ACKNOWLEDGMENTS

First and foremost, the biggest thanks go to my parents and my sister for the consistent encouragement and belief in me during my studies. Your faith in my abilities has been a constant source of motivation and determination to achieve my goals.

Thank you Gonçalo for the inspiring motivational speeches and for always believing in me. Your confidence in my potential has been a significant boost during difficult moments.

I am also profoundly grateful to my amazing friends and family. Thank you for standing by me, offering encouragement, and sharing in both the struggles and successes.

Finally, my appreciation goes to Professor Marlon for the attentive guidance and invaluable support. Your patience, insights and encouragement have been crucial in this process.

This journey would not have been possible without the contributions of all these remarkable individuals.

Thank you.

ABSTRACT

In recent years, health concerns and sustainability issues have intensified, highlighting the critical weight of food in promoting both human health and environmental sustainability. As individuals become more mindful of the effect of their diet choices on personal well-being and the planet, it is crucial to understand individuals' habits and consciousness. This research aimed to investigate how grocery consumers' health and environmental consciousness shape their food choices, while exploring how the shopping landscape - digital and physical - moderates these relationships. Two models were developed and tested. Data were compiled through an online questionnaire sent out via social media, resulting in 415 valid responses analyzed using Smart PLS 4. Findings from the first model revealed that health consciousness significantly influenced healthy food choices, with the shopping landscape moderating this effect. Specifically, individuals with higher health consciousness tended to favor healthier options when shopping digitally. Similarly, results from the second model indicated that environmental consciousness strongly influenced sustainable food choices during grocery shopping, with the shopping landscape as a moderator. Consumers with higher environmental consciousness preferred more sustainable food items when shopping digitally compared to when shopping physically. The outcomes enhanced the understanding of how health and environmental consciousness impact food choices, contributing to consumer behavior models by emphasizing the dual impact of health and environmental factors. Furthermore, comprehending the influence of digital and physical landscapes on consumer choices offers retailers valuable insights to refine product offerings, customize marketing strategies, and optimize store layouts according to consumer preferences and needs.

KEYWORDS

Health Consciousness; Environmental Consciousness; Shopping Landscape; Grocery Shopping; Food choices; Consumer Behavior

Sustainable Development Goals (SDG):

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LIST OF ABBREVIATIONS AND ACRONYMS

HC	Health Consciousness
EC	Environmental Consciousness
HFC	Healthy Food Choice
SFC	Sustainable Food Choice
SL	Shopping Landscape
M	Mean
STDEV	Standard Deviation
PLS	Partial Least Square
SEM	Structural Equation Modelling
CA	Cronbach's alfa coefficient
CR	Composite Reliability
AVE	Average Variance Extracted
VIF	Variance Inflation Factor
SRMR	Standardized Root Mean Square Residual
NFI	Normed Fit Index
O	Original Sample

1. INTRODUCTION

Food has constantly played a pivotal role in society; however, its significance has considerably changed. It is no longer perceived merely as something individuals consume for survival, a physiological necessity. Instead, it is seen as a representation of culture, traditions, principles, lifestyle, and the social and economic trends (Martinelli & De Canio, 2022).

Simultaneously, the food system experiences continuous change driven by evolving consumer dynamics, shifting preferences, transformations in production, processing, and distribution systems (WHO. Regional Office for Europe, 2021). These changes pose challenges for both public health and global well-being. Increasing concerns about personal health and the environment have heightened the demand for nutritionally beneficial foods that minimize ecological footprints, further raising awareness of the broader impacts of food selections (Herrero et al., 2023; Chinea et al., 2020).

The rise in the number of cases of lifestyle-related diseases, such as chronic illnesses, overweight, obesity, and mental health issues, and the presence of food intolerances and allergies, such as gluten, has prompted consumers to be more concerned about their well-being and eating habits (Kjaergård et al., 2013; Asioli et al., 2017). This growing concern has sparked increased interest in healthy foods and the adoption of nutritious diets. As awareness grows, health consciousness emerges as a critical determinant in how individuals prioritize and manage their health. It encompasses their awareness of health-related issues and their proactive efforts to enhance well-being (Kusumaningsih et al., 2019). Therefore, health-conscious consumers actively seek ways to improve their overall health, showing preference for nutritious and natural food choices that positively contribute to their health (Tan et al., 2021). In the literature, health consciousness arises as a critical factor influencing consumer behavior, especially within the green and organic product purchases context (Parashar et al., 2023; Imani et al., 2021).

Conversely, the enhanced interest in environmental sustainability arises from the discernible and concerning impacts of food cultivation and consumption on global climate alterations, deforestation, and pollution. The global food system significantly contributes to environmental issues, accounting for substantial percentages of carbon dioxide emissions (Van Der Waal et al., 2022), greenhouse gas emissions (Meijers et al., 2021), freshwater use, and pollution in various regions (Springmann et al., 2018). This awareness prompts consumers to pay closer attention to their dietary choices and future consumption. Factors such as the origin of the food, agricultural practices, and its overall environmental footprint have become crucial considerations for consumers seeking options aligned with their social and environmental values. Stemming from people's knowledge of the adverse environmental consequences linked with irresponsible actions (Tan et al., 2021), environmental consciousness pertains to the psychological factors influencing individual's inclination toward

environmentally friendly behaviors (Mishal et al., 2017). Studies focusing on environmental consciousness emphasized its positive weight on the intent to buy organic food items (Wang et al., 2020; Prakash et al., 2018).

Moreover, consumers are not merely reassessing and adjusting their food choices but also reshaping their approach to consumption. A notable surge in e-commerce has been observed recently, driven by the widespread availability and easy access to mobile devices and the enhanced usability of online shopping platforms (Gomes & Lopes, 2022). In this context, food choices via digital platforms, such as digital grocery shopping, are increasingly popular (Martín et al., 2019), especially post-COVID-19 (Valenčič et al., 2023).

Research has investigated the differences in grocery purchasing behavior and product acquisitions between digital and physical stores. Recent studies have primarily focused on discerning these disparities across pre-pandemic, pandemic, and post-pandemic periods (Meister et al., 2023; Grashuis et al., 2020). Furthermore, studies exploring digital versus physical grocery shopping baskets have indicated that online shoppers tend to allocate a lower budget to unhealthy food items (Chintala et al., 2023; Zatz et al., 2021; Huyghe et al., 2017). Nevertheless, existing literature has not concurrently examined how both digital and physical landscapes moderate the relationship involving health consciousness and healthy food selections, as well as environmental consciousness and sustainable food selections.

Given this, the purpose of this dissertation is to explore the significant research question: What is the moderating effect of the shopping landscape, digital and physical, on the relationship between grocery shopper's health consciousness and environmental consciousness and their food choices? It aims to inspects how the levels of health and environmental consciousness among grocery shoppers influence their food choices and examines whether these relationships are moderated by the type of shopping landscape.

Chapter 2 comprises an examination of the literature concerning health and environmental consciousness, healthy and sustainable food choices, and the moderating role of shopping landscapes. To fulfill the objective of this research, two frameworks and eight hypotheses were constructed.

Chapter 3 addresses the methodology employed for data collection and analysis. Smart PLS 4 was selected as the software for testing the two developed models, given its user-friendly interface and suitability for marketing models.

Following the data analysis results, showcased in Chapter 4, Chapter 5 delves into the interpretations of the outcomes and both theoretical insights and practical implications.

Finally, Chapter 6 presents and summarizes the main findings, addressing specific constraints, and proposing ideas for further investigations.

2. LITERATURE REVIEW

To begin this investigation, a detailed literature review was conducted and is presented in this chapter, focusing on concepts and definitions pertinent to the research topic, including health consciousness, environmental consciousness, healthy food choice and sustainable food choice, and the moderating role of the digital and physical landscape in food selection.

2.1. HEALTH CONSCIOUSNESS

Health consciousness encompasses a person's leaning to prioritize health and actively integrate health-related habits and behaviors into their daily routines and consumption patterns (Imani et al., 2021; Kusumaningsih et al., 2019; Amin & Tarun, 2022). As a result, health-conscious individuals are dedicated to maintaining or improving their health level and life quality through the deliberate selection of healthier products, such as natural, healthy, and nutritious food items (Kaynak & Ekşi, 2014; Arcese et al., 2023). When confronted with a food decision, health-conscious consumers prioritize attributes associated with health care, contrasting with less health-conscious consumers who place a higher emphasis on taste and other non-health-related factors (Mai & Hoffmann 2012).

Building upon this foundation, the existing research showcases the significant role of health consciousness in influencing consumer behavior towards health-centric food choices (Kang et al., 2015). This aligns with broader literature, where health consciousness is acknowledged as essential for enhancing attitudes and fostering a greater inclination to purchase healthier versions of products (Prasad et al., 2008; Pham et al., 2018). Moreover, health consciousness was found as a key factor shaping consumers' willingness to spend extra on health and wellness food items (Ali & Ali, 2020). Similarly, evidence suggested that consumers with a greater levels of health consciousness, differing from those with lower health consciousness, typically exhibit more favorable responses to healthier menu options and strive to eat healthier (Lee et al., 2014; Kang et al., 2015).

In addition, health-conscious individuals consistently favor organic food over conventionally grown alternatives (Rana & Paul, 2017; Parashar et al., 2023). Research demonstrated a positive power of health consciousness and attitudes concerning organic food on buying intents (Kusumaningsih et al., 2019). Health consciousness was linked to the intent to acquire green products (Nguyen et al., 2020). Studies show that health consciousness influences actions and intentions to buy green items positively (Amin & Tarun, 2022; Tan et al., 2021).

Despite a substantial body of literature exploring health consciousness and its impact on organic food selection and green product purchasing intentions, there is currently no research that concurrently, explores the importance of health consciousness on shaping healthy food choices, in the context of grocery shopping and investigates the differences that the shopping landscape may pose, therefore this research is going to fill this gap.

2.2. ENVIRONMENTAL CONSCIOUSNESS

Environmental consciousness is the level of awareness among individuals regarding the detrimental environmental impacts arising from human activities and their inclination to adopt environmentally responsible actions (Tan et al., 2021; Mishal et al., 2017). It encompasses understanding of environmental factors, attitudes, and behaviors related to the alteration of environmental conditions (Jain et al., 2020). Consequently, environmental-conscious consumers are characterized by a heightened concern for environmental issues and engage in ethical comportment by contemplating the effects of their everyday consumption on the society and the earth (Pino et al., 2012). This elevated environmental cognizance translates into their purchase decisions, as they actively project their environmental concerns and adjust their buying behaviors to contribute to environmental improvement (Ayub et al., 2020).

With the growing environmental concern, consumers have compelled companies to be more vigilant in addressing environmental issues, demanding products less harmful to the planet (Imani et al., 2021; Gadenne et al., 2011), such as, environmental-friendly, sustainable and green products (Jiang & He, 2022; Kerber et al., 2023).

The literature on environmental consciousness and concern is extensive, particularly in the green and organic products context. Research has demonstrated that environmental apprehension enhanced intentions to buy green items (Jainswal & Kant, 2018; Kusumaningsih et al., 2019). Additionally, research has proven that environmental consciousness had an influence on green purchase mindset and apparent customer efficacy (Mishal et al., 2017). Research further revealed that environmental consciousness positively influences organic food buying intent (Wang et al. 2020). Similarly, Ayub et al. (2020) exposed that for young consumers, the environmental consciousness meaningfully affected individuals' intentions to acquire organic food (Ayub et al. 2020).

Despite the increasing volume of research, there remains a noticeable gap in studies focusing on the effect of environmental consciousness on sustainable food choices, especially within the context of grocery shopping, compared to those on organic and green choices. Hence, this dissertation aims to explore this relationship, addressing this gap, and determine whether it is moderated by the shopping landscape.

2.3. HEALTHY FOOD CHOICE

The rise in lifestyle-related diseases, encompassing chronic illnesses, obesity, diabetes, and mental health concerns, has prompted consumers to prioritize their health and alimentary choices (Wongprawmas et al., 2021 Kjaergård et al., 2013). This amplified perception has catalyzed a notable shift towards healthier food options and diets (Tan et al., 2021; Mai & Hoffmann 2012).

Concepts and definitions of what constitutes a healthy food choice vary widely and are subject to considerable interpretation (Kang et al., 2015). A consensus on the definition of healthy foods remains elusive due to the diverse perceptions held by individuals (Raine et al., 2018; Lake et al., 2007). While some individuals describe healthy foods based on their low sugar or sodium content, others perceive them as having reduce fat or calorie levels (Chen et al., 2006). Conversely, the World Health Organization outlines a healthy diet as one characterized by ample consumption of vegetables and fruits, reduced intake of fats, especially those derived from animals, and limited consumption of sugars and salt (WHO, 2020).

Research developed by Kim et al. (2013) discovered that individuals who highly value their health are more inclined to opt for nutritious food options (Kim et al., 2013). This inclination towards healthy eating extends beyond mere sporadic choices, as elucidated by Vázquez et al. (2009), who found that individuals aspiring to lead a healthy lifestyle demonstrate a sustained interest in eating nutritious foods regularly (Vázquez et al., 2009). Furthermore, health consciousness emerges as a pertinent factor shaping individuals' motivation to consume healthy foods (Shin et al., 2018; Ali & Ali, 2020).

The impact of the digital landscape, including the influence of digital influencers, the use of informational and food delivery applications and the digital shopping environment, on healthy food choice has also been studied, with mixed findings (Coates et al., 2019; De Jans et al., 2021; Blom et al., 2021). A study conducted among users of food delivery applications indicated that the digital food environment was perceived as unhealthy (Osaili et al., 2023). In contrast, previous research identified technology apps as effective mediums, offering comparable efficacy to traditional interventions in enhancing healthy food purchasing behaviors and nutrition-related outcomes (Lim et al., 2021). On top of that, studies have showed that consumers in an online shopping environment are likely to purchase reduced number of unhealthy alternatives, such as candies and desserts, compared to offline shopping (Zatz et al., 2021; Huyghe et al., 2017). These contrasting outcomes accentuate the complex and varied impact of the digital landscape on food choices, emphasizing the need to further investigation.

2.4. SUSTAINABLE FOOD CHOICE

To address the climate crisis, loss of biodiversity, contamination of water, non-sustainable water usage, and other adverse effects stemming from the existing food system's impact on the natural environment, it is crucial a prompt shift towards adopting more sustainable dietary patterns (Van Der Waal et al., 2022; Springmann et al., 2018). Thus, informed and sustainable food choices become imperative for mitigating the adverse impacts on the planet, while simultaneously cultivating resilient and equitable food systems for the future (Abrahamse, 2020).

Sustainable food choices prioritize environment, social, and economic sustainability across production, distribution, and utilization processes (Verain et al., 2021; Muresan et al., 2021). These choices may involve selecting organic, locally sourced, seasonal, or ethically produced foods, alongside efforts to reduce food waste and support regenerative agricultural practices (Meijers et al., 2021; Abrahamse, 2020).

Environmental apprehension can facilitate sustainable food options, while others may pose obstacles, for instance, when sustainable options are perceived as less palatable or less convenient (Verain et al., 2015, Verain et al., 2016). Furthermore, numerous factors that influence the decision to choose sustainable products can be found (Rizkalla, 2018; Dimitrova et al., 2022). Demographic characteristics, namely, gender, age, and education attainment also shape attitudes towards sustainable food decisions (Muresan et al., 2021; Brochado et al., 2016). Research specifies that females tend to show greater willingness than males to engage in sustainable consumption behaviors, and this tendency is often linked to increased awareness of environmental issues and higher levels of education (Lazaric et al., 2019).

Organic food items are often perceived as more sustainable by consumers, supported by the belief that organic farming methods promote soil health, biodiversity conservation, and reduced chemical use compared to conventional farming (Reganold & Wachter, 2016). Moreover, consumers often associate organic production with ethical considerations, as, animal welfare and the reduction of pesticide residues in food products (Verain et al., 2015; Parashar et al., 2023). Therefore, individuals who are concerned about the environment tend to choose organic options.

Recent research has explored the influence of the digital landscape on sustainable food choices, focusing on interventions like digital nudging, persuasive technology, and mobile applications (Hedin et al., 2019; Berger et al., 2020; Van Der Waal et al., 2022). A study on mobile devices as sustainable shopping guides revealed that basic eco-rankings reduce decision uncertainty, while extended rankings increase sustainable product selection under specific conditions (Weber, 2021). Additionally, targeted communication in online contexts may effectively encourage sustainable grocery purchases (Blom et al., 2023).

2.5. MODERATING ROLE OF THE DIGITAL LANDSCAPE ON FOOD CHOICES

The moderating effect of the digital landscape on consumer health consciousness and environmental consciousness in food choice is a complex and multifaceted phenomenon. Recognizing the dynamic role of technology in molding consumer behavior and preferences is crucial when exploring this relationship.

Digital food environments can be defined as the online platforms, applications, and virtual spaces that individuals interact with to explore, select, purchase, and engage with food-related information in the digital realm (WHO, 2021; Valenčič et al., 2023) and have revolutionized the way consumers interact with food-related information, advertisements, and purchasing opportunities (Ligaraba et al., 2022; Blitstein et al., 2020).

Multiple researchers have demonstrated that offering diverse information on nutrition, sustainability, and ethical practices to consumers can significantly influence their food choices (Huang et al., 2006; Van Der Waal et al., 2022; Meijers et al., 2021). For illustration, in an online supermarket experiment, exposure to health messages encouraging meat reduction effectively led meat consumers to choose plant-based replacements (Segovia et al., 2022). Similarly, research found that digital shoppers receiving recommendation on lower saturated fat products were more likely to opt for healthier options (Huang et al., 2006).

Likewise, the rise of social media influencers and digital marketing plans amplified the impact of the digital landscape on consumer perceptions and purchasing decisions (Lim et al., 2021; Calvo-Porral et al., 2021; De Jans et al., 2021).

Research on online grocery shopping has also shed light on consumer behavior in the digital landscape. Studies have shown that individuals tend to choose fewer non-healthy alternatives when online shopping (Zatz et al., 2021; Huyghe et al., 2017). However, digital grocery shopping is also accompanying with dares such as a limited variety of products, lower availability of fresh vegetables, and lower tendency for impulse purchases (Chintala et al., 2023).

The digital landscape has emerged as a prominent influence on food choices, presenting new opportunities to address ongoing challenges within our food system, particularly concerning health and environmental worries (Blom et al., 2021). Despite the benefits of digital platforms in facilitating informed decision-making and promoting awareness of environmental and health issues (Segovia et al., 2022), they may also present challenges such as information overload, misleading advertising, and algorithmic biases (Wongprawmas et al., 2021).

None of the literature reviewed has examined the moderating role of digital landscape in the relationship between health and environmental consciousness on food choices. Hence, this study will contribute to the current literature by investigating this aspect.

2.6. MODERATING ROLE OF THE PHYSICAL LANDSCAPE ON FOOD CHOICES

When exploring how the physical landscape influences the intersection of consumer health and environmental consciousness with food choices, it is indispensable to take into consideration the environmental factors inherent in traditional retail settings.

The physical landscape encompasses traditional brick-and-mortar stores, supermarkets, farmer's markets, and other physical spaces where consumers interact with food products (Leng et al., 2019). Historically, most food choices have taken place in physical settings (Valenčič et al., 2023). Unlike digital landscape, the physical landscape offers tangible experiences such as browsing aisles, examining product labels, and interacting with store personnel (Chen & Antonelli, 2020; Steils, 2021). These experiences assume a vital role in shaping shoppers' perceptions, preferences, and ultimately, food choices.

Research indicates that the physical layout and design of retail spaces can influence consumer behavior, decision-making processes, and their food choices (Zhong & Moon, 2020; Verain et al., 2016). For instance, studies have shown that the placement of healthier food options at eye level or near checkout areas can rise their visibility and possibility of selection (Falbe et al., 2021; Huitink et al., 2020). Besides, interventions in small food stores determined that shelf labels and posters are commonly employed strategies for promoting healthy foods at the moment of purchase (Gittelsohn et al., 2012).

Similarly nudging practices on physical stores, have emerged as effective strategies to encourage healthy and sustainable eating (Arno & Thomas, 2016; Langen et al., 2022). Candario and Chanon (2020) unveiled that nudges are more effective when directed towards discouraging unhealthy eating habits rather than promoting healthier eating habits overall (Candario & Chanon, 2020). Additionally, the social aspect of shopping in physical environments cannot be overlooked. Consumer interactions with store staff, other shoppers, and community members can influence perceptions of food choices and reinforce social norms related to health and sustainability (Winkler et al., 2020). Furthermore, the presence of community-based initiatives, such as cooking classes, nutrition workshops, and food co-ops, can further shape consumer attitudes and behaviors towards food (Jones & Potter, 2016).

Overall, the physical landscape plays a significant role in influencing food choices, and understanding the interplay between physical shopping environments and consumer decision-making processes is crucial for formulating effective interventions and strategies to encourage healthier and environmentally friendly food decisions. None of the existing literature has investigated how the physical landscape moderates the relationship between health and environmental consciousness in influencing food choices. Thus, this study aims to fill this gap in the current literature by exploring this dynamic interaction.

2.7. CONCEPTUAL MODELS AND PROPOSED HYPOTHESES

Instead of developing a single conceptual model, two were proposed to represent different conceptual domains: Health consciousness and Environmental consciousness. This approach aimed to facilitate a comparative analysis of similarities and differences between the two domains, while also allowing each domain to be investigated with clarity and greater detail.

Based on previous cited literature, **Figure 1** illustrates a proposed framework by depicting the moderating effect of the digital and physical landscape on the link involving health consciousness and healthy food choice.

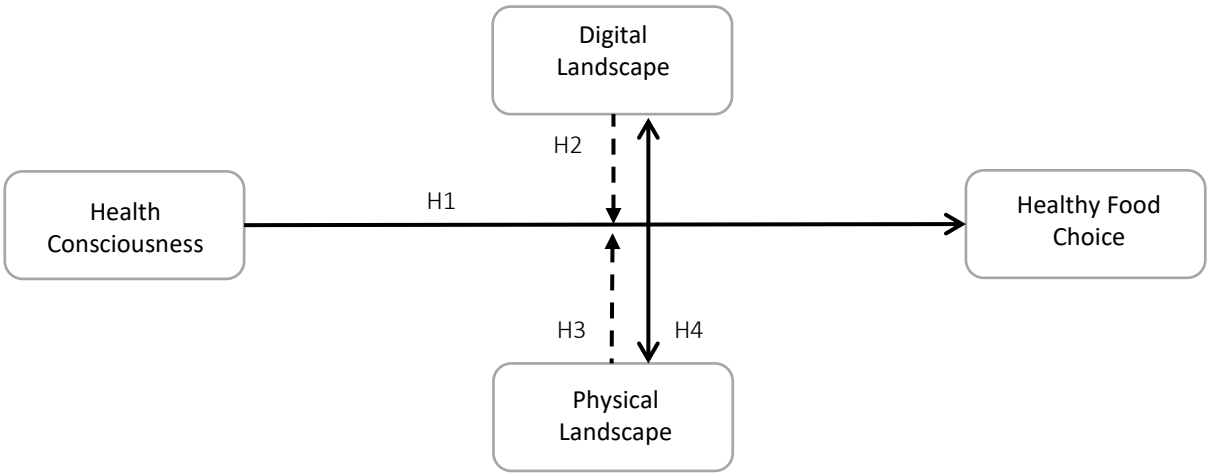


Figure 1 – Conceptual model for Health Consciousness

H1: Health consciousness positively influences healthy food choice

H2: Digital landscape is a moderator of the relationship between health consciousness and healthy food choice

H3: Physical landscape is a moderator of the relationship between health consciousness and healthy food choice

H4: Digital and physical landscapes have different impacts on the relationship between health consciousness and healthy food choice

In the same rein, **Figure 2** introduces a proposed framework by illustrating the moderating effect of the digital and physical landscape in the connection concerning environmental consciousness and sustainable food choice.

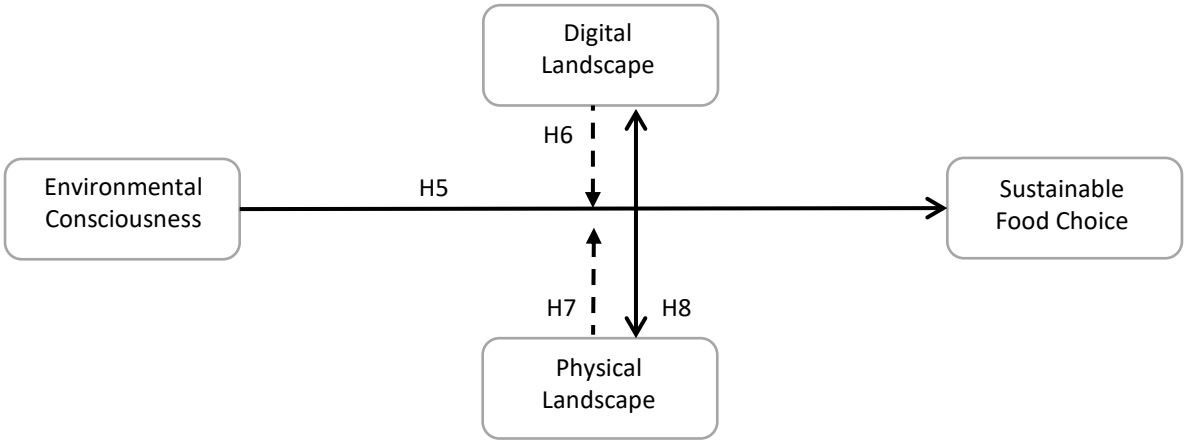


Figure 2 – Conceptual model for Environmental Consciousness

H5: Environmental consciousness positively influences sustainable food choice

H6: Digital landscape is a moderator of the relationship between environmental consciousness and sustainable food choice

H7: Physical landscape is a moderator of the relationship between environmental consciousness and sustainable food choice

H8: Digital and physical landscapes have different impacts on the relationship between environmental consciousness and sustainable food choice

3. METHODOLOGY

In this chapter, the research methodology is comprehensively elucidated, encompassing the methods employed for data collection and further analysis.

A quantitative research methodology was utilized. Quantitative analysis relies on mathematical and statistical models to analyze and interpret data, emphasizing objective measurements and numerical analysis of the collected data (Babbie, 2020). The main objective was to perceive how grocery consumers' health and environmental consciousness influenced their food selections and to examine whether the shopping landscape is a moderator of these relationships. Furthermore, it aspired to uncover potential differential impacts of these two landscapes on these relationships.

3.1. DATA COLLECTION

To fulfill the research objective, quantitative data was gathered and analyzed. An online questionnaire was chosen as the method for gathering the data due to its efficiency in acquiring data from a large and diverse sample, thereby enhancing the credibility and reliability of the conclusions drawn. The structured format of surveys promotes objective data collection, minimizing biases and streamlining both data collection and analysis processes for increased efficiency. The questionnaire collected data that informed the two developed models, and it is available on **Appendix A.**

The questionnaire was developed using Qualtrics and was initially created in English and later translated to Portuguese. At the beginning of the questionnaire, a consent statement was presented to inform individuals about the study objectives, time needed to complete the questionnaire, and their rights as participants. This statement outlined that individuals could choose to take part and could leave at any point, free from any consequences. It also underlined the confidentiality of responses and the academic purposes for which the data would be used. Additionally, the statement included a declaration of consent, confirming participants' understanding of the research's objective and their agreement to participate voluntarily.

Furthermore, the questionnaire covered predefined constructs on health consciousness, environmental consciousness, healthy food choice, and sustainable food choice, drawing from existing research. The participants responded using a 5-point Likert scale, where responses ranged from 1- strongly disagree to 5- strongly agree. The moderating effect of the shopping landscape was investigated by categorizing participants into digital grocery shoppers or physical grocery shoppers, based on their typical grocery purchasing habits, indicated by the question "How do you usually make your grocery purchases?". In addition, questions pertaining to grocery shopping frequency, gender, age, education level and dietary patterns

were included to delineate potential demographic variations in attitudes and behaviors towards food choices.

Measurement items for each construct were derived from existing scales, incorporating some modifications for better alignment with the research context, as detailed in **Table 1**.

Table 1 – Constructs and Scales

Construct	Code	Item	Source
Health Consciousness	**HC1**	I reflect a lot about my health	Adapted from Parashar et al., 2023 and Alexandra et al., 2022
	HC2	I'm very self-conscious about my health	
	HC3	I'm generally attentive to my inner feelings about my health	
	HC4	I'm constantly examining my health	
	HC5	I'm alert to changes in my health	
	HC6	I choose food carefully to ensure better health	
Environmental Consciousness	**EC1**	The balance of nature is very delicate and can be easily upset	Adapted from Parashar et al., 2023 and Alexandra et al., 2022
	EC2	I am extremely worried about the situation of the global environment and its consequences for my future	
	EC3	When I think of ways industries pollute the environment, I get frustrated	
	EC4	At my house we chose products that result from sustainable production	
	EC5	I have switched products for ecological reasons	
	EC6	When I have a choice between two equal products, I purchase the one less harmful to other people and the environment	
Healthy Food Choice		*In the grocery shopping context, I tend to choose...*	Adapted from Cheval et al., 2017 and the healthy diet definition by WHO 2020
	HFC1	Fruits and vegetables (either fresh or frozen)	
	HFC2	Foods rich in fats (sausages, bacon, ham…)	
	HFC3	Natural, not processed food (organic food)	
	HFC4	Salty foods (Chips, crackers, canned broths...)	
	HFC5	Sugary foods (Chocolates, biscuits, cakes, ice cream...)	
Sustainable Food Choice		*In the grocery shopping context, I tend to choose...*	Adapted from Verain et al., 2021 and Verain et al., 2025
	SFC1	Fruits and vegetables	
	SFC2	Seasonal and local products	
	SFC3	Products produced in an environmentally friendly way	
	SFC4	Products packaged in an environmentally friendly way	
	SFC5	Organic products (organic meat, dairy, fruits, vegetables…)	
	SFC6	Products with a sustainability label	

The questionnaire received approval from NOVA IMS Ethics Committee on March 25th, 2024, (available in **Appendix B**), confirming compliance with ethical research guidelines, and further reinforcing the research's validity and reliability. Moreover, to elevate the credibility of the study results, a pre-test was made with a sample of 25 individuals from March 28th to 30th, 2024. This pre-testing phase allowed for minor revisions and improvements, ensuring the clarity and unambiguousness of the survey questions. Additionally, it evaluated the time necessary to finish the survey. The responses from the pre-test participants were incorporated in the final analysis.

The final questionnaire was shared via social media, namely, WhatsApp, Instagram, Email, and academic groups affiliated with NOVA IMS, from April 1st to April 22nd, 2024. This diverse distribution strategy aimed to encompass a wide variety of perspectives and attract a larger amount of respondents, thereby securing the creation of a diverse and substantial dataset.

3.2. DATA ANALYSIS

The questionnaire garnered a total of 444 responses. In spite of that, since participation was entirely voluntary and respondents were under no obligation to complete it, some individuals did not finish the questionnaire. As a result, these incomplete responses were not considered in the analysis. Subsequently, the analysis concentrated on the 415 completed questionnaires. These responses illustrated a wide array of demographic characteristics, facilitating the collection of representative and diverse data pertaining to the role of health consciousness and environmental consciousness on food selections in both digital and physical grocery shopping.

As previously noted, to study the moderating effect of the shopping landscape (SL), respondents were categorized into two groups: digital grocery shoppers and physical grocery shoppers. This classification was determined by their response to a question regarding their typical method of grocery purchases, whether digital or physical. In line of this, the questionnaire received responses from 97 digital grocery shoppers, representing 23% of the sample, and 318 responses from physical grocery shoppers, constituting 77% of the total participants.

Frequency distribution was employed to present the frequency and percentage of participants across all categories, without distinguishing between digital or physical grocery shoppers. This facilitated an elucidation of the demographic structure of the sampled population, and the results are displayed in **Table 2**.

When asked about the frequency of grocery shopping on a typical month, the most common response was 3-4 times per month, accounting for 40% of participants, followed by 1-2 times per month at 25%, 5 to 6 times at 17%, and more than 6 times per month at 18%.

The results predominantly stemmed from female respondents, constituting 63% of the sample, while male respondents represented a smaller portion at 37%. Moreover, the prevailing age range among respondents was 18-24, representing 29%, followed by the ages ranging from 55 to 64, which accounted for 20% of participants.

In terms of education level, most participants had completed at least one university degree, with 47% possessing a Bachelor's level, 36% a Master's degree, and 5% a Doctoral level. Regarding dietary patterns, most participants, 65%, did not follow a specific pattern. Among the remaining 35% of the respondents, who had a specific dietary pattern, 3% identified as vegan, 7% as vegetarian or pescetarian, 10% followed a gluten and/or lactose-free diet, 14% practiced calorie restriction, and finally, 1% adhered to dietary patterns related to religion.

Table 2 – Participants' Demographics

Variable	Answer	Frequency	Representative %
Grocery shopping frequency	1-2 times a month	103	25%
	3-4 times a month	167	40%
	5-6 times a month	69	17%
	more than 6 times a month	76	18%
Gender	Male	154	37%
	Female	261	63%
	Prefer not to say	0	0%
Age	18-24 years old	122	29%
	25-34 years old	72	17%
	35-44 years old	48	12%
	45-54 years old	61	15%
	55-64 years old	81	20%
	65 or +65 years old	31	7%
Education level	Basic school level	2	0,5%
	High school level	49	12%
	Bachelor's degree	193	47%
	Master's degree	151	36%
	Doctoral degree	20	5%
Dietary patterns	Vegan	11	3%
	Vegetarian/Pescetarian	29	7%
	Gluten free and/or lactose free	40	10%
	Caloric restriction	59	14%
	Patterns associated with religion	5	1%
	No specific dietary patterns	271	65%

A descriptive statistical analysis, including the Mean (M) and standard deviation (STDEV) for every item, was conducted to quantify the constructs presented in this research, as illustrated in **Table 3**, providing preliminary information about each construct's central tendency and variability in responses.

The means for items related to health consciousness varied between 3.3 to 4.0, with standard deviations spanning from 0.7 to 1.1, reflecting moderate to high health consciousness and variability among participants. Regarding environmental consciousness, the means of the items ranged between 3.4 and 4.0, with standard deviations between 0.8 and 1.1, indicating diverse environmental consciousness among respondents. The means of items forming the healthy food choice construct ranged from 3.3 to 4.2, indicating a wide range of perceptions regarding healthy food choices. The standard deviations ranged from 0.8 to 1.1, suggesting differences in healthy eating attitudes among respondents. Finally, the sustainable food choice items had means between 3.3 and 4.3 and standard deviations between 0.8 and 0.9, indicating a positive inclination toward sustainable food choices among respondents, with moderate variation in attitudes.

Table 3 – Descriptive statistics

Construct	Item	M	SD
Health Consciousness	HC1	3,998	0,811
	HC2	4,036	0,745
	HC3	3,971	0,779
	HC4	3,289	1,116
	HC5	4,014	0,741
	HC6	3,569	1,046
Environmental Consciousness	EC1	4,070	0,837
	EC2	3,913	0,887
	EC3	3,913	0,917
	EC4	3,364	0,944
	EC5	3,366	1,083
	EC6	3,677	0,995
Healthy Food Choice	HFC1	4,212	0,849
	HFC2	3,822	1,033
	HFC3	3,716	0,932
	HFC4	3,581	1,108
	HFC5	3,316	1,086
Sustainable Food Choice	SFC1	4,294	0,798
	SFC2	4,051	0,897
	SFC3	3,533	0,904
	SFC4	3,463	0,877
	SFC5	3,680	0,903
	SFC6	3,318	0,924

4. RESULTS

The analysis of the research outcomes is presented in this chapter, organized into two sections. The first section validates the reliability and validity of the measurement model, covering indicator reliability and construct reliability and both convergent and discriminant validity. The second, assesses the structural model to evaluate the proposed hypotheses.

The validation of the measurement model results for the two proposed conceptual models (the first for Health Consciousness and the second for Environmental Consciousness, displayed on **Figure 1** and **Figure 2**, respectively) will be presented together. However, the estimation of the structural model will be separated into two sub evaluations: Structural Model for Health-Model (for Health Consciousness) and Structural Model for Environmental-Model (for Environmental Consciousness), to ensure greater clarity and depth.

For this research, the partial least square (PLS) technique of structural equation modeling (SEM) was utilized to estimate the research models. Therefore, Smart PLS 4 was elected as the tool for data analysis because of its specialized focus on SEM and its suitability for analyzing complex relationships. Since, Smart PLS 4 offers a powerful yet accessible platform for conducting SEM analysis, by utilizing it, this study aimed to conduct rigorous statistical analysis to uncover meaningful insights into the relationships between health and environmental consciousness, food choices, and the moderating part of the shopping landscape.

4.1. MEASUREMENT MODEL

To internally validate the proposed models, a reliability analysis of the scales composing the variables of interest was conducted and it is presented here jointly for the two research models. To estimate the internal consistency, Cronbach's alpha (CA) was employed, a well-established statistical method that varies between 0 to 1. Greater values of CA suggest greater reliability, typically with a threshold of 0.70 or higher considered indicative of strong reliability (Hair et al., 2021). All constructs showed strong internal consistency, denoted by CA values surpassing the 0.70 threshold.

To further validate the structural integrity of the measurement models, Composite Reliability (CR) and Average Variance Extracted (AVE) were observed. On one hand, the CR is another measure of internal consistency, with values typically regarded as acceptable when above 0.70 (Hair et al., 2021); all the constructs met this criterion. On the other hand, AVE gauges the extent to which a construct accounts for the variability in its indicators, serving as a measure of convergent validity. AVE should be greater than 0.500, to be considered a good level of convergent validity (Henseler et al., 2009).

Initially, the AVE value of the healthy food choice (HFC) construct did not exceed 0.500 (it was 0.485), compromising convergent validity of Health-Model. Consequently, one of the items

from the construct (HFC3) was removed due to its lowest factorial loading (0.640). Afterward, the AVE for the construct increased to 0.548.

The observed values for CA, CR, and AVE are exposed in **Table 4**. All values met the criteria established on the literature, indicating that both Health-Model and Environmental-Model demonstrated internal reliability and achieved convergent validity.

Table 4 – Construct Reliability and Validity

Construct	CA	CR	AVE
Health Consciousness (HC)	0,854	0,897	0,593
Environmental Consciousness (EC)	0,851	0,889	0,573
Healthy Food Choice (HFC)	0,725	0,828	0,548
Sustainable Food Choice (SFC)	0,856	0,893	0,585

To assess discriminant validity, the Fornell-Larcker, Cross-loadings, and the Heterotrait-Monotrait ratio (HTMT) were utilized (Henseler et al., 2014).

The Fornell-Larcker criterion, stipulates that the square root of for all construct's AVE (highlighted in bold in Table 5) should exceed the correlations with the remaining constructs (Fornell & Larcker, 1981). The obtained values are presented in **Table 5** and show that the criterion was met.

Table 5 – Fornell-Larcker criterion

Construct	HC	EC	HFC	SFC	SL
HC	**0,770**				
EC	0,439	**0,757**			
HFC	0,565	0,423	**0,740**		
SFC	0,498	0,701	0,498	**0,765**	
SL	-0,078	-0,132	-0,139	-0,119	1

Cross-loadings should not exceed the loading of each indicator within its respective construct (Henseler et al., 2014). Upon reviewing **Table 6,** which exhibits the cross-loadings for each research item, it can be inferred that all the constructs met the criterion.

Moreover, if the HTMT is below the threshold of 0.9, discriminant validity is established (Henseler et al., 2014). **Table 7** illustrates the observed HTMT values. Therefore, the HTMT also indicated that the discriminant validity was established.

Table 6 – Cross loadings

Construct	HC	EC	HFC	SFC
HC1	0,792			
HC2	0,788			
HFC3	0,768			
HC4	0,761			
HC5	0,736			
HC6	0,777			
EC1		0,616		
EC2		0,712		
EC3		0,776		
EC4		0,801		
EC5		0,835		
EC6		0,782		
HFC1			0,674	
HFC2			0,759	
HFC4			0,811	
HFC5			0,710	
SFC1				0,630
SFC2				0,762
SFC3				0,868
SFC4				0,807
SFC5				0,675
SFC6				0,819

Table 7 – Heterotrait-Monotrait ratio (HTMT)

Construct	HC	EC	HFC	SFC
HC				
EC	0,496			
HFC	0,682	0,513		
SFC	0,579	0,793	0,639	

4.2. STRUCTURAL MODEL

Upon completing the analysis of the two measurement models and confirming their reliability and validity the following step was to assess the structural models. As already mentioned, this evaluation will be divided into two: Structural Model for Health-Model (Health Consciousness) and Structural Model for Environmental-Model (Environmental Consciousness). Although the same dataset was used for both models, this approach allowed for a focused examination of how individuals' consciousness varies and impacts health-related choices versus environmentally sustainable choices. By separating these models, a clearer understanding of the distinct influences and pathways underlying these domains emerged, while also facilitating the clarity of the analysis and leading to more precise insights.

4.2.1. STRUCTURAL MODEL FOR HEALTH-MODEL

Before examining the Health-Model, which the primary goal was to discover the role of health consciousness (HC) in shaping healthy food choice (HFC) and whether the shopping landscape, categorized into digital and physical, moderated this connection, the Variance Inflation Factor (VIF) was investigated. VIF is a measure utilized to judge multicollinearity between the predictor variables in a regression analysis. A VIF less than 5 is generally considered acceptable, indicating that the level of multicollinearity among variables is not excessively high (Hair et al., 2021). **Table 8.1** contains the VIF values for the different relationships present in Health-Model. The predictors were considered to have moderate correlation.

Table 8.1 – Model Estimation (VIF)- Health-Model

	VIF
HC -> HFC	3,221
SL -> HFC	1,012
SL x HC -> HFC	3,203

The Standardized Root Mean Square residual (SRMR) measures the disparity separating observed and model-implied correlation matrices, assessing the average discrepancies as an objective gauge of model fit. An SRMR value below 0.08 or 0.10 typically indicates a better fit (Schermelleh-Engel et al., 2003). Additionally, lower d_ULS and d_G indices, ideally near 0, indicate a better model fit. Moreover, the chi-square estimates the difference among the observed and expected covariance matrices, where lower values signify a more optimal fit. Finally, the Normed Fit Index (NFI) evaluates the model by comparing its chi-square value to that of a null model. Values close to 1 reveal a better fit (Ding et al., 1995). Based on these criteria and **Table 9.1**, which illustrates model fit, it was settled that Health-Model exhibited a good overall fit.

Table 9.1 – Model Fit- Health-Model

	Saturated model	Estimated model
SRMR	0,092	0,094
d_ULS	0,556	0,578
d_G	0,150	0,156
Chi-square	358,734	366,311
NFI	0,792	0,788

To evaluate the association between the hypotheses and the constructs, the structural model underwent bootstrapping analysis. This method was utilized to assess path coefficients, employing 5,000 bootstrap samples (Sarstedt et al., 2017). The findings are displayed in **Table 10.1**, illustrating the results obtained for Health-Model.

Table 10.1 – Bootstrapping results- Health-Model

	Original Sample (O)	Mean (M)	Standard Deviation (STDEV)	T statistics	P values
HC -> HFC	0,813	0,810	0,059	13,825	0,000
SL -> HFC	-0,195	-0,199	0,090	2,153	0,031
SL x HC -> HFC	-0,371	-0,362	0,080	4,636	0,000

Another crucial aspect in assessing the structural model is the determination of the coefficient of determination (R^2), which embodies the fractions of variation in the endogenous latent variables explicated by the exogenous constructs connected to them (Sarstedt et al., 2017). R^2 values exceeding 0.50 are generally considered moderate. For Health-Model the R^2 value was calculated at 0.358, suggesting that the research Health-Model could account for 35.8% of the variance of the construct healthy food choice.

4.2.1.1. INFLUENCE OF HEALTH CONSCIOUSNESS ON HEALTHY FOOD CHOICES

Previous research has demonstrated that health consciousness drives individuals to make health-focused food choices. Specifically, people with elevated levels of health consciousness are more inclined to prioritize nutritious and beneficial food options in their diet (Lee et al., 2014; Prasad et al., 2008; Pham et al., 2018). This propensity stems from their intensified perception of the power of dietary choices on well-being (Imani et al., 2021; Kusumaningsih et al., 2019). Moreover, evidence points out that health-conscious shoppers are more prone to seek out and purchase healthier items, such as organic foods, low-fat alternatives, and nutrient-dense items (Pham et al., 2018; Rana & Paul, 2017). This trend reflects their

commitment to maintaining a healthy lifestyle and their proactive approach to disease prevention and health maintenance.

In this research context, the weight of health consciousness on grocery shoppers' healthy food choices was investigated. The path coefficient (β) from health consciousness to healthy food choice (HC -> HFC) was 0.813, indicating a strongly statistically significant relation ($p < 0.001$). The t-value of 13.825, which is significantly greater than the critical value (typically 1.96 for a 95% confidence level), confirmed the robustness of this relationship. This significant and strong positive relationship indicated that greater levels of health consciousness were associated to healthier food selections.

Consequently, the proposed hypothesis H1 (HC positively influences HFC) was supported, since the results discovered that health consciousness had a positive effect on healthier food choices. In essence, shoppers who were more health-conscious were determined to choose healthier options while grocery shopping. Thus, these results are consistent with previous research.

Hypothesis H1: *supported*

4.2.1.2. MODERATING EFFECT OF THE SHOPPING LANDSCAPE

The literature also considers the shopping landscape when evaluating food choices. For example, researchers have investigated the impact of the digital landscape, including the role of influencers and food delivery apps, on food choices (De Jans et al., 2021; Coates et al., 2019). Literature have demonstrated that unhealthy choices are the prevailing favorites on food delivery apps (Osaili et al., 2023). Conversely, evidence suggests that people who digitally grocery shop tend to avoid unhealthy products compared to those who shop in physical stores (Huyghe et al., 2017; Zatz et al., 2021). Moreover, the influence of the physical setting on food selection has also been analyzed. Studies on the impact of placing healthier food options at eye level or near checkout counters found an increase in healthier food picks (Falbe et al., 2021; Huitink et al., 2020).

In the present model, the focus was on how health consciousness affected healthy food choices in the grocery shopping and understanding the potential role of the shopping landscape as a moderator. For that, both the direct effect of shopping landscape on healthy food choice and interaction term and healthy food choice were observed.

The path coefficient from the shopping landscape to healthy food choice (SL -> HFC) was -0.195, accompanied by a p-value of 0.031, denoting a statistically relevant but negative direct effect. This suggested that the type of shopping landscape (digital or physical) had a modest but significant direct impact on healthy food choices.

Furthermore, the path between the interaction term and healthy food choice (SL x HC ->HFC) denoted a value of -0.371 and was highly significant, since the p-value was above 0.001. This negative coefficient indicated that the shopping landscape moderated the connection between health consciousness and healthy food choices, supporting the hypotheses H2 (digital landscape is a moderator of the relationship between HC and HFC) and H3 (physical landscape is a moderator of the relationship between HC and HFC).

Figure 3 shows the simple slope analysis for Health-Model, which demonstrated how the relationship between HC and HFC varied across different shopping landscapes. The digital landscape (red line) revealed a steeper slope, compared to the physical landscape (green line). This reflected that in the digital grocery shopping landscape, the relationship between HC and HFC was stronger, which means that individuals who prioritize health were more inclined to choose healthier options in a digital setting, possibly due to improved contact to information, a wider set of options available online or reduced impulses, as past studies have already stated (Segovia et al., 2022; Huang et al., 2006, Zatz et al., 2021). By comparison, in the physical shopping landscape, the slope was less steep, suggesting that in the physical grocery shopping landscape, the influence of health consciousness on healthier food selection was weaker.

Based on these findings, it was evident that both the digital and physical landscapes exerted distinct effects on the relationship between the two constructs, thus confirming hypothesis H4 (digital and physical landscapes have different impacts on the relationship between HC and HFC), aligning with the current literature.

Hypotheses H2, H3 and H4: *supported*

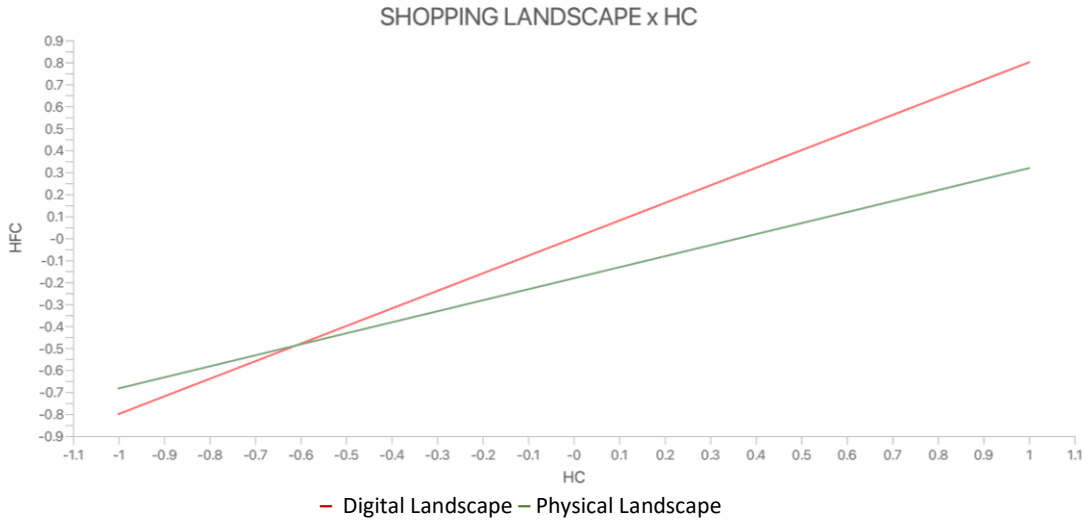


Figure 3 – Simple slope analysis- Health-Model

4.2.2. STRUCTURAL MODEL FOR ENVIRONMENTAL-MODEL

All procedures used to evaluate the structural model for Environmental-Model were conducted analogously to those employed for the evaluate the structural model for Health-Model (**section 4.2.1**).

In alignment with the objective of Environmental-Model, which aimed to investigate the effect of environmental consciousness (EC) on sustainable food choice (SFC) and whether the shopping landscape (SL), encompassing both digital and physical landscapes, moderated this relationship, the issue of multicollinearity was addressed.

An examination of multicollinearity was conducted using VIF, mirroring the approach taken in structural model for Health-Model. Upon reviewing the VIF values, presented in **Table 8.2**, multicollinearity was evaluated for Environmental-Model. It was noted that all relationships exhibited VIF values below 5, indicating a moderate correlation among variables (Hair et al., 2021).

Table 8.2 – Model Estimation (VIF)- Environmental-Model

	VIF
EC -> SFC	4,050
SL -> SFC	1,043
SL x EC -> SFC	3,984

The fit measures were also analyzed for Environmental-Model and were displayed on **Table 9.2.** Considering the established thresholds, presented on the literature, and previously mentioned, for each indicator, Environmental-Model was deemed to exhibit a good model fit.

Table 9.2 – Model Fit- Environmental-Model

	Saturated model	Estimated model
SRMR	0,079	0,076
d_ULS	0,574	0,530
d_G	0,199	0,199
Chi-square	487,86	475,594
NFI	0,813	0,818

Similar to structural model for Health-Model, structural model for Environmental-Model, was subjected to bootstrapping analysis, to assess path coefficients, employing 5000 bootstrap samples (Sarstedt et al., 2017). **Table 10.2** illustrates the outcomes of the bootstrapping analysis for Environmental-Model.

The coefficient of determination (R^2) was also observed, and it revealed that the Environmental-Model reported 51% of the variability in sustainable food choice.

Table 10.2 – Bootstrapping results- Environmental-Model

	O	M	STDEV	T statistics	P values
EC -> SFC	0,931	0,931	0,048	19,444	0,000
SL -> SFC	-0,013	-0,014	0,073	0,171	0,864
SL x EC -> SFC	-0,312	-0,311	0,070	4,458	0,000

4.2.2.1. INFLUENCE OF ENVIRONMENTAL CONSCIOUSNESS ON SUSTAINABLE FOOD CHOICE

Environmental consciousness has been thoroughly researched as a factor of purchase decisions and buying intentions across various product categories. Individuals with high environmental consciousness are acutely aware of environmental issues and exhibit a heightened concern for the planet's well-being. Accordingly, they tend to choose more eco-friendly products to reduce their damaging effect on the earth (Jiang & He, 2022; Ayub et al., 2020). As highlighted by recent literature, this increased environmental concern drives these consumers towards sustainable food choices, namely, organic foods, sustainably produced and packaged items, and other green alternatives (Verain et al., 2015, Verain et al., 2016; Kerber et al., 2023). This pattern denotes that environmental consciousness significantly influences the preference for products that are perceived to be environmentally friendly.

In this research, it was clear that environmental consciousness played a meaningful role in shaping sustainable food choices, displaying a positive and statistically noteworthy relationship. The path coefficient (β) of 0.931 and a p-value below 0.001 emphasizes the robust association between heightened environmental consciousness and sustainable food choices. In addition, the substantial t-value of 19.444, surpassing the typical critical value (1.96 for a 95% confidence level), further validated the solidity of this relationship.

Thus, the proposed hypothesis H5, positing that EC positively influences SFC, finds strong support in the gathered data. Given that, these findings are consistent with prior research.

Hypothesis H5: *supported*

4.2.2.2. MODERATING EFFECT OF THE SHOPPING LANDSCAPE

Research has extensively explored the digital landscape's influence on sustainable food choices, focusing on interventions such as digital nudging, persuasive technology, and mobile apps. For illustration, studies discovered that digital nudges can significantly influence consumer behavior in favor of more sustainable options (Hedin et al., 2019; Berger et al., 2020). In this regard, literature on eco-rankings on mobile devices discovered that extended rankings increased the selection of sustainable products (Weber, 2021). Additionally, Blom et al. (2023) demonstrated that targeted communication on the online encourages sustainable grocery purchases. In contrast to digital landscape, the physical shopping landscape offers tangible experiences, crucial in influencing consumer decisions toward sustainable food choices (Blom et al., 2023). Also, there is evidence that in-store displays, and staff recommendations can guide consumers toward more sustainable options (Chen & Antonelli, 2021).

The path coefficient from the shopping landscape to sustainable food choice (SL -> SFC) was -0.013 and the p-value was 0.864, pointing to a lack of statistically significant direct effect. This suggested that the type of shopping landscape (digital or physical) alone, did not have a meaningful direct impact on sustainable food elections in this model.

However, the interaction term coefficient (SL x EC -> SFC) was -0.312 and highly significant ($p < 0.001$), revealing that the shopping landscape moderated the relationship between EC and SFC. This suggested that the strength of the association between environmental consciousness and sustainable food choices decreased in the context of the shopping landscape, whether digital or physical. In this sense, hypotheses H6 (digital landscape is a moderator of the relationship between EC and SFC) and H7 (physical landscape is a moderator of the relationship between EC and SFC) were confirmed.

Furthermore, **Figure 4** illustrates how the connection between EC and SFC varied across the different two types of shopping landscape. The red line represents the digital shopping landscape, and the green line illustrates the physical landscape. Observing the digital landscape, it was perceivable that the relationship between EC and SFC was stronger, implying that environmental-conscious individuals were more inclined to make sustainable food choices in a digital shopping environment. Following the same reasoning, when an individual grocery shops physically, the influence of environmental consciousness on sustainable food choice was weaker.

Hence, the digital shopping landscape appeared to amplify the power of environmental consciousness on sustainable food choices more than the physical shopping landscape, suggesting that consumers who demonstrate environmental consciousness are more prone to make sustainable food choices when shopping online. Since the different landscapes

demonstrated different impacts on the studied relationship, hypothesis H8 (digital and physical landscapes have different impacts on the relationship between EC and SFC) was also supported.

Hypothesis H6, H7 and H8: *supported*

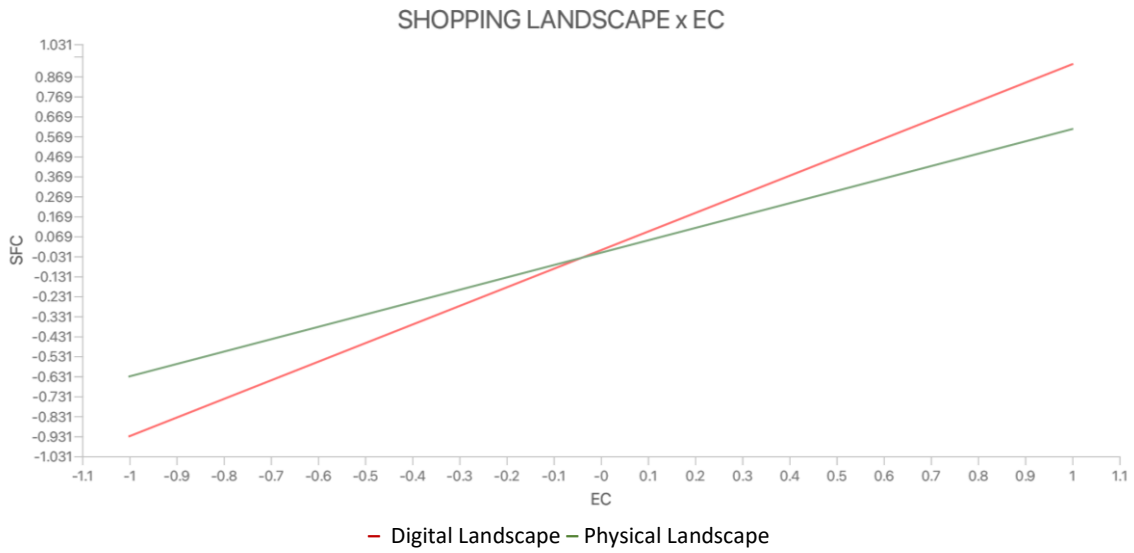


Figure 4 – Simple slope analysis- Environmental-Model

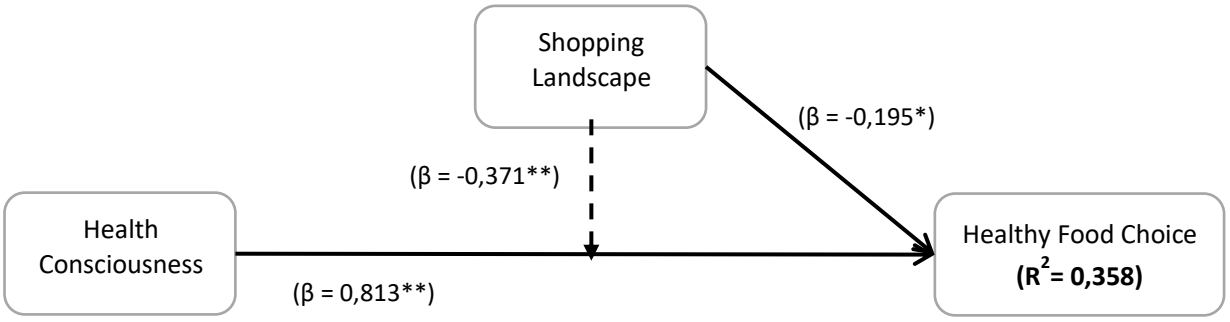
5. DISCUSSIONS AND IMPLICATIONS

This chapter offers a wide-ranging discussion of the outcomes obtained from the analysis, aligning them with the research objectives and hypotheses. The implications drawn from these findings are interpreted in view of existing literature.

This dissertation aimed to underscore the importance of health and environmental consciousness in shaping food choices and investigate the differential impacts of digital and physical shopping landscapes as potential moderators of these relationships.

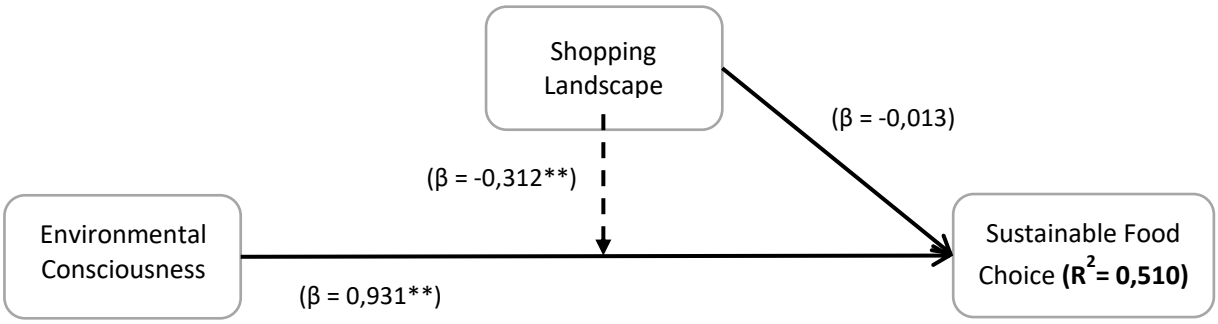
For that, two research models were proposed and eight hypotheses were drawn. The first model (Health-Model) aimed to analyze, in the context of grocery shopping, the connection involving health consciousness and healthy food choices, and to perceive if it was moderated by the shopping landscape explained 35.8% of the variability in healthy food choice. The second model (Environmental-Model), seeked to examine the impact of environmental consciousness on sustainable food options and to examine if the shopping landscape influenced this relationship. This model clarified 51% of the variability in sustainable food choices.

Figures 5 and 6 illustrate the primary results of structural models for Health-Model and Environmental-Model, respectively. **Table 11** provides a summary of the proposed hypotheses and the outcomes of their testing.



Note: Standardized coefficients (β); ** p< 0,001; * p< 0,05

Figure 5 –Structural model for Health-Model results



Note: Standardized coefficients (β); ** p< 0,001; * p< 0,05

Figure 6 – Structural model for Environmental-Model results

Table 11 – Summary of hypotheses

Description	Model	Hypothesis	t-value	p-value	Conclusion
HC positively influences HFC	Health-Model	H1	13,825	0,000	Supported
SL moderates the relationship between HC and HFC	Health-Model	H2	4,636	0,000	Supported
		H3			Supported
		H4			Supported
EC positively influences SFC	Environmental -Model	H5	19,444	0,000	Supported
SL moderates the relationship between EC and SFC	Environmental -Model	H6	4,458	0,000	Supported
		H7			Supported
		H8			Supported

The findings indicated that individuals who are health conscious—those who recognize health-related concerns and take actions to enhance their well-being—tend to favor healthy food items, such as fruits, vegetables, and low-sugar and low-salt foods, when grocery shopping. Specifically, the analysis demonstrated that health consciousness significantly influences healthier food choices (β = 0.813; p < 0.001). This relationship aligns with the outcomes of prior research (Rana & Paul, 2017; Prasad et al., 2008; Lee et al., 2014; Pham et al., 2018).

Similarly, results showed that environmental consciousness strongly impacts sustainable food selection during grocery shopping. Grocery shoppers who are environmental conscious—aware of the adverse influences of human activities on the environment and who engage in behaviors supporting environmental sustainability—show a greater tendency to choose sustainable food options (β= 0.931; p < 0.001). These options include items that are sustainably produced and packaged, seasonal, locally produced, and organic. This result is

coherent with recent literature on the role of environmental consciousness in shaping food selection (Kerber et al., 2023; Verain et al., 2016).

Moreover, the digital and physical shopping landscapes were evaluated as moderators in the relationships between health consciousness and healthy food choices, and environmental consciousness and sustainable food choices. This analysis was built on the responses to the first question present in the questionnaire: "How do you usually make your grocery purchases?" Respondents had the option to select either "Digitally (website, apps)" or "Physically (supermarkets, markets)". For the analysis, the moderating effect of the digital landscape was inspected using the responses from individuals who selected "Digitally (website, apps)". This subset included data from 97 individuals, representing 23% of the total sample. Conversely, the moderating effect of the physical landscape was analyzed using the responses from those who picked "Physically (supermarkets, markets)". This subset included data from 318 respondents, accounting for 77% of the total sample.

The grocery shopping landscape, whether digital or physical, was found to significantly impact the strength of the relationships concerning health consciousness and healthy food choices, as well as environmental consciousness and sustainable food choices. Findings clearly demonstrate that individuals who shop for groceries digitally are more inclined to select healthier and more sustainable food options compared to those who shop in physical stores. This suggests that the digital shopping environment can significantly steer consumer behavior towards more health-conscious and eco-friendly choices.

In conclusion, these results confirm all the proposed hypotheses. Overall, this research highlights the important role that both health and environmental consciousness play in shaping consumer food choices, and the moderating influence of the shopping environment on these relationships.

Next, this research's theoretical and practical contributions are discussed.

5.1. THEORETICAL IMPLICATIONS

This work present theoretical implications as it advances the literature in various ways, hence the theoretical implications are mentioned here.

First, the outcomes of the research expand the understanding of how health consciousness and environmental consciousness influence food choices, offering a nuanced perspective that integrates these two dimensions within the context of grocery shopping. Also, the outcomes contribute to the literature regarding sustainable and healthy consumption, by revealing how environmental consciousness and health consciousness drive sustainable food consumption and healthy food consumption, respectively, in different shopping settings.

Second, the existing literature predominantly examines how health consciousness and environmental consciousness impact the selection of organic food items (Wang et al., 2020; Ayub et al., 2020; Rana & Paul, 2017; Parashar et al., 2023). Therefore, the study broadens the scope by investigating not only organic food but also two wider categories: healthy and sustainable foods. This expansion enhances the understanding of consumer behavior across diverse dietary domains. Furthermore, most research has focused on either health consciousness or environmental consciousness individually. The studies that addressed both consciousnesses together primarily examined their effects on choices, purchases, or purchase intentions of organic food. By analyzing both consciousnesses in a broader context, this study can enrich existing consumer behavior models by highlighting the dual impact of health and environmental factors.

Third, by examining the moderating effect of digital and physical shopping landscapes, the present research introduces a new layer to the consumer decision-making process. This adds to the theoretical framework by illustrating how different shopping landscapes can influence consumer choices, thereby providing a deeper knowledge of consumer behavior in varied contexts.

Thus, this research contributes a unique perspective compared to previous studies examining the weight of health and environmental consciousness on food selection. Additionally, by delving into the dual impact of the shopping landscape, it extends beyond traditional considerations and highlights the nuanced interplay between individual values and shopping landscapes in guiding consumer decisions.

5.2. PRACTICAL IMPLICATIONS

By examining the dual impact of health and environmental consciousness on food choices and considering the moderating effects of shopping landscapes, this study provides valuable insights for retailers and identifies marketing opportunities that can inform real-world applications. This chapter explores these practical implications that the results of this research can offer.

Understanding how digital and physical landscapes influence consumer choices allows retailers to optimize their product assortments, marketing messages, and store layouts to better align with consumer needs and preferences. Retailers can leverage the insights retrieved from this research to tailor strategies and offers according to the preferences and sensitivities of consumers in different shopping environments. By tailoring marketing strategies to emphasize both the health and environmental benefits of products, retailers can attract a more diverse and conscientious consumer base. In physical stores, this might involve creating dedicated sections for healthy and sustainable products, prominently displaying

these items, and using clear signage to highlight their benefits. Online retailers can employ targeted advertising and personalized recommendations to make these products more visible and appealing to consumers who prioritize health and sustainability.

Moreover, the research underscores the growing importance of digital channels in shaping consumer behavior. Retailers can invest in technologies that enhance the online shopping experience, such as personalized recommendations based on health preferences or eco-friendly product labels. By seamlessly integrating technology into the shopping process, retailers can meet the evolving necessities and preferences of digitally adept grocery individuals.

Businesses can develop comprehensive educational campaigns that highlight the positive impact of these choices on individual health and the environment. Retailers and brands can engage with consumers through workshops, cooking classes, and content on social media that showcases healthy and sustainable recipes. Providing clear and accessible information on product labels regarding nutritional content and environmental impact can also empower consumers to make better choices.

Lastly, marketers can use the findings to craft targeted campaigns and messaging that resonate with consumers' health and environmental consciousness, considering the varying impact of digital and physical shopping environments. By emphasizing health and sustainability benefits on online platforms or highlighting convenience and affordability in physical stores, marketers can effectively appeal to consumers across different channels.

6. CONCLUSIONS

This chapter presents the conclusions drawn from the research, along with encountered limitations and recommended paths for future investigations.

The objective of this dissertation was to examine how grocery consumers' health and environmental consciousness shape their food choices, and to discover the moderating role of different shopping landscapes on these relationships.

The research began with a broad literature review to build the conceptual models and formulate the hypotheses. An online survey was developed, using the Qualtrics platform, and distributed via social media, resulting in 415 valid responses. Data analysis was conducted using Smart PLS 4. The measurement models were considered to ensure reliability and validity. Upon confirming the validity of the models, the structural models (Health-Model and Environmental-Model) were evaluated to examine the hypotheses.

The results of Health-Model, which studied the role of health consciousness in shaping healthy food choices and the part of shopping landscape as a moderator, indicated that health consciousness significantly influences healthy food choices among grocery consumers. Specifically, individuals with higher health consciousness were more probable to opt for healthier food items, whereas those with inferior health consciousness were less inclined to do so. Additionally, the shopping landscape was found to moderate this relationship. Shoppers with superior levels of health consciousness tended to choose healthier foods when shopping digitally but opted for less healthy options when shopping in physical stores.

For Environmental-Model, which examined the role of environmental consciousness on shaping sustainable food choices and the moderating role of the shopping landscape, it was found that environmental consciousness significantly influenced sustainable food choices. Consumers with higher environmental consciousness preferred more sustainable food options, while those with lower environmental consciousness were less likely to make such choices. The shopping landscape also moderated this relationship, with environmental-conscious consumers tending to select more sustainable food items when shopping digitally compared to when shopping physically.

In conclusion, this dissertation demonstrated the positive force of health and environmental consciousness on healthy and sustainable food choices, respectively. It was also proven that the shopping landscape moderates these relationships. Additionally, digital and physical shopping landscapes exert distinct effects on the connections concerning health consciousness and healthy food choices, as well as environmental consciousness and sustainable food choices.

6.1. LIMITATIONS

While this dissertation provides valued understandings into the role of health consciousness and environmental consciousness in shaping food choices, and the part of the shopping landscape in these relationships, several constraints must be recognized.

Firstly, the application of a questionnaire for data collection inherently depends on the cooperation and honesty of the participants. In addition, participants were informed on the study's goal before completing the questionnaire, which could have introduced some bias in their responses. They might have been inclined to provide socially desirable answers rather than their true behaviors and preferences.

Secondly, the moderating effect of the shopping landscape was investigated based on participants' self-reported shopping habits. Participants indicated whether they usually purchased their groceries digitally or physically. This approach resulted in different sample sizes for each group, with about 23% of the respondents shopping digitally and 77% shopping physically. The disparity in sample sizes might have affected the strength and applicability of the verdicts related to the moderating role of the shopping landscape.

Other limitation of this study is that most participants reported having a university-level education (47% with a Bachelor's degree, 36% with a Master's degree, and 5% with a Doctoral degree). Therefore, collecting data from individuals with lower educational levels would be beneficial. This broader data collection could enhance the generalizability of the results, allowing them to be extended to all educational levels.

Additionally, although it was not explicitly asked, it can be inferred that most of the participants lived in Portugal. This geographical concentration could restrict the applicability of the results to other regions or nations with varying shopping behaviors and cultural settings.

Finally, this research focuses specifically on the context of grocery shopping. The results may not be directly apply to other forms of shopping or consumer behavior in general.

These limitations highlight areas for improvement in future research, as outlined below.

6.2. INDICATIONS FOR FURTHER STUDIES

Building on the findings and the limitations of the present research, numerous areas for future exploration can be pinpointed.

First, expanding the demographic diversity of the sample could offer a more thorough comprehension of how health and environmental consciousness shape food choices. Future studies could investigate these relationships across various age groups, income brackets,

cultural and educational contexts to determine if the findings hold true in a broader context. Additionally, extending the geographical scope of the research to include participants from various countries could help determine if the observed relationships are consistent across different regions and cultural setting, enhancing the generalizability of the findings.

Another potential area for future work is conducting longitudinal studies. By following participants over an extended period, researchers can assess changes in health and environmental consciousness over time and their long-term impact on food choices. This approach would deliver important insights into the stability and evolution of these behaviors.

Also, to ensure a more balanced representation of participants across digital and physical shopping modalities, future research could actively seek out more people who shop digitally if there aren't enough or use methods such as dividing the participants into groups based on certain characteristics to make sure each group is represented fairly. By mitigating the imbalance in sample sizes, researchers can enhance the statistical power and reliability of analyses pertaining to the moderating effect of the shopping landscape.

Another suggestion for future research is to broaden the scope beyond just grocery shopping realm. Exploring other types of retail environments, for instance, food options in restaurants or even different and specific product categories, namely, cosmetics or cleaning items.

And finally, it would be interesting if future studies delved into the role emerging technologies, like AI recommendations or virtual reality, and the product’s price, in influencing the consumer behavior towards healthier and more sustainable food options.

These suggested directions for future research highlight the potential for continued exploration and innovation in understanding and promoting health and environmental consciousness in food choices. By addressing these areas, future research can build on the foundations laid by this work, contributing to the ongoing scholarly discourse and practical applications in this field.

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APPENDIX A- QUESTIONNAIRE

Q1 Thank you for considering participating in this questionnaire. This questionnaire is part of the development of a Master's dissertation at NOVA IMS in Data Driven Marketing with a specialization in Digital Marketing and Analytics. The questionnaire is available in English and Portuguese.

This research aims to investigate the impact of health consciousness and environmental consciousness on food choices in the context of grocery shopping, and to examine whether this relationship is mediated by the shopping landscape.

Your participation is entirely voluntary. You can choose not to continue your participation at any time. Your answers will be treated with confidentiality and used exclusively for academic purposes. No information that could identify you will be disclosed.

The average time to complete the questionnaire is **5 minutes**. For any questions, please contact via email: 20220166@novaims.unl.pt

Thank you for your attention and cooperation

Q2 By clicking "I agree" I declare that I am 18 years of age or over, and agree to participate in this research. I declare that I was informed that my participation in this study is voluntary and that the information collected is completely confidential and will be only used for academic purposes.

- ○ I agree (1)
- ○ I do not agree (2)

Page Break

Q3 How do you usually make your grocery purchases?

- Physically (supermarket, market) (1)
- Digitally (website, app) (2)

Q4 In a typical month, how many times do you usually grocery shop?

- 1- 2 times a month (1)
- 3- 4 times a month (2)
- 5- 6 times a month (3)
- more than 6 times a month (4)

Page Break

Please reply to the following statements in a scale from **1 (strongly disagree)** to **5 (strongly agree)**

	1- Strongly disagree (1)	2- Disagree (2)	3- Neutral (3)	4- Agree (4)	5- Strongly agree (5)
I reflect a lot about my health (1)	○	○	○	○	○
I'm very self-consciousness about my health (2)	○	○	○	○	○
I'm generally attentive to my inner feelings about my health (3)	○	○	○	○	○
I'm constantly examining my health (4)	○	○	○	○	○
I'm alert to changes in my health (5)	○	○	○	○	○
I choose food carefully to ensure better health (6)	○	○	○	○	○

Q6 Please reply to the following statements in a scale from **1 (strongly disagree)** to **5 (strongly agree)**

	1- Strongly disagree (1)	2- Disagree (2)	3- Neutral (3)	4- Agree (4)	5- Strongly agree (5)
The balance of nature is very delicate and can be easily upset (1)	○	○	○	○	○
I am extremely worried about the situation of the global environment and its consequences for my future. (2)	○	○	○	○	○
When I think of ways industries pollute the environment, I get frustrated (3)	○	○	○	○	○
At my house we chose products that result from sustainable production (4)	○	○	○	○	○
I have switched products for ecological reasons (5)	○	○	○	○	○

When I have a choice between two equal products, I purchase the one less harmful to other people and the environment (6)	○	○	○	○	○

Page Break

Q7 Please reply to the following statements in a scale from **1 (strongly disagree) to 5 (strongly agree)**

In the **grocery shopping context**, I tend to choose...

	1- Strongly disagree (1)	2- Disagree (2)	3- Neutral (3)	4- Agree (4)	5- Strongly agree (5)
Fruits and vegetables (either fresh or frozen) (1)	○	○	○	○	○
Foods rich in fats (sausages, bacon, ham…) (2)	○	○	○	○	○
Natural, not processed food (organic food) (3)	○	○	○	○	○
Salty foods (Chips, crackers, canned broths...) (4)	○	○	○	○	○
Sugary foods (Chocolates, biscuits, cakes, ice cream...) (5)	○	○	○	○	○

Q8 Please reply to the following statements in a scale from **1 (strongly disagree)** to **5 (strongly agree)**

In the **grocery shopping context**, I tend to choose...

	1- Strongly disagree (1)	2- Disagree (2)	3- Neutral (3)	4- Agree (4)	5- Strongly agree (5)
Fruits and vegetables (1)	○	○	○	○	○
Seasonal and local products (2)	○	○	○	○	○
Products produced in an environmentally friendly way (3)	○	○	○	○	○
Products packaged in an environmentally friendly way (4)	○	○	○	○	○
Organic products (organic meat, dairy, fruits, vegetables…) (5)	○	○	○	○	○
Products with a sustainability label (6)	○	○	○	○	○

Start of Block: Demographics

Q9 What is your gender?

- Male (1)
- Female (2)
- Prefer not to say (3)

Q10 What is your age?

- 18-24 years old (1)
- 25-34 years old (2)
- 35-44 years old (3)
- 45-54 years old (4)
- 55-64 years old (5)
- 65 or +65 years old (6)

Q11 What is your highest level of education completed?

- Basic school level (1)
- High school level (2)
- Bachelor's degree (3)
- Master's degree (4)
- Doctoral degree (5)

Q12 Do you follow any specific diet or have any food restrictions?

- Vegan (1)
- Vegetarian/ Pescetarian (2)
- Gluten free and/or lactose free (3)
- Caloric restriction (4)
- Patterns associated with religion (5)
- No specific dietary patterns (6)

End of Block: Demographics

Q7 Please reply to the following statements in a scale from **1 (strongly disagree) to 5 (strongly agree)**

In the **grocery shopping context**, I tend to choose...

	1- Strongly disagree (1)	2- Disagree (2)	3- Neutral (3)	4- Agree (4)	5- Strongly agree (5)
Fruits and vegetables (either fresh or frozen) (1)	○	○	○	○	○
Foods rich in fats (sausages, bacon, ham…) (2)	○	○	○	○	○
Natural, not processed food (organic food) (3)	○	○	○	○	○
Salty foods (Chips, crackers, canned broths...) (4)	○	○	○	○	○
Sugary foods (Chocolates, biscuits, cakes, ice cream...) (5)	○	○	○	○	○

Q8 Please reply to the following statements in a scale from **1 (strongly disagree)** to **5 (strongly agree)**

In the **grocery shopping context**, I tend to choose...

	1- Strongly disagree (1)	2- Disagree (2)	3- Neutral (3)	4- Agree (4)	5- Strongly agree (5)
Fruits and vegetables (1)	○	○	○	○	○
Seasonal and local products (2)	○	○	○	○	○
Products produced in an environmentally friendly way (3)	○	○	○	○	○
Products packaged in an environmentally friendly way (4)	○	○	○	○	○
Organic products (organic meat, dairy, fruits, vegetables…) (5)	○	○	○	○	○
Products with a sustainability label (6)	○	○	○	○	○

End of Block: Default Question Block

Start of Block: Demographics

Q9 What is your gender?

- Male (1)
- Female (2)
- Prefer not to say (3)

Q10 What is your age?

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- Caloric restriction (4)
- Patterns associated with religion (5)
- No specific dietary patterns (6)

End of Block: Demographics

APPENDIX B- ETHICS COMMITTEE APPROVAL

This is to certify that

Project No.: **DDMKT2024-3-154348**

Project Title: **Impact of Health Consciousness and Environmental Consciousness on food choices- The mediating effect of the shopping landscape**

Principal Researcher: **Catarina Santos-Vitor**

according to the regulations of the Ethics Committee of NOVA IMS and MagIC Research Center this project was considered to meet the requirements of the NOVA IMS Internal Review Board, being considered **APPROVED** on 3/25/2024.

It is the Principal Researcher's responsibility to ensure that all researchers and stakeholders associated with this project are aware of the conditions of approval and which documents have been approved.

The Principal Researcher is required to notify the Ethics Committee, via amendment or progress report, of

- Any significant change to the project and the reason for that change;
- Any unforeseen events or unexpected developments that merit notification;
- The inability of the Principal Researcher to continue in that role or any other change in research personnel involved in the project.

Lisbon, 3/25/2024

NOVA IMS Ethics Committee
ethicscommittee@novaims.unl.pt

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