Gestão & Regionalidade

**Recebido em**: 29/11/2023
**Aceito em**: 28/03/2024

# Sustainable food choices: consumers' perceptions and purchase intentions

## *Escolhas alimentares sustentáveis: percepção e intenção de compra do consumidor*

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**Abstract**
Sustainable food choices represent a commitment to the future of the planet. This study addresses global challenges in the food system by analyzing the interactions among purchase intention, sustainability perception, product attributes, sustainable attitude, and gender. The responses of 206 participants were collected through a questionnaire inspired by the study of Van Loo et al. (2017), and the results were analyzed using multiple regression and cluster analysis. The sample revealed significant interactions between purchase intention, product attributes, and sustainable attitude, with women showing a greater inclination toward sustainability. This study contributes to the theory by expanding the original research in a diverse context. In practical terms, it guides businesses in developing marketing strategies, emphasizing the importance of considering product attributes and sustainable attitudes to promote conscious consumption, as well as influencing public policies on regulation and information.
**Keywords:** sustainable food; purchase intention; consumer behavior.

**Resumo**
Escolhas alimentares sustentáveis são um compromisso com o futuro do planeta. Este estudo aborda os desafios globais do sistema alimentar, analisando a interação entre a intenção de compra, percepção de sustentabilidade, atributos de produto, atitude sustentável e gênero. As respostas de 206 participantes foram coletadas através de um questionário inspirado no estudo de Van Loo et al. (2017), e os resultados foram analisados por meio de regressão múltipla e análise de clusters. A amostra revelou interações significativas entre intenção de compra e atributos do produto e atitude sustentável, com as mulheres demonstrando maior propensão à sustentabilidade. Este trabalho contribui com a teoria ao ampliar o estudo original em um contexto diversificado. Para a prática, orienta empresas sobre estratégias de marketing, destacando a importância de considerar atributos do produto e atitude sustentável para promover o consumo consciente, além de influenciar políticas públicas de regulamentação e informação.
**Palavras-chave:** alimentação sustentável; intenção de compra; comportamento do consumidor.

**Citação**: Lourenço, C. E., Santos, V. M., & Dominguez, D. A. (2025). Sustainable food choices: consumers' perceptions and purchase intentions. *Gestão & Regionalidade*, v. 41, e20259364. https//doi.org/10.13037/gr.vol41.e20259364

## 1 Introduction

The need to commit to the environmental agenda and a sustainable economic model is crucial for maintaining life on Earth. The food system, responsible for 25% of global greenhouse gas emissions, intensive soil and water use, water pollution, and soil degradation, affects 33% of available arable land (FAO, 2015). As a major driver of environmental degradation, it emphasizes the need to adopt a lower-impact diet. A sustainable diet ensures food and nutritional security, has a low environmental footprint, protects and respects biodiversity and ecosystems, and is culturally acceptable, economically fair, and accessible (FAO, 2010).

Meat production has a particularly significant environmental impact, contributing to deforestation for pastureland and grain crop cultivation, and accounting for 29% of the global water footprint associated with food production (Rijsberman, 2017). Meat demand is directly linked to GDP, and production is expected to double by 2050 due to projected population growth (Nam, Jo & Lee, 2010). This increase implies further deforestation and intensive water use (Rijsberman, 2017). The United Nations' Sustainable Development Goals, including "Action Against Global Climate Change" (Goal 13), aim to address these environmental challenges by 2030.

In response to the rising demand for sustainable alternatives, the market has introduced practical options for lower-impact diets, such as plant-based "meats," which have gained popularity since 2017. These alternatives aim to replicate the taste and texture of beef while reducing environmental impact and eliminating animal suffering. Companies like Beyond Meat and Impossible Foods, both based in the USA, produce plant-based meat alternatives from soy, peas, and other legumes, significantly lowering their environmental footprint. For example, Impossible Foods' products generate 89% fewer greenhouse gas emissions, use 96% less land, and consume 87% less water than conventional beef (Moses, 2019). The plant-based meat market has experienced remarkable growth, surpassing USD 20 billion in 2020 and growing at an annual rate of 11.3%—outpacing conventional processed meats (9.1%). This trend has led major food companies and fast-food chains to develop their own plant-based offerings to remain competitive. In Brazil, the sector has also expanded significantly, with a projected compound annual growth rate of 13.8% over the next five years, nearly double that of beef (7.6%) and processed seafood (7.1%) (Euromonitor, 2020a, 2020b). Among Brazil's fast-growing food tech sector, Fazenda Futuro stands out as a key global competitor following its acquisition of funding to support expansion into European and U.S. markets.

Given the urgency of transitioning to sustainable diets with reduced meat consumption, mitigating climate change, and fostering the plant-based market, this study aims to explore how consumers' perceptions of sustainability, product attributes, sustainable attitudes, and gender influence their purchase intention of sustainable products. This study examines how consumers' perceptions of sustainability, product attributes, sustainable attitudes, and gender influence their intention to purchase sustainable products. Building on the work of Van Loo, Hoefkens, and Verbeke (2017), who conducted an online survey with European consumers, this research replicates the methodology with Brazilian consumers.

This article presents a literature review covering food production, purchase intention, perception, sustainable attitude, and product attributes. The methodology proposed by Van Loo et al. (2017) was replicated in São Paulo, testing three hypotheses related to sustainability perception (PS), product attributes (PA), sustainable attitude (SA), and gender (G) to assess purchase intention for sustainable products. The results are analyzed using multiple regression

and cluster analysis. Finally, the study discusses key findings, highlights limitations, and suggests directions for future research.

## 2 Theoretical foundations

### 2.1 Food production and sustainable diet guidelines

Adopting a sustainable diet depends on consumers' purchasing intentions. Increasingly, consumers seek sustainable products, including organic options, which have a lower environmental impact (Lourenço et al., 2022). However, sustainable purchasing intention requires both accessibility—affordable prices and product availability—and trust, which is influenced by clear labeling and positive prior experiences (Carvalho, Salgueiro & Rita, 2015).

The food production system presents a paradox. While it is highly productive, capable of meeting 123% of global caloric needs (FAO, 2016), it remains ineffective at eradicating hunger and promoting health. It is a major driver of environmental degradation (FAO, 2018). According to the FAO (2018), approximately 820 million people worldwide suffer from food insecurity, while 2.1 billion people are affected by obesity, and the incidence of diabetes has doubled over the past three decades (Willett et al., 2019).

Modern diets negatively impact both human health and the environment. They are characterized by excessive consumption of calories, sugar, saturated fats, processed foods, and red meat (Willett et al., 2019), leading to high greenhouse gas emissions and environmental degradation. In response, experts recommend a sustainable diet summarized by the principle: "Eat real food, not too much, and mostly plant-based" (EAT Initiative). This diet emphasizes vegetables, fruits, whole grains, legumes, nuts, and unsaturated oils while advocating for low to moderate consumption of seafood and white meat and minimal intake of red meat, processed meat, sugars, refined grains, and starchy vegetables (Willett et al., 2019). Additional considerations include prioritizing seasonal and locally sourced foods, reducing food waste, and choosing fish from sustainable sources (FAO, 2010).

Raising consumer awareness about the health and environmental impacts of food is essential for promoting sustainable diets (Marty, Chambaron, de Lauzon-Guillain & Nicklaus, 2022). Factors such as personal values, product characteristics, price, availability, quality, brand perception, and advertising also play a significant role in shaping sustainable purchasing intentions (Marty et al., 2022; Spears & Singh, 2004). Consumers' choices often reflect their moral and social values, particularly in the context of sustainable consumption (Ye, Lu & Lu, 2020). However, promoting sustainability remains challenging, as consumers tend to resist change, and public policies have a limited impact (ul Haque, Yamoah & Sroka, 2020).

The Theory of Planned Behavior (TPB) (Ajzen, 1991) provides a valuable framework for understanding the factors that influence sustainable food choices. According to TPB, sustainable purchasing intention is shaped by three key factors: consumers' attitudes toward food, social norms surrounding consumption, and perceived behavioral control. Thus, increasing awareness of food's health and environmental impact, providing clear product information, fostering positive social norms around sustainable choices, and improving access to sustainable options can enhance both purchasing intention and behavior.

### 2.2 Perception of Sustainability

Elkington (1997) introduced the concept of the *Triple Bottom Line*, a framework that encourages companies to commit to sustainability across three dimensions: environmental, economic, and social. However, Garnett (2014) argues that while sustainability is inherently multidimensional, consumers tend to associate sustainable diets primarily with environmental concerns.

To better understand consumer perceptions of food sustainability, Van Loo et al. (2017) conducted a survey-based study. Their findings indicate that respondents prioritized environmental factors (ranging from 3.45 to 3.89 on a 5-point scale) over social factors (ranging from 2.94 to 3.35), aligning with Garnett's (2014) observations.

The underemphasis on the social dimension of sustainability is a recurring trend. Toussaint, Lorenzo, and Alvarado (2020) found that few scientific studies analyze the social pillar's role in food industry sustainability and its impact on consumer choices. Despite evidence that social factors influence purchasing behavior, they remain overlooked.

Consumers also struggle to obtain reliable information to make informed decisions due to a lack of transparency and the prevalence of greenwashing—a practice where companies mislead consumers by exaggerating their environmental efforts (Aji & Sutikno, 2015). This underscores the need for trusted institutions, such as governments, businesses, and the media, to provide accurate and transparent information (Toussaint et al., 2020).

Thus, the first hypothesis is formulated as follows:

H1: An increase (or decrease) in consumers' perception of sustainability increases (or decreases) their intention to purchase sustainable products.

## 2.3 Product Attributes

Sustainable eating has become a key priority for policy-making in the 21st century. When making purchasing decisions, consumers tend to prioritize factors such as appearance, taste, price, brand, and convenience of use. The European Union's seals of excellence, such as Protected Geographical Indication and Designation of Origin, are considered relevant because they regulate the quality and origin of products. In contrast, environmental and social certificates, attributes like recyclable packaging, and indications of 'food miles' are perceived as less relevant by consumers (Annunziata & Scarpato, 2014).

Bangsa and Schlegelmilch (2020) observed that connections between sustainable product attributes and consumer decision-making influence three stages: information-seeking behavior, formation of a set of considerations, and product choice. Furthermore, when consumers choose ethical products, they show greater involvement and seek more information, with price and nutritional information as the most relevant variables. Other important factors include brand, taste, aesthetics, and functionality, while sustainable seals or certifications were considered less influential.

For Chan and Zhang (2022), consumers' perceptions of food healthiness are related to perceived health benefits and expected impacts on their well-being. However, consumers often struggle to evaluate food nutritional information, often relying on intuition or lay beliefs to make judgments. To assist in their evaluations, sensory and cognitive cues are used, with blue and green associated with healthy products and red with unhealthy products.

Plasek, Lakner, and Temesi (2020) conducted a study to identify the key factors influencing customers' perception of food healthiness, categorizing them into labels and health claims, product category, packaging shape and color, ingredients, organic origin, and sensory

characteristics. The study found that communicated information, prior knowledge, and product category have the most significant impact on consumers' perceptions of food healthiness. Additionally, organic origin and ingredients with reduced sodium, sugar, or fat are also significant factors. The results regarding the shape and color of the packaging were inconclusive, while sensory factors exert a strong influence, and perceptions of healthiness cannot be compensated for the lack of sensory attractiveness.

The greater the perception of healthiness, the greater the probability of purchase (Steinhauser, Janssen & Hamm, 2019). The credibility of health benefits affects the customer's willingness to pay and purchase the product (Plasek & Temesi, 2019). Nutritionists argue that there are no intrinsically healthy or unhealthy foods, but rather nutritious foods and healthy diets, given differences in individual characteristics, diseases, metabolisms, and digestion (Plasek et al., 2020). This definition of perceived healthiness is in line with the proposal by Chan and Zhang (2022). Building on these findings, the second hypothesis is:

H2: An increase (or decrease) in consumers' perception of product attributes increases (decreases) their intention to purchase sustainable products.

## 2.4 Sustainable Attitude

Understanding consumer motivations is crucial to promoting the adoption of a healthy, sustainable diet. According to Van Loo et al. (2017), engaging consumers in discussions about their health and sustainability is essential to encouraging healthier and more sustainable eating habits. However, the decision to adopt a diet with lower consumption of animal-based foods can also be influenced by other factors, such as concerns about animal welfare, financial savings, or the desire for a lean, muscular body (De Boer, De Witt & Aiking, 2016). To effectively promote behavioral change, it is necessary to provide concrete suggestions for modifying eating habits and emphasize the positive consequences of these changes (De Boer et al., 2016).

Hielkema and Lund (2021) identified three consumer groups in their study: (1) intentional consumers, who aim to reduce their consumption of animal protein; (2) unintentional consumers, who have no such intention; and (3) reducer consumers, who have already adopted a diet with reduced animal protein intake. Moving from intention to actual behavior change depends primarily on environmental awareness and social influence. Having three or more people in one's social circle who reduce or exclude animal proteins facilitates information sharing and provides examples and support for dietary changes (Lacroix & Gifford, 2019).

The transition from intentional consumers to reducer consumers, as described by De Boer et al. (2016), is often hindered by practical barriers such as learning how to cook plant-based meals, identifying suitable restaurant options, and making ingredient substitutions. Additionally, ingrained habits (such as not reflecting on food choices) and socio-cultural associations—such as linking meat consumption to masculinity—can discourage some individuals, particularly men, from reducing their meat intake (Hielkema & Lund, 2021). These findings are consistent with those of Lacroix and Gifford (2020) and Hielkema and Lund (2021), indicating that meat substitutes are one of the most effective ways to reduce meat consumption, as they allow for incremental dietary changes without drastically altering familiar meals.

To develop an effective communication strategy, it is crucial to understand the target audience and tailor messaging accordingly. Van Loo et al. (2017) identified two main consumer segments: those engaged with sustainability and those who are not. Engaged consumers respond well to fact-based information, which should be presented clearly and concisely. The use of graphics and images to illustrate key messages can be particularly effective for this group. Conversely, unengaged consumers are more receptive to familiar visual formats, colors, and elements. They also respond better to concise messages, as they tend to focus only on information that is easy to absorb quickly. Therefore, communication with this group should not require significant cognitive effort (De Boer, Schösler & Aiking, 2014).

De Boer et al. (2014) compared the effectiveness of two strategies for reducing meat consumption: “meatless days” versus “fewer but better sources of animal protein.” They proposed reducing weekly meat consumption by one-third, which could be achieved through approaches such as one or two meat-free days or smaller meat portions throughout the week. However, the authors noted a potential limitation of the "meat-free day" strategy: it does not explicitly communicate the need to reduce total protein intake and replace animal protein with plant-based sources. Furthermore, there is a risk of a “rebound effect,” in which individuals compensate for a meat-free day by consuming more meat on subsequent days.

Another critical aspect is consumer education, which involves providing information on plant-based protein sources, the amounts needed to meet nutritional needs, guidelines for moderate animal protein consumption, and the health and environmental benefits of reducing or eliminating animal products from the diet (Hielkema & Lund, 2021). Based on these considerations, the third hypothesis of this study is:

H3: An increase (or decrease) in consumers' sustainable attitude increases (or decreases) their intention to purchase sustainable products.

Research suggests that gender plays a significant role in shaping sustainable attitudes and behaviors. Studies consistently show that women are more likely than men to reduce their meat consumption, with 70% of vegetarians being women. Conversely, men—especially those who are overweight—are less likely to adopt a plant-based diet, with 70% identifying as carnivores. These behavioral differences may be partially attributed to traditional gender roles and societal expectations, such as the association of meat consumption with masculinity (Hielkema & Lund, 2021).

Rozin, Hormes, Faith, and Wansink (2012) found that men tend to perceive meat consumption as a marker of masculinity, whereas fish and vegetables are viewed as less masculine. However, other factors, such as social class and education level, can also influence the relationship between gender and sustainable diets (Roos, Prättälä & Koski, 2001). De Boer et al. (2014) conducted interviews with Finnish engineers (upper class) and carpenters (lower class), revealing distinct attitudes toward sustainable diets based on social class. Engineers expressed greater concern about health, emphasizing the importance of consuming vegetables and engaging in physical activity. They also associated food and cooking (particularly on weekends) with life’s pleasures. In contrast, carpenters viewed health and cooking as feminine responsibilities and considered meat a necessity, believing that "lighter" meals were insufficient to provide the energy needed for physically demanding work.

## 3 Methodology

This study builds on the work of Van Loo et al. (2017), who conducted an online survey with 2,783 adults from four European countries: the United Kingdom (n = 714), Germany (n = 700), Belgium (n = 684), and the Netherlands (n = 685). The original questionnaire was adapted and translated into Portuguese. The objectives of the current study align with those of Van Loo et al. (2017), including: (1) exploring consumers' associations with sustainability in the food context; (2) identifying similarities and differences in consumers' perceptions of an environmentally sustainable diet, a healthy diet, and a plant-based diet; (3) evaluating consumer engagement with healthy and sustainable eating by identifying consumer segments; and (4) mapping these segments.

The study aimed to examine the relationship between the variable "Purchase Intention" and the variables "Perception of Sustainability," "Product Attributes," "Sustainable Attitude," and "Gender." Each survey question was associated with one of these constructs, and multiple regression analysis was used to assess their relationships.

A non-probabilistic sample was recruited from São Paulo and its metropolitan region using snowball sampling (Bockorni & Gomes, 2021). Participants completed an online survey via Google Forms, which was disseminated through social media platforms such as Facebook and WhatsApp groups. At the end of the questionnaire, respondents were asked to provide demographic information to enable additional analyses. The collected data included gender, age, housing situation (living alone; living with other adults, without children; or living with other people, including children), education level (primary education completed, secondary education incomplete, secondary education completed, higher education incomplete, higher education completed, and postgraduate studies—master's or doctoral level), and occupation (full-time, part-time, unemployed and seeking work, retired, student, or other).

## 3.1 Collection instrument and adaptations of the original

Table 1 summarizes the structure of the instrument, linking each question to its corresponding objective and measurement scale.

**Table 1**

Questions about sustainable eating

| Question | Goal | Scale |
|---|---|---|
| Q1: Consumer perceptions of sustainability | Provide data regarding the construct "Perception of Sustainability" (independent variable) | 1 "Not at all" and 7 "Definitely" |
| Q2: How consumers perceive a healthy, sustainable, plant-based diet. | Provide data regarding the construct "Product Attributes" (independent variable) | Quantify from 1 to 7. |
| Q3 and Q4: Self-report on sustainable eating | Provide data regarding the "Purchase Intention" construct (dependent variable) | 1 "Does not apply to me at all" and 7 "Totally applies to me" |
| Q5 and Q6: Consumer perceptions of their healthy and sustainable habits | Analyze perceptions and compare with other people in the same age group | 1 "Totally disagree" and 7 "Totally agree" |
| Q7 and Q8: Importance and concern for a healthy and sustainable diet | Analyze the respondent's involvement with healthy and sustainable eating | 1 "Totally disagree" and 7 "Totally agree" |
| Q9 and Q10: Consumer concerns about their health and sustainability | Provide data regarding the construct of "Sustainable Attitude" (independent variable) | 1 "Not at all worried" and 7 "Extremely worried" |

| | | |
|---|---|---|
| Q11, Q12 and Q13: Attitude towards plant-based diets | Determine the percentage of consumers who believe they consume plant-based foods (based on the definition provided by the American Institute for Cancer Research [AICR]) | 10-point semantic differential scale, 1 "Extremely negative" and 10 "Extremely positive" |

To enhance the alignment between context and objectives in Van Loo et al. (2017), this study introduced additional questions. The item “Reduce meat consumption” was added to the first block, while the statement “I control my fat intake and replace most saturated fats with unsaturated vegetable oils and margarine” was modified. Specifically, “margarine” was replaced with “unsaturated vegetable oils (such as olive oil, sesame oil, avocado oil)” due to margarine’s partially hydrogenated nature, which contains harmful trans fats (Vasconcelos Costa, Bressan & Sabarense, 2006).

In the final block, the question “Which of these foods do you consider vegetable protein alternatives, compared in a meal to a portion of animal protein?” was replaced with a single-answer question: “Which of these foods do you consider to be the best vegetable protein alternative, compared to a portion of animal protein in a meal?” This change aimed to improve clarity in identifying consumers' ideal choices.

Given the educational differences between European and Brazilian consumers, additional explanations were provided for “Plant-based burgers (e.g., Futuro Burger, Impossible Burger, Seara)” alongside well-known local brands. Descriptions and examples were also included for “Falafel (Chickpea Burger),” “Mushrooms (Shimeji, Shiitake, among others),” “Textured Soy Protein, Tofu, or Tempeh (fermented soy),” “Combination of Cereals and Legumes,” “Vegetable Protein Powder,” “Quinoa,” and “Dark Green Leafy Vegetables (spinach, arugula, watercress).”

However, it is important to note that “Mushrooms (Shimeji, Shiitake, among others),” “Quinoa,” and “Dark Green Leafy Vegetables (spinach, arugula, watercress)” cannot be considered protein substitutes equivalent to a typical portion of animal protein in the Brazilian diet. For reference, while 100g of grilled chicken fillet contains 31g of protein, 100g of cooked white shiitake has only 1.56g, 100g of cooked quinoa contains 5g, and 100g of cooked spinach provides 2.88g. These adjustments were made for comparison purposes with the original study, even though they do not offer equivalent protein mass in the Brazilian context.

Finally, to obtain more robust statistical results, all questions were measured using both Likert and Semantic Differential scales, ranging from 1 to 7 points instead of 1 to 5.

### 3.3 Data collection

Data collection lasted 15 days, beginning in May 2022. A total of 377 responses were collected, of which 206 were valid and completed the entire questionnaire. Some respondents mentioned the large number of questions, suggesting that future studies could improve this aspect. However, to maintain consistency with the structure of Van Loo et al. (2017), the number of questions remained unchanged.

Among the 206 valid responses, 135 respondents were female, 62 were male, and nine preferred not to disclose their gender. In terms of age distribution, 90 respondents were between 18 and 24 years old, 16 were between 25 and 34, 17 were between 35 and 44, 31 were between 45 and 54, 34 were between 55 and 64, 9 were over 65, and 9 preferred not to disclose.

Regarding household composition, 33 respondents lived alone, 124 lived with other adults (without children), 40 lived with other people (including children), and nine preferred

not to disclose. In terms of education, nine respondents had completed high school, 74 had incomplete higher education, 63 had completed higher education, 51 held a postgraduate degree, and 9 preferred not to disclose.

Finally, regarding occupation, 63 respondents worked full-time, 43 worked part-time, three were unemployed, 16 were retired, 57 were students, 10 selected "other," and nine preferred not to disclose.

### 3.4 Data processing

Initially, the data were tested for suitability for linear regression. A scatter plot was used to assess linearity, revealing a linear relationship. Normality was evaluated using a Q-Q plot (quartile comparison), which showed no significant deviation from normality.

Homoscedasticity was assessed graphically from residual variance plots, and multicollinearity was assessed using the variance inflation factor (VIF), which yielded a maximum value of 1.415. None of these tests indicated significant deviations from expected values, confirming the data's suitability for statistical analysis.

## 4 Results

The first item, which assessed consumers' perception of the meaning of sustainability, had an average score of 5.46 (66.8%), indicating that respondents generally recognized this relationship. Questions related to the environmental dimension scored the highest, with an average of 5.88 points (72%), followed by the social dimension at 5.26 (64.4%) and the economic dimension at 5.19 (63.6%). These results align with findings from Garnett (2014) and Van Loo et al. (2017), indicating that despite the multidimensional nature of sustainability, consumers primarily associate it with environmental issues.

In the second item, adjectives were used to measure perceptions of healthy, sustainable, and plant-based diets. The average score was 4.79 (58.7%), suggesting a neutral to positive perception among respondents.

The third item examined healthy eating habits by asking respondents to rate how similar their current diet is to their ideal diet. The average score was 4.37 (53.5%), indicating an intermediate level of healthy eating. Similarly, the fourth item assessed sustainable eating habits, with an average score of 4.16 (50.9%). Although this value was slightly lower, it also suggested a moderate degree of sustainable food intake.

The fifth item explored respondents' subjective assessment of their diet's healthfulness, yielding an average score of 4.58 (56.1%), indicating a slightly higher perception of healthfulness compared to previous items. The sixth item replicated this analysis but focused on sustainability, producing a lower average score of 4.14 (50.7%), consistent with the results from the fourth question.

The seventh item assessed respondents' engagement with healthy eating, yielding an average score of 5.54 (67.8%), indicating a high level of involvement. The eighth item examined involvement in sustainable eating, with an average score of 4.81 (58.9%). While lower than engagement with healthy eating, this result still suggests a moderate to high level of involvement. Encouraging consumers to engage more actively with their health and sustainability concerns is a key factor in increasing the adoption of healthy and sustainable diets (Van Loo et al., 2017).

The ninth item measured respondents' health concerns, with an average score of 5.40 (66.1%), indicating a high level of concern. The tenth item assessed sustainability-related concerns, with a slightly lower average of 5.13 (62.8%), but still reflecting a significant level of awareness.

The eleventh item measured the percentage of plant-based food intake, with respondents reporting an average of 45%, which falls below the median.

The twelfth item asked respondents to identify plant-based alternatives to animal protein that are comparable in a meal. The majority selected “Mushrooms (Shimeji, Shitake, among others)” as their preferred alternative. This finding is consistent with research by Chan and Zhang (2022), which suggests that consumers may struggle to accurately assess the nutritional value of food options, even when motivated to make healthier choices.

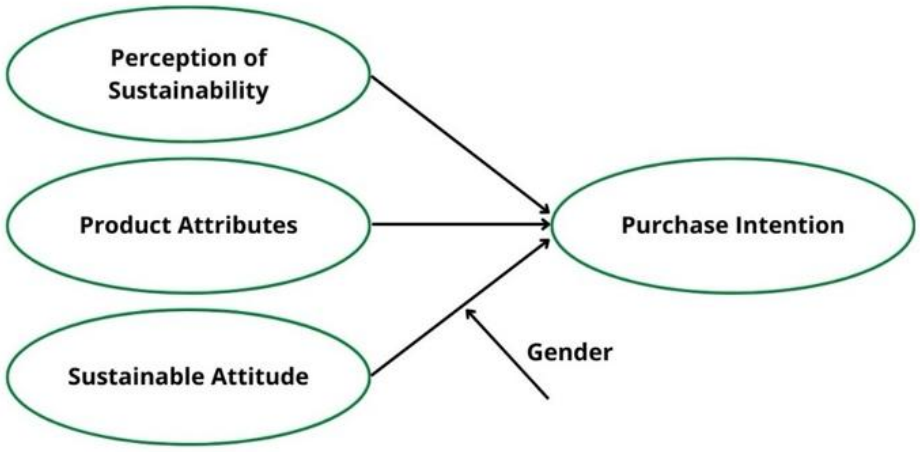
Finally, the thirteenth item evaluated respondents’ attitudes toward plant-based diets using a 10-point semantic differential scale. The average score of 6.39 (57.5%) indicates a generally positive, albeit moderate, perception of plant-based diets.

## 4.1 Analysis model

This study investigated the relationship between “Purchase Intention” (PI) for sustainable products and three key factors: “Perception of Sustainability” (PS), “Product Attributes” (PA), and “Sustainable Attitude” (SA). Additionally, the study examined whether gender (G) moderates the relationship between sustainable attitude (SA) and purchase intention (PI). Figure 1 presents the proposed model.

**Figure 1**

Nomological model.




A multiple regression analysis was conducted using the collected data, with Purchase Intention (PI) as the dependent variable and Perception of Sustainability (PS), Product Attributes (PA), Sustainable Attitude (SA), and Gender (G) as independent variables. An interaction term between SA and G was also included in the model.

$$PI=0.3429 + 0.0723\ PS + 0.3953\ PA + 0.2731\ SA + 0.1019\ G + 0.017\ SA * G$$

The data for each variable were obtained as follows: "Purchase Intention" was calculated by averaging the responses to Q4, "Perception of Sustainability", Q1, "Product Attributes, Q2, "Sustainable Attitude" from Q10 and "Gender" was obtained from demographic data. Table 2 presents the multiple regression results.

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**Table 2**

Multiple regression results

| Predictor | Coefficient | Estimative | Standard Error | T-Test | P-value |
|---|---|---|---|---|---|
| Constant | β0 | 0.3429 | 0.5266 | 0.6512 | 0.5156 |
| PS | β1 | 0.0723 | 0.0846 | 0.8549 | 0.3936 |
| PS | β2 | 0.3953 | 0.0729 | 5.4217 | 0.0000 |
| SA | β3 | 0.2731 | 0.0989 | 2.7620 | 0.0063 |
| G | β4 | 0.1019 | 0.5724 | 0.1781 | 0.8588 |
| SA*G | β3.4 | 0.0170 | 0.1106 | 0.1537 | 0.8780 |

The multiple regression analysis revealed significant relationships between Purchase Intention (PI) and Product Attributes (PA) ($p < 0.0001$), as well as between Purchase Intention and Sustainable Attitude (SA) ($p = 0.0063$). These findings indicate that the likelihood of these associations occurring by chance is minimal, confirming their statistical significance.

In contrast, the relationships between Purchase Intention and Perception of Sustainability (PS) ($p = 0.3936$) and Purchase Intention and Gender (G) ($p = 0.8588$) were not significant, suggesting these variables are not meaningfully associated; i.e., the differences between groups are random, and these variables are not associated with each other. Additionally, the interaction between Sustainable Attitude, Gender, and Purchase Intention was also non-significant ($p = 0.878$).

Although the sample size was small, a post hoc analysis was conducted using the 'alphaN' package in R (Wulff & Taylor, 2023) to adjust the alpha level and optimize the balance between Type I and Type II errors (Lakens, 2021). For 206 respondents, the significance level was adjusted from 0.05 to 0.021. This confirms that the regression coefficients for Product Attributes and Sustainable Attitude, as well as the relationship between Sustainable Attitude and Purchase Intention, remain significant even under the most conservative conditions.

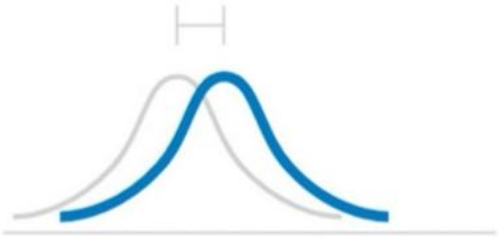
## 4.2 Multigroup Analysis

The multigroup analysis revealed that females (group 1) had significantly higher CI scores ($M = 4.31$, $SD = 1.16$) than males (group 0, $M = 3.82$, $SD = 1.35$). An independent samples t-test, assuming unequal variances, confirmed that this difference was statistically significant ($t(114.33) = 2.55$, $p = 0.012$), with a 95% confidence interval of [-0.868, -0.108] and a moderate effect size (Cohen's $d = 0.44$), as illustrated in Figure 2. The standard language

effect size suggests that, when randomly selecting a pair of values, there is a 60.82% probability that the value from group 1 will be greater than the value from group 0.

**Figure 2**

Comparison chart of Purchase Intention means between groups 1 (female) and 0 (male), with the respective effect sizes (Cohen's d).



| Type | Value | Selected |
|---|---|---|
| r | 0.23 | |
| Cohen's d | 0.44 | ✓ |
| Hedge test (g) | 0.44 | |

A multigroup regression analysis was conducted to examine whether Perception of Sustainability (PS), Product Attributes (PA), Sustainable Attitude (SA), and gender (G1, dummy variable) were significant predictors of Purchase Intention (PI). The regression model indicated that these predictors collectively explained 37.10% of the variance in Purchase Intention, with a significant overall effect ($R^2 = 0.37$, $F(4, 201) = 29.64$, $p < 0.001$).

Further examination of the individual predictors revealed that both Product Attributes (PA, $\beta = 0.35$, $t = 5.66$, $p < 0.001$) and Sustainable Attitude (AS, $\beta = 0.31$, $t = 4.49$, $p < 0.001$) were significant predictors of Purchase Intention (PI).

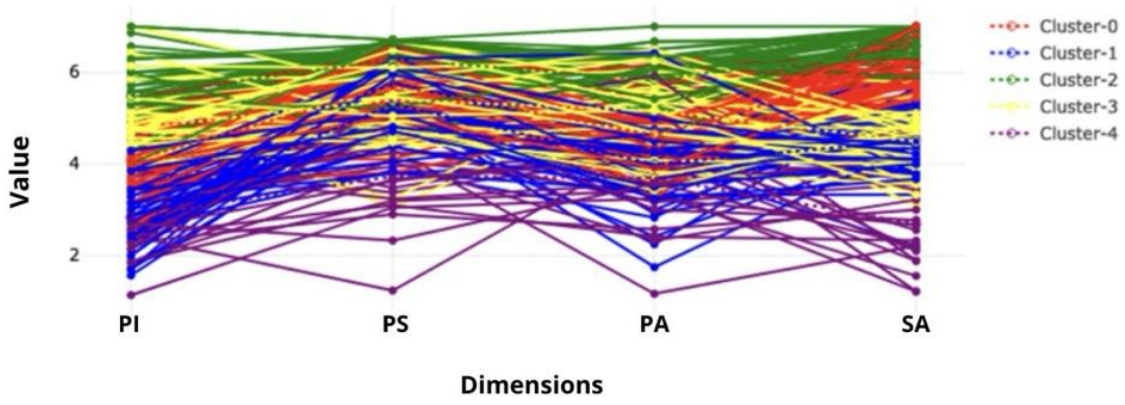
Group 0 had lower scores for Perception of Sustainability (Mdn = 5.29) than Group 1 (Mdn = 5.76). A Mann-Whitney U test confirmed that this difference was statistically significant ($U = 3745.00$, $p = 0.023$, $r = 0.16$).

Similarly, Group 0 scored lower on Perception of Product Attributes (Mdn = 4.58) than Group 1 (Mdn = 4.92). A Mann-Whitney U test confirmed that the difference in Sustainable Attitude scores between the two groups was also statistically significant ($U = 3862.50$, $p = 0.048$), with a moderate effect size ($r = 0.14$).

Furthermore, Group 0 had lower scores for Sustainable Attitude (Mdn = 4.67) compared to Group 1 (Mdn = 5.44). This difference was statistically significant ($U = 3646.50$, $p = 0.012$) and had a moderate effect size ($r = 0.18$).

Finally, the segment analysis identified five distinct clusters based on Sustainable Attitude and Purchase Intention scores, as illustrated in Figure 3. These clusters provide valuable insights into different market segments and can inform targeted marketing strategies and business decisions.

**Figure 3**
Cluster analysis.




The segment analysis identified five distinct segments, described as follows:

- "Inconsistent" Segment (Cluster 0 – Red): Individuals in this group score high on Sustainable Attitude, Perception of Sustainability, and Product Attributes but have low Purchase Intention. They recognize sustainability and view sustainable products positively, but show little intention to purchase them. Factors such as cost, availability, or perceived quality may influence their reluctance.

- "Resistant" Segment (Cluster 1 – Blue): These individuals score high on Perception of Sustainability and Product Attributes but low on Purchase Intention and Sustainable Attitude. While they perceive many products as sustainable and possessing sustainable attributes, they neither intend to purchase them nor hold a positive attitude toward sustainability.

- "Aware" Segment (Cluster 2 – Green): This segment includes individuals who score high in all four categories (PI, PS, PA, and SA). They are highly aware of sustainability and demonstrate a strong willingness to purchase sustainable products.

- "Potential" Segment (Cluster 3 – Yellow): These individuals score high on Purchase Intention and Sustainable Attitude but low on Perception of Sustainability and Product Attributes. They are inclined to buy sustainable products and have a favorable attitude toward sustainability, but may struggle to identify products with sustainable attributes or recognize them as truly sustainable.

- "Disconnected" Segment (Cluster 4 – Purple): Individuals in this segment score low across all four dimensions (Purchase Intentions, Perception of Sustainability, Product Attributes, and Sustainable Attitude). Their low engagement suggests a lack of awareness or interest in sustainable practices and products.

## 5 Discussion

The data analysis revealed a significant interaction effect between Product Attributes and Sustainable Attitude on Purchase Intention, suggesting that both the specific attributes of products and consumers' sustainable attitudes jointly influence their intention to purchase sustainable products. This finding validates the three hypotheses tested. In contrast, no significant interaction was observed among Perception of Sustainability, Sustainable Attitude, and Gender with Purchase Intention, suggesting that these factors do not significantly impact consumers' propensity to purchase sustainable products.

Consistent with Garnett (2014), this study confirmed that sustainability is a multidimensional concept, encompassing various dimensions. The environmental dimension scored the highest (5.88), while the economic (5.19) and social dimensions (5.26) received lower scores. These findings emphasize the importance of Product Attributes in influencing consumers' purchase intentions. As Chan and Zhang (2022) observed, many consumers struggle to evaluate food products based on nutritional value and often rely on intuition or general beliefs. In this study, a majority of participants incorrectly classified shimeji as a protein alternative comparable to animal protein.

Aligning with Hielkema and Lund (2021), this study also found that women were more likely to reduce meat consumption, comprising 70% of the vegetarian sample. This emphasizes the role of gender in sustainable consumption patterns. Women scored higher across all analyzed variables, including Perception of Sustainability, Product Attributes, Sustainable Attitude, and Purchase Intention. Future research should delve deeper into the factors driving these gender differences—such as beliefs, interests, and knowledge—to design more targeted marketing strategies and product innovations.

To increase the purchase intention of sustainable products, this study identified opportunities for each segment. For the “Disconnected” segment, education on sustainability is crucial. In contrast, the “Aware” segment requires marketing campaigns that reinforce behavior and reward (e.g., reward programs) and leverage digital platforms to disseminate positive user experiences. This segment presents a more suitable target audience for the 'meat-free days' campaign. The “Inconsistent” needs campaigns that remove barriers and make sustainable products more accessible, while the “Resistant” segment must be impacted with campaigns that highlight the quality and effectiveness of sustainable products. Finally, for the “Potentials” segment it is necessary to focus on the marketing mix, improving the product offering, and ensuring that they are truly sustainable.

## 6 Conclusion

This study examined consumers' perceptions of sustainability in São Paulo, focusing on how they associate sustainable practices with food systems, their attitudes toward dietary choices and sustainable product attributes, and the potential impact of gender on purchase decisions. A modified version of the questionnaire developed by Van Loo et al. (2017) was used to explore consumers' perceptions of food system sustainability. The instrument was administered to a sample of 206 individuals.

This research expands the existing literature by providing novel insights from a sample collected in the Global South, offering a contrast to the original study by Van Loo et al. (2017). The findings have important implications for practice, as they enhance our understanding of consumers’ perceptions of sustainability and provide guidance on how to promote sustainable behaviors effectively. Understanding how consumers interpret and respond to sustainability concepts is crucial for developing educational and awareness-raising strategies. For example, initiatives such as “meat-free days” can be optimized by clearly communicating the importance of reducing animal protein intake and promoting plant-based alternatives for long-term health benefits.

Moreover, the study underscores the need for companies and governments to enhance consumers’ understanding of sustainable products by emphasizing specific product attributes and promoting a sustainable attitude, ultimately boosting purchase intention for sustainable products.

In conclusion, market segmentation is a valuable marketing strategy for understanding consumer behavior heterogeneity. This study identified five distinct segments that can be targeted through tailored marketing strategies to promote sustainable products and increase purchase intentions. However, it is important to acknowledge the limitations of this research. The relatively small sample size and the absence of social class stratification are notable limitations, particularly in the Brazilian context. Future research should expand the sample size and explore additional contexts. Furthermore, there is a need to explore the roles of gender, age, and culture in shaping consumers' purchasing intentions, offering valuable insights for a more comprehensive understanding of the factors that influence sustainable purchasing behavior.

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