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Consumers' knowledge, practices, and perceptions about conventional and sustainable food packaging

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Abstract

The aim of the study is to evaluate consumers' knowledge, practices, and perceptions about conventional and sustainable food packaging. Cross-sectional, descriptive, and exploratory study conducted with consumers in Vitória city, Espírito Santo State, Brazil. A questionnaire was applied to 163 consumers. Regarding the sociodemographic characteristics of the participants, most of them were women, in the age group 18-24 years, did not live with a partner and had individual income. Consumers reported quality as the most important factor taken into consideration at food purchasing time and indicated that always observe the packaging conditions at purchasing time. Most consumers reported that packaging presents a fundamental role in their purchase decision, and they have mentioned also that material's type influences their decision to purchase a food product. In addition, consumers preferred biodegradable packaging rather than the traditional one, whereas most of them reported to be willing to pay up to 5% more for products if their packaging had lesser environmental impact. Therefore, it appears that consumers evaluate products' packaging at purchasing time, but lack of information about the material type used for packaging and about its environmental implications is a serious issue that avoids behavior's changes from taking place.

Keywords: consumer behavior; food packaging; environment.

Practical Application: Knowledge, practices, and perceptions about food packaging are crucial to the sustainable systems.

1 Introduction

Food packaging is fundamental in ensuring safe food and is designed to communicate with consumers and trigger their desire to buy a product (Abejón et al., 2020). Furthermore, packaging gives information about the producer, brand, origin, quantity, ingredients, nutritional value, and messages related to the environmental aspects (Schifferstein et al., 2021). However, the current consumption routine, in association with new technologies, has led to increased waste production (Landim et al., 2016; Deshwal et al., 2019; Williams et al., 2020; Schifferstein et al., 2021; Oloyede & Lignou, 2021). So, packaging materials can remain in the environment for a long period-of-time (Fabri et al., 2005; Landim et al., 2016) and based in this have been questioned mainly when fossil-based materials and a linear model the packaging design process are applied (Williams et al., 2020).

Increase food production and consumption has resulted in greater environmental impact and social implications (Lazzarini et al., 2017; Herbes et al., 2020). According to Abejón et al. (2020), in 2023, total value in the total packaging business could be $1 trillion, and in the next years, could be added an extra $150 billion. As the amount of packaging increases, companies see themselves forced to take responsibility for the product's whole life cycle (Karaski et al., 2016). Thus, interest in developing environment-friendly packaging and the interest for using recyclable materials and packaging constituents has been continuously increasing (Klaiman et al., 2016). Consequently, over the last decades, packaging industries have been developing more sustainable packaging systems and processes (Landim et al., 2016; Oloyede & Lignou, 2021). This fact responds to the concerns of governments and consumers who request for green or eco-friendly packaging (Oloyede & Lignou, 2021).

About to the process to generate lesser environmental impact, it is worth mentioning that consumers also play essential role in demanding sustainable packaging, since they are the ones who decide about the products to be purchased and consumed (Macena et al., 2021). In the last decades, consumers have prefered food in environmentally friendly packaging (Popovic et al., 2019; Dilucia et al., 2020). Consumers' intention to purchase sustainable food depends on several factors, such as knowledge, motivation, and access to information about the topic (Lazzarini et al., 2017). Price is a prevalent factor in sustainable products and consumers' decision it based on more significant environmental concerns. Then, it is followed by aspects such as high quality and greater product functionality (Martinho et al., 2015). Consequently, food product consumption is associated with the amount and quality of information available to consumers, whose the decision to purchase is not only based on product replacement or obligation, but mainly on their identification with the product and with its shared values (Gonçalves et al., 2016).

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Although consumers are often concerned with environmental issues, there is a contradiction in how they define the ecologically responsible way of doing things and the way they act in their daily lives (Nascimento et al., 2014; Fortunati et al., 2019; Han et al., 2018; Herbes et al., 2020; Adam et al., 2021). This contradiction reveals lack of clarification about product consumption and/or disposal (Nascimento et al., 2014). Several consumers fail to understand the environmental impact caused by their purchase decisions about the packaging because of the lack of information about it (Herbes et al., 2020; Popovic et al., 2019). Thus, the present study aimed to assess consumers' knowledge, practices, and perception about conventional and sustainable food packaging.

2 Materials and methods

A cross-sectional, descriptive, and exploratory study was conducted with consumers of two supermarkets in Vitória city, Espírito Santo State, Brazil, from February to May 2019. It adopted a non-probabilistic convenience sampling method to recruit regular food product consumers. The convenience sample was applied due to the recruitment facility and considered the interest to participate. Researchers remained at each supermarket to identify the maximum number of consumers available and that were interested to participate in the study. The research was approved by the Research Ethics Committee of the Federal University of Espírito Santo, under process n. 3.073.513.

2.1 Questionnaire survey

An investigative questionnaire was used to collect information about consumers' profile, practices, perceptions, and knowledge about the packaging types used in food products. The questionnaire was prepared based on studies conducted by Gonçalves et al. (2016), Karaski et al. (2016) and Scott & Vigar-Ellis (2014), as well as on information collected on websites belonging to the Brazilian National Health Surveillance Agency and to the Brazilian Packaging Association. The questionnaire comprised 28 multiple-choice questions to enable congruent answers and shorten the time necessary to fill it up due to the place where the survey was developed. Before starting the survey, a pilot test was carried out to 30 consumers to assess whether the information included in the questionnaire is understandable to potential participants and to check the application time. After this, questionnaires were applied by a trained researcher and filled out by participants, without external interferences. Consumers with habits to purchase food in selected supermarkets were included in the study. The inclusion criteria are consumers 18 years old or more. Participants who were unable to complete the questionnaire were excluded from the survey. The consumers who agreed to participate have signed the Informed Consent Form.

The first part of the questionnaire comprised 7 questions concerning consumers' sociodemographic variables (gender, age, marital status, occupation, education level and individuals live in the same residence). The second part of it encompassed 11 questions focused on collecting information about consumers' purchasing profile (purchase frequency; purchasing decisions for food products; analyze the packaging characteristics when you are buying food products; purchased a product with sustainable packaging) and practices adopted based on food packaging. The third part of the questionnaire comprised 10 questions associated with consumers' perception and knowledge about the possibility of packaging reusing, recycling, and disposal, as well as questions about materials used in food packaging (knowledge about characteristics and decomposition time of the packaging materials, environmental impacts; pay more for sustainable packaging).

2.2 Data analysis

Results were tabulated in Microsoft Excel 2007® software and subjected to descriptive statistical analysis based on percentage quantitative values. Data were analyzed in the IBM SPSS® software version 22.0.

3 Results and discussion

3.1 Sociodemographic features

In total, 163 consumers were interviewed, 73.0% (n = 119) were women, 41.7% (n = 68) were in the age group 18-24 years, 62.6% (n = 102) did not live with a partner and 58.3% (n = 95) reported to have individual income (Table 1). As for education level, 49.7% (n = 81) of participants had an undergraduate degree. In research conducted by Macena et al. (2021), they observed a similar result, and most participants were female (70.4%) and 69.8% had an undergraduate degree.

Table 1. Sociodemographic features of food consumers in Vitória city, Espírito Santo State, Brazil, 2019.

Variable	Rate	n
Gender		
Female	73.0	119
Male	27.0	44
Age		
18-24 years old	41.7	68
25-44 years old	38.0	62
45-64 years old	17.8	29
Older than 65 years	2.5	4
Marital status		
No partner	62.6	102
With partner	37.4	61
Occupation		
Salaried worker	58.3	95
Unemployed	41.7	68
Education level		
Elementary school	10.4	17
High school	29.5	48
Undergraduate degree	49.7	81
Postgraduate	10.4	17
How many individuals live in the same residence		
Live alone	6.8	11
1-3	69.9	114
4 or more	23.3	38

3.2 Consumer practices associated with food packaging

Based on the current results, 28.8% (n = 47) of participants reported going grocery shopping once a week, whereas 82.8% (n = 135) of them classified need/replacement as the main factor driving food purchasing. In addition, 69.9% (n = 114) of interviewees reported that quality is the main factor taken into consideration when purchasing products. Moreover, 62.0% (n = 101) of participants always check the conditions of the packaging when purchasing food products. For practices associated with food packaging, 64.4% (n = 105) of interviewees reported that packaging presents a fundamental role in their purchase decision-making process. In addition, 83.2% (n = 129) of consumers reported that observe packaging's physical conditions at the time to purchase food products (Figure 1). This is a positive outcome since research institutions, health surveillance agencies and consumer protection services always recommend consumers not to buy crumpled, rusted or violated food packaging due to likely food contamination and deterioration (Brasil, 2001; Dantas et al., 2011; Brasil, 2012).

The physical condition of food packages must be observed since it can indicate product changes, or even deterioration; therefore, it should not be purchased and/or consumed. Packages must have seals or closure systems capable of preventing their unintentional opening under reasonable conditions (Brasil, 2001). Opening evidence systems (seals, lids with rupture ring, lids with vacuum indicator, among others) are used to protect food from being tampered with; moreover, they make it easier for consumers to identify any irregularity in each package (Jorge, 2013). Therefore, consumers benefit from paying attention to the packaging condition, since it prevents them from purchasing products in poor physical condition. Companies have been continuously investing in technologies capable of increasing their competitiveness by focusing on an important purchase factors such as product quality, safety, and visual appeal to win consumers' trust.

In total, 58.3% (n = 95) of consumers sometimes read food packaging labels. Product expiration date was the most mentioned item; it was reported by 108 consumers as the highest priority item. In addition, 52.9% (n = 9) of consumers who do not read labels, reported disinterest as the reason for such behavior. This outcome deserves attention as consumer practice because, according to Law n. 8.078/90 (which addresses the consumer protection code (Brasil, 2012), consumers must pay attention to packaging labels and the information available before purchasing any product. It is essential to make consumers increasingly aware of product labels and overcome their limitations. Labels are an intermediate mechanism between product and consumers' choice. Rather than just being an obligation, they can also provide relevant information about the purchased product. According to Nascimento et al. (2014), limitations such as font size, validity and lack of information clarity impair consumers' understanding of the purchased product. Thus, it is necessary improving food consumers' education, awareness, access to information, and sharing information about food labels and packaging to enable them to make better choices.

Moreover, 55.8% (n = 91) of consumers have mentioned that the packaging material type influences their purchase decision. In addition, plastic material was the most consumed packaging type, according to 158 consumers (Figure 2). This result reflects the extensive use of this material on packaging systems, and this became a concern because of most plastics are produced from petroleum and are discarded in the environment (Macena et al., 2021).

Plastic materials are widely used in packaging systems because they represent low costs to companies and because they can be applied to different food packaging types (Marsh & Bugusu, 2007; Cazón & Vázquez, 2021). These are also the reasons why plastic materials' production and disposal reach high levels and, consequently, they are the materials most often thrown in the trash (Langley et al., 2011; Landim et al., 2016). As plastic is not degradable, the inappropriate discarding created an environment problem, reaching places as oceans, for example (Licciardello, 2017; Cazón & Vázquez, 2021; Macena et al., 2021). In addition, plastics recycling is a complex process, which makes it impractical or inconvenient (Licciardello, 2017; Cazón & Vázquez, 2021).

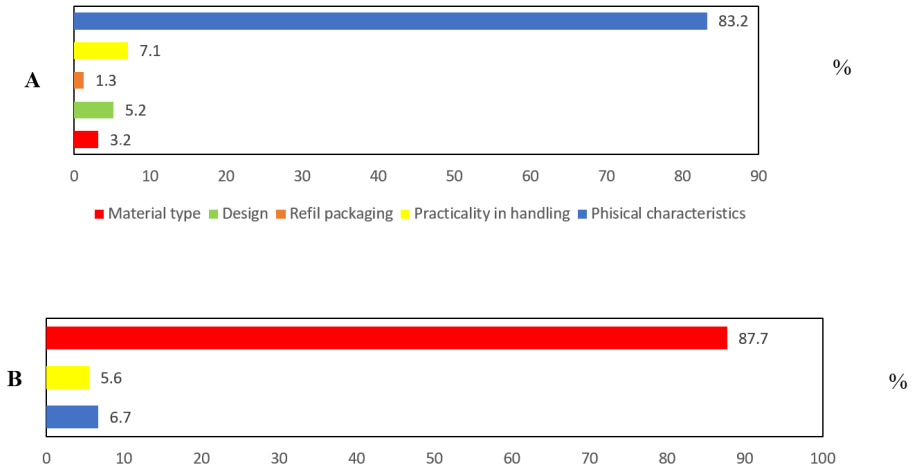

Figure 1. Percentual of consumer practices associated with food packaging, Vitória, Espírito Santo, Brazil. (A) Aspects observed in packaging at the time to purchase food products. (B) Packaging factors influencing the purchase of food products.

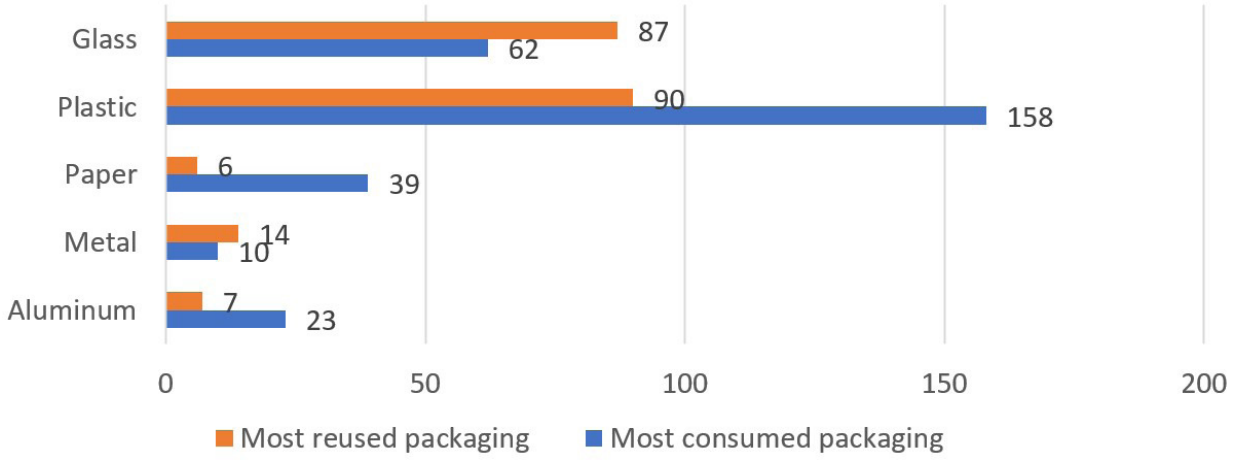

Figure 2. Food packaging material types mostly consumed and reused by consumers in Vitória, Espírito Santo, Brazil. Data are expressed in the number of times that consumers mentioned the items.

It is important to emphasize that it is up to consumers to find out about the level of benefit to the environment associated with the use of a particular packaging, since lack of new requirements allow manufacturers to keep on acting in the same way; after all, the pressure made by consumers is what forces companies to change. Although most plastic materials used in packaging are used for less than a week, their prolonged durability in the environment turns them into polluting waste. This issue, and the fact that most synthetic polymers are designed based on product performance and durability, rather than on material degradability and recyclability enabled accumulating millions of tons of plastic materials laying on the oceans and landfills (World Economic Forum, 2016; Sangroniz et al., 2019; Macena et al., 2021).

The concept mostly mentioned as definition of sustainable/environment-friendly packaging refers to materials that are not harmful to humans or environment – it was mentioned 81 times (Figure 2). This outcome indicates the concern of more than half of consumers with packaging materials. On the other hand, the outcome concerning the most used material type deserves attention. According to Oloyede & Lignou (2021), from a technical perspective, sustainable packaging has a low environmental impact based on life-cycle assessments. On the other hand, for consumers, a sustainable package design has the eco-friendliness of the packaging. In recent years, the reduction of waste deriving from packaging has been addressed (Sangroniz et al., 2019). The environmental impact caused by food packaging depends on the material used to produce it and on its features. The option made for the packaging material and design is essential to help better understand products' sustainable performance (Simon et al., 2016; Abejón et al., 2020). According to Lindh et al. (2016), consumers avoid or prefer a particular material type rather than the other, depending on their needs and demands; 61.3% (n = 100) of consumers reported to have had a hard time handling some food packaging types, whereas 93.3% (n = 152) of them reported buying food packages that can be easily opened. As for sustainable consumption practices, 20.9% (n = 34) of consumers have already purchased an item because it is said to be/seen as sustainable, based on the information available in the packaging.

3.3 Consumers' knowledge and perceptions about food packaging

According to consumers, glass was the most reused food packaging type, and it was mentioned 87 times, followed by plastic materials, which were mentioned 76 times. Glass packaging shape makes it highly reusable; consequently, glass is the most recycled and reused material. Such a finding may be linked to the value associated with products or to individuals' perception about the high value of this material (Langley et al., 2011). The reuse of different packaging residues has been constantly addressed as one of the main goals to achieve sustainable development (Miyazato et al., 2007).

Consumers are more aware of products made from recycled glass because they know the long tradition in the recycling cycle of this material (Langley et al., 2011). Glass accounts for 6% of the packaging production value in Brazil. Although the time is taken by glass to fully degrade in the environment remains undetermined, its impact on the environment gets increasingly smaller due to its full recyclability and reusability. Plastic is also significantly reused, which is not a positive aspect when it comes to food products, since plastic materials can transfer substances from the packaging to the food, due to physical-chemical phenomena, to plastic material contamination in the environment where its disposal takes place, or to chemical substances used in recycling processes (Wikström et al., 2018; Brasil, 2016). According to Ellen MacArthur Foundation (2017), plastic packaging accounts for 26% of total plastic materials used worldwide; approximately 72% of these materials are currently lost, 40% of them end up being discarded in landfills, whereas 32% is discharged in the ocean and in urban areas. Although plastic recycling rates have increased, only 14% of this material is recycled and, after additional treatment application, only 5% of the material cost is retained. In Macena et al. (2021), study consumers understand that recycling plastic can reduce environmental pollution and stimulate sustainability.

Consumers have different perceptions about plastics (Langley et al., 2011). Plastic packaging requires accessible labeling, so that consumers can know and understand which

plastic material types can and cannot be recycled and reused (Langley et al., 2011). Government agencies recommend plastic materials' use only for the intended purposes and based on the manufacturer's instructions. In addition, some recycled plastics should not be used for food packaging, since the recycling process takes place at temperatures lower than that necessary for safe contaminant disposal (Brasil, 2001; Marsh & Bugusu, 2007; Brasil, 2012; Jorge, 2013). Thus, consumers must be aware of plastic packaging reuse and disposal processes. Consumers have a strong influence on the packaging manufacturing process since companies aim at meeting their needs (Marsh & Bugusu, 2007). Cellulosic packaging can also be used by the food industry in the form of cardboard and paper packaging. This material has advantages such as presentation in different thicknesses and shapes, the likelihood of being combined with other materials, easy printing, low weight, resistance to low temperatures and recyclability. However, it also has disadvantages such as low mechanical resistance, poor barrier to gas and water vapor and lack of inertia. According to Jorge (2013), paper and cardboard box degradation time is 3 to 6 months and at least 6 months, respectively.

The glass was acknowledged by consumers as the material taking longer time to decompose in nature – it was mentioned 45 times. It was followed by metal and plastic, which were both mentioned 36 times. This result corroborates information collected at the website of the Ministry of the Environment (Brasil, 2019). According to which, glass takes more than 1,000 years to decompose fully. Since glass is an inorganic and non-combustible material, its chemical degradation and physical erosion are slow (Jorge, 2013). However, glass is a highly recyclable and reusable material (Langley et al., 2011). According to consumers, although plastics and metals require the longest decomposition time, plastics cause worse environmental impacts than metals (Licciardello, 2017). Thus, this is a negative outcome when it comes to environmental aspects, since traditional plastic materials can lead to severe environmental issues due to their long degradation time and to features that hinder the action of enzymes and microorganisms (Landim et al., 2016). Plastic recycling remains incipient due to its low production cost and to the use of these recycled materials in another's use (Landim et al., 2016). Although issues such as environmental degradation and global warming have raised concern about sustainable development (Herbes et al., 2020), consumers lack knowledge about the impact of packaging materials on the environment, since it hinders conscious environmental decision-making and indicates the need of guiding and informing this population about the environmental impacts caused by inappropriate packaging disposal. Therefore, it is increasingly necessary to enable the environmental profile of packaging materials to support consumers' choices (Lindh et al., 2016; Herbes et al., 2020).

As for the destination given to food packaging, 71.8% (n = 117) of consumers reported to throw them in the garbage after food consumption; of these, 60.2% (n = 71) do not separate inorganic from organic waste (Figure 3). Waste generated by human action could be treated before being sent to the destination as incineration, composting and recycling. These strategies are indicated with the objective of reducing the volume of solid waste to be disposed of in landfills (Miyazato et al., 2007).

As for the reason why they do not separate inorganic from organic waste, 62.0% (n = 44) reported lack of selective collection, 21.1% (n = 15) have mentioned that they do not have time to do it and 16.9% (n = 12) reported a lack of interest in doing so. The separation of recyclable materials by consumers generates benefits such as reduced costs with later recycling stages, be it by shortening the washing cycles or by reducing material contamination with dirt (Karaski et al., 2016). Cases reporting no separation between inorganic and organic waste due to lack of selective collection prevent recyclable materials from being sold to recycling cooperatives and contribute to waste accumulation (Palombini et al., 2017). Separate waste types can be efficiently recycled and have been doing this where possible (Macena et al., 2021).

According to Jorge (2013), it is necessary investing in the implementation of programs and in selective collection equipment for sorting centers to have a satisfactory waste recycling system. In addition, it is necessary to demand the separation between inorganic and organic products, since it is essential to generate several benefits to society and to the environment, such as reducing waste volume and stimulating citizenship through community participation. Moreover, recycling adds value to work performed by waste pickers, due to consumers' environmental awareness. This process enables gains in business actions. Likewise, it is necessary to commit to and developing public policies at federal,

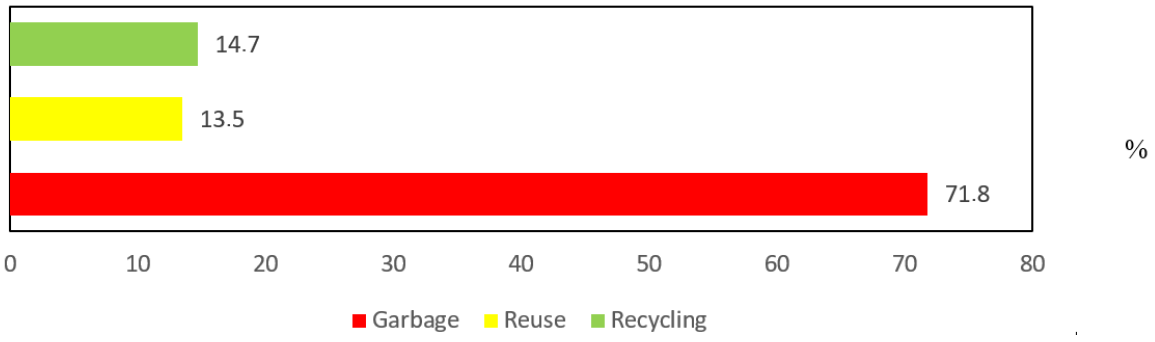

Figure 3. Destination given by consumers (%) to used packaging materials, Vitória, Espírito Santo, Brazil.

state, and municipal levels to boost the recycling market based on new investments and innovations aimed at overcoming taxation issues (Compromisso Empresarial para Reciclagem, 2019). Law n. 12.305/10 has established basic principles, such as the concept of shared accountability, since finding solutions for urban waste is a challenge faced by public authorities, consumers, and companies (Brasil, 2010). According to the Business Commitment to Recycling (Compromisso Empresarial para Reciclagem, 2019), there are many challenges associated with waste management processes – such as technical and financial difficulties, as well as political discontinuity. These challenges need to be faced to close the dumps distributed countrywide, to increase the scope of recycling processes and to avoid environmental and social impacts caused by inappropriate waste disposal.

Thus, consumers must understand the role played by them in this process, by taking into consideration their purchase behavior and associated ethical issues. According to Tseng et al. (2020), sustainable consumption transition is a process in which it ceases to be unsustainable and becomes sustainable. For this to happen it is necessary to engage in a change of views, positions and tactics by consumers and regulators authorities, while focusing on the quality of life. This is complex due to the nature of consumer behavior (Dong et al., 2020) and that changing it is critical to promote transitions towards sustainable consumption practices (Tseng et al., 2020).

To enable such an understanding, public authorities must invest in advertisement campaigns aimed at instructing consumers about how, where and the reason why they should properly dispose of their garbage and its destinations (Nascimento et al., 2014). Sometimes consumers do not associate their daily actions with environmental impact. Thus, it is extremely important to educate consumers so they can understand the entire life cycle of products purchased by them and take into consideration aspects such as disposal at the time to purchase these products (Nascimento et al., 2014; Côrtes et al., 2016). Such behaviors may reflect at the time of purchase, which may be related to internal and external factors of the consumer about green consumption that will influence their behavior (Orzan et al., 2018). Therefore, it is essential to develop strategies aimed at reducing the impact of packaging waste to encourage consumers to demand and take environmentally accountable actions (Herbes et al., 2020).

As for the time required for food packaging decomposition, 27.6% (n = 45) of consumers reported that it would take more than 100 years for the material to fully decompose in nature. Moreover, 80.4% (n = 131) of consumers reported not to take into consideration the packaging material decomposition time at the time to purchase a given product, whereas 48.1% (n = 63) of interviewees reported lack of information as the reason for not taking into consideration packaging decomposition time. These results are negative since consumers' lack of knowledge about the environmental impact caused by these materials may be associated with a lack of clarity in information about the product. Lack of information can prevent consumers from playing their due role and from acting in a conscious way. This outcome highlights the importance of providing more information or guidance about the environmental impact caused by inappropriate packaging disposal (Nascimento et al., 2014; Lindh et al., 2016).

Most importantly, 97.5% (n = 159) of participants have highlighted the importance of having the time necessary for the material to decompose in nature described on the packaging, whereas 95.1% (n = 155) of them have emphasized the relevance of having the best way to prepare the product to generate lesser environmental impact described on the package. Moreover, 88.3% (n = 144) of consumers reported that they would choose the biodegradable food packaging over the traditional/conventional one, regardless of price, whereas 69.3% (n = 113) of participants reported being willing to overpay for packaging that caused lesser environmental impact – 85.0% (n = 96) of them would be willing to pay up to 5% more for food packaging that caused lesser environmental impact. In addition, 44.2% (n = 72) of consumers have mentioned that they would buy recyclable packaging to make their contribution to environmental preservation. Accordingly, it is important to mention that consumers should understand the difference between sustainable and conventional packaging, as well as acknowledge their benefits (Herbes et al., 2020). Sustainable packaging refers to expected responses associated with environmental aspects, such as reducing the use of materials, resources, and energy (Licciardello, 2017). Therefore, food packaging innovations help consumers to develop environmental awareness and to understand their environmental responsibilities (Herbes et al., 2020). Thus, manufacturers and public authorities should implement environmental policies and regulations to help consumers improve their trust in, and knowledge about, sustainable products (Vega-Zamora et al., 2019).

4 Conclusion

Consumers had shown the habit of observing packaging material integrity and type at purchasing time, as well as reported that this factor influences their decision to purchase a given food product. The consumers demonstrated a preference to biodegradable packaging over conventional. However, do not take into consideration the packaging material decomposition time at purchasing time and this demonstrate a superficial knowledge about environmental impacts of food packaging choice. This outcome indicates that a lack of information makes difficult for them to choose the best food packaging. Thus, it is necessary informing and educating consumers about packaging materials capable of a having lesser environmental impact to improve sustainable habits of the society.

References

Abejón, R., Laso, J., Margallo, M., Aldaco, R., Blanca-Alcubilla, G., Bala, A., & Fullana-I-Palmer, P. (2020). Environmental impact assessment of the implementation of a Deposit-Refund System for packaging waste in Spain: a solution or an additional problem? *The Science of the Total Environment*, 721, 137744. http://dx.doi.org/10.1016/j.scitotenv.2020.137744. PMid:32169649.

Adam, I., Walker, T. R., Clayton, C. A., & Bezerra, J. C. (2021). Attitudinal and behavioural segments on single-use plastics in Ghana: implications for reducing marine plastic pollution. *Environmental Challenges*, 4(1), 100185. http://dx.doi.org/10.1016/j.envc.2021.100185.

Brasil, Agência Nacional de Vigilância Sanitária – ANVISA. (2001, June 13). Resolução de Diretoria Colegiada - RDC nº 91, de 11 de maio de 2001. *Diário Oficial da República Federativa do Brasil*, seção 1.

Brasil, Agência Nacional de Vigilância Sanitária – ANVISA. (2016, February 11). *Uso de PET reciclado em embalagens e outros materiais destinados ao contato com alimentos. (Informe Técnico nº 71, de 11 de fevereiro de 2016)*. Retrieved from http://antigo.anvisa.gov.br/documents/33916/388729/informe+t%C3%83%C2%A9cnico+n%C3%82%C2%BA+71,+de+11+de+fevereiro+de+2016/e03dac30-111d-4793-a57e-a454a3862f74?version=1.1.

Brasil, Congresso Nacional. (2010, August 3). Institui a Política Nacional de Resíduos Sólidos; altera a Lei nº 9.605, de 12 de fevereiro de 1998; e dá outras providências. (Lei nº 12.305, de 2 de agosto de 2010). *Diário Oficial da República Federativa do Brasil*, seção 1.

Brasil. (2012). *Código de Proteção e Defesa do Consumidor. Código de proteção e defesa do consumidor e legislação correlata* (5th ed.). Brasília: Senado Federal.

Brasil. Ministério do Meio Ambiente. (2019). *O que é embalagem.* Retrieved from: http://www.mma.gov.br/responsabilidade-socioambiental/producao-e-consumo-sustentavel/consumo-consciente-de-embalagem/impacto-das-embalagens-no-meio-ambiente.html.

Cazón, P., & Vázquez, M. (2021). Bacterial cellulose as a biodegradable food packaging material: a review. *Food Hydrocolloids*, 113, 106530. http://dx.doi.org/10.1016/j.foodhyd.2020.106530.

Compromisso Empresarial para Reciclagem – CEMPRE. (2019). *CEMPRE review 2019*. Retrieved from https://cempre.org.br/wp-content/uploads/2020/11/CEMPRE-Review2019.pdf

Côrtes, P. L., Dias, A. G., Fernandes, M. E. S. T., & Pamplona, J. M. V. (2016). Comportamento ambiental: estudo comparativo entre estudantes brasileiros e portugueses. *Ambiente & Sociedade*, 19(3), 111-134.

Dantas, S. T., Saron, E. S., Dantas, F. B. H., Gatti, J. A. B., Kiyataka, P. H. M., & Soares, B. M. C. (2011). Influência da danificação mecânica de embalagens metálicas na interação com o produto acondicionado: creme de leite. *Brazilian Journal of Food Technology*, 14(4), 294-300. http://dx.doi.org/10.4260/BJFT2011140400035.

Deshwal, G. K., Panjagari, N. R., & Alam, T. (2019). An overview of paper and paper-based food packaging materials: health safety and environmental concerns. *Journal of Food Science and Technology*, 56(10), 4391-4403. http://dx.doi.org/10.1007/s13197-019-03950-z. PMid:31686671.

Dilucia, F., Lacivita, V., Conte, A., & Nobile, M. A. (2020). Sustainable use of fruit and vegetable by-products to enhance food packaging performance. *Foods*, 9(7), 857. http://dx.doi.org/10.3390/foods9070857. PMid:32630106.

Dong, X., Liu, S., Li, H., Yang, Z., Liang, S., & Deng, N. (2020). Love of nature as a mediator between connectedness to nature and sustainable consumption behavior. *Journal of Cleaner Production*, 242, 118451. http://dx.doi.org/10.1016/j.jclepro.2019.118451.

Ellen MacArthur Foundation. (2017). *The new plastics economy: catalysing action*. Retrieved from https://www.ellenmacarthurfoundation.org/publications/the-new-plastics-economy-rethinking-the-future-of-plastics-catalysing-action

Fabri, A. R., Ensinas, A. V., Machado, I. P., & Bizzo, W. A. (2005). Uso da avaliação de ciclo de vida (acv) em embalagens de plástico e de vidro na indústria de bebidas no Brasil. *Brazilian Journal of Environmental Sciences*, 1, 47-54.

Fortunati, E., Mazzaglia, A., & Balestra, G. M. (2019). Sustainable control strategies for plant protection and food packaging sectors by natural substances and novel nanotechnological approaches. *Journal of the Science of Food and Agriculture*, 99(3), 986-1000. http://dx.doi.org/10.1002/jsfa.9341. PMid:30191564.

Gonçalves, P., Vargas, A., & Fróes, R. (2016). Percepções sobre consumo produto e embalagem de alimentos. *Semioses*, 10(3), 40-48. http://dx.doi.org/10.15202/1981996X.2016v10n3p40.

Han, J. W., Ruiz-Garcia, L., Qian, J. P., & Yang, X. T. (2018). Food packaging: a comprehensive review and future trends. *Comprehensive Reviews in Food Science and Food Safety*, 17(4), 860-877. http://dx.doi.org/10.1111/1541-4337.12343. PMid:33350114.

Herbes, C., Beuthner, C., & Ramme, I. (2020). How green is your packaging—a comparative international study of cues consumers use to recognize environmentally friendly packaging. *International Journal of Consumer Studies*, 44(3), 258-271. http://dx.doi.org/10.1111/ijcs.12560.

Jorge, N. (2013). *Embalagens para alimentos*. São Paulo: Cultura Acadêmica.

Karaski, T. U., Ribeiro, F. M., Pereira, B. R., & Arteaga, L. P. S. (2016). *Embalagem e sustentabilidade: desafios e orientações no contexto da economia circular*. São Paulo: CETESB.

Klaiman, K., Ortega, D. L., & Garnache, C. (2016). Consumer preferences and demand for packaging material and recyclability. *Resources, Conservation and Recycling*, 115, 1-8. http://dx.doi.org/10.1016/j.resconrec.2016.08.021.

Landim, A. P. M., Bernardo, C. O., Martins, I. B. A., Francisco, M. R., Santos, M. B., & Melo, N. R. (2016). Sustentabilidade quanto às embalagens de alimentos no Brasil. *Polímeros*, 26(spe), 82-92. http://dx.doi.org/10.1590/0104-1428.1897.

Langley, J., Turner, N., & Yoxall, A. (2011). Attributes of packaging and influences on waste. *Packaging Technology & Science*, 24(3), 161-175. http://dx.doi.org/10.1002/pts.924.

Lazzarini, G. A., Visschers, V. H. M., & Siegrist, M. (2017). Our own country is best: factors influencing consumers' sustainability perceptions of plant-based foods. *Food Quality and Preference*, 60, 165-177. http://dx.doi.org/10.1016/j.foodqual.2017.04.008.

Licciardello, F. (2017). Packaging, blessing in disguise. Review on its diverse contribution to food sustainability. *Trends in Food Science & Technology*, 65, 32-39. http://dx.doi.org/10.1016/j.tifs.2017.05.003.

Lindh, H., Olsson, A., & Williams, H. (2016). Consumer perceptions of food packaging: contributing to or counteracting environmentally sustainable development? *Packaging Technology & Science*, 29(1), 3-23. http://dx.doi.org/10.1002/pts.2184.

Macena, M. W., Carvalho, R., Cruz-Lopes, L. P., & Guiné, R. P. F. (2021). Plastic food packaging: perceptions and attitudes of Portuguese consumers about environmental impact and recycling. *Sustainability*, 13(17), 9953. http://dx.doi.org/10.3390/su13179953.

Marsh, K., & Bugusu, B. (2007). Food packaging? Roles, materials, and environmental issues. *Journal of Food Science*, 72(3), R39-R55. http://dx.doi.org/10.1111/j.1750-3841.2007.00301.x. PMid:17995809.

Martinho, G., Pires, A., Portela, G., & Fonseca, M. (2015). Factors affecting consumers' choices concerning sustainable packaging during product purchase and recycling. *Resources, Conservation and Recycling*, 103, 58-68. http://dx.doi.org/10.1016/j.resconrec.2015.07.012.

Miyazato, T., Battistelle, R., & Valarelli, I. (2007). Caracterização de chapas de partículas compostas de resíduos cartonados e de celulose e papel. *Brazilian Journal of Environmental Sciences*, 7, 21-26.

Nascimento, L. F. M., Trevisan, M., Figueiró, P. S., & Bossle, M. B. (2014). Do consumo ao descarte de produtos e embalagens: estamos alienados? *Revista de Administração da UFSM*, 7(1), 33-48. http://dx.doi.org/10.5902/198346596298.

Oloyede, O. O., & Lignou, S. (2021). Sustainable paper-based packaging: a consumer's perspective. *Foods*, 10(5), 1035. http://dx.doi.org/10.3390/foods10051035. PMid:34068639.

Orzan, G., Cruceru, A. F., Bălăceanu, C. T., & Chivu, R.-G. (2018). Consumers' behavior concerning sustainable packaging: an exploratory study on romanian consumers. *Sustainability*, 10(6), 1787. http://dx.doi.org/10.3390/su10061787.

Palombini, F. L., Cidade, M. K., & Jacques, J. J. (2017). How sustainable is organic packaging? A design method for recyclability assessment via a social perspective: a case study of Porto Alegre city (Brazil). *Journal of Cleaner Production*, 142(4), 2593-2605. http://dx.doi.org/10.1016/j.jclepro.2016.11.016.

Popovic, I., Bossink, B. A. G., & van der Sijde, P. C. (2019). Factors influencing consumers' decision to purchase food in environmentally friendly packaging: what do we know and where do we go from here? *Sustainability*, 11(24), 7197. http://dx.doi.org/10.3390/su11247197.

Sangroniz, A., Zhu, J., Tang, X., Etxeberria, A., Chen, E. Y. X., & Sardon, H. (2019). Packaging materials with desired mechanical and barrier properties and full chemical recyclability. *Nature Communications*, 10(1), 3559. http://dx.doi.org/10.1038/s41467-019-11525-x. PMid:31395871.

Schifferstein, H. N. J., Boer, A., & Lemke, M. (2021). Conveying information through food packaging: a literature review comparing legislation with consumer perception. *Journal of Functional Foods*, 86, 104734. http://dx.doi.org/10.1016/j.jff.2021.104734.

Scott, L., & Vigar-Ellis, D. (2014). Consumer understanding, perceptions and behaviours with regard to environmentally friendly packaging in a developing nation. *International Journal of Consumer Studies*, 38(6), 642-649. http://dx.doi.org/10.1111/ijcs.12136.

Simon, B., Amor, M. B., & Földényi, R. (2016). Life cycle impact assessment of beverage packaging systems: focus on the collection of post-consumer bottles. *Journal of Cleaner Production*, 112, 238-248. http://dx.doi.org/10.1016/j.jclepro.2015.06.008.

Tseng, M.-L., Sujanto, R. Y., Iranmanesh, M., Tang, K., & Chiu, A. S. F. (2020). Sustainable packaged food and beverage consumption transition in Indonesia: persuasive communication to affect consumer behavior. *Resources, Conservation and Recycling*, 161, 104933. http://dx.doi.org/10.1016/j.resconrec.2020.104933.

Vega-Zamora, M., Torres-Ruiz, F.J. & Parras-Rosa, M., (2019). Towards sustainable consumption: keys to communication for improving trust in organic foods. *Journal of Cleaner Production,* 216, 511–519.

Wikström, F., Verghese, K., Auras, R., Olsson, A., Williams, H., Wever, R., Grönman, K., Pettersen, M. K., Møller, H., & Soukka, R. (2018). Packaging strategies that save food: a research agenda for 2030. *Journal of Industrial Ecology*, 23(3), 532-540. http://dx.doi.org/10.1111/jiec.12769.

Williams, H., Lindström, A., Trischler, J., Wikström, F., & Rowe, Z. (2020). Avoiding food becoming waste in households – the role of packaging in consumers' practices across different food categories. *Journal of Cleaner Production*, 265(1), 121775. http://dx.doi.org/10.1016/j.jclepro.2020.121775.

World Economic Forum. (2016). *The new plastics economy: rethinking the future of plastics*. Retrieved from https://www.weforum.org/reports/the-new-plastics-economy-rethinking-the-future-of-plastics