



Proceedings of

# RESEARCHFORA

INTERNATIONAL CONFERENCE

CAIRO, EGYPT



In Association with



12 13

April 2023

---

PROCEEDINGS OF  
**RESEARCHFORA**  
**INTERNATIONAL CONFERENCE**  
CAIRO, EGYPT

---

*Organized by*



**Date of Event:**

12<sup>th</sup> – 13<sup>th</sup> April, 2023

**Event Co-Sponsored by**



**Corporate Address**

**INSTITUTE OF RESEARCH AND JOURNALS**  
Plot No-30, Dharma Vihar, Khandagiri, Bhubaneswar, Odisha, India  
Mail: [info@iraj.in](mailto:info@iraj.in), [www.iraj.in](http://www.iraj.in)

Publisher: **Institute for Technology and Research (ITRESEARCH)**

© 2023, Researchfora International Conference, Cairo, Egypt

**ISBN:** 978-93-90150-32-8

**Edn:** 1197

No part of this book can be reproduced in any form or by any means without prior written permission of the publisher.

**Disclaimer:** Authors have ensured sincerely that all the information given in this book is accurate, true, comprehensive, and correct right from the time it has been brought in writing. However, the publishers, the editors, and the authors are not to be held responsible for any kind of omission or error that might appear later on, or for any injury, damage, loss, or financial concerns that might arise as consequences of using the book.

**Type set & Printed by:**

**Institute for Technology and Research (ITRESEARCH)**

Bhubaneswar, India

# CONSUMER PERSPECTIVES ABOUT THE QUALITY AND SAFETY OF PLASTIC MATERIALS USED FOR PACKAGING OF FOOD PRODUCTS

<sup>1</sup>RAQUEL P. F. GUINÉ, <sup>2</sup>MORGANA WEBER, <sup>3</sup>LUÍSA PAULA CRUZ-LOPES

<sup>1,2</sup>ESAV and CERNAS-IPV / Polytechnic of Viseu,

<sup>3</sup>ESTGV / Polytechnic of Viseu

E-mail: <sup>1</sup>raqueguine@esav.ipv.pt, <sup>2</sup>morganaweber.m@gmail.com, <sup>3</sup>lvalente@estgv.ipv.pt

---

**Abstract** - Food packaging is essential in today's globalized markets to preserve the foods or beverages, guaranteeing their quality and safety along the food supply chain. Plastics have been used extensively for food packaging due to their many advantages, like being light, cheap, and versatile. However, some of the chemical molecules released from plastics may have toxic effects on the human body if ingested, and they are also harmful to the environment. In this way, the present work investigated consumer awareness about food quality and safety when in contact with plastic packaging materials, and also the impact of these plastics on human health. The research was conducted through a questionnaire survey applied after approval by the Ethics Committee to a sample of 487 Portuguese participants. The obtained results revealed that most of the participants consider food safety and quality aspects when buying food products (85% and 93% of respondents, respectively). As recognized by the participants, the most important functions of the plastic package were to protect and preserve the food. It was also found that the general consumer still has very limited knowledge about the possible toxicity of molecules that could migrate from the plastic to the food. Nevertheless, other adverse effects of plastics related to environmental pollution and degradation of marine fauna are well recognised. So, in conclusion, it is necessary to further inform the Portuguese citizens about possible toxicity of some chemical compounds present in plastic packaging which can reach the human body, either by being released from the package into the food or by being absorbed from the environmental micro plastics which are becoming abundant in nature as result of incorrect plastic disposal.

---

**Keywords** - Food Packaging, Food Safety, Knowledge, Human Health, Questionnaire Survey.

---

## I. INTRODUCTION

The global demand for plastic packaging has reached nearly 150 million tonnes by 2020, and is still on the rise every year[1]. Plastic packaging has many benefits, by being cheap, easy to use, convenient, and allows good guaranty of preservation of food along the supply chain. Hence, plastics have become a first choice when opting for a packaging material destined to contain food products, due to the high resistance, durability, bio-inertness, and cost efficacy[2]. The types of plastic most frequently used for packaging foods and beverages(F&B) are polyethylene, polyethylene terephthalate, polyamide, polycarbonate, and polypropylene, which may be reinforced with barrier materials[3]–[5].

The F&B industry is undoubtedly one of the major sectors demanding for single-use packaging, playing a relevant role in how the companies providing consumer goods shift towards more sustainable packaging alternatives. The F&B sector signifies a great fraction of the total consumer expenditure and belongs to the fast-moving industry of consumer goods[6].

Both the production and disposal of plastic packaging materials have a harmful impact on the environment, being also impacting for the human health. Therefore, the rapid growth in plastic waste and absence of proper handling can further augment these adverse effects [7]. The plastic package has been reported has having major adverse effects on human health, as well as

other intervenient in the food chain, like land animals or fish, which will later be ingested by humans. Lin et al. [8] conducted a study mimicking daily life exposure to plastic food package bags, and analysed the effects on the reproductive and neurobehavioral responses in zebrafish. Their results confirmed that plastic affected reproduction and behaviour, with stronger effects on males. Xu et al. [9] evaluated the effects of plastics on Chinese adolescents and found that consuming food that has been packed in plastic materials moderates the association of phthalate exposure with emotional symptoms in adolescents. The phthalates are used as plasticizers and can easily migrate from the plastic package into the foods therein contained [10]. Also Bisphenol A is on the focus, by being also released from plastics and having a carcinogenic effect on humans, as demonstrated by many studies: papillary thyroid cancer [11], lung cancer [12], breast cancer [13], [14], prostate cancer [15], colorectal cancer [16], [17], oral cancers [18]. The potential harmful effects of plastic materials used for food packaging are not yet fully explained to the general population, who are more aware of the effects of plastics on the environment [19]. Hence, the objective of this research was to understand how the consumers perceive the quality and safety issues related to the use of plastic materials to pack food products. Hence, the objective of this research was to understand how the Portuguese consumers perceive the quality and safety issues related to the use of plastic materials to pack food products.

## II. MATERIALS AND METHODS

This research was performed using a questionnaire survey applied to a convenience sample, due to the facility of recruitment and according to the free will to participate. Although convenience samples have been reported as having some restrictions, they are quite valuable for conducting exploratory research [20], [21]. The data collection was made using the internet platform Google Forms, having the invitations to participate in the study being sent by e-mail and social networks. This research followed the international standardized ethical principles (Declaration of Helsinki) both when preparing the questionnaire and collecting the data. The Ethical Commission at the Polytechnic Institute of Viseu approved this research and the corresponding data collection instruments (questionnaire) with reference 09/SUB/2021. Participation was only allowed to those who agreed to participate after informed consent was provided. No personal identification was collected and the participants could terminate their responses at any time without submitting the form.

## III. SAMPLE CHARACTERIZATION

The sample was constituted by 487 participants, 70.4% being females and 29.6% males. The participants were distributed by the following age classes: 41.0% of young adults (aged from 18 to 30 years), 35.7% of middle aged adults (aged between 31 and 50 years) and 23.3% of senior adults (aged 51 years or more). The great majority had a university degree, 69.8%, against only 30.2% with a lower level of education.

## IV. RESULTS

Our results showed that most of the participants in the survey actually buy their own foods (69%) and when doing food shopping they tend to avoid them (39%) and look for alternatives (30%). Only a small fraction, 11% do not think about the possible negative impact of the plastic packaging that they buy (Figure 1).

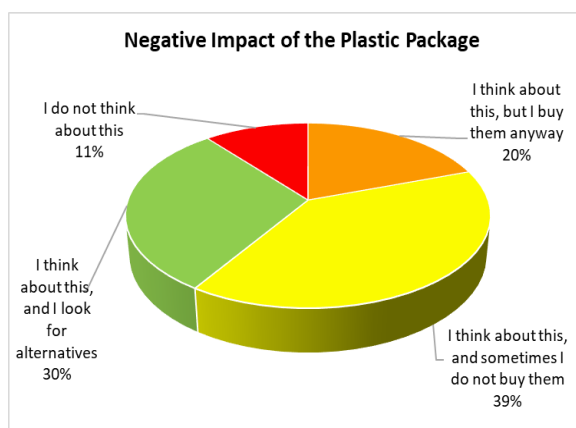


Figure 1. Participants' shopping practices regarding the impact of the plastic package.

The participants tend to take in consideration the quality aspects of the food contained inside plastic packaging, as expressed by 84% of the sample (Figure 2). On the other hand, Figure 3 shows that safety issues are less relevant for a higher percentage of participants, and about one third (33%) assume they do not think about the safety of plastic packed foods.

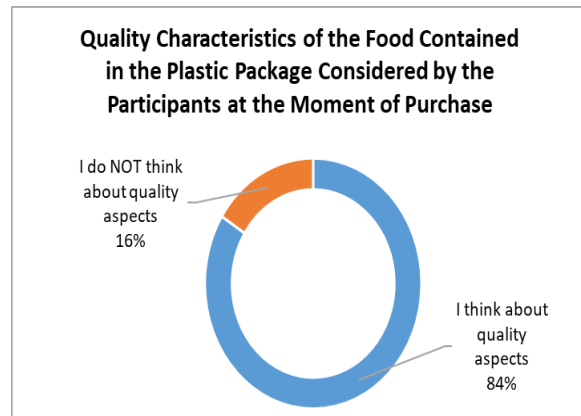


Figure 2. Participants' concerns about quality at the moment of purchase.



Figure 3. Participants' concerns about safety at the moment of purchase.

Figure 4 shows the different factors that could influence the participants to decide buying foods packed in plastic. From the different options tested in the questionnaire, the aspects that showed to be highly relevant to influence the participants' decision were, in decreasing order: quality of the product, price/promotions, food safety, capacity of preservation, general aspect, environment/being recyclable, Information of the product in the label, being a familiar brand and being disposable. On the contrary, the aspects less valued were, in increasing order, the resistance of the material, size, facility to handle, weight and facility to open. These results reveal that the quality and safety of the product come on top of the concerns when purchasing food, but the price and promotions are also very important with people trying to save money by taking advantage of special offers, when they appear.

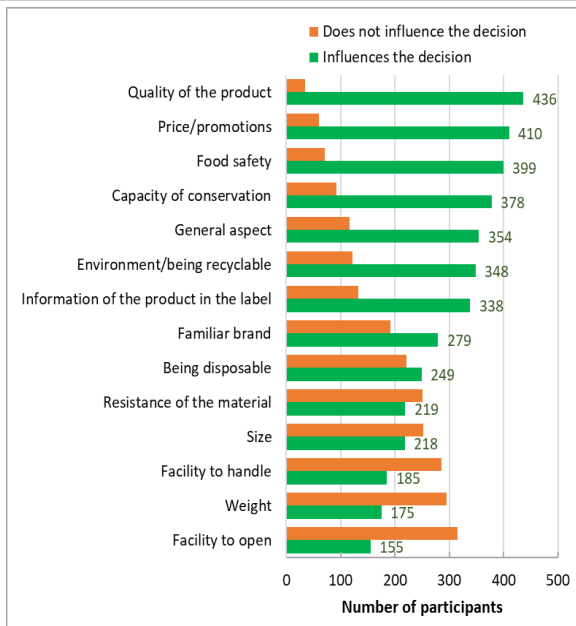


Figure 4. Factors that influence the participants' decision to purchase a food packed in plastic.

Figures 5 and 6 show, respectively, the principal advantages and disadvantages that the participants believe the plastic packages have. Among the advantages to highlight the facility to transport (14%), being recyclable (12%), food conservation and hygiene (both with 11%). Other perceived advantages were not so relevant for the participants in this study, such as protection of the food product (10%), the possibility to reuse the package (10%), the cost (9%), a possible valorisation of the product (9%), the duration (9%) and easy to open (only 5%).

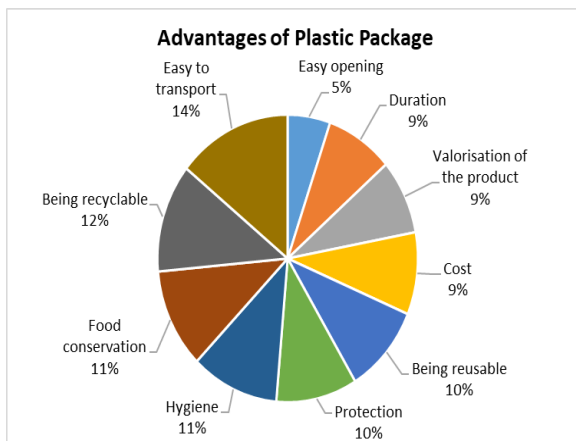


Figure 5. Perceived advantages of the plastic package.

In what concerns the disadvantages (Figure 6), the most relevant ones relate to their environmental impact, by being a pollutant (30%), not being biodegradable (28%), originating plastic garbage in the oceans (25%). Some other disadvantages were not considered so relevant, like possible influence of the package on the physical properties of the food (7%), being of single use (7%) or having low resistance (3%).

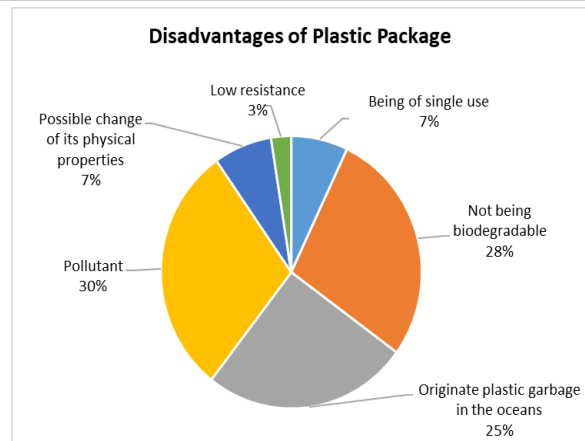


Figure 6. Perceived disadvantages of the plastic package.

The participants in this study revealed high concerns about the impact of plastics on human health, both individual and also on the perspective of public health (Figures 7 and 8, respectively).

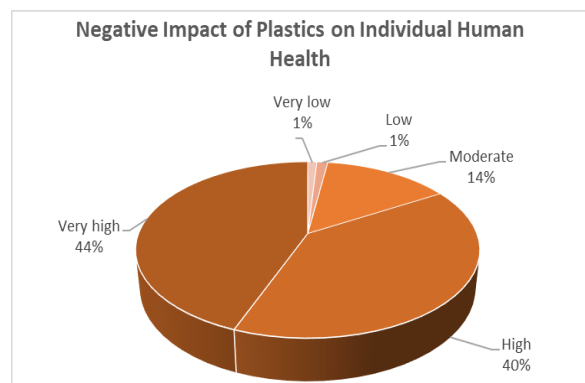


Figure 7. Perceived negative impact of plastics on individual human health.

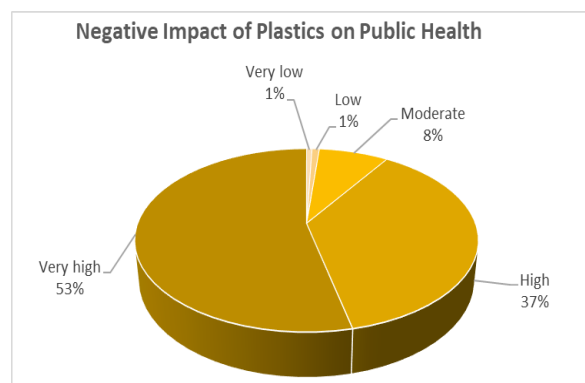


Figure 8. Perceived negative impact of plastics on public health.

While 40% considered the impact on individual human health high and 44% considered it very high (Figure 7), with respect to the impact on public health (Figure 8) the values were slightly lower for the very high category (37%) but considerably higher for the very high category (53%). These results indicate that the general people in Portugal are considerably aware of the harmful consequences of plastics to the human health.

## V. CONCLUSION

The results of this work showed that the Portuguese are concerned about the possible hazardous effects of plastic contaminants migrating into the foods they consume, and they consider this a danger to the human health and public health as well. However, when purchasing foods, a considerable number of participants still do not try to avoid the plastic food containers. Additionally, they perceive in these packaging materials a high number of advantages, mostly related to convenience, but they also sense some disadvantages, mainly related to their pollutant nature.

## ACKNOWLEDGMENTS

Thanks to FCT – Foundation for Science & Technology (Proj. UIDB/00681/2020), CERNAS and Polytechnic of Viseu for the support and financing.

## REFERENCES

- 1) "Plastics - the Facts 2020 • Plastics Europe," Plastics Europe. <https://plasticseurope.org/knowledge-hub/plastics-the-facts-2020/> (accessed Dec. 21, 2022).
- 2) N. Navarre, J. M. Mogollón, A. Tukker, and V. Barbarossa, "Recycled plastic packaging from the Dutch food sector pollutes Asian oceans," *Resources, Conservation and Recycling*, vol. 185, p. 106508, Oct. 2022, doi: 10.1016/j.resconrec.2022.106508.
- 3) M. W. Macena, R. Carvalho, L. P. Cruz-Lopes, and R. P. F. Guiné, "Perceptions and knowledge regarding quality and safety of plastic materials used for food packaging," *Open Agriculture*, vol. 7, no. 1, pp. 132–146, Jan. 2022, doi: 10.1515/opag-2022-0066.
- 4) K. Bhunia, S. S. Sablani, J. Tang, and B. Rasco, "Migration of Chemical Compounds from Packaging Polymers during Microwave, Conventional Heat Treatment, and Storage," *Comprehensive Reviews in Food Science and Food Safety*, vol. 12, no. 5, pp. 523–545, 2013, doi: 10.1111/1541-4337.12028.
- 5) T. M. Guerreiro, D. N. de Oliveira, C. F. O. R. Melo, E. de Oliveira Lima, and R. R. Catharino, "Migration from plastic packaging into meat," *Food Research International*, vol. 109, pp. 320–324, 2018, doi: 10.1016/j.foodres.2018.04.026.
- 6) A. (Anya) Phelan, K. Meissner, J. Humphrey, and H. Ross, "Plastic pollution and packaging: Corporate commitments and actions from the food and beverage sector," *Journal of Cleaner Production*, vol. 331, p. 129827, Jan. 2022, doi: 10.1016/j.jclepro.2021.129827.
- 7) Y. Jang, K. Nam Kim, and J. Woo, "Post-consumer plastic packaging waste from online food delivery services in South Korea," *Waste Management*, vol. 156, pp. 177–186, Feb. 2023, doi: 10.1016/j.wasman.2022.11.036.
- 8) J. Lin et al., "Leachate from plastic food packaging induced reproductive and neurobehavioral toxicity in zebrafish," *Ecotoxicology and Environmental Safety*, vol. 231, p. 113189, Feb. 2022, doi: 10.1016/j.ecoenv.2022.113189.
- 9) H. Xu et al., "Moderating effects of plastic packaged food on association of urinary phthalate metabolites with emotional symptoms in Chinese adolescents," *Ecotoxicology and Environmental Safety*, vol. 216, p. 112171, Jun. 2021, doi: 10.1016/j.ecoenv.2021.112171.
- 10) A. Beltifa et al., "Plasticizers and bisphenol A, in packaged foods sold in the Tunisian markets: study of their acute in vivo toxicity and their environmental fate," *Environ Sci Pollut Res Int*, vol. 24, no. 28, pp. 22382–22392, Oct. 2017, doi: 10.1007/s11356-017-9861-0.
- 11) L. Zhang et al., "A case-control study of urinary concentrations of bisphenol A, bisphenol F, and bisphenol S and the risk of papillary thyroid cancer," *Chemosphere*, vol. 312, p. 137162, Jan. 2023, doi: 10.1016/j.chemosphere.2022.137162.
- 12) J. Qu, W. Mao, K. Liao, Y. Zhang, and H. Jin, "Association between urinary bisphenol analogue concentrations and lung cancer in adults: A case-control study," *Environmental Pollution*, vol. 315, p. 120323, Dec. 2022, doi: 10.1016/j.envpol.2022.120323.
- 13) V. Shivam, A. Boobalan, S. Nallusamy, K. Ponnusamy, P. Veluchamy, and P. M. Siva, "Genomic approach to identify association of environmental bisphenol-A (BPA) in daily use plastics as molecular disruptors in breast cancer," *Human Gene*, vol. 32, p. 101026, May 2022, doi: 10.1016/j.mgene.2022.101026.
- 14) H. He et al., "Urinary bisphenol A and its interaction with CYP17A1 rs743572 are associated with breast cancer risk," *Chemosphere*, vol. 286, p. 131880, Jan. 2022, doi: 10.1016/j.chemosphere.2021.131880.
- 15) P. Sánchez et al., "Impact of chronic exposure of rats to bisphenol A from perinatal period to adulthood on intraprostatic levels of 5 $\alpha$ -reductase isozymes, aromatase, and genes implicated in prostate cancer development," *Environmental Research*, vol. 212, p. 113142, Sep. 2022, doi: 10.1016/j.envres.2022.113142.
- 16) Y. Deng et al., "Bisphenol A exposure, interaction with genetic variants and colorectal cancer via mediating oxidative stress biomarkers," *Environmental Pollution*, vol. 287, p. 117630, Oct. 2021, doi: 10.1016/j.envpol.2021.117630.
- 17) X. Hong et al., "Lipidomic biomarkers: Potential mediators of associations between urinary bisphenol A exposure and colorectal cancer," *Journal of Hazardous Materials*, vol. 427, p. 127863, Apr. 2022, doi: 10.1016/j.jhazmat.2021.127863.
- 18) T. F. A. Almeida et al., "Effects of high-dose bisphenol A on the mouse oral mucosa: A possible link with oral cancers," *Environmental Pollution*, vol. 286, p. 117296, Oct. 2021, doi: 10.1016/j.envpol.2021.117296.
- 19) M. W. Macena, R. Carvalho, L. P. Cruz-Lopes, and R. P. F. Guiné, "Plastic Food Packaging: Perceptions and Attitudes of Portuguese Consumers about Environmental Impact and Recycling," *Sustainability*, vol. 13, no. 17, Art. no. 17, Jan. 2021, doi: 10.3390/su13179953.
- 20) R. P. F. Guiné, S. G. Florença, K. Villalobos Moya, and O. Anjos, "Edible Flowers, Old Tradition or New Gastronomic Trend: A First Look at Consumption in Portugal versus Costa Rica," *Foods*, vol. 9, no. 8, Art. no. 8, Aug. 2020, doi: 10.3390/foods9080977.
- 21) R. P. F. Guiné, S. G. Florença, M. J. Barroca, and O. Anjos, "The Link between the Consumer and the Innovations in Food Product Development," *Foods*, vol. 9, no. 9, Art. no. 9, Sep. 2020, doi: 10.3390/foods9091317.

