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Short Communication

The COVID-19 pandemic and single-use plastic waste in households: A preliminary study

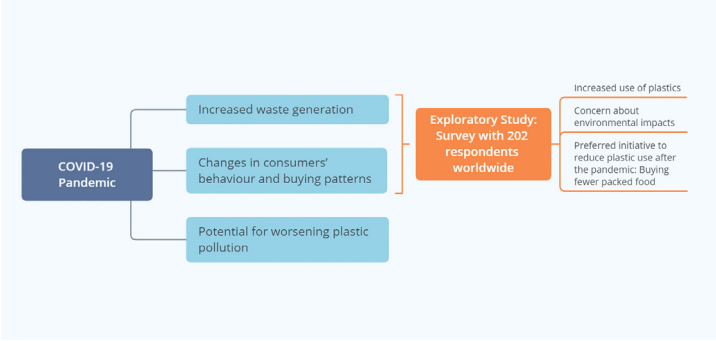
Walter Leal Filho [a,c], Amanda Lange Salvia [b,*], Aprajita Minhas [c], Arminda Paço [d], Celia Dias-Ferreira [e,f]

[a] Department of Natural Sciences, Manchester Metropolitan University, Chester Street, Manchester M1 5GD, UK
[b] Graduate Program in Civil and Environmental Engineering, University of Passo Fundo, Campus I-BR 285, São José, Passo Fundo, RS 99052-900, Brazil
[c] European School of Sustainability Science and Research, Hamburg University of Applied Sciences, Germany
[d] Universidade da Beira Interior, Núcleo de Estudos em Ciências Empresariais (NECEUBI), Rua Marquês d'Ávila e Bolama, 6201-001 Covilhã, Portugal
[e] Universidade Aberta, Department of Sciences and Technology, Lisbon, Portugal
[f] CERNAS - Research Center for Natural Resources, Environment and Society, Coimbra, Portugal

HIGHLIGHTS

- The results of a worldwide survey with 202 respondents from 41 countries are presented.
- The COVID-19 pandemic led to increased consumption of single-use plastics.
- The main reasons seem to be associated with food packaging and of plastic bags.
- The results indicate promising opportunities for the packaging industry.

GRAPHICAL ABSTRACT



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ABSTRACT

The Coronavirus pandemic promoted an unprecedented change in consumption habits, especially as lockdowns contributed to the increase in online shopping and in delivery services. One of the consequences is the substantial amounts of plastic waste produced, which can undermine the efforts to reduce plastic pollution. In this context, this commentary explores, as a preliminary study, the impacts of the Coronavirus pandemic in relation to single-use plastic waste in households by means of an international survey with 202 participants distributed over 41 countries worldwide.

1. Introduction: plastic waste and its growth in the time of COVID-19

For many years, plastic waste has become a matter of great international concern, especially plastic debris in oceans (Leal Filho et al., 2019). This concern has been intensified during the COVID-19 pandemic, in the context of which the amount of plastic waste has increased substantially. This increase is associated with significant pressures and dangers to ecosystems and to the natural environment (Silva et al., 2021).

The levels of both macro (e.g. large particles) and micro plastic (e.g. plastic fragments less than 5 mm in length) have increased significantly in connection with the consumption of plastic based materials associated with the treatment of patients and general health care associated with COVID-19. This was mainly attributed to the discarding of single

* Corresponding author.
E-mail address: amandasalvia@gmail.com (A.L. Salvia).

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use personal protective equipment (PPE) which are most made of plastic. This includes disposable gloves and masks.

It was found that the global plastic consumption of medical gloves and face masks worldwide in 2020 was approximately 69 billion units per month (Kalina and Tilley, 2020). The increase in plastic production has added a considerable pressure to the developing countries that already struggled with the handling of plastic waste prior to the pandemic (Parashar and Hait, 2020).This was further increased by the amount of plastic used for packing in e-commerce and food takeaways (Parashar and Hait, 2020), a phenomena partly related to the limited availability of bio-based plastics, whose use is not as detrimental to the environment (Silva et al., 2021).

Another example of increased plastic usage can be provided from China, where plastic waste increased from 40 t per day before the pandemic, to around 240 t per day during the pandemic. Furthermore, the amount of medical waste generation containing significant percentages of plastics showed a rise of 370% during the pandemic (Klemeš et al., 2020; Parashar and Hait, 2020).

These examples, and other documented in the literature (e.g. ESDO, 2020) illustrate how the substantial amounts of plastic waste produced during the time of the pandemic have been undermining the global efforts to curb plastic waste pollution. The lockdowns, the increase in online shopping and in delivery services have also contributed to change in consumption of plastic products in households. In this context, this commentary focused on exploring the impacts of pandemic in relation to single-use plastic waste in households.

2. Exploratory study

In order to understand the impacts of the crisis caused by COVID-19 in relation to single-use plastic waste in households, a quantitative approach is used. The data collection for the self-report study followed a structured questionnaire survey (see Appendix A), made available through the online platform Google Forms between February and April 2021. The survey consisted of a total of twelve closed-ended questions on demographic details and aspects of consumption of single-use plastic waste in households. The survey instrument was then shared with a global audience via various scientific mailing lists, the networks of the European School of Sustainability Science and Research (ESSSR), and the Inter-University Sustainable Development Research Programme (IUSDRP).

The sample was composed of 202 respondents from 41 countries (Australia, Austria, Bangladesh, Belarus, Brazil, Cameroon, Canada, Chile, Côte d'Ivoire, Cyprus, Denmark, Egypt, Finland, Germany, Ghana, Guatemala, India, Iran, Ireland, Italy, Japan, Lithuania, Malaysia, Malta, Mexico, Nigeria, Peru, Philippines, Portugal, Romania, Serbia, Singapore, Slovenia, Spain, Sri Lanka, Sweden, Switzerland, Uganda, UK, USA, Vietnam). Around two third of the sample is composed of women (67% female, 32% male, 1% other) and over 75% of the respondents are postgraduates (high school 2%, graduate 21%, postgraduate 77%). Regarding age group, more than half of the sample is divided into the groups of 30–39 gears and 40–49 years (27% and 30%, respectively), followed by 22% with 50–59 years, 13% with 18–29 years and 8% with 60+ years.

When asked about a possible change in the consumption of single-use plastics during the lockdowns, 58% of the respondents indicated that the consumption increased. In general, the increase in the use of single-use plastic was not so expressive though, with more than 1/3 of respondents indicating an increase of 20% or less while only 10% of respondents reported an increase over 30%. Other responses split up between no change in use (27%) and decreased consumption (15%).

As can be observed in Fig. 1, when asked to specify the changes in the consumption of different materials, it can be noted that for most materials a substantial change in consumption was not observed. The most remarkable results refer to the increase of food packaging in 50% of the households and of single-use plastic bags in 35% of the households. As expected, the majority (66%) increased the consumption of single-use masks, given the mandatory use for health protection. The respondents that indicated decreased or no change in use of these products are probably supporting the use of other alternatives for health protection (reusable cloth masks or reusable face shields).

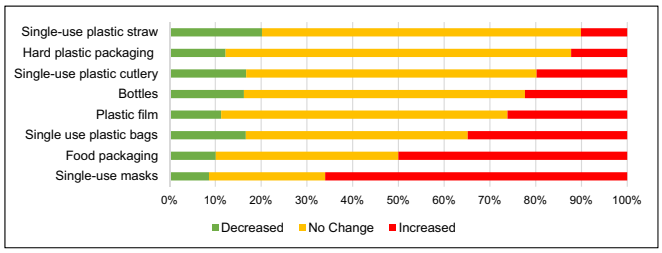

Fig. 1. Change in consumption of plastic materials during the lockdown (in percentage of respondents per category).

Probably because the general increase rate was not so expressive, the level of worry about the amount of plastic produced in the household during the lockdown was not so high as one could expect, as results from this survey indicate. Only 21% of the sample indicated to be extremely worried, followed by 27% of respondents moderately worried. 15% of the sample indicating not being worried at all. On the other hand, over 90% of the sample expressed concern in terms of impact of plastic waste in the environment (69% extremely concerned and 22% quite concerned).

The survey also investigated different efforts to separate plastic waste and to reduce the consumption of single-use plastics. Both indicated positive results: almost 85% of the respondents said they already used to separate plastic waste and continued doing so during the lockdown and 90% indicated they intend to reduce the use of single-use plastic in their day-to-day life after the pandemic. Regarding ways of reducing this consumption, the most voted initiative was buying fewer packed food (selected by 65% of the respondents), which indicates an interesting potential for the industry of alternative packaging products and for brands to re-think their products' design. Around 59% of the respondents indicated both re-using plastic bags and using cloth/fabric bag for shopping, followed by 52% of responses stating intention to avoid the use of plastic straws. Other responses included using stainless steel cutlery (39%), buying drinks in glass bottles instead of plastic bottles (33%) and using glass or steel containers for shopping (33%).

3. Conclusion

The results of this preliminary and self-report study show that, as expected, the COVID-19 pandemic and its consequents lockdowns brought changes in consumers' behaviour, not only regarding their buying patterns but also in the amount of waste produced. Here we intended to analyse the production of household plastic waste, as well as single use products as the disposable gloves and masks. In fact, more than half of the consumers inquired assumed that its consumption augmented, emphasising the increase of food packaging and of single-use plastic bags. Even so, a considerable number of individuals are making efforts to separate plastic waste and to reduce the consumption of single-use plastics.

When thinking about ways of reducing this plastic consumption, one of the solutions proposed was buying fewer packed food. Thus, the food industry and the retailers could take advantage of these business opportunities by providing alternative packaging (e.g. bioplastics or allowing to purchase in bulk). The reuse is also a strategy that can be implemented by some companies since consumers show some predisposition to enter in the circular economy.

Communication professionals, and non-governmental environmental organizations, should make an effort to sell the idea of limiting the use of unnecessary single-use plastic during the pandemic, promoting other ways of consuming certain items (ex. reusable masks). It is necessary not to forget that the impact of the single-use plastic aggravated with this pandemic, will last for many years.

In future it would be useful to research more about green consumer buying behaviour in pandemic scenarios, relating it, not only with plastic waste, but also with other waste production in households.

Supplementary data to this article can be found online at https://doi.org/10.1016/j.scitotenv.2021.148571.

CRediT authorship contribution statement

Walter Leal Filho: Conceptualization, Writing - Reviewing; **Amanda Lange Salvia:** Data collection and Writing; **Aprajita Minhas:** Data collection and Writing; **Arminda Paço:** Writing - Reviewing; **Celia Dias Ferreira:** Writing - Reviewing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

ESDO, 2020. ESDO's online press briefing on Covid-19 pandemic outbreak 14,500 tons of hazardous plastic waste in a month. Retrieved from. https://esdo.org/esdos-online-press-briefing-on-hazardous-plastic-waste-generation-in-a-month-during-covid-19-pandemic.

Kalina, M., Tilley, E., 2020. "This is our next problem": cleaning up from the COVID-19 response. Waste Manag. 108, 202–205. https://doi.org/10.1016/j.wasman.2020.05.006.

Klemeš, J.J., Van Fan, Y., Tan, R.R., Jiang, P., 2020. Minimising the present and future plastic waste, energy and environmental footprints related to COVID-19. Renew. Sust. Energ. Rev. 127, 109883. https://doi.org/10.1016/j.rser.2020.109883.

Leal Filho, W., Havea, P.H.H., Balogun, A.-L., Boenecke, J., Maharaj, A.A., Ha'apio, M., Hemstock, S.L., 2019. Plastic debris on Pacific Islands: ecological and health implications. Sci. Total Environ. 670, 181–187. https://doi.org/10.1016/j.scitotenv.2019.03.181.

Parashar, N., Hait, S., 2020. Plastics in the time of COVID-19 pandemic: protector or polluter? Sci. Total Environ. 759, 144274. https://doi.org/10.1016/j.scitotenv.2020.144274.

Silva, A.L.P., Prata, J.C., Walker, T.R., Duarte, A.C., Ouyang, W., Barcelò, D., Rocha-Santos, T., 2021. Increased plastic pollution due to COVID-19 pandemic: challenges and recommendations. Chem. Eng. J. 405, 126683. https://doi.org/10.1016/j.cej.2020.126683.