COVID-19 and Waste Production in households: a trend analysis

Science of The Total Environment

Volume 777, 10 July 2021, 145997

https://www.sciencedirect.com/science/article/abs/pii/S0048969721010640?via%3Dihub

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Abstract

Apart from the health aspects and the high death toll, the COVID-19 pandemic has, since its official recognition in March 2020 caused may social and economic problems. It has also led to many environmental ones. For instance, the lockdowns have led to higher levels of consumption of packaged products, and of take-away food.

This paper reports on an international study on the increased consumption and subsequent changes in the amounts of waste produced since the COVID-19 pandemic. The results show that 45-48% of the respondents observed an increased consumption of packed food, fresh food, and food delivery. One of the main reasons for the increased waste generation during the lockdown was the fact that people have spent more time at home. In addition, increases of 43% and 53% in food waste and plastic packaging. Drawing from comparisons on the amount of domestic waste produced before and during the pandemic, the findings suggest that some specific types of municipal waste have visibly increased, putting additional pressure on waste management systems. This characterises one of non-intended effects of the COVID-19 pandemic. The results from this study provide useful insights to city administrations and municipal utilities on consumption patterns during emergency situations. This, in turn, may support more systemic and strategic measures to be taken, so as to curtail the increase of household waste during pandemic situations.

Keywords: COVID-19, Waste generation, Waste management, Households waste, International wide.

1. Introduction:

The novel 2019 coronavirus first emerged in December 2019 in Wuhan, China. It was not until January 2020 that researchers distinguished and classified the virus from ordinary pneumonia (Chen et al., 2020). The virus is easily transmitted through droplets released from an infected individual's mouth or nose (Chen et al., 2020). Due to the easy transmission of COVID-19, the virus soon spread to other parts of the world, with international travel accounting for the largest percentage of the spread (Gössling et al., 2021). In March 2020, the World Health Organisation classified COVID-19 as a pandemic (WHO, 2020a). The virus's epicentre shifted quickly from China to Europe and, after that, to the United States of America (WHO, 2020b). The highest number of confirmed cases were recorded in South Africa within the African continent, and this number rose rapidly as winter arrived (WHO, 2020c). The increase in cases in the southern hemisphere and the drop in increases in some countries in the northern hemisphere are attributed to seasonal patterns. COVID-19 has been shown to spread more quickly in colder temperatures than warmer temperatures (Poole, 2020). Since the outset of the pandemic in early 2020, the world has experienced a so-called “second wave” in early 2021, whereby the virus -and the mutant variations- have widely spread across the world.

The onset of the pandemic posed many global challenges, especially in the health sector. The influx of patients requiring hospital facilities and ICU spaces placed a significant burden on healthcare systems (Remuzzi & Remuzzi, 2020). Many countries were forced to intensify procuring procedures for additional medical resources, PPE, equipment, and hospital beds (Ranney et al., 2020), whereas other countries that had treaty agreements in place were forced to break such agreements and ration their medical resources for themselves (Anderson et al., 2020).

Apart from this, most countries put in place several lockdown regulations, causing many businesses to reduce the scope of their activities, or to simply close. In many instances, companies have had to retrench workers or place staff on short work hours (Parolin & Wimer, 2020). This has caused an increase in the unemployment rate in many countries (Bonaccorsi et al., 2020). In other cases, lockdown regulations have included international travel bans, which have caused substantial losses to the tourism industry and- since it contributes significantly to the economy of many countries- to a GDP decrease in countries around the world (African-Union, 2020; Ozili, 2020).

Apart from the health sector, the most severe effects of the pandemic were felt in households and day-to-day life. The lockdowns and the social distancing associated with them, have resulted in widespread job losses (Kawohl & Nordt, 2020). Aside from this trend, many breadwinners in the families have been infected or have lost their lives due to the virus, further diminishing income. The mental health of individuals who anticipated -or faced- financial constraints during the pandemic has also deteriorated, causing an increase in suicide rates (Bhuiyan et al., 2020). In all, the pandemic has caused numerous people and households to be plunged into poverty, thus increasing the poverty rate in many countries, especially in developing nations (Singh, 2020).

More specifically, the lack of -or substantially reduced- income has threatened the food security of millions of households. The lack of food compromises human health and makes people more susceptible to contracting the virus (Devereux et al., 2020). Studies have shown that household spending has increased by at least 50% despite the dwindling income. This has been attributed to people attempting to stockpile food at home. In contrast, a sharp decline in spending related to luxuries and travel (including public transportation) was also observed (Baker et al., 2020).

Aside from this, many schools have shut down due to lockdowns. Wealthier families have had the privilege of home-schooling their kids or using online learning tools. In other cases, more impoverished families are unable to provide the same benefit to their children, leading to inequalities in education systems as a result of lack of infrastructure and connectivity (Owusu-

106 Fordjour et al., 2020; Sahu, 2020). A recent study has shown that the closure of schools and
107 day-care facilities as a result of the pandemic, has severely affected working mothers and has
108 contributed to gender inequalities (Alon et al., 2020). Most working mothers form part of the
109 workforce, and have had their work impaired by the pandemic. In some cases, unemployed
110 fathers are now taking responsibility for children's primary care, which is defying social norms
111 in certain countries. This is not always possible, as some fathers do not have flexible work
112 arrangements (Alon et al., 2020). Apart from the health aspects and the high death toll, the
113 COVID-19 pandemic has caused many social and economic problems since it was officially
114 classified as a world issue in March 2020. It has also led to some environmental ones. For
115 instance, the lockdowns have led to higher consumption levels of packaged products and
116 containers from take away food. In this context, the objective of this paper is to report on the
117 increased consumption and subsequent changes in the amount of several types of household
118 waste produced in an adverse context - the COVID-19 pandemic. Its novelty lies on the fact
119 that this is an international study which investigated several types of household waste
120 production across a number of different countries.

121 **2. COVID-19 and Consumption**

122 According to World Health Organisation (WHO), the Americas, Europe, and South-East Asia
123 have been reported as the most affected regions in absolute numbers of confirmed cases of
124 COVID-19 (WHO, 2020d), as of November 24, 2020. France, Russia, Spain, United Kingdom,
125 Italy, and Germany have been confirmed to be the most impacted countries by COVID-19 in
126 Europe. The measures are taken to prevent and control the spread of COVID-19 had
127 numerous effects on the food supply, eating behaviour , and dietary practices of millions of
128 people worldwide.

129 According to the European Field Marketing Partners report (EFMP, 2020), some key stages
130 in consumer behaviour linked to COVID-19 can be identified, as people moved from
131 awareness about COVID-19 to physical restrictions and final lockdown in March 2020.
132 Regarding food purchase and consumption, two main stages can be highlighted. The first
133 stage is buying food in bulk or panic buying. At the beginning of the pandemic, the

understanding of the virus and its consequences was limited, and people started to make provision of food, sometimes in inadequate large amounts, to mitigate future risks of food shortage. Such a situation was observed throughout different countries in the world. For example, 84% of respondents in Norway reported that they purchased extra dry goods, 38% reported buying additional canned goods, and 37% - extra frozen food due to the COVID-19 outbreak (Statista, 2020).

Similarly, in other countries in Europe and the USA, frozen and packaged food purchases have increased since March 2020, as people preferred to buy long lasting food products. According to market research data (Morrison, 2020), customer behaviour has rapidly changed during the first wave of COVID-19. Packed food sales in Italy have peaked by March 15, making 33,8% in comparison with a year ago. In France and the UK, the packed food demand continued to grow and reached the highest values by March 22, 49,8% and 69,6 %. In the USA, the rapid increase of packed food sales from 10 % to 76 - 77 % was observed within the first two weeks in March 2020 (Morrison, 2020).

A similar tendency with growing customer demand was seen in the frozen food sector. The highest demand was observed in the USA and the UK with 92,7% and 84,4 % respectively versus a year ago. In Italy, frozen food demand started to stabilize after March 15 and reached 36,7% by March 22. In France, the steady growth of customer demand for frozen food was observed from 8 to March 22 (Morrison, 2020). Buying food in bulk was observed in many other countries. Thus, in Vietnam, 38% of respondents reported that they had been engaged in panic buying, purchasing mainly dry food such as rice, noodles, pasta, and flour (Statista, 2020).

During the second wave of COVID-19 pandemic in autumn and winter 2020, panic buying was not an issue for most people since the fear of merely running out of food has receded. The second stage, when analyzing consumer behaviour linked to COVID-19, is living in quarantine. During this period, people were getting used to living in their new reality and making less impulsive and irrational purchases. Going to restaurants or quick-service restaurants was restricted, and people started to cook more meals at home. Thus, according

to Bracale and Vaccaro (2020), people began to buy more pasta, flour, eggs, long-life milk, frozen foods, and less fresh food during Italy's quarantine. The sales of snacks have dropped in relation to homemade bread, pizza, and cakes.

During the quarantine period, online grocery shopping and food delivery increases while the store visits decrease. According to market research made by McKinsey & Company (2020) in October 2020, customers purchasing online in the "Food takeout and delivery" category has grown by 15-29% in the USA, Italy, and Japan. As of May 31, 16% of respondents in Germany and 19% in the UK stated that they had preferred restaurant delivery/takeaway online instead of offline shopping. Besides, 10% of respondents in Germany and 30% in the UK reported that they had chosen food and drink delivery (e.g., from the supermarket) instead of going to the stores (Statista, 2020). In Vietnam, more than 58% of respondents reported that they purchased more online during the COVID-19 outbreak (Statista, 2020).

The increase of online food purchase and restaurant delivery means the growth of packaging since it has been hailed as a key to ensure health and safety for the customers during the pandemic. According to some estimations, e-commerce and takeaway service are expected to continue growing alongside packaging materials (Felton, 2020). In addition to physical changes in lifestyle, many people have experienced negative emotions like depression, stress, and fear about COVID-19. These negative emotions could lead to overeating, the so-called "emotional eating," particularly junk food. Thus, more than a third of consumers reported that they purchased more of alcohol and snack because they required it more during social distancing measures in the United States in 2020 (Statista 2020). In Italy, more than 34% of respondents have reported that they had increased appetite, and more than 48% of the population had the perception of weight gain (Di Renzo et al., 2020).

It can be concluded that COVID-19 has a significant impact on people's consumption behaviour around the world. Consumption patterns of the people changed to more practical during lockdown; however, it could sometimes lead to overeating. People preferred to buy products with long shelf life, such as packed or frozen food. Home delivery and takeaway sales have also increased since the COVID-19 outbreak.

3. Methodology

The study employed a quantitative research methodology. The data collection was carried out with the help of a survey, which was developed by the research team. The survey items were developed based on an extensive review of the international literature, including reports and public documents, around the subject matter of the production of waste within households (e.g. Devereux et al., 2020; Ikiz et al., 2021; Jribi et al., 2020) during the onset of the COVID-19 pandemic. The final version of the survey contained three sections, namely Section 1: Demographic Information, Section 2: Level of Consumption, and Section 3: Waste Generation and Management. Section 1 contained 11 items, while Sections 2 and 3 had 7 items and 11 items.

Before finalizing the survey for data collection, an expert validation exercise was conducted to determine the suitability of the items developed. A total of five international experts in the area of sustainable consumption and production, waste management and recycling, environment and sustainability, and public health provided feedback to the items in the survey. Some of highlights from the expert validation exercise are as listed below:

1. Adjustments in the number of sections and items within each section
2. Fine-tune of the suitability of some of items related to the research aims. The survey was designed to identify the increases in consumption and changes in waste production since the pandemic. A few questions were modified in section 2, so as to cater for a better understanding of the extent of waste products such as packed food, fresh food (e.g. fruits and vegetables), online or takeaway food others. The goal was to identify whether they increased, decreased, or if no changes were observed. Following a recommendation by the panel of experts, more options were added in the questions related to increased waste production, and about waste segregation.

Upon addressing the feedback from the expert validation process, and in order to ensure the validity of the data, a pilot study (i.e. a pre-test) was conducted with six respondents. The pilot

study's findings revealed that the survey instrument was adequate, with minor changes. Both steps (i.e. the validation with experts in the area and pilot application with additional respondents) ensured the validity and reliability of the data collection instrument The finalized survey items were then transferred into a Google Form. Using a purposive sampling approach, combined with techniques such as snowballing and chain referrals, the link to the on-line survey instrument was then shared with a global audience via the research team, the networks of the European School of Sustainability Science and Research, and via , the Inter-University Sustainable Development Research Programme (IUSDRP). Data collection was carried out from August 2020 to November 2020. In accordance with research ethics protocols, respondents were informed that their participation in the study was voluntary. Participants were informed that the answers they provided would be treated with the strictest confidence, and the protection of their personal data will be upheld at all times.

4. Results and Discussion

4.1 Demographics

The survey resulted in a total of 204 responses. Participants of the study originated from 23 countries, namely Portugal, Italy, Germany, Brazil, Estonia, United States, Australia, Canada, Singapore, United Kingdom, Denmark, Spain, Poland, Finland, Bangladesh, Argentina, Chile, Ireland, New Zealand, Japan, Malaysia, Indonesia, and Vietnam. 61.6% of the respondents were male, while 37.4% were female. The balance 1% of respondents preferred not to disclose their gender.

In terms of the respondents' age distribution, those between the ages of 31 and 40 made up the largest pool of respondents, with 36% of the total. This was followed by respondents between the ages of 21-30 years of age at 30%. Respondents between the ages of 41 to 50 were the third largest group of respondents totalising 15.3%, followed by those within the 15-20 age group, with 8.9%. 7.4% of the respondents were from the ages of 51-60, while those from the age group of 61 and over were the least represented in the survey, accounting for 2.5% of the total number of respondents. In terms of the level of education, the majority of the

246 respondents have post-graduate qualifications. This group makes up 61.4% of the total
247 number of respondents. This is followed by graduates at 33.2%. The remaining respondents
248 were made up of those with qualification at high school or under.
249 Respondents of the survey are made up of many occupation levels, including upper
250 management, middle management, junior management, administrative staff, trained
251 professionals, skilled laborers, consultants, temporary employees, and the self-employed
252 partners in a business, students, retirees, and the unemployed. They thus represent a variety
253 of social sectors and income levels. Trained professionals and students made up two of the
254 largest respondent groups at 24.3% each, while the unemployed made up the least, with a
255 total respondent rate at 2.5%. The majority of respondents' net monthly household income
256 was €500 - €1000 at 20.9%, while the 19.9% of respondents who preferred not to disclose
257 their monthly household income made up the second-largest respondent group. Interestingly,
258 19.9% of respondents had also chosen not to reveal their monthly household income.
259 The majority of respondents, namely 81.9%, live in urban areas, with 40.8% of them living in
260 flats and 32.8% and 17.4% of them living in detached houses and semi-detached houses.
261 Most households have two adults and children less than 18 years of age. At the height of the
262 COVID19 pandemic, 55.7% of respondents were in partial lockdown, 37.4% in full lockdown,
263 and 6.9% not in lockdown. When responding to the survey, 71% of the respondents were not
264 experiencing lockdown, 25.3% were in partial lockdown, while the remaining respondents
265 were in full lockdown.
266
267 *4.2. Level of Consumption and Waste Generation*
268 The respondents were then asked about their consumption of packed food, fresh food such
269 as fruits and vegetables, online or takeaway food during the lockdown between March and
270 June 2020, and any changes in the amount of waste generated. Table 1 shows the summary
271 and extent of consumption and waste generation for the sample.
272
273 *Table1. Summary of Consumption and Waste generation*

Consumption and Waste generation		Responses (%)	Distribution of responses (%)				
			Blanks	Up to 10%	Between 10%-20%	Between 20%-30%	Over 30%
Packed Food (N=204)	No change	40%	100%	-	-	-	-
	Yes, it has increased	48%	0%	37%	33%	14%	15%
	Yes, it has decreased	12%	8%	12%	36%	32%	12%
Fresh food (N=203)	No change	36%	100%	-	-	-	-
	Yes, it has increased	45%	1%	22%	37%	23%	17%
	Yes, it has decreased	18%	0%	46%	41%	11%	3%
Food Delivery (N=204)	No change	39%	100%	-	-	-	-
	Yes, it has increased	46%	0%	33%	32%	16%	18%
	Yes, it has decreased	16%	0%	22%	19%	19%	41%
Waste generation (N=204)	No change	21%	100%	-	-	-	-
	Yes, it has increased	55%	3%	36%	35%	16%	10%
	Yes, it has decreased	11%	5%	27%	50%	14%	5%
	Don't know	13%	100%	-	-	-	-

Table 1 shows that 45%-48% of the respondents observed increased consumption of packed food, fresh food, and food delivery during the pandemic. About 36-40% of respondents experienced no change, and 12-18% experienced decreased consumption. In terms of waste production, more than half of the sample (55%) indicated an increase in waste generation during the lockdown period. Most of the increase or decrease in consumption or waste generation is between 10% and 20%, as shown in Table 1. As stated by Morrison (2020), according to market researchers, frozen and packed food purchases increased due to panic buying, as consumers stocked their home with long-lasting food). Sharma et al. (2020) have also reported an increased demand for food delivery options and a consequent increase in waste generation, especially of plastic products.

Respondents were also asked about the reasons for the potential change in a waste generation. Figure 1 summarises the results, pointing out a balanced distribution of responses across the provided options. Other responses include less socialization, eating at home instead of going out, using masks, and having children at home instead of nurseries, for example, which leads to an increase in cooking activities and therefore in waste generation. All these reasons relate to common causes explored by other authors: the stay-at-home

291 policies and preventives measures against COVID-19 (e.g., increased consumption of masks,
292 gloves, toilet papers, food delivery) (Ikiz et al. 2021; Sarkodie & Owusu, 2020)
293
294

Figure 1. Reasons for change on waste generation during the lockdown (N=173)

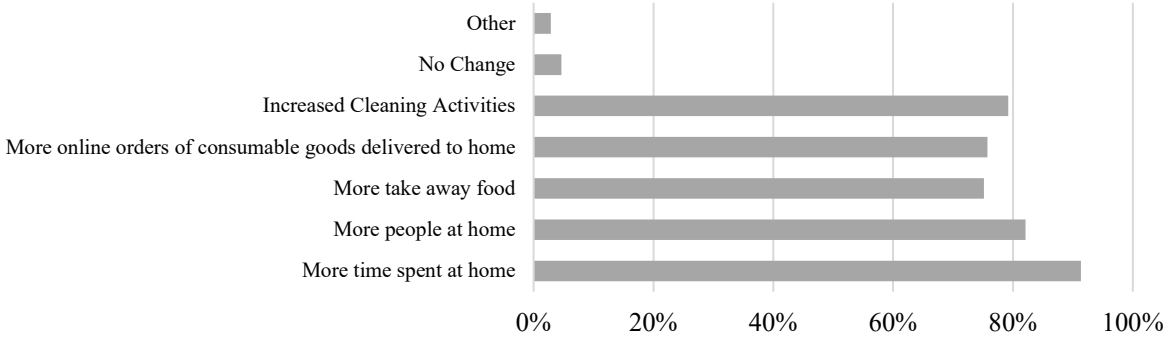
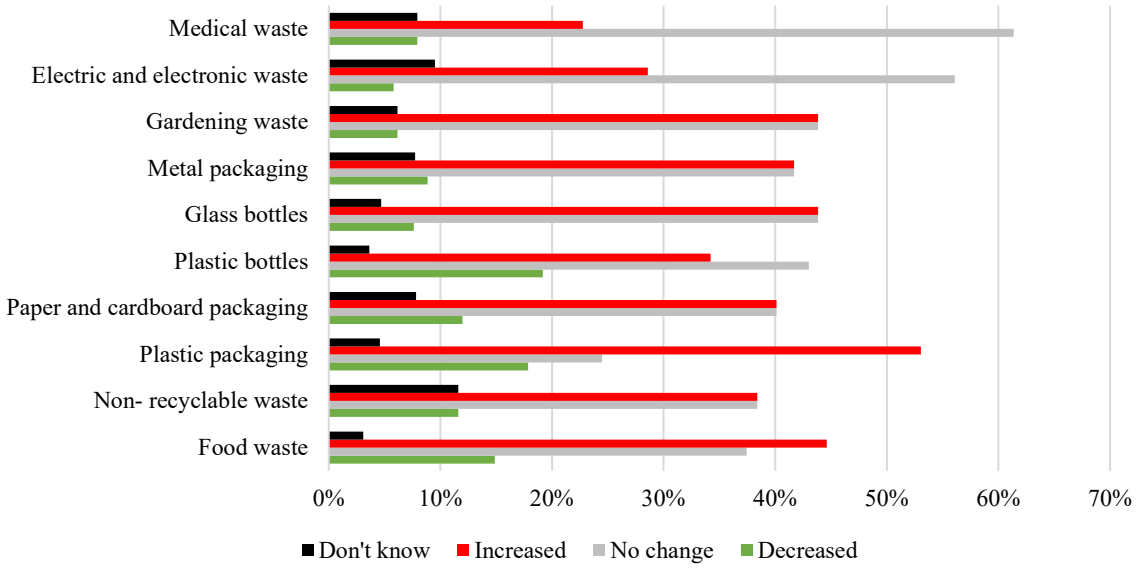


Figure 2 summarises the results of the change in types of waste generated during the lockdown. The highest increase was observed for plastic packaging and food waste (53% and 45%, respectively). Other types of packaging (e.g., metal, paper) and glass bottles, and gardening waste, are also among the items with a higher percentage of increased generation. Most respondents also reported no change in waste generation, with higher medical and electronic waste rates, for example.

Figure 2. Change in types of waste generation during the lockdown



307 Explicitly focusing on food waste, the respondents were asked to rank the necessary
308 household items discarded during the lockdown (from 1 the least to 5 the most discarded).
309 Table 2 presents the average per item, with the most discarded items, including fruits and
310 vegetables (2.63) and the least discarded potatoes (1.08). In March 2020, more consumption
311 and purchase were reported in Italy for Bread (180.7%), yeast (189.6%), and cereals/grains
312 (131.4%). Moreover, the UK reported an increased consumption of canned meat (143%).
313 Similarly, the purchase of dried potato products increased in Germany by 202% (Morrison,
314 2020). Ikiz et al. (2021) and Jribi et al. (2020) reflect that although the lockdown led to an
315 overall increase in food waste, in some contexts decreases may be possible, in respect of
316 eating less food or increasing the re-use of leftovers.

317 *Table 2: Ranking of items most discarded during the lockdown (1 - the least; 5 - the most)*

Item	Average	Standard Deviation
Fruits/ Vegetables	2.63	1.42
Meat	2.25	1.35
Dairy Products	2.18	1.29
Bread	2.16	1.24
Fish/Seafood	2.14	1.26
Ready-made meals	2.05	1.26
Canned Food	1.99	1.20
Milk	1.97	1.29
Cereal/grain products	1.96	1.19
Potatoes	1.8	1.08

318

320 Table 3 presents the responses to a set of questions related to regulations for waste
321 separation by the local city council, existence of different litter bins to separate waste at home,
322 and efforts to segregate waste. In case more changes in waste regulations have been applied,
323 the sample might not have been aware or noticed any difference (49%), whereas 57% of the
324 sample indicated changes in this aspect. Regarding household efforts, it was possible to
325 observe that the separation of waste is still a topic that deserves further measures, as almost

half the sample indicated a negative response. Just a third of the sample (32%) indicated they have increased their efforts to segregate waste properly during the lockdown.

Table 3. Questions and responses related to Waste Management

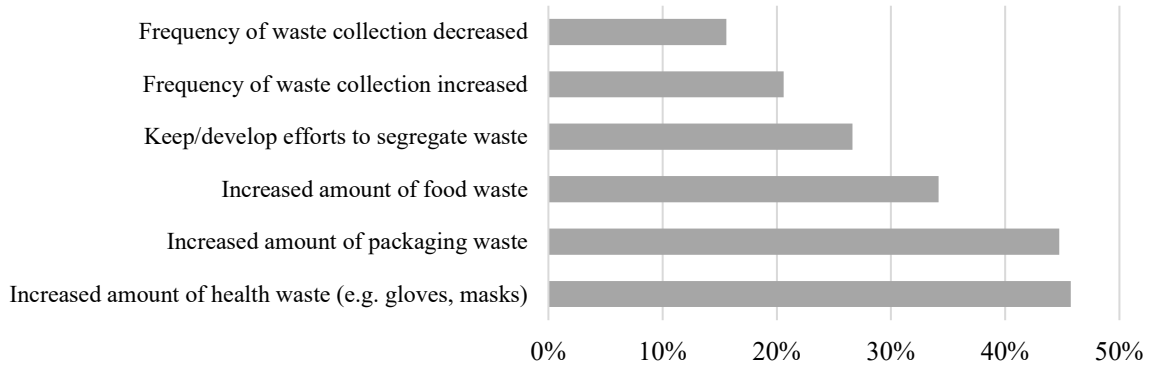
Question	Response options (%)		
Have local council regulations been changed in your city/district/area in terms of household waste separation during the lockdown? (N=204)	Yes	No	Don't know
	19	57	49
Do you use different bins for the separation of household waste (e.g. black waste for general waste, green bin for fruits/vegetables, etc)? (N=202)	Yes	No	-
	55	45	-
Have your efforts to segregate waste (organic and recyclables) changed in your household during the lockdowns? (N=204)	Yes, they decreased	No change	Yes, they increased
	4	64	32

The respondents were also asked about sustainable packaging purchases (e.g., reusable packaging, biodegradable packaging), where 30.9% agreed that they always look for sustainable packaging options. About 47.5% of respondents practice that occasionally, and 20.6% stated that they never look for sustainable packaging options while buying food online.

4.3. Challenges, outcomes, and measures for waste management

The COVID-19 pandemic resulted in challenges and impacted waste management in various ways. For instance, in connection with changes in the amount of waste produced, changes were seen in connection with disposal rates in households, changes in waste composition, and swifts in waste distribution (Fan et al., 2021). Figure 3 presents the main challenges regarding waste management at households during the lockdown. The highest percentages (45% of the respondents) were associated with an increased amount of health and packaging waste. A study by Fan et al. (2021) also reported increased plastic waste production, and that online meal delivery increased by 73% during the pandemic in Singapore.

346 *Figure 3. Main challenges regarding waste management at households during the lockdown*
347 *(N=199)*



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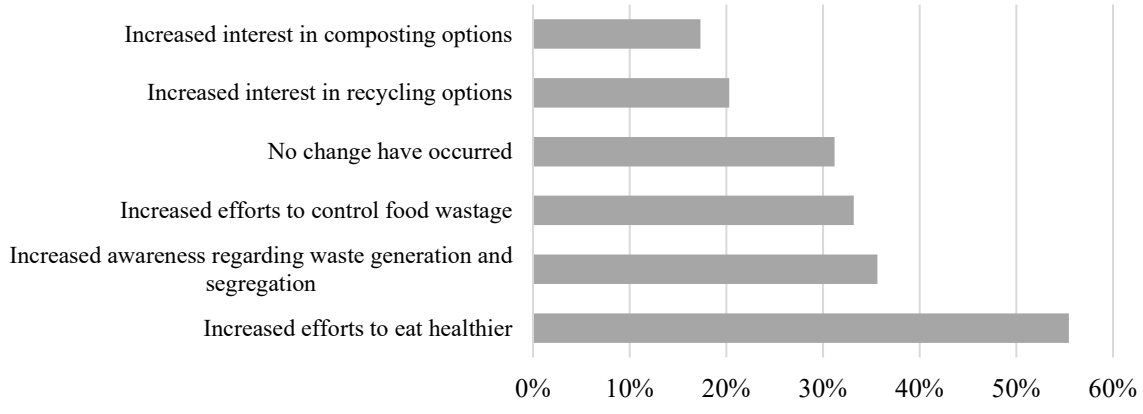
349

350 Respondents were also argued about possible positive implications of the lockdown to their
351 households (Figure 4). 55% of the respondents indicated increased efforts to eat healthier,
352 followed by efforts related to implement waste separation and prevent food wastage (36% and
353 33%, respectively).

354 *Figure 4. Outcomes of the lockdown in the households (N=202)*

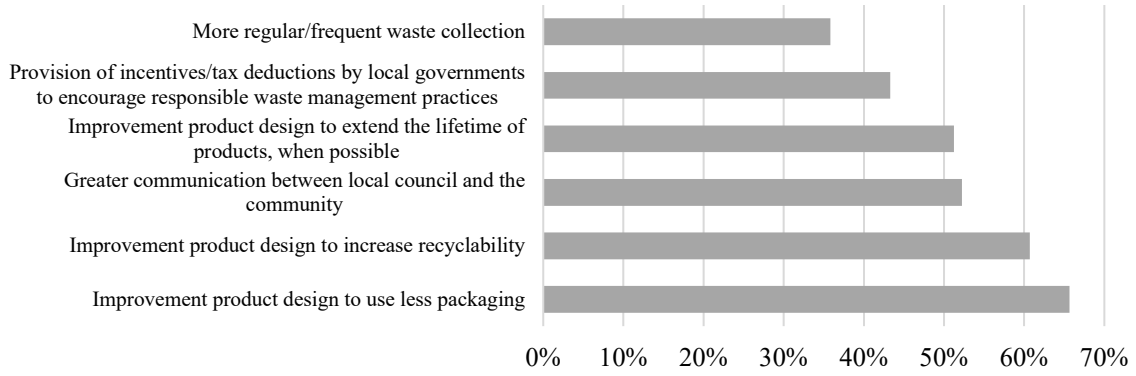


355

356 The lockdown experience seemed to have made some people reflect about measures that
357 could be intensified for better waste management during disaster situations. Most responses
358 (Figure 5) indicated the need for improving product design to use less packaging (66%) or to
359 increase recyclability (61%). Moreover, about 51-52% of respondents indicated to extend the

lifetime of product design and better communication between the local council and the community. According to the United Nations Environment Programme, in order to better raise awareness and establish better communication between healthcare staff and the public, guidelines should be developed for the handling, treatment and disposal of waste generated during pandemic conditions. There should be clear responsibilities and roles assigned to collecting waste under such exceptional conditions (UNEP, 2020).

Figure 5. Measures that should be intensified for better waste management during disaster situations (N=201)



Implementing an appropriate waste management system assures the continuity and functionality of workers and waste services during the CODID-19 pandemic. It is also important to put measures in place to protect the safety of workers at waste collection and disposal facilities, and to foster the improvement in recycling services (Sarkodie & Owusu, 2020).

5. Conclusions

This study has presented evidences which show that the lockdowns triggered by the pandemic led to an increase in levels of consumption in households, and to changes in the amounts of waste and recycling. These items have, in turn, put an additional pressure on the waste management systems of many cities around the world. The increases in consumption were

initially due to purchasing food in bulk or panic buying. It could then be explained by the fact that many citizens were forced to stay home. As a result, the purchase of frozen and packaged food increased significantly since March 2020. Many consumers preferred to buy long-lasting food products and changed their habits by shopping more online or taking away food.

The study presented here involved 204 consumers from several countries. About half of the respondents noticed an increase in packed food, fresh food, and food delivery. Consequently, more waste generation was reported, especially in respect of plastic packaging and food waste. But not all trends were negative, since a significant number of individuals mentioned their efforts to eat healthier food, and to separate the waste produced at home.

This situation also led to consumers being more critical with food producing companies, pointing out that they should implement measures such as improve product design to use less packaging, or increase the recyclability of the packaging they use. Nevertheless, this responsibility should be also shared with public entities. These may, for instance provide better infra-structure for selective waste collection, or for recycling. Complementarily, it could also be useful to identify effectives way to reward citizens who actively participate in waste prevention efforts. Although many people think it is challenging to reduce waste, small actions can be taken (e.g., composting, replacing disposable products with durable ones, avoiding over packaging, etc.).

Another issue is how the municipalities efficiently manage household waste during the pandemic. In our study, if some changes in waste regulations have been applied, it was observed that about half of the sample might not have been aware of these new regulations, or noticed any change. Thus, it is important to identify best practices and analyze the key success factors, so as to increase the capacity of waste management systems to respond to pandemic crises, while keeping waste prevention and recycling high on the agenda. In many places, the interruptions in some commercial activities, and diminishing tourist flows have also influenced waste generation, which may free capacity to focus on household waste management. Another matter of relevance is the communication with residents: changes to collection services should be better communicated, preferably well in advance. The

population should also be "educated" to better collaborate with local management waste authorities, by engaging on reductions on the amount of waste generated in households.

Regarding the limitations of our study, we recognize that using a convenience sample that is country diversified reduces the possibility of picking specific local trends. On the other hand, it caters for a greater degree of generalization. The limited number of responses can be also considered a limitation of the study. Nonetheless, the study provides a welcome contribution to the literature since is has enabled an overview of trends in 23 countries spread across the various geographical regions. This serves the purpose of illustrating the wide-ranging impacts of the COVID-19 pandemic on households´ consumption habits, in face of the lockdowns it triggered.

In respect of future research, and since the world is still facing a second wave, it could be useful to analyze other stakeholders' perspectives regarding household waste (e.g., municipalities, producers, supermarkets) since these sectors have also been experiencing changes due to the lockdowns. The search for other explanations about individuals' behaviour could also be studied using other research perspectives such as green buying behaviour, green consumption, lifestyle changes, or economic incentives to consumers, among others.

Funding: This research was performed by the European School of Sustainability Science and Research (ESSSR), and the Inter-University Sustainable Development Research Programme (IUSDRP). It did not receive any specific grant from funding agencies from the public, commercial, or not-for-profit sectors

Declaration of competing Interest: The author declares no competing interest.

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