

Article

COVID-19 and Households Waste in Hispanic America: An Assessment of Trends

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Abstract: The COVID-19 pandemic has caused many social and economic problems in Hispanic America, a region with fragile health and economic systems and many inequalities. The pandemic has negatively influenced various aspects of life and led to changes in various habits and behaviours, including consumption. However, the extent to which the pandemic has influenced households, and waste production, in particular, is not well known. In this context, this paper reports on a study aimed at identifying changes in waste production across households under the special conditions created by the pandemic in Hispanic America. The majority of the respondents stated that their level of satisfaction with waste management policies in their countries did not change much during the pandemic. Only a few stated that they were more satisfied than before. Overall, the results suggest that, like previous crises, the COVID-19 outbreak may generate changes regarding household consumption and waste management in Hispanic America. At the same time, these findings stress the need to improve waste management practices. Some measures that may be adopted to allow Hispanic American countries to better cope with increases in waste production in times of pandemics are listed.

Keywords: COVID-19; sustainability; consumption; waste management; behaviour; Latin America

1. The COVID-19 Pandemic in Latin America

The COVID-19 pandemic has significantly impacted the lives of many [1,2] and has certainly changed the way people behave, act, and face the future [3,4]. As a result of the relevant decrease in greenhouse gas emissions and the subsequent air pollution, some positive outcomes were observed for ecosystems worldwide during a short period at the beginning of the pandemic. Nevertheless, there were also inevitable negative effects generated by the rapid increase in demand for plastic products such as food and grocery delivery packaging [5] or medical and personal protective equipment [6]. In this regard, plastic pollution is crucial because of the extensive footprints of plastics on natural ecosystems and public health [7].

In some regions, changes are likely to be more extreme and their impact felt for an extended period, exacerbating existing problems associated with poverty and social inequity. Indeed, this is the case in Latin America, where the pandemic has instigated a humanitarian crisis [8,9], already identified as the worst in recent history [10].

Regarding health care, most Latin American countries present fragile and segmented systems that make their populations vulnerable [8,11,12]. Notwithstanding differences between countries, common problems occurring across Latin America include the inability of healthcare systems to deal with the considerable increase in infection resulting from the second wave of COVID-19 and the appearance of new virus variants [13].

In addition, by aggravating the problems associated with the informal economy, instigating high levels of unemployment, and increasing gender inequalities, the pandemic has led to an increase in the number of people experiencing poverty or extreme poverty across Latin America [9,14]. Indeed, much of the social progress achieved over the last 20 years has practically been reversed in the last twelve months [8]. Projections from the Inter-American Development Bank (IDB) highlight increased poverty and public debt in the short term when the actions by governments in the region are taken into account [15].

A survey performed by the United Nations Economic Commission for Latin America and the Caribbean (ECLAC) across 18 Latin American countries found that in 2020, 33.7% of the population was living in poverty conditions (circa. 209 million people) and 12.5% in extreme poverty conditions (circa. 78 million people) [16]. As well as the acute impacts felt by individuals, high levels of poverty also have implications for broader society. Poverty and other social inequalities have grave implications for waste management. Indeed, they have been shown to encourage waste generation, limit access to waste infrastructure, and hinder policy implementation [17]. In addition to presenting a global health crisis and causing an economic crisis in many countries, the COVID-19 pandemic has driven a distinct shift in household consumption behaviours and exacerbated environmental problems due to the increased consumption of single-use goods, take away products, and pre-packed food [5].

Regarding the environmental aspects of the region, Latin America has presented serious deficiencies regarding the lack of wastewater treatment and waste management of plastic materials. The pandemic aggravated the scenario due to the increased utilization of single-use plastic materials, in particular, the use of plastic personal protective equipment. The situation can be more critical when the ocean coast is considered [18]. Previous studies have addressed this issue from a local or national perspective, but there seems to be a gap in understanding the challenges generated by the pandemic regarding waste management from a regional perspective.

Against this background, this research aims to explore the effects generated by the COVID-19 pandemic on household waste in Hispanic America. For this purpose, we applied a survey used by Leal Filho et al. (2021) [5]. This research presents several contributions to the literature. First, it offers preliminary results regarding changes experienced by households' waste management habits because of the COVID-19 pandemic. Second, it shows some behavioural trends common to several countries in the region. It also presents some changes in consumption habits associated with the COVID-19 pandemic in Hispanic American countries, as well as some interesting lessons regarding some of the areas where attention is needed in terms of responses to pandemic situations.

The paper is structured as follows. It starts by reviewing the impact of the COVID-19 pandemic in Latin America, with a special focus on Hispanic America. It then continues by presenting the research methodology applied in this study. This is followed by a detailed presentation and discussion of the main results. The last section is dedicated to a conclusion, where the main contributions are presented, as well as some limitations and further lines of research.

2. Impact of COVID-19 on Household Consumption and Waste Generation

The relevance of proper solid waste management is commonly underestimated as regards its effects on public health [19]. When focused on household consumption and subsequent waste generation, the various impacts of COVID-19 can be categorized across three interlinking themes: structural constraints, economic circumstances, and social-psychological factors, which are noted variably within the literature, for example, [20–23], and are explored in more detail in the ensuing text.

Structural constraints are caused by direct measures, such as national lockdowns and explicit stay-at-home instructions [23], as well as indirect consequences from the closure of extradomestic consumption channels, for example, restaurants/cafes, schools, and workplace canteens [24], the cancellation of mass events, and mobility restrictions [23]. Globally, these structural constraints changed consumption habits by forcing households to prepare and consume all their meals at home [25]. In turn, this meant that the generation of waste changed location from a place(s) of work (often serviced via commercial waste management contracts) to generation within the household (serviced via domestic services or local authorities) [26]. Indeed, [24] found that the partial reallocation from extra-domestic (i.e., restaurants, cafes, canteens, etc.) consumption to home preparation caused a 12% increase in the amount of food waste generated. Likewise, a 5–30% increase in the amount of residential solid waste generated was reported in New York City [27], complemented by a 50% reduction in the amount of waste generated by the commercial and industrial sectors.

The onset of mobility restrictions led to the expansion of online shopping platforms, where consumers can purchase products and have them delivered to their households with ease [28]. Indeed, [29] noted that the number of consumers using grocery pickup services and other delivery services increased significantly from the onset of the pandemic, driven by fears over COVID-19 and concerns about safety. The increased use of online shopping outlets and home delivery services had consequences for energy use (e.g., in transportation) and waste production [30]. Concerning the latter, the increased purchasing of online food and groceries led to the increased generation of common packaging wastes such as single-use plastics and cardboard [26].

Changes in economic circumstances also had implications for consumer behaviour. The increased prevalence of working from home, redundancies, and furlough schemes has led to households having more spare time and sustained cohabitation among families [25]. While this may be a positive consequence for some, other negative impacts have become apparent, particularly where reduced pay and redundancies jeopardize household food security [31]. Furthermore, the subsequent negative influence on disposable income affects the net volume and patterns of household consumption. A shift has been noted from the consumption of durable and non-essential goods towards food staples and other essentials [32].

The perception of risk and the subsequent behaviours employed to minimize it have impacted household consumption through the increased prevalence of panic purchasing [24], stockpiling, and overbuying [29]. The reduction in shopping frequency is also attributed to anxiety and a need to minimize perceived risks, coinciding with a decline in the purchase of fresh produce, where consumers have favoured non-perishable items instead [23]. These behaviours, driven by socio-psychological factors, have been exacerbated by supply chain issues and food shortages within stores [29]. The implications of increased panic buying, stockpiling, and overbuying on waste generation include the increased disposal of perishable products and leftovers [33]. Here, the panic-buying behaviours noted at the beginning of the pandemic led to more food waste being generated due to a lack of foresight, bad cooking habits, limited storage, and the hoarding/overbuying of food items with low-shelf lives [24,26].

Furthermore, increased levels of stress and anxiety experienced during the pandemic have led to the greater consumption of “comfort foods” [23]. While the fondness for “comfort foods” (sensorily appealing foods high in fat, sugar, and carbohydrates) has been

universal during the pandemic, specific food groups have differed among nations. For example, European studies have shown that Spanish consumers ate more indulgent foods and snacks and drank more alcohol throughout the day [24]. In comparison, the Danish consumed more pastries and alcohol, the Norwegians consumed more high-sugar food and beverages [23], and the French consumed more processed meats, sugary foods and beverages, and alcohol [34]. In contrast, Italian residents, as well as consuming more chocolate, chips, and snacks [23], increased their consumption of homemade pizza, bread, and desserts [25], items that have symbolic family and cultural values and are linked with pre-existing socialization habits [35].

A further point of note is the implication of these changing behaviours on attitudes towards sustainability. Indeed, Escursell, Llorach-Massana, and Roncero (2021) highlight that while consumers are becoming more environmentally conscious regarding their purchases from brick-and-mortar stores, when purchasing goods from online outlets, other variables such as price, volume, and time of delivery are prioritized over sustainability. This trend has been mirrored during the COVID-19 pandemic with a returned preference for single-use plastics, where the action to reduce the risks of contamination/infection outweighs any ambitions to behave more sustainably [20].

In summary, the COVID-19 pandemic has accentuated existing problems across Latin America and cancelled out the social gains achieved over the past two decades [8]. As Rivarola Puntigliano [10] suggests, the current situation is not simply a pandemic crisis, but a “multiple crises” scenario. Sharma et al. [20] note that the advent of the pandemic has resulted in an unprecedented socio-economic-ecological crisis that has, and will continue to, threaten the lives and livelihoods of people while rewinding decades of sustainable development. Literature from around the world has also indicated that the ongoing pandemic has implications for waste management through increased levels of poverty [27] and/or changes to household consumption [36]. Indeed, Liang et al. [36] conclude that changes to consumption habits during the pandemic have “without exception” led to difficulties in plastic waste management and the reversal of policies that focus on the reduction in single-use plastic consumption. While studies have investigated the impact of the pandemic on consumption and waste within prominent nations such as China, Japan, Brazil, Canada, and Germany [23,36,37], impacts across Latin America are less well known. At the same time, in line with the effects that the pandemic generated in other parts of the world, it poses some challenges for household waste management, but at the same time, it contributed to the stress of some opportunities for improving the provision of this public service at the local level [38]. In this context, this research aims to shed light on the effects of the pandemic on household waste production across Hispanic America.

3. Methodology

To explore the implications of the COVID-19 pandemic on waste generation across Hispanic America, this study employed a quantitative approach. The objective was to evaluate the opinion of households across Hispanic America concerning changes in household consumption and in waste production as a consequence of the pandemic. Data were collected using an online survey developed by the research team, and the results were analysed using descriptive statistics. The survey was based on Leal Filho et al. (2021) [5], who performed an international study on the increased consumption and subsequent changes in the amounts of waste produced since the COVID-19 pandemic.

Consequent to the purpose of this research, the novel aspect considered in the present study was the inclusion of a section dedicated to the formulation of public policies, and the perception of respondents regarding public waste management during the pandemic. For this reason, the survey contained four sections: Section 1: Background: to collect information on the respondents’ country, gender, age group, level of education, occupation, household income, housing, living place, and stages of lockdown. Section 2: Level of Consumption: to assess the respondents’ perception of the changes in the consumption of packed, fresh, and delivered food. Section 3: Waste generation: to assess the respondents’

perception of the changes in waste generation and the reasons for these changes. Section 4: Waste Management and Formulation of Public Policies: to assess the respondents' perception of the changes in household waste management and in public policies related to waste management. Items in each of the four sections were identified to capture the major structural issues regarding the perception of households about the problems addressed in this research. The survey included 31 questions in total: 11 questions regarding the general background (Section 1); 7 questions about the level of consumption (Section 2); 4 questions concerning waste generation (Section 3); and 9 questions focused on waste management and the formulation of public policies (Section 4).

The questionnaire was validated by a group of international and regional experts in the fields of environment and sustainability, waste management and recycling, sustainable consumption and production, and public health. Some of the comments from the expert validation included adjustments in the number of sections and items within each section and adaptation of some questions/options for clarity. Upon addressing the feedback from the expert validation process, a pilot application (i.e., a pre-test) was performed with six respondents to ensure completeness and clarity. The findings from this pilot application revealed that the survey instrument was satisfactory, with minor changes. The final survey instrument was created in Spanish using Google Forms (Google LLC, Mountain View, CA, USA) and is presented in Supplementary Materials.

To recruit participants, a purposive sampling approach was employed, in combination with techniques such as chain referrals and snowballing. This consisted of an invitation to participate alongside a link to the online survey, which was shared with Hispanic American audiences via the research team, the networks of the European School of Sustainability Science and Research (ESSSR), and the Inter-University Sustainable Development Research Programme (IUSDRP). Data collection was carried out between March and April 2021. In line with research ethics protocols, the participants were informed that participation was entirely voluntary, that all responses would be treated in the strictest confidence, and that data protection rules would always be upheld. The results of the survey are presented in the subsequent section and all figures show information gathered using that questionnaire.

4. Results and Discussion

4.1. Demographics

As mentioned earlier, we applied an adapted version of the survey used by Leal Filho et al. [5], and the study received a total of 102 responses from consumers in the following 10 Hispanic American countries: Argentina (17%), Bolivia (2%), Chile (13%), Colombia (15%), Costa Rica (2%), Dominican Republic (1%), Ecuador (5%), Guatemala (8%), Mexico (34%), and Peru (4%). Their distribution across the region is presented in Figure 1. Responses were not solicited from Brazilian consumers in this study as detailed research has already been performed on Brazilian consumers in the Portuguese language. Therefore, the results represent a preliminary analysis of the situation in the region that shows trends in several Hispanic-American countries.

Descriptive statistics from participants reveal that the majority of the respondents are female (71%) and have achieved higher educational levels (31% undergraduate and 51% postgraduate level). Over half of the respondents are within the youngest age group (18–29 years, 54%); correspondingly, 40% belong to the category “Student” in the occupation assessment.

Nevertheless, as the survey focused on households, the background section also collected information on net monthly household income, type of household, and household composition to help better comprehend the socio-economic characteristics of the participants and allow the identification of trends in different countries within the region. Almost 50% of respondents have a net monthly income between USD501 and USD1500, and the majority live in detached houses (63%). As per household characteristics, in 44%, the number of people is two adult residents in total (44%), and the number of households

with no children is 66%. Complete demographic categories and distributions can be seen in Table 1.

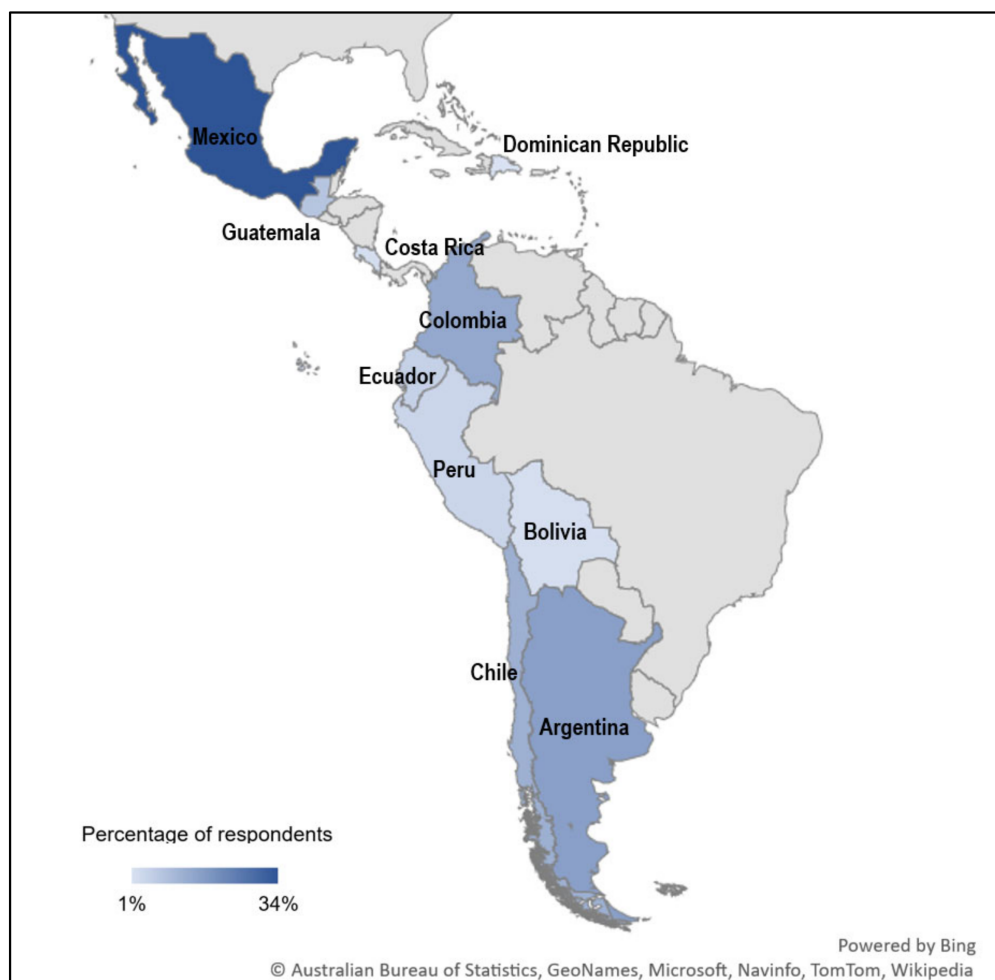


Figure 1. Survey participating countries.

With respect to the national pandemic response, the use of widespread lockdowns was particularly common in all countries included in this research. The results show that respondents experienced the trend of full lockdown during the worst phase of the pandemic (67%) and partial lockdown during survey participation (March–May 2021; 65%).

4.2. Consumption

Regarding household consumption during the pandemic, 30% of respondent households reported an increase in the consumption of industrially processed foods, while 26% said that the consumption of such products had been reduced. It is important to mention that 43% of the respondents did not report a change in this aspect of their food consumption. Overall, this indicates that the trend of change was minimal, with those that increased their consumption of industrially processed food balancing out those that decreased consumption.

On the other hand, trends in the consumption of organic and natural food paint a different picture. Indeed, 51% of respondents stated an increase in the consumption of organic and natural foods such as fruits and vegetables during the COVID-19 pandemic. Among the respondents that increased their consumption of organic and natural food, less than a quarter (23%) increased their intake by 30%, while 40% increased their intake by only 10–20%. Only 10% of respondents reduced their consumption of organic and natural foods. Figure 2 compares the results of these categories.

Table 1. Sample demographic characteristics.

Age Group	Distribution	Net Monthly Household Income	Distribution
18–29	54%	Below USD500	6%
30–39	26%	USD500 to USD1000	25%
40–49	13%	USD1001 to USD1500	21%
50–59	5%	USD1501 to USD2000	11%
60+	2%	USD2001 to USD2500	8%
Education Level	Distribution	USD2501 to USD3000	4%
Postgraduate	51%	Above USD3000	14%
University	31%	Prefer not to say	13%
High School	14%	Type of housing	Distribution
Primary school/secondary school	4%	Detached house	63%
Gender	Distribution	Flat	34%
Female	71%	Semi-detached house	2%
Male	29%	Rural	1%
Occupation	Distribution	Number of adults	Distribution
Student	40%	1	14%
Skilled Labourer	15%	2	44%
Consultant	10%	3	21%
Administrative Staff	10%	4 or more	21%
Self-employed/Partner	7%	Number of children (<18 yo)	Distribution
Middle Management	7%	none	66%
Temporary Employee	5%	1	19%
Upper Management	4%	2	11%
Junior Management	2%	3	4%
Trained Professional	1%	4 or more	0%

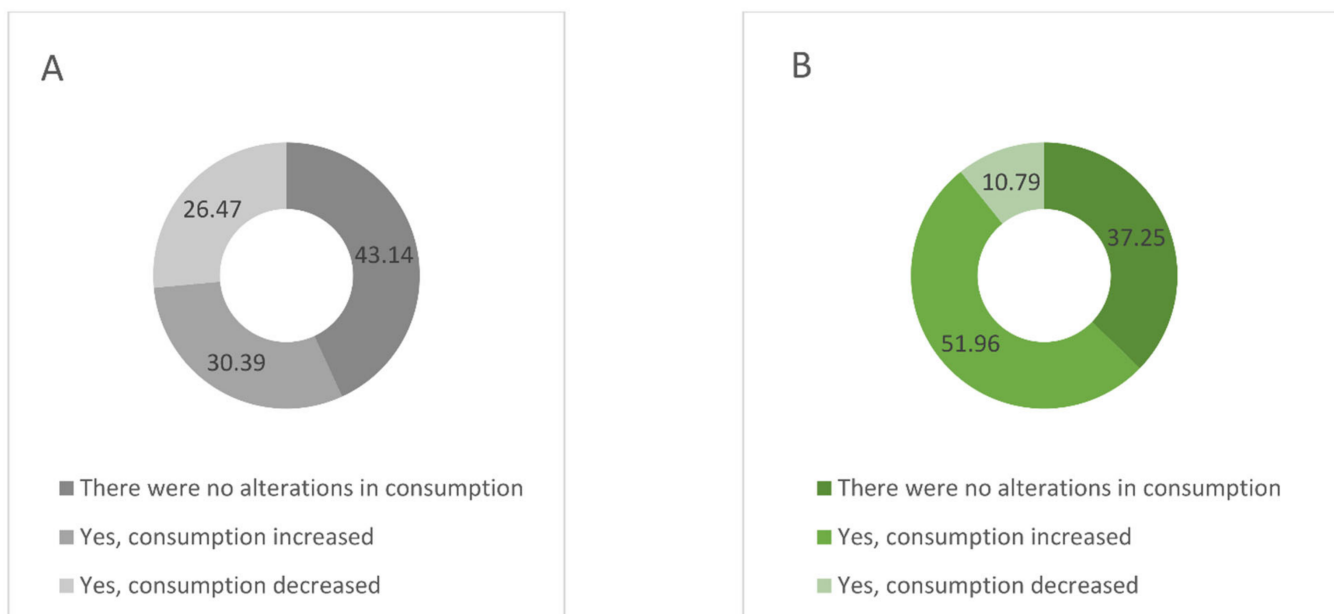


Figure 2. Variation in the consumption of industrially processed foods (A) and of fresh/organic products (e.g., fruits and vegetables) (B) during confinement in 2020.

These results indicate a trend towards the increased consumption of organic and natural foods, which is aligned with Ouhsine et al. [39]. This study, based in Morocco, observed a slight increase in the consumption of fruits and vegetables during the lockdown alongside a corresponding drop in the consumption of meat products. As detailed in that article, this trend can be explained by consumer intentions to strengthen the immune system through the increased intake of fibre and vitamins, often found in fruit and vegetables. As well as a change in the types of products consumed, the survey respondents indicated a change in how products were purchased. In this research, 63% of the households acknowledged an increase in the use of online shopping and home delivery channels, while less than a third (29%) stated no change, and only 8% reported a decrease.

Overall, these results indicate a trend towards the increased consumption of organic and natural foods, which is aligned with Ouhsine et al. [39]. This study, focused in Morocco, observed a slight increase in the consumption of fruits and vegetables during the lockdown alongside a corresponding drop in the consumption of meat products. Likewise, a study by Di Renzo et al. [40] in Italy also demonstrated that 15% of the interviewed respondents changed to the organic consumption of fruits and vegetables during the lockdown and a reduction in the consumption of savoury snacks and processed meat. A similar trend is seen in another study conducted in Morocco, Algeria, and Tunisia during the COVID-19 pandemic [41]. This study also shows the increased consumption of healthy foods such as organic and biobased foods to improve people's immunity to prevent infection. These trends can be explained by consumer intentions to strengthen the immune system through the increased intake of fibre and vitamins, often found in fruit and vegetables.

However, the findings of Janssen et al. [23] show that there is less consumption of fresh fruits and vegetables in Denmark, Germany, and Slovenia and more consumption of canned food, frozen food, and cake and biscuits during the COVID-19 pandemic. This can be explained by people's intention to reduce shopping frequency due to the high risk and anxiety of COVID-19, which led to an increase in the consumption of food with longer shelf life during the pandemic. Another study in Italy [35] revealed that people tended to take more pasta, flour, and long-life frozen fruits than fresh fruits and vegetables during the lockdown, which is consistent with the findings of Janssen et al. [23]. Concerning changes in the types of products consumed, the survey respondents indicated a change in how products were purchased. Here, 63% acknowledged an increase in the use of online shopping and home delivery channels. Less than a third (29%) stated no change, and only 8% reported a decrease.

Overall, the results indicate that the pandemic (specifically during lockdowns) had a marked impact on the way households were purchasing goods, and thus consumption behaviours, with an increasing trend in online shopping and home-delivered products. On the other hand, it is important to note that this trend did not extend out to takeaway food, since consumers opted to cook more at home. Of course, the products consumed, and the channels used to consume them can have a significant impact on the amount (and composition) of waste generated.

4.3. Waste Generation

Concerning household waste generation, the US HUNTER study [42] reported that home cooking increased in 54% of USA households during the lockdown. This supports findings from this study, where 57% of the respondents reported a reduction in food waste, possibly explained by the increased usage of recipes and time to prepare the food. Clearly indicating more sustainable human behaviours during the COVID-19 pandemic.

However, when efforts to ensure the correct separation of waste are considered, a different story appears.

In this research, over half of the respondents (57%) claimed to make no changes during the pandemic, in terms of efforts to separate wastes correctly (Figure 3). That being said, about 41% of respondents did state that efforts to properly separate waste were increased.

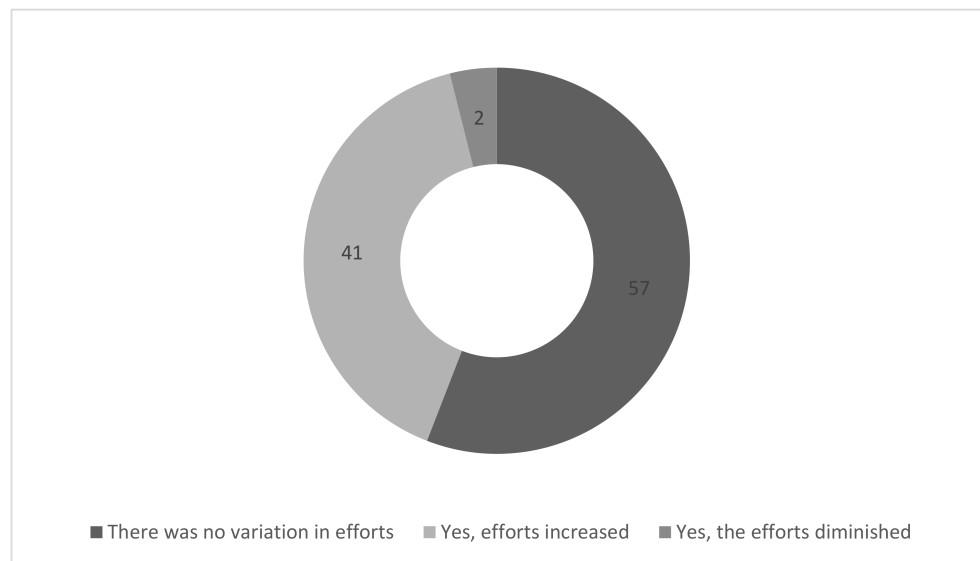


Figure 3. Variation of efforts to separate waste during confinement (in percentage).

Against this background, it is important to analyse barriers to waste separation and address the main challenges that hinder such activities within homes. When asked what the main difficulties encountered were, 49% of respondents stated the growing number (and types) of packages that are destined for waste (Figure 4). This is especially pertinent due to the many adaptations among businesses that changed the ways in which households purchase and consume food. On the other hand, 42% of the respondents affirmed that the requirements to use masks and other personal protective equipment (PPE) during the pandemic have caused a new type of health waste to emerge within their homes. In line with this, 32% of the respondents declared challenges to maintaining or increasing waste management efforts, and 28% of the participants recognized problems managing the increased amount of food waste. It is important to highlight that only 1% of the respondents declared no challenges in managing waste generated during the COVID-19 pandemic, stressing how relevant changes in households were. These results are in line with previous findings that stressed the fact that the increased waste generation experienced during the pandemic exacerbated risks for the environment and human health [7].

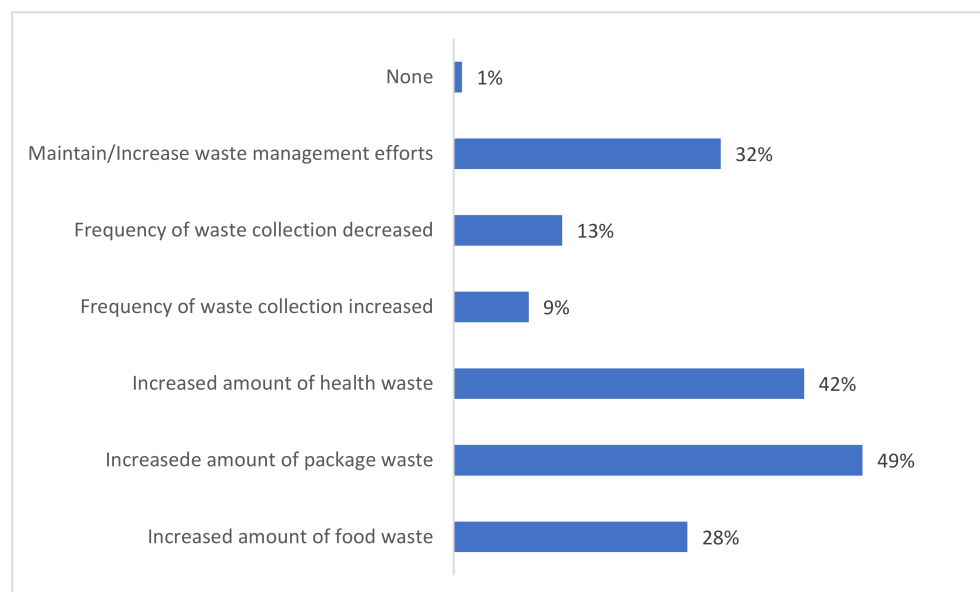


Figure 4. The main challenges regarding waste management during confinement (in percentage).

Similar findings were reported by Sarkodie et al. [33], where the use of single-use PPE such as gloves and masks led to an increase in the generation of domestic solid waste. These findings are supported by Chenarides et al. [29], where the results obtained from a survey in the US found that three-quarters of the respondents started to buy more food due to a lack of stock in supermarkets, and half of the respondents bought more food than usual. Furthermore, the number of participants using food collection services increased by about 255%, and those using food delivery services increased by 158%, thus considerably increasing domestic solid waste generation.

Finally, this study indicates the potential implications of the pandemic on consumer attitudes and behaviours, particularly concerning the management of waste. As shown in Figure 5, behavioural changes at a household level detected a growing interest in composting (32%) and recycling (40%) as well as increased efforts to eat healthier (51%). This increased awareness regarding waste generation was reported by 33% of respondents, the same share who declared increased efforts to control food waste.

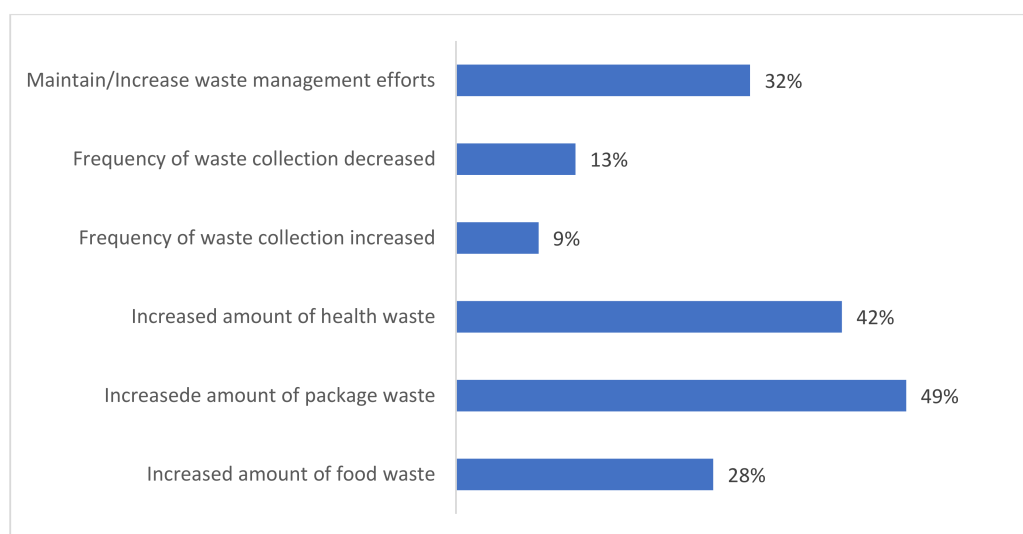


Figure 5. Which items can be considered a result of the lockdown?

4.4. Waste Generation and Public Policy Formulation

Alongside consumer attitudes and behaviours concerning waste generation at a household level, this survey also sought to assess the extent to which views and policies regarding waste management, at a public level, have been affected by the pandemic. When asked if public authorities within their city made any changes to the waste collection and separation processes during the pandemic, 48% of respondents reported no change, with 27% reporting some change, and 25% stating that they did not know or preferred not to answer.

The participants were also asked which measures they thought should be introduced or intensified to improve waste management during a disaster and/or pandemic situations in their home countries and by local authorities. The key results largely referred to product design, stakeholders' consultation, and public policy. As shown in Figure 6, when presented with six proposed measures that could be introduced or intensified during subsequent pandemic or disaster situations, most respondents indicated that five out of the six proposals could help public authorities to identify citizens' priorities and thereby improve waste management services [20]. These results, comparable to Tchetchik et al. [43], suggest a trend towards increasing recycling, as well as initiatives that improve sustainable consumption and waste management.

Additionally, the participants were asked to indicate their level of agreement regarding the adequacy of current public policies and procedures for waste collection and management. As presented in Figure 7, the findings indicate a strong tendency towards dissatisfaction regarding current public policies and procedures. Across the six statements,

on average, 32% of the respondents strongly disagreed, while 36% disagreed. These results suggest that citizens perceive much room for waste management improvement, confirming previous findings by Fan et al. [22].

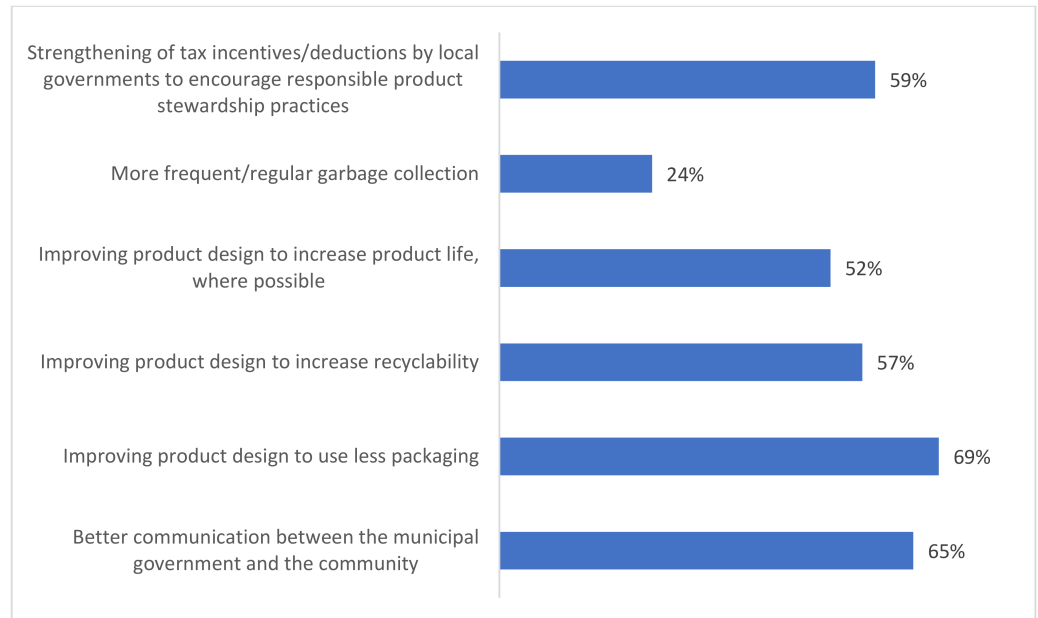


Figure 6. Measures that respondents consider should be intensified to improve waste management during a disaster and/or pandemic situation.

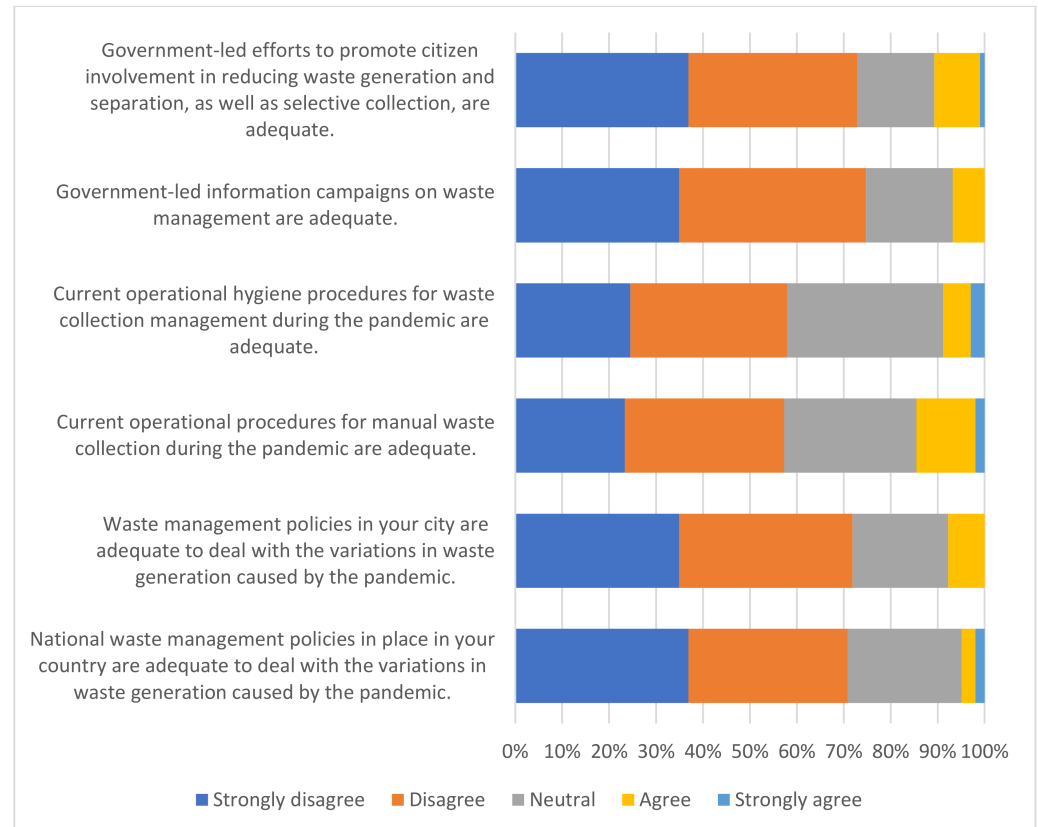


Figure 7. Participants' perception of public policies and procedures for waste collection and management.

Likewise, the respondents were asked to declare their degree of satisfaction with the political activities within their own country with respect to waste management. When considering six critical issues (as shown in Figure 8), the results highlight a relatively low level of citizen fulfilment regarding current public policies, with on average 39% of the responses corresponding to not satisfied and 41% to moderately satisfied.

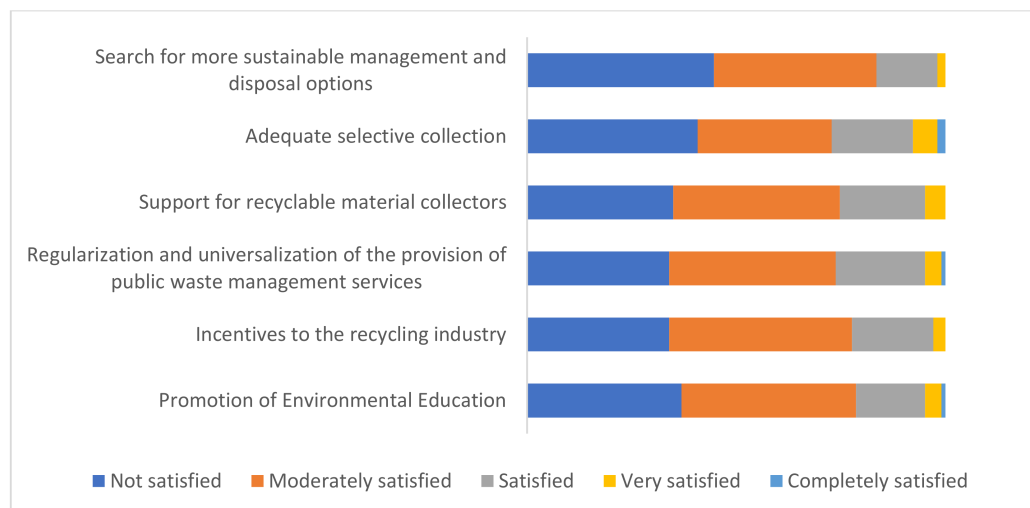


Figure 8. Participants' degree of satisfaction with the political action in waste management in their own countries.

Finally, the respondents were asked if their level of satisfaction with the waste management policy in their country had changed during the pandemic. Most of the respondent participants indicated that there has been no recognizable difference (63%), while 25% declared lower satisfaction, and only 12% stated that they were more satisfied than before.

Overall, these results suggest that, like previous crises, the COVID-19 outbreak may generate changes regarding household consumption and waste management in Hispanic America [44]. At the same time, these findings stress the need to improve waste management efficiency [45]. More precisely, this research indicated that (1) household routines changed, i.e., more working from home, more domestic consumption; (2) consumer behaviours changed, i.e., more online shopping, healthier food, and more home cooking; (3) attitudes to sustainability improved, i.e., increased interest in recycling and composting; and (4) an overall dissatisfaction towards current public policies.

5. Conclusions

This paper presents a study on the impact of the COVID-19 pandemic on household consumption and domestic waste production across Hispanic America. This research has a quantitative nature and uses descriptive statistics to analyse its results. Although the sample is non-probabilistic and follows a distribution that is not completely representative of the population of Hispanic America, the study serves to shed light on the topic and fill in the literature gap, but with no ambition of claiming to be comprehensive.

The results obtained allow some conclusions to be drawn. For instance, the sample revealed that there were no clear trends in the household consumption of industrially processed products. However, in contrast, over half of the respondents reported the increased consumption of organic and natural foods during the pandemic. In addition, the changes in demand and habits influenced better separation behaviours by about 40% of the respondents. This may be because people were at home, and either they were more aware of the waste they generated or they had more time to complete separation activities. Nevertheless, some of them have stated they have faced challenges in respect of waste separation, both in terms of the diversity of waste (e.g., food waste or packaging) and in

the disposal of face masks. On the other hand, there were some positive changes associated with household waste generation. For instance, the growing interest in composting and recycling, as well as increased attention towards healthier eating, can be associated with a reduction in the amounts of waste produced, providing an even greater benefit. The fact that public authorities did not significantly change the waste management procedures during confinement, as revealed by nearly half of the respondents, suggests many were ill-prepared to handle the new situation.

This paper has some limitations. Firstly, the sample entails the participation of 102 consumers, and this cannot be regarded as comprehensive. Therefore, the findings could not be generalized to populations and are of a purely exploratory nature and show trends regarding the view of mostly young, female, educated people from middle-income households. Secondly, the respondents were the ones who could have been reached via the authors and their networks. In this context, the online questionnaire administration did not allow for clarification or follow-up on behalf of the respondents. Moreover, the online survey was open for a limited period of time, and the authors had no mechanism to validate the reliability of the answers. In these cases, the respondents might have the incentive to provide answers that present themselves as individuals with a higher commitment to sustainability than they actually are.

However, despite these constraints, which are not uncommon among similar studies, the research provides a contribution to the literature since it is one of the few studies that has reported on trends related to waste management associated with COVID-19 in Argentina, Bolivia, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, Guatemala, Mexico, and Peru.

In terms of future prospects, the pandemic represents a wake-up call in respect of the need to pay better attention to the management of waste, especially waste prevention. The contribution of this study to society is two-fold. Firstly, it shows that in times of pandemic, a new dynamic in respect of waste products may be expected. Secondly, the increased consumption was oriented towards natural and organic food, which shows a positive trend in terms of the carbon footprint of food products. This is an advancement since previous pandemics have encouraged the use of conserved food. Finally, the trend of online shopping may be a reason for concern because it may generate package waste.

This paper has two main implications: it has shown the changes in consumption habits associated with the COVID-19 pandemic in Hispanic American countries and illustrates some of the areas where attention is needed in terms of responses to pandemic situations. Moving forward, some measures that could be adopted by Hispanic American countries to better cope with changes in waste production during future pandemics include: (1) the provision of more and better infrastructure for waste collection so that household waste is not disposed of on the streets; (2) enhanced awareness of consumers in respect of ways to prevent waste generation; (3) a greater emphasis on methods and tools for waste separation since this may encourage people to segregate; and (4) more intensive efforts among producers of industrialised food to re-design their products and packaging so that they may have an appropriate shelf-life on the one hand, but may also be biodegradable on the other, hence alleviating the pressure on the environment. Finally, it seems to be necessary to encourage public authorities to prepare policies—or at least contingency plans—in the field of waste management during pandemics so that city utilities may be able to better cope with the changes in waste generation. This includes not only the collection but also the separation of the various fractions for subsequent reuse.

Supplementary Materials: The following supporting information can be downloaded at: <https://www.mdpi.com/article/10.3390/su142416552/s1>, Supplementary Material: Questionnaire—COVID-19 and Household Waste Production in Latina America.

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References

1. Khan, A.H.; Tirth, V.; Fawzy, M.; Mahmoud, A.E.D.; Khan, N.A.; Ahmed, S.; Ali, S.S.; Akram, M.; Hameed, L.; Islam, S.; et al. COVID-19 Transmission, Vulnerability, Persistence, and Nanotherapy: A Review. *Environ. Chem. Lett.* **2021**, *19*, 2773–2787. [[CrossRef](#)] [[PubMed](#)]
2. Khan, A.H.; Abutaleb, A.; Khan, N.A.; El Din Mahmoud, A.; Khursheed, A.; Kumar, M. Co-Occurring Indicator Pathogens for SARS-CoV-2: A Review with Emphasis on Exposure Rates and Treatment Technologies. *Case Stud. Chem. Environ. Eng.* **2021**, *4*, 100113. [[CrossRef](#)]
3. Brum, M.; De Rosa, M. Too Little but Not Too Late: Nowcasting Poverty and Cash Transfers' Incidence during COVID-19's Crisis. *World Dev.* **2021**, *140*, 105227. [[CrossRef](#)] [[PubMed](#)]
4. Maurizio, R.; Bertranou, F. The Labor Market in Latin America at the Time of the COVID-19 Pandemic: Impacts, Responses and Perspectives. *Gac. Med. Caracas* **2020**, *128*, S156–S171. [[CrossRef](#)]
5. Leal Filho, W.; Voronova, V.; Kloga, M.; Paço, A.; Minhas, A.; Salvia, A.L.; Ferreira, C.D.; Sivapalan, S. COVID-19 and Waste Production in Households: A Trend Analysis. *Sci. Total Environ.* **2021**, *777*, 145997. [[CrossRef](#)]
6. Aragaw, T.A.; Mekonnen, B.A. Understanding Disposable Plastics Effects Generated from the PCR Testing Labs during the COVID-19 Pandemic. *J. Hazard. Mater. Adv.* **2022**, *7*, 100126. [[CrossRef](#)]
7. Al Qahtani, S.; Al Wuhayb, F.; Manaa, H.; Younis, A.; Sehar, S. Environmental Impact Assessment of Plastic Waste during the Outbreak of COVID-19 and Integrated Strategies for Its Control and Mitigation. *Rev. Environ. Health* **2021**, *37*, 585–596. [[CrossRef](#)]
8. Gideon, J. Introduction to COVID-19 in Latin America and the Caribbean. *Bull. Lat. Am. Res.* **2020**, *39*, 4–6. [[CrossRef](#)]
9. Lotta, G.; Kuhlmann, E. When Informal Work and Poor Work Conditions Backfire and Fuel the COVID-19 Pandemic: Why We Should Listen to the Lessons from Latin America. *Int. J. Health Plann. Manag.* **2020**, *36*, 976–979. [[CrossRef](#)]
10. Puntigliano, A.R. Pandemics and Multiple Crises in Latin America. *Lat. Am. Policy* **2020**, *11*, 313–319. [[CrossRef](#)]
11. Pizuorno, A.; Fierro, N.A. Latin America and Chronic Diseases: A Perfect Storm during the COVID-19 Pandemic. *Ann. Hepatol.* **2021**, *22*, 100332. [[CrossRef](#)] [[PubMed](#)]
12. The Lancet COVID-19 in Latin America: A Humanitarian Crisis. *Lancet* **2020**, *396*, 1463. [[CrossRef](#)]
13. Litewka, S.G.; Heitman, E. Latin American Healthcare Systems in Times of Pandemic. *Dev. World Bioeth.* **2020**, *20*, 69–73. [[CrossRef](#)] [[PubMed](#)]
14. Caetano, G.; Pose, N. Impactos Del Covid-19 En Los Escenarios Latinoamericanos Contemporáneos. *Rev. Perfiles Latinoam.* **2021**, *29*, 2. [[CrossRef](#)]
15. IDB Opportunities for Stronger and Sustainable Postpandemic Growth: 2021 Latin American and Caribbean Macroeconomic Report. Available online: <https://flagships.iadb.org/en/MacroReport2021/Opportunities-for-Stronger-and-Sustainable-Postpandemic-Growth> (accessed on 14 July 2022).
16. CEPAL COVID-19 Observatory in Latin America and the Caribbean. Economic and Social Impact. Available online: <https://www.cepal.org/en/topics/covid-19> (accessed on 1 May 2022).

17. Vieira, V.H.A.d.M.; Matheus, D.R. The Impact of Socioeconomic Factors on Municipal Solid Waste Generation in São Paulo, Brazil. *Waste Manag. Res.* **2018**, *36*, 79–85. [[CrossRef](#)]
18. Alfonso, M.B.; Arias, A.H.; Menéndez, M.C.; Ronda, A.C.; Harte, A.; Piccolo, M.C.; Marcovecchio, J.E. Assessing Threats, Regulations, and Strategies to Abate Plastic Pollution in LAC Beaches during COVID-19 Pandemic. *Ocean Coast. Manag.* **2021**, *208*, 105613. [[CrossRef](#)]
19. Singh, E.; Kumar, A.; Mishra, R.; Kumar, S. Solid Waste Management during COVID-19 Pandemic: Recovery Techniques and Responses. *Chemosphere* **2022**, *288*, 132451. [[CrossRef](#)]
20. Sharma, H.B.; Vanapalli, K.R.; Cheela, V.S.; Ranjan, V.P.; Jaglan, A.K.; Dubey, B.; Goel, S.; Bhattacharya, J. Challenges, Opportunities, and Innovations for Effective Solid Waste Management during and Post COVID-19 Pandemic. *Resour. Conserv. Recycl.* **2021**, *800*, 149605. [[CrossRef](#)]
21. Hantoko, D.; Li, X.; Pariatamby, A.; Yoshikawa, K.; Horttanainen, M.; Yan, M. Challenges and Practices on Waste Management and Disposal during COVID-19 Pandemic. *J. Environ. Manag.* **2021**, *286*, 112140. [[CrossRef](#)]
22. Fan, Y.V.; Jiang, P.; Hemzal, M.; Klemeš, J.J. An Update of COVID-19 Influence on Waste Management. *Sci. Total Environ.* **2021**, *754*, 142014. [[CrossRef](#)]
23. Janssen, M.; Chang, B.P.I.; Hristov, H.; Pravst, I.; Profeta, A.; Millard, J. Changes in Food Consumption During the COVID-19 Pandemic: Analysis of Consumer Survey Data From the First Lockdown Period in Denmark, Germany, and Slovenia. *Front. Nutr.* **2021**, *8*, 635859. [[CrossRef](#)] [[PubMed](#)]
24. Aldaco, R.; Hoehn, D.; Laso, J.; Margallo, M.; Ruiz-Salmón, J.; Cristobal, J.; Kahhat, R.; Villanueva-Rey, P.; Bala, A.; Batlle-Bayer, L.; et al. Food Waste Management during the COVID-19 Outbreak: A Holistic Climate, Economic and Nutritional Approach. *Sci. Total Environ.* **2020**, *742*, 140524. [[CrossRef](#)] [[PubMed](#)]
25. Caso, D.; Guidetti, M.; Capasso, M.; Cavazza, N. Finally, the Chance to Eat Healthily: Longitudinal Study about Food Consumption during and after the First COVID-19 Lockdown in Italy. *Food Qual. Prefer.* **2021**, *95*, 104275. [[CrossRef](#)] [[PubMed](#)]
26. Iivari, N.; Sharma, S.; Ventä-Olkkonen, L. Digital Transformation of Everyday Life—How COVID-19 Pandemic Transformed the Basic Education of the Young Generation and Why Information Management Research Should Care? *Int. J. Inf. Manag.* **2020**, *55*, 102183. [[CrossRef](#)]
27. Sharma, H.B.; Vanapalli, K.R.; Samal, B.; Cheela, V.R.S.; Dubey, B.K.; Bhattacharya, J. Circular Economy Approach in Solid Waste Management System to Achieve UN-SDGs: Solutions for Post-COVID Recovery. *Sci. Total Environ.* **2021**, *800*, 149605. [[CrossRef](#)] [[PubMed](#)]
28. Carolan, M. Practicing Social Change during COVID-19: Ethical Food Consumption and Activism Pre- and Post-Outbreak. *Appetite* **2021**, *163*, 105206. [[CrossRef](#)] [[PubMed](#)]
29. Chenarides, L.; Grebitus, C.; Lusk, J.L.; Printezis, I. Food Consumption Behavior during the COVID-19 Pandemic. *Agribusiness* **2021**, *37*, 44–81. [[CrossRef](#)]
30. Escursell, S.; Llorach-Massana, P.; Roncero, M.B. Sustainability in E-Commerce Packaging: A Review. *J. Clean. Prod.* **2021**, *280*, 124314. [[CrossRef](#)]
31. Arndt, C.; Davies, R.; Gabriel, S.; Harris, L.; Makrelov, K.; Robinson, S.; Levy, S.; Simbanegavi, W.; van Seventer, D.; Anderson, L. COVID-19 Lockdowns, Income Distribution, and Food Security: An Analysis for South Africa. *Glob. Food Sec.* **2020**, *26*, 100410. [[CrossRef](#)]
32. Echegaray, F. What POST-COVID-19 Lifestyles May Look like? Identifying Scenarios and Their Implications for Sustainability. *Sustain. Prod. Consum.* **2021**, *27*, 567–574. [[CrossRef](#)]
33. Sarkodie, S.A.; Owusu, P.A. Impact of COVID-19 Pandemic on Waste Management. *Environ. Dev. Sustain.* **2021**, *23*, 7951–7960. [[CrossRef](#)] [[PubMed](#)]
34. Marty, L.; de Lauzon-Guillain, B.; Labesse, M.; Nicklaus, S. Food Choice Motives and the Nutritional Quality of Diet during the COVID-19 Lockdown in France. *Appetite* **2021**, *157*, 105005. [[CrossRef](#)] [[PubMed](#)]
35. Bracale, R.; Vaccaro, C.M. Changes in Food Choice Following Restrictive Measures Due to COVID-19. *Nutr. Metab. Cardiovasc. Dis.* **2020**, *30*, 1423–1426. [[CrossRef](#)] [[PubMed](#)]
36. Liang, Y.; Song, Q.; Wu, N.; Li, J.; Zhong, Y.; Zeng, W. Repercussions of COVID-19 Pandemic on Solid Waste Generation and Management Strategies. *Front. Environ. Sci. Eng.* **2021**, *15*, 115. [[CrossRef](#)] [[PubMed](#)]
37. Ikiz, E.; Maclaren, V.W.; Alfred, E.; Sivanesan, S. Impact of COVID-19 on Household Waste Flows, Diversion and Reuse: The Case of Multi-Residential Buildings in Toronto, Canada. *Resour. Conserv. Recycl.* **2021**, *164*, 105111. [[CrossRef](#)] [[PubMed](#)]
38. Adusei-Gyamfi, J.; Boateng, K.S.; Sulemana, A.; Hogarh, J.N. Post COVID-19 Recovery: Challenges and Opportunities for Solid Waste Management in Africa. *Environ. Chall.* **2022**, *6*, 100442. [[CrossRef](#)]
39. Ouhsine, O.; Ouigmane, A.; Layati, E.; Aba, B.; Isaifan, R.J.; Berkani, M. Impact of COVID-19 on the Qualitative and Quantitative Aspect of Household Solid Waste. *Glob. J. Environ. Sci. Manag.* **2020**, *6*, 41–52. [[CrossRef](#)]
40. Di Renzo, L.; Gualtieri, P.; Pivari, F.; Soldati, L.; Attinà, A.; Cinelli, G.; Cinelli, G.; Leggeri, C.; Caparello, G.; Barrea, L.; et al. Eating Habits and Lifestyle Changes during COVID-19 Lockdown: An Italian Survey. *J. Transl. Med.* **2020**, *18*, 229. [[CrossRef](#)]
41. Ben Khadda, Z.; Ezrari, S.; Radouane, N.; Boutagayout, A.; El Housni, Z.; Lahmamsi, H.; Zahri, A.; Houssaini, T.S.; El Ghadraoui, L.; Elamine, Y.; et al. Organic Food Consumption and Eating Habit in Morocco, Algeria, and Tunisia during the COVID-19 Pandemic Lockdown. *Open Agric.* **2022**, *7*, 21–29. [[CrossRef](#)]

42. HUNTER Food Study 2020. Special Report. America Gets Cooking: The Impact of COVID-19 on America's Food Habits. Available online: <https://www.slideshare.net/HUNTERNY/hunter-food-study-special-report-america-gets-cooking-231713331> (accessed on 10 July 2021).
43. Tchetchik, A.; Kaplan, S.; Blass, V. Recycling and Consumption Reduction Following the COVID-19 Lockdown: The Effect of Threat and Coping Appraisal, Past Behavior and Information. *Resour. Conserv. Recycl.* **2021**, *167*, 105370. [[CrossRef](#)]
44. Sarkis, J.; Cohen, M.J.; Dewick, P.; Schröder, P. A Brave New World: Lessons from the COVID-19 Pandemic for Transitioning to Sustainable Supply and Production. *Resour. Conserv. Recycl.* **2020**, *159*, 104894. [[CrossRef](#)] [[PubMed](#)]
45. Yousefi, M.; Oskoei, V.; Jonidi Jafari, A.; Farzadkia, M.; Hasham Firooz, M.; Abdollahinejad, B.; Torkashvand, J. Municipal Solid Waste Management during COVID-19 Pandemic: Effects and Repercussions. *Environ. Sci. Pollut. Res.* **2021**, *28*, 32200–32209. [[CrossRef](#)] [[PubMed](#)]