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Household food waste generation during COVID-19 pandemic and unprecedented economic crisis: The case of Lebanon

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ABSTRACT

Background: The COVID-19 pandemic has interrupted economies and food systems globally, leading to substantial consequences on food waste, which is also influenced by political and economic factors. To date, information on the attitudes and behaviors of households regarding food waste generation in developing countries like Lebanon, witnessing a multifaceted economic and COVID-19 crisis, is scarce. Previous studies reported that around one third of the food produced in Lebanon gets lost or wasted. This study aims to update the attitudes and behaviors determining household food waste in Lebanon in light of the COVID-19 pandemic and unprecedented economic crisis.

Methods: Participants (n = 1251) from the five governorates of the country filled out a structured questionnaire composed of 3 sections and 31 questions. The variable "eat everything prepared" was used as a proxy for food waste. The effects of different socio-behavioral and demographic characteristics on household food waste generation in the country were estimated using a Logistic regression on STATA.

Results: Most participants (69%) reported that the economic crisis had a greater impact on their food shopping and eating behaviors compared to the COVID-19 pandemic. In comparison, 65% reported that their household food waste generation did not change because of the COVID-19 pandemic, and 47% reported that their household food waste generation decreased because of the economic crisis. Employment status, income, educational level, and the number of householders did not affect food waste generation. Feelings of guilt, thinking of ways to use leftovers, and frequent preparation of more dishes were negatively associated with food waste generation while eating out and buying special offers showed the opposite effect.

Conclusion: Our findings provide a better understanding of more effective community-based food waste-related interventions in Lebanon. Future research is still needed to explain the medium and long-term effects of COVID-19 and the economic crisis on food waste-related behaviors in the country since the behavioral changes uncovered in the current study might be temporary during the pandemic and the economic crisis and not permanent. This issue should be verified in the future using longitudinal surveys.

1. Introduction

The rapid world population growth is a major factor in the rise of the global demand for food [1]. On the other hand, the Food and Agriculture Organization (FAO) estimated that approximately one-third of all food produced worldwide is either lost or wasted, and half of the wasted food is at the level of households (Whitacre et al., 2019). Food waste (FW) is becoming a major problem worldwide because of the global population increase [2]. It represents a global problem in the ethical, social, environmental, sustainability, and economic contexts. Under the prime concern of "Responsible Consumption and Production," decreasing food waste was included among the United Nations Sustainable Development Goals 2030. Reducing food waste is a sustainable and essential way to feed a world population where around 821 million people still do not

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have adequate nutrition [3]. A growing literature has shown that various interactions and decisions related to purchasing and managing food are the main causes of food waste. This identifies a wide and diverse set of behavioral, sociodemographic, and attitude-related factors [4]. Factors including food appearance and taste, socio-economic status and shopping attitudes of consumers, poor knowledge, packaging mistakes, and incorrect health and safety-related beliefs about leftovers all affect food waste and contribute to its increase [5]. Concerning appearance, it is considered a universal attribute of all products and demonstrates the first sensory impression of the food item. It influences the item's acceptability by approving or disapproving of the consumers' sensory and hedonic expectations and assumptions. Damages and blemishes that occur post-harvest on fruits and vegetables affect consumer perception of quality and reduce purchase decisions [4].

Moreover, it has been confirmed that FW increases when consumers buy food from supermarkets compared to small or local markets [6]. These factors affect consumer behavior and differ between individuals, eras (rural/urban), and countries. FW mostly results from poor food-management routines and behaviors, including planning, purchasing, storing, cooking, eating, and managing leftovers. These routines and behaviors significantly affect food waste performance [7]. Several FW studies showed that households contribute significantly to total FW. In fact, household FW ranges from 28.4% to 31.9%, which appears to be significantly higher than in other businesses [8]. In Europe, households represent the main contributor to food waste generation (92 kg per person). Next comes the processing sector (33 kg per person), followed by food service (21 kg per person), primary production (18 kg per person), and the wholesale and retail sector (9 kg per person) [9].

With the emergence of the COVID-19 pandemic in December 2019 and its associated consequences – lockdowns, food trade limitations, economic decline, and increasing food inflation – economies and food systems were interrupted globally, resulting in substantial food security consequences in major shifts in food security [10,11]. For example, food production systems optimized for supplying food products to food service sectors could not respond rapidly when schools, restaurants, and hospitality companies closed their doors suddenly (Chenarides et al., 2020). Even grocery stores saw a sharp increase in demand as consumers attempted to stockpile food. This incompatible supply and demand resulted in unsold crops and, therefore, FW. Additionally, families that previously ate food away from home and went grocery shopping several times a week reduced time devoted to these activities to near zero all of a sudden. On the one hand, eating food away from home decreased as restaurants closed their doors.

On the other hand, health officials only encouraged visiting the grocery store once every two weeks. As a result of these significant changes in household time, household FW was remarkably affected (Scharadin et al., 2020). Additionally, in response to the fear and uncertainty that the pandemic has imposed, people have resorted to panicky impulse buying, leading to food waste [12]. People began to panic-buy and stockpiled essential and non-perishable products to face possible scarcity. The increase in purchases affected carbohydrate-rich staples like bread and pasta, ultra-high temperature (UHT) milk, canned fish and food, flour, eggs, frozen foods, cold cuts, and water (Schacchi et al., 2021). Factors such as less socialization, eating at home instead of schools and nurseries, eating out, and having children at home increase cooking activities and hence increase waste generation [13]. However, according to Ref. [14]; several early studies assessing the impact of COVID-19 on household food waste have discussed that the amount of food waste may decrease if consumers pay more attention to avoid wasting food due to fear of disruptions in food supply or shopping difficulties. Therefore, even if people panic and stockpile food during the COVID-19 pandemic, household food waste may decrease if people try to use or consume everything they have bought [15]. Finally, it has been reported that even though food waste may decrease during the COVID-19 pandemic, it remains possible that it might increase in the long term because of stockpiled food expiring and going to waste [16].

According to a report by the World Bank published in 2020, Lebanon is undergoing a serious and lengthy economic depression mainly due to inappropriate policy responses to a group of compounded crises like the country's biggest financial crisis, the COVID-19 pandemic, and the Port of Beirut explosion. Additionally, the World Bank has classified the current Lebanese economic crisis as one of the top 10 most severe global crises since the 19th century. The financial crisis and the collapse of the Lebanese pound have put the food security of vulnerable Lebanese at risk. Since 2019, the consumer price index has increased by 240%, and food prices have increased by an alarming 367%. This has affected food security by increasing prices and threatening the country's ability to produce food. Lebanon's GDP severely decreased from about $55 billion in 2018 to around $20.5 billion in 2021. In addition, the real GDP per capita decreased by 37.1%, usually seen during conflicts or wars. As for the COVID-19 pandemic in Lebanon, from 3 January 2020 to 3 February 2022, there were 939,282 confirmed cases of COVID-19, accompanied by 9638 deaths (World Health Organization, 2022). This number increased from 15 March 2022 to 1,085,232 confirmed cases of COVID-19 and 10,211 deaths, reported to World Health Organization (WHO). The outbreak of this pandemic further contributes to the economic decline, aggravating existing weaknesses and increasing the vulnerabilities of all Lebanese residents. On the one hand, it placed extra pressure on an already collapsing economy and has overloaded national social safety nets and the health system. On the other hand, poor social safety nets, little water, and electricity supply, weak solid waste management and disposal, and overcrowded living conditions in many Lebanese areas increased the risk of spreading the virus. According to a report by the [17,18]; the already declining food security situation was worsened a lot because of movement restrictions, income loss, and food and non-food price inflation imposed by the virus outbreak. Finally, and as simultaneously seen in many countries worldwide and the Middle East and North Africa (MENA) region, Lebanese consumers demonstrated increased food-hoarding and panic-shopping behaviors. They also increasingly bought more processed foods than nutritious and perishable food items because they are cheaper and have longer shelf lives. The changes that accompanied the economic crisis, such as inflation, increases in food prices, and shortage of many food items, may have contributed to the adoption of the panic-buying and hoarding behaviors noticed among the Lebanese population [19].

[5] evaluated the determinants of Lebanon's household food waste generation, while [20–22] assessed food waste generation at the level of restaurants in Lebanon. Those aforementioned studies reported that around one third of the food produced in Lebanon get lost or wasted. That finding was identified when the economic status in Lebanon was completely different than the unprecedented crisis that the country is currently witnessing. In addition, studies from the literature highlighted differences in food waste behavior and generation during the COVID-19 pandemic [10,11]; Chenarides et al., 2020). However, no study reported enough evidence on how families have reacted to a doubled-faced economic and pandemic crisis in Lebanon regarding food waste generation. Therefore, this study aims to assess current household attitudes and behaviors determining food waste in Lebanon compared to the pre-COVID-19 pandemic and the economic crisis, in the aim to inform community-based interventions and policy development to limit food waste generation.

2. Methods

2.1. Questionnaire

A previously validated and published, culturally specific structured questionnaire in the Arabic language from Ref. [5] was used in our study. The first section was composed of 13 questions that covered the participants' demographic characteristics. It included questions about gender, the participant's role in the household, the participant's

educational level, household area and the number of rooms, total household monthly income, the person in charge of grocery shopping, and the number of household members. The second section consisted of 8 questions covering participants' attitudes about shopping and eating. It included questions about the amount of money usually spent on food frequency of grocery shopping from minimarkets and supermarkets for food and non-food items. The questionnaire got a minor adaptation to draw the context of how the COVID-19 pandemic and the economic crisis that Lebanon has been enduring since October 2019 affected food waste determinants. One example of a survey question is: "What is your current behavior as compared to before the COVID-19 pandemic concerning eating/dining out?"

Another example is: "In your opinion, which crisis had more impact on your behavior?" Another example: "Compared to before the economic crisis and the COVID-19 pandemic, please indicate how much you agree with the following statement: "I feel guilty when I throw food away," and the answer was based on a scale from 1 to 5 where a response of 1 means the participant strongly disagrees and a response of 5 means that the participant strongly agrees. Finally, the third section was composed of 10 questions and covered attitudes related to food waste, such as "Compared to before the economic crisis and the COVID-19 pandemic, how often do you eat everything you prepare/serve?" the average time that was needed to complete the questionnaire was 15 min. The modified, updated version was piloted to assess the readability and the average time needed for completion.

2.2. Study population

A convenient sample of households from the five governorates (Beirut, Mount Lebanon, South, North, Bekaa) of Lebanon was called between June 2021 and January 2022 by trained researchers from our institution. The sample size that could be reached was 1251. The researcher explained the objectives of the survey, ensured anonymity and confidentiality, and obtained the consent of the participants. The interviewer asked about the person in charge of food preparation or supervision of the preparation. If the selected person was not at home, a follow-up was conducted up to one time before declaring a non-response. To ensure the geographical representation of the survey, the number of households to be interviewed in each governorate was selected proportionally to the number of registered voters in each governorate. The survey was approved for ethical compliance by the Institution Review Board (IRB) of the Lebanese American University (LAU.SAS.LM3.2/Jul/2021). No personal identifiers were collected to ensure the anonymity of the respondents. The study was completely voluntary, and participants were informed that they could withdraw from the study at any time or refrain from answering any question(s).

2.3. Methodology and empirical strategy

The effect of various sociodemographic and behavioral factors was estimated utilizing a Logistic regression using STATA. We opted to use the previously published variable whether the respondent "eats everything prepared" (or "*eat all*") as a proxy for food waste. In Ref. [5]; this variable revealed a strong and significantly negative with the total weight of food waste." Any increase in this variable will therefore be interpreted as a decrease in food waste [5]. The variable "eat everything prepared" will be then used as a binary dependent variable which takes values of 1 if the respondent responded "Frequently/Regularly" and 0 if the respondent reposnded "Sometimes at most." A binary Logit model was conducted, and variables that achieved statistical significance with at least 90% confidence were selected to reach a working model. After cleaning the data and managing all missing data, the final sample size was 1101 participants.

3. Results and discussion

Sample characteristics are presented in Table 1. Women respondents made up 62% of the sample, 71% of respondents were employed, and 47% had a university graduate as the highest-educated family member. Most participants (69%) reported that the economic crisis had a greater impact on their food shopping and eating behaviors. In comparison, 65% reported that their household food waste generation did not change because of the COVID-19 pandemic, and 47% reported that their household food waste generation decreased because of the economic crisis (Table 1).

Regarding model estimates (Table 2), the participant's employment status and income were not found to be correlated with eat all and hence were not associated with the amount of food waste. This observation does not align with a [5] study in Lebanon, carried out before the pandemic and economic crisis. According to Ref. [5]; being self-employed or employed decreases the probability of eating and thus increases the chances of generating more food waste. Moreover, Abeliotis et al. (2016) presented similar results showing that lower-income households generate less leftover than higher-income households. Another study by Ref. [14] done in Italy during the COVID-19 pandemic found that a low household income also decreases the probability of generating too much food waste, assuming that employed and self-employed participants earn more money than unemployed ones.

On the contrary, an economic crisis occurred in Italy during the pandemic and was caused by the national lockdown [14]. This issue increased the tendency of all people to decrease food waste and eat everything that has been bought, proving that economic crises can cause all people to become more aware of food waste, irrespective of their income or employment status. This could be because, during emergencies affecting food security, like economic crises and pandemics, people of all economic statuses become aware of food waste due to fear of losing access to food. A major example is the Beirut port explosion that hit Lebanon in 2020, destroying the national wheat silos and interrupting all import and export processes, thus posing a serious threat to food security. Acquiring basic commodities, including food, became a major

Table 1
Socio-demographic characteristics (gender, employment, education) of the study sample and effect of COVID-19 pandemic and economic crisis on household food waste generation (decreased/increased/unchanged) in Lebanon.

Characteristics		%
Gender (N = 1243)	Male	37.7
	Female	62.3
Governorate of residence (N = 1243)	Beirut	33.4
	Bekaa	7.6
	Mount Lebanon	40.0
	South	9.8
	North	9.0
The person in charge of food shopping is (N = 1239)	Employed/Self-employed	71.1
	Unemployed	28.9
Highest level of education in the household (N = 1211)	Elementary/ Intermediate/ Vocational	3.1
	Secondary/Highschool/ University	96.9
The crisis that had a greater impact on your food shopping and eating behaviors (N = 1242)	COVID-19	25.9
	Economic crisis	68.8
	Don't know/refuse to answer	5.3
Effect of COVID-19 on the amount of food waste (N = 1237)	Decreased	27.7
	Unchanged	65.2
	Increased	7.1
Effect of the economic crisis on the amount of food waste (N = 1197)	Decrease	47.4
	Unchanged	52.6

Table 2
Parameter estimates of the binary logic model.

Variable	N	Coef. (odds ratio)	z	P > z	[95% conf.	interval]
Constant/Total	1101	0.395	−1.41	0.160	0.108	1.442
Employed/Self-employed						
No	311	(base)				
Yes	790	1.144	0.75	0.453	0.805	1.625
Highest level of education in the household						
Elementary/ Intermediate/ Vocational	33	(base)				
Secondary/ High school/ University	1068	1.133	0.29	0.769	0.492	2.609
Total number of people in the household						
1 occupant	23	(base)				
2–3 occupants	264	1.097	0.18	0.855	0.406	2.965
>3 occupants	814	0.901	−0.21	0.833	0.341	2.377
Place where usually eat meals						
Only/Mainly at home	783	(base)				
Partly at home, partly out	286	0.414***	−4.81	0.000	0.289	0.593
Mainly eating out/only eating out	32	0.220***	−3.34	0.001	0.091	0.535
Prepare different dishes each day						
Sometimes at most	604	(base)				
Frequently/ Regularly	497	2.817***	5.88	0.000	1.995	3.978
Feeling guilty when throwing food away						
Disagree/ Neither	116	(base)				
Agree	985	3.381***	4.68	0.000	2.029	5.633
Think of ways to use leftovers						
Disagree/ Neither	420	(base)				
Agree	681	1.834***	3.47	0.001	1.302	2.582
Buy special offers						
Disagree/ Neither	449	(base)				
Agree	652	0.548***	−3.37	0.001	0.386	0.778
Income adjustment following LBP devaluation						
No	634	(base)				
Yes	458	0.803	−1.33	0.183	0.581	1.109
Behavior under the COVID-19 pandemic - Eating/dining out						
Decreased	879	(base)				
Unchanged	185	0.751	−1.11	0.267	0.453	1.244
Increased	34	0.380**	−2.13	0.033	0.156	0.927
Behavior under the COVID-19 pandemic - Ordering delivery						
Decreased	601	(base)				
Unchanged	255	1.162	0.63	0.530	0.728	1.856
Increased	239	0.940	−0.24	0.812	0.566	1.561
Behavior under the COVID-19 pandemic - Visits to the supermarket						
Decreased	441	(base)				
Unchanged	525	0.628**	−2.10	0.036	0.407	0.970
Increased	127	0.640	−1.29	0.197	0.324	1.262
Behavior under the COVID-19 pandemic - Home food preparation						
Decreased	73	(base)				
Unchanged	452	2.621***	2.61	0.009	1.272	5.399
Increased	572	2.134**	2.06	0.040	1.037	4.390
Behavior under the COVID-19 pandemic - Food Waste						
Decreased	288	(base)				
Unchanged	733	1.559*	1.90	0.058	0.985	2.467
Increased	78	0.818	−0.52	0.601	0.384	1.740
Behavior during the Economic Crisis - Eating/dining out						
Decreased	866	(base)				
Unchanged	198	0.583*	−1.90	0.058	0.333	1.018
Increased	34	0.853	−0.30	0.762	0.305	2.387
Behavior under the Economic Crisis - Ordering delivery						
Decreased	758	(base)				
Unchanged	250	1.109	0.38	0.707	0.648	1.898
Increased	87	1.679	1.31	0.189	0.774	3.639
Behavior during the Economic Crisis - Visits to the supermarket						
Decreased	410	(base)				
Unchanged	493	1.690**	2.27	0.023	1.075	2.655
Increased	192	3.497***	3.81	0.000	1.836	6.659
Behavior under the Economic Crisis - Home food preparation						
Decreased	103	(base)				
Unchanged	447	0.827	−0.55	0.583	0.420	1.629
Increased	546	0.998	−0.01	0.995	0.514	1.937
Behavior under the Economic Crisis - Food Waste						
Decreased	506	(base)				
Unchanged	560	0.629**	−2.25	0.024	0.420	0.941
Increased	35	0.780	−0.55	0.585	0.320	1.903

Legend: *p < .1; **p < .05; ***p < .01.

concern because 70% of Lebanon's overall trade passed through the Beirut port before the blast (WFP, 2022). Our finding can be attributed to the fact that even if people are employed and earn high incomes, the country is experiencing food insecurity; it will be difficult to find food to buy, resulting in people paying more attention to food and thus reducing food waste generation.

Regarding educational level, no association with food waste generation was found (Table 2). This is not in line with the study by Ref. [5]; which showed that the higher the level of education in a household, the less food waste it generates. Another study in Egypt (Abdelradi, 2017) supported [5] findings. On the other hand, a study done on Finnish households found no correlation between the amount of food waste and the level of education [23]. It must be kept in mind that these studies were done prior to the pandemic. Our finding could be explained by the fact that people pay extra attention to food waste during emergencies, irrespective of their educational level. Moreover, the social impact of the current economic crisis has been dreadful for all Lebanese population groups, with no exceptions, while they were already suffering from the economic recession caused by the COVID-19 pandemic.

Our study did not show an association between the number of householders and food waste generation (Table 2), which does not align with [5]; which reported a positive relationship between the number of householders and the food waste volume. Another study by Ref. [6] done in Serbia during the pandemic found that larger families tend to buy more food and, therefore, waste more food. On the contrary, a study done in Italy reported that in large families, food waste decreased during the COVID-19 lockdown, and it was thought to be because bigger households can reuse leftovers more efficiently and because the household food preparer has more time to organize and cook the food during the lockdown [14]. Additionally, a study done in Japan found that smaller families understood household food waste better during the pandemic than larger families. In comparison, larger families showed a higher tendency to excessive food purchases [24]. Therefore, our results could be explained by the effect of employability, income, and educational level. During such an unprecedented economic crisis facing Lebanon, all families, with no exceptions, pay extra attention to food waste generation.

The place where a participant usually eats their meals was included in the model as a variable that acts as a contributor to *eat all*, and the results suggest that the more a person eats out of their home, the less they *eat all* what is prepared at home, and the more they waste food (Table 2). For participants who partly eat their meals at home and partly out (including the workplace), the probability of not eating everything

prepared and wasting more food increases compared to eating only at home (OR = 0.22), whereas for participants who mainly or only eat their meals out, the probability of waste is even higher (OR = 4.14) (Table 2). In addition, participants who prepare different dishes each day "frequently/regularly" compared to "sometimes at most" have a higher tendency to eat everything prepared and reduce food waste (OR = 2.82); the odds are almost three times higher (Table 2). This finding was in accordance with [5]. In Italy [14], reported that during the COVID-19 pandemic, a small percentage of the participants reported an increase in food waste production caused by the increased amount of food they cooked.

On the other hand [25], reported that families have been cooking more often and spending more time cooking at home since the beginning of the pandemic. The frequency of cooking at home is positively associated with unavoidable food waste, such as egg shells and peels of fruits and vegetables, but negatively associated with avoidable food waste. Moreover, in a study done on US consumers during the pandemic, it was reported that there were significant changes in which respondents used foods in their households, particularly through behaviors predicted to conserve available food and eliminate the need to buy groceries very often [26]. This may explain the observed decrease in food waste in our study.

In addition, participants who report feeling guilty when wasting food have a higher probability of eating all they prepared, indicating a decreased food waste generation behavior (OR = 3.34) (Table 2). This goes in line with [5]. In addition, a study in Romania reported that moral behaviors, including guilt about wasting food, were an important contributor to food waste reduction and planning to reduce food waste [27]. Similarly, a study conducted in the USA showed that respondents who expressed guilt about disposing of food generated less food waste [28]. Many studies suggested that guilt, in particular, may be an effective motivational tool underlying food waste reduction [27]. However, one limitation of this type of question is that it does not represent the real feeling of respondents who might want to be considered as "good" and thus give out this answer.

Furthermore, participants who think of ways to use leftovers have a higher probability of eating all, indicating decreased food waste generation behavior (OR = 1.83) (Table 2). This finding was reported as well by Ref. [5] before the current pandemic and economic crisis. In addition, the odds of eating all increase (therefore, food waste decreases) significantly for those for whom the COVID pandemic led them to keep preparing food at home or do it more often, compared to those who now prepare food at home less often (Table 2). The COVID-19 pandemic resulted in families becoming less busy because of the cancellation of several activities, leading to more time to plan meals and prepare food [25]. The related restrictions also resulted in more people working remotely from home, which may have led to improved food-management behaviors, including using leftovers. People also improved their cooking skills during the pandemic, which are closely related to the ability of a household to keep and reuse leftovers and properly store leftovers [9]. Finally [29], mentioned that since the start of the COVID-19 pandemic, consumers had included multiple positive food management behaviors, including better food shopping and planning, enhanced food storage in households, and increased usage of leftovers. This suggests a noticeable shift toward more sustainable food consumption and a positive behavioral shift in food waste which has been observed in many other countries, like Tunisia (Ben Hassen et al., 2020), Qatar (Ben Hassen et al., 2020), the USA [30], and Italy [31], all of which support our finding.

Participants tend to "buy special offers" when a deteriorating economic situation exists, like in the case of Lebanon, because of the search for lower prices and higher quantities. Moreover, participants who buy more special offers more than half the time are less likely to eat everything prepared and, thus, 50% more likely to waste food (OR = 0.55) (Table 2). This was reported in Ref. [5] study. In a study done in Italy by Ref. [14]; during the pandemic, people who bought more food than they needed reported an increase in food waste generation. Other studies have indicated that shopping for food on special offers often increases food waste generation by motivating and encouraging over-purchasing [27]. In addition, buying special offers is one of the most important features of immoderate buying that is considered to be one of the main contributors to food waste generation [5]. Moreover, during an economic crisis, people usually search for products on special offers to save money and buy greater quantities for the same price. If the expiry date is not considered, this could lead to the expiration of the products and, consequently, waste them.

Only one study [5] was carried out before in Lebanon to assess the behaviors and attitudes regarding the household food waste generation in Lebanon. In that study, the data was collected in 2016 and 2017 prior to the COVID-19 pandemic and unprecedented economic crisis that started in the country since 2019. Both crises affected the household food waste generation as reported in the current study. There are many limitations to our study. First, the overrepresentation of women and educated individuals compromised the sample's representativeness and, consequently, the degree to which the current results could be generalized to the Lebanese adult population. It is believed this is related to Lebanon's cultural context and situation, where women are in charge of cooking, food management, and food shopping in most households. As a result, women were more interested in participating in the survey. Furthermore, the current results are based on state, not revealed behavior. Self-reported questionnaire answers are known to be exaggerated at times, and respondents may be too embarrassed to reveal the truth regarding some questions. In addition, a questionnaire survey is considered too subjective to measure the real situation of food waste since the participants tend to declare less food waste in the survey than has been wasted in reality. Even though one way to reveal people's intentions is by directly asking them, other approaches are needed to collect behavior data in future studies. Finally, regarding the changes in consumer attitudes, the behavioral changes uncovered in the current study might be temporary during the pandemic and the economic crisis and not permanent. This issue should be verified in the future using longitudinal surveys.

4. Conclusion

In conclusion, the outcomes of the COVID-19 pandemic and the Lebanese economic crisis greatly depend on the epidemiological situation, the baseline situation, and resilience to shocks. The study results are valuable country-specific inputs for designing evidence-based policies during the recovery of Lebanon's post-pandemic and post-economic crisis. For instance, some positive effects of these two crises, such as adopting more sustainable diets and reduction of food wastage for instance, can be grasped to promote the transformation towards more sustainable consumption patterns in the country. As the current study emphasizes the immediate and short-term effects of the pandemic and the economic crisis, which are not over yet, future studies are hence very much needed, especially those looking at explaining the long-term effects of the crises on food purchase and consumption as well as waste generation behaviors. These behaviors are well associated with food insecurity in the country. In this regard, the findings reported in the current study require verification using future longitudinal surveys to verify if the behaviorial changes were temporary. This and other future studies would become a critical structure and framework for government planning and readiness for future shocks and pandemic/economic crises.

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.

Data availability

Data will be made available on request.

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