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EDITED BY
Melissa Pflugh Prescott,
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REVIEWED BY
C. Anne Claus,
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Universitat Politecnica de Catalunya, Spain

*CORRESPONDENCE
Ali Chalak
ac22@aub.edu.lb
Mohamad G. Abiad
ma192@aub.edu.lb

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The influence of religion and religiosity on food waste generation among restaurant clienteles

Hussein F. Hassan[1], Lilian A. Ghandour[2], Ali Chalak[3]*, Pamela Aoun[4], Christian J. Reynolds[5] and Mohamad G. Abiad[4]*

[1]Nutrition Program, Department of Natural Sciences, School of Arts and Sciences, Lebanese American University, Beirut, Lebanon, [2]Department of Epidemiology and Population Health, Faculty of Health Sciences, American University of Beirut, Beirut, Lebanon, [3]Department of Agriculture, Faculty of Agricultural and Food Sciences, American University of Beirut, Beirut, Lebanon, [4]Department of Nutrition and Food Sciences, Faculty of Agricultural and Food Sciences, American University of Beirut, Beirut, Lebanon, [5]Centre for Food Policy, Department of Health Services Research and Management, City, University of London, London, United Kingdom

Introduction: Food waste is a global issue of primary concern due to its repercussions on the environment, food security, and the economy. Our study aimed to explore the impact of religion and religiosity on food waste generation among restaurant clienteles in Lebanon, a religiously diverse country.

Methods: A convenient sample of 927 restaurant patrons dining out in Greater Beirut was interviewed face-to-face, and leftovers at each table were collected and weighed.

Results: Christian diners were found to waste significantly less ($p < 0.05$) than Druze and Muslim patrons in restaurants serving Lebanese and non-Lebanese food. Individuals (19.1% of respondents) from both religions who reported that their relationship with God is the priority in life waste similarly compared to those who claimed to have other priorities. The higher the religiosity score among both Christians and Muslims/Druze groups was, the lower the food waste quantity got, highlighting the reduced wasteful behavior among highly religious people.

Discussion: Based on these findings, including religious cues in consumer-based interventions to reduce food waste can be more effective. This can be achieved through marketing campaigns that communicate religious-based messages to trigger religious beliefs that reduce food waste, using physical spaces and rituals of mosques and churches.

KEYWORDS

food waste, religiosity, restaurant customers, food waste behavior, restaurant, behavior

Introduction

Food waste is considered one of the major problems facing today's food systems. Around 931 million tons of food is wasted across the households, food service, and retail sectors; this is equivalent to one-third of the global food production (UNEP, 2021). According to the United Nations Environment Programme (UNEP), food waste is defined as food and the associated inedible parts removed from the human food supply chain in the retail, food service, and household sectors (UNEP, 2021). According to

FAO, food loss is the decrease in the quantity or quality of food resulting from decisions and actions by food suppliers in the chain, excluding retail, food service providers, and consumers. On the other hand, food waste results from purchasing decisions and actions by consumers or decisions by retailers and foodservice providers that affect consumer behavior (FAO, 2019). Global average food waste was estimated to be 74, 32, and 15 kg/capita/year in the household, food service, and retail sectors, respectively, which is equivalent to generating 569, 244, and 118 million tons of food waste in the household, foodservice, and retail sectors, respectively (UNEP, 2021).

Food loss and waste have great repercussions on the environment, food security, and the economy. If food loss and waste are a country, they would be the third-largest emitter of greenhouse gas emissions after USA and China (UNEP, 2021). The global carbon footprint of food loss and waste is 3.3 gigatons of carbon dioxide (UNEP, 2021). In fact, 24% of food emissions come from food loss and waste. 15% of food emissions come from food loss, while 9% are from food waste (Poore and Nemecek, 2018). In parallel, more than 820 million people worldwide are deprived of sufficient food, with ∼3.1 million children estimated to die yearly due to undernutrition (FAO, 2015; Aamir et al., 2018; UNEP, 2021). If just 25% of the wasted food were saved, 870 million severely malnourished people could be potentially fed (Morone et al., 2019).

In fact, the quantity of wasted food is sufficient to meet the increasing demand for food to feed 9 billion people by 2050 (FAO, 2011). This is not to mention the annual economic costs for food loss and waste amounting to about 2.6 trillion USD, with USD 700 billion deemed environmental costs. At the same time, USD 900 billion is attributed to social costs (UNEP, 2020). Reducing food waste represents a "triple win" as it alleviates hunger, cuts back on associated costs for companies, farmers, and people, saves land and water resources, reduces greenhouse gas emissions, and mitigates impacts on climate change (Abiad and Meho, 2018). Food waste reduction is one of the Sustainable Development Goals (SDGs) supported by the U.N. and adopted by the member states to protect the planet, end poverty, and ensure wealth. SDG 12, titled "Ensure sustainability consumption" in particular, addresses the food waste matter in its 3rd target: "by 2030, halve per capita global food waste at retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses" (UN, 2015).

Restaurants have different service types (fine dining, casual, quick service, take away, and buffets). The food waste generated from each type differs (Garrone et al., 2014). A typical restaurant operation includes raw ingredients' procuring and preparing, cooking, storing, and serving. Each activity contributes differently to food waste generation. For instance, Gunders (2012) states that 4–10% of food purchased is lost in restaurants. Consumer behavior has been identified as a critical determinant of restaurant food waste. For instance, gaining a comprehensive understanding of consumer food waste behavior in restaurants can help mitigate food waste (Papargyropoulou et al., 2016; Wang et al., 2017; Martin-Rios et al., 2018). In the literature, several factors affecting consumer food waste generation were reported. These include attitudes related to shopping and reuse of leftovers (Graham-Rowe et al., 2014; Stancu et al., 2016), favorable individual patterns (Graham-Rowe et al., 2014; Stancu et al., 2016), perceived behavioral constraints, which is a measure capturing the degree to which people perceive that they have the ability, means, and opportunity to do a certain behavior (Russell et al., 2017), personal standards including intention, moral obligation, self-identity, action planning, and past recycling behavior (Pakpour et al., 2014), and individuals' activism, which is an attitude object that reflects individuals' intentional mindset to take part of the wellbeing of public as well as the value of doing so (Elhoushy and Jang, 2020).

Despite the fact that religiosity as a motivating parameter to reduce food waste is very important since most people are affiliated in general with some form of religion, food waste reduction initiatives mainly focused so far on environmental and economic-based approaches while neglecting religion-based schemes (Zamri et al., 2020). This was highlighted by Porpino (2016) and Elhoushy and Jang (2020) who pointed out a gap in knowledge *vis-à-vis* the role of religion and religiosity in influencing consumer food waste generation.

Researchers have studied the role of religion in shaping different consumption behaviors with the effect of religion and religiosity on food consumption depending on how believers tend to follow the teaching of the different types of religion (Bonne et al., 2007; Siyavooshi et al., 2019; Elhoushy and Jang, 2020). Lebanon, a small country in the Middle East with an area of 10,452 km^2 and a population of ∼7 million, is known for its cultural and religious diversity. The country has 18 officially recognized religious groups (sects) classified under three main heavenly religions: Islam, Christianity, and Druze (one of the major religious groups in the Levant characterized by an eclectic system of doctrines, cohesion, and loyalty among its members). This diversity presents an opportunity for exploring the role of religion and religiosity on food waste generation in Lebanon. Worth noting that one's religious affiliation in Lebanon is not merely a function of individual preference or a reflection of religious involvement. One might be identified as Christian or Muslim without really being a follower of that religion; thus, it is also important to look into "religiosity," which is the level of religious involvement (Koenig et al., 2015; Bandaly and Hassan, 2020). On the other hand, Mezze is a main component of the cuisine in Lebanon. It is similar to Mezeluri of Romania, Tapas of Spain, and Stuzzichini of Italy. Mezze involves a variety of hot and cold small dishes, ranging from bread, raw vegetables, pickles, and dips, to complete meal consisting of salads, grilled meats, and desserts. Those dishes are in general shared by different individuals at the table. Mezze can range up to 60

TABLE 1 Restaurants classification based on the average cost for two people.

Restaurant type	The average cost for two people	No of participants N (%)
Quick bites	Less than LBP 15,000	5 (0.54)
Casual dining	LBP 15,0001–50,000	278 (29.99)
Premium casual dining	LBP 50,001–LBP 120 000	523 (56.42)
Fine dining	More than LBP 120 001	121 (13.05)
	Total	927 (100)

TABLE 2 Restaurants classification based on the menu type.

Restaurant type	No. of participants	Percent
Lebanese/Mezze type	496	53.51
International food/Diners	431	46.49
Total	927	100

dishes, making food waste generation inevitable (Chalak et al., 2021).

Food waste in Lebanon was tackled before by Chalak et al. (2021) who explored the factors contributing to food waste generation among consumers in restaurants serving Mediterranean-type cuisine in Lebanon. In addition, Zeineddine et al. (2021) investigated the plate food waste generated while dining out in the country. Furthermore, Mattar et al. (2018) assessed the attitudes and behaviors shaping household food waste generation in Lebanon. However, in the aforementioned studies, the effect of religion and religiosity was not assessed. Seizing the opportunity of the uniqueness and diversity of the Lebanese culture and religious beliefs, the present study explores the influence of religion and religiosity on food waste generation among restaurant clienteles.

Methodology

Study design and population

A convenience sample of 927 adult restaurant patrons (aged 18–65) eating out during lunch or dinner at different restaurants providing Lebanese and non-Lebanese cuisine in Beirut and its suburbs were interviewed from December 2018 through April 2019. The data collection was conducted throughout the week, and no data was collected during Ramadan or lent season. A list of restaurants was obtained in October 2018 using the Zomato application (a restaurant aggregator and food delivery start-up, Zomato, 2010), which operates in Lebanon. Four restaurant categories were created based on Zomato's classification of average price for two people (≤LBP15000, LBP15001–50000, LBP50,001–LBP120,000, and >LBP120,000) (Table 1). To ensure diversity between restaurants' classifications, the number of participants (collected surveys) in each of the four categories was proportional to the number of restaurants in each classification (Table 1). Table 2 provides the classification of restaurants according to the type of menu they serve.

Questionnaire development

A survey was developed in English, including 33 questions to assess the attitudes and behaviors associated with food waste generation among consumers eating out at restaurants in Lebanon. The survey was translated to Arabic by a sworn translator and back-translated to English to validate the translation. Minor modifications were made to some questions. It was piloted to test its clarity and the average time needed to complete it. Data collected comprise the participants' demographic characteristics, attitudes, and culturally appropriate behaviors related to food waste, and ethical and religious questions inspired by the "Belief into Action Scale—BIAC" and "The Centrality of Religiosity Scale—CRS." BIAC is a 10-item scale considered a reliable and valid measure of religious commitment. The scale seeks to convert simple belief into action. The action is then evaluated based on the individuals' classification and ranking of their daily practices and activities, including how they devote their time and spend their money (Koenig et al., 2015).

CRS measures the significance of religious meanings in behavior intended to be applied in Abrahamitic contexts (Jewish, Christian, and Muslim). The CRS measures the general strengths of five theoretically defined core aspects of religiosity (public practice, private practice, religious experience, ideology, and the intellectual dimensions), which can be considered representative of the total of religious life (Huber and Huber, 2012), and it was used in this study. Its validity has been shown in a study involving more than 100,000 participants across 25 countries.

The study was approved by the Institutional Review Board (IRB) at the American University of Beirut (AUB) for ethical compliance. No personal identifiers were collected, and participation in the study was voluntary.

Data collection

Data collection comprised a face-to-face interview with the person who placed the order on the table after explaining to the participants the aim of the study and consenting them to participate. In Lebanon, it is common for one person places an order on behalf of the table customers in restaurants. The characteristics of the participants are summarized in Table 3. Once the diners completed their meals, the table was approached

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TABLE 3 Sample characteristics.

Variable	N	%
Gender		
Male	395	42.6
Female	532	57.4
Age group		
25 or younger	368	39.7
26–35	280	30.2
36 or older	279	30.1
Individual monthly income		
LBP2,400,000 or less	362	39.1
LBP2,401,000 or more	296	31.9
Don't know/Prefer not to answer	269	29.0
Have you ordered alcoholic drinks?		
Yes	192	20.7
No	735	79.3
Nr. of persons on the table		
1–2 people	412	44.4
3–4 people	345	37.2
>4 people	170	18.3
Number of dishes per person		
<2 dishes	636	68.6
2–4 dishes	177	19.1
>4 dishes	114	12.3
Number one priority in life		
Relationship with God	177	19.1
Other	750	80.9
Religious belief		
Christian	413	44.6
Muslim/Druze	363	39.2
Other/Prefer not to answer	151	16.3
Religiosity score (0–45)		
0–1 (Lower decile)	85	9.2
2–25 (Middle 8 deciles)	673	72.6
26–45 (Upper decile)	91	9.8
Not reported	78	8.4

upon asking for the bill so that the participant's response to the questionnaire would not affect their waste generation. The aim of the study was communicated to a representative of each table, the person who placed the order. Their consent was obtained before answering the questions. Then, food leftovers, including inedible parts such as bones, pits, etc., were collected and weighed at each table in the restaurant cuisine to the nearest gram. Beverages and sauces were excluded from the assessment. Collected leftovers were from all persons seated at the assessed table and not that of the respondent only. Accordingly, for each survey, an average waste quantity was calculated by dividing the amount of food waste generated by the number of consumers at the table.

Statistical analysis

The Tobit model was applied in our analysis, given that 361 respondents (i.e., 38.9%) had zero food waste generated at their table. This adopted model is recommended for data with "limited dependent" censored variables (often referred to as "corner solution" models) (Baum, 2006; Wooldridge, 2012). To explain the systematic variation in the amount of food waste generated (expressed in grams per person), a set of covariates was selected. The calculated Tobit model estimates are shown in Table 4, along with the proportions of their respective levels in the sample. We also used the model estimates to appraise expected food waste quantities for the overall sample (grand mean) with 95% confidence intervals.

As for the characteristics of the zero waste group were compared to the other respondents in terms of various characteristics and utilizing chi-square tests of independence. At the 5% significance level, independence for gender, age, number of persons on the table, and individual monthly income could not be rejected, suggesting these two groups have similar profiles to these characteristics. In contrast, the zero waste group was significantly likelier to order fewer dishes per person on the table, spend less on a meal, and less likely to be in the restaurant for leisure (as opposed to Business or convenience).

The different subsamples were categorized utilizing the covariates' various levels or interactions of these variables. Within each covariate or two-way interaction between covariates, pairwise comparisons of the expected food waste estimates across various subpopulations were conducted and reported in Table 4. All analyses were carried out using Stata 16.1 (StataCorp LLC, Texas, USA).

Results

Religious belief and religiosity effect on food waste generation

The study included 927 restaurant clients with the majority being females (57.4%). The majority of the participants were aged above 26 (60.3%), 79.3% did not order alcohol, 39.1% earn <2.4 million Lebanese pounds per month.

The estimated model and expected food waste values are reported in Table 4. All sample and subsample estimates of food waste turned out to be highly significantly different from zero ($p < 0.01$), as further attested by the fact that none of these estimates' confidence intervals overlapped with 0. The results suggest that when eating out in Lebanon, the expected waste is 121.6 g/person. Christian diners tend to waste less (107.9 g/person) as compared to Druze and Muslim diners (132.6 g/person) in Lebanese and non-Lebanese restaurants, and the differences were significantly different ($p < 0.05$). When it comes to the highest priority in life, respondents (19.1% of the participants) from both religions who reported their relationship

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TABLE 4 Model and expected food waste estimates.

Variable	Model	Expected waste (g/person)		95% Conf. int.
Model and expected food waste estimates—Simple/Main effects				
Constant/Grand mean	187.75***	121.6		(109.8–133.4)
Type of restaurant				
Lebanese restaurant (mezze-type)	–	159.8		(139.8–179.9)
Non-Lebanese restaurant	−123.57*	85.3		(70.3–100.2)
Gender				
Male	–	111.3	A	(95.0–127.6)
Female	34.29*	129.6	A	(114.0–145.1)
Age group				
≤25	–	123.9	A	(105.5–142.3)
26–35	9.86	129.3	A	(108.6–150.0)
≥36	−24.32	111.2	A	(91.6–130.7)
Individual monthly income				
≤LBP2,400,000	–	127.8	A	(108.8–146.8)
>LBP2,400,000	−31.02	111.4	A	(91.7–131.0)
Don't know/Prefer not to answer	−5.2	124.9	A	(104.3–145.6)
Number one priority in life				
Relationship with god	–	123.4	A	(97.6–149.1)
Other	−4.09	121.2	A	(108.2–134.1)
Religious belief				
Christian	–	107.9	A	(91.3–124.6)
Muslim/Druze	−7.34	132.6	A	(113.1–152.1)
Religiosity score (scale 0–45)				
0–1 (Lower decile)	–	154.3	B	(105.2–203.4)
2–25 (Middle 8 deciles)	−98.44*	123.8	AB	(110.9–136.7)
26–45 (Upper decile)	−114.59	91.6	A	(60.2–123.1)
Model and expected food waste estimates—Interactions				
Religious Belief × Religiosity score				
Christian × 0–1	–	163.0	AB	(92.9–233.1)
Christian × 2–25	–	104.8	AB	(86.8–122.8)
Christian × 26–45	–	81.8	A	(33.5–130.2)
Muslim/Druze × 0–1	–	158.4	AB	(61.0–255.8)
Muslim/Druze × 2–25	74.4	140.8	B	(118.6–163.0)
Muslim/Druze × 26–45	15.26	85.2	A	(44.5–125.8)
Type of restaurant × Religiosity score				
Lebanese restaurant × 0–1	–	192.0	D	(127.3–256.7)
Lebanese restaurant × 2–25	–	160.4	D	(139.6–181.3)
Lebanese restaurant × 26–45	–	142.0	CD	(87.9–196.0)
Non-Lebanese restaurant × 0–1	–	116.6	ABCD	(54.5–178.8)
Non-Lebanese restaurant × 2–25	−10.76	88.6	BC	(70.8–106.5)
Non-Lebanese restaurant × 26–45	−85.51	50.4	A	(17.9–83.0)
Variance	74,537.46***			
Restaurant's price range for 2 people				
≤LBP50,000	–	143.8	A	(120.9–166.6)
LBP50,001-LBP120,000	−71.90***	104.9		(90.9–118.9)
>LBP120,000	9.5	149.4	A	(117.1–181.8)
Have you ordered alcoholic drinks?				
Yes	–	129.0	A	(103.6–154.3)
No	−17.07	119.7	A	(106.8–132.6)

(Continued)

TABLE 4 (Continued)

Variable	Model	Expected waste (g/person)		95% Conf. int.
Nr. of persons on the table				
1–2 people	–	139.1	B	(121.4–156.9)
3–4 people	−41.23*	116.4	AB	(98.7–134.2)
>4 people	−87.93***	93.7	A	(72.0–115.3)
Number of dishes per person				
<2 dishes	–	97.3		(84.6–110.0)
2–4 dishes	99.20***	150.6		(122.2–179.0)
>4 dishes	240.32***	249.5		(202.3–296.8)
Model fit				
Nr. respondents	927			
Log-Likelihood	−4,217.85			
Likelihood ratio $\chi 2$	185.50***			
Akaike information criterion (AIC)	8,495.71			
Bayesian information criterion (BIC)	8,640.67			

* $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.
All expected waste estimates are significantly different from 0 at the 1% significance level.
Expected waste estimates sharing a letter in the group label are not significantly different at the 5% significance level.
Main effect and interaction estimates involving the "Not reported" level of "Religiosity score" are not reported to save space and can be provided upon request.

with God as the number one priority tend to waste practically the same as those who claimed to have other priorities such as friendships, career, health, independence and financial security (123.4 and 121.2 g/person, respectively).

Furthermore, our results suggest that the greater the religiosity level, the lesser the food waste quantity. Participants from a lower religiosity decile (religiosity score 0–1) wasted 68.4% significantly more than those in the highest decile (religiosity score 26–45), which is translated to 154.3 g/person and 91.6 g/per person, respectively. This finding highlights reduced wasteful behavior among highly religious people. Upon further examining the moderating role of religious belief, we found that the association between food waste and religiosity level held only for Muslims and Druze respondents but not Christians. Indeed both Muslim/Druze and Christian respondents waste relatively low amounts of food when belonging to the highest religiosity decile (85.2 and 81.8 g/person, respectively). Muslim and Druze respondents from the highest religiosity decile waste significantly less than the middle eight and lowest deciles (140.8 and 158.4 g/person, respectively). The differences become insignificant for Christian respondents, even though the waste of the middle eight and lowest religiosity deciles appear to be substantially higher (104.8 and 163.0 g/person, respectively). We also examined the moderating role of "restaurant type" and found that the reduction of waste with increasing religiosity was both more significant and pronounced in non-Lebanese restaurants. In this restaurant type, individuals from the lowest and middle eight religiosity deciles waste roughly 131.3 and 75.7% more than those from the highest decile (116.6, 88.6, and 50.4 g/person, respectively), though the difference is only significant between the middle eight and the highest religiosity decile. On the other hand, for restaurants serving Lebanese cuisine, the former two deciles wasted only 35.3 and 13 percent more than the highest religiosity decile, and the differences were insignificant.

Discussion

Skirbekk et al. (2018) stated that 62% aged 15 to 59 reported being affiliated with a religion in 2010, and this percentage is expected to increase by 2050, reaching 58%. Islam prohibits wastage in every aspect of life, not only regarding food waste but also in energy, and time, among others. Even though Muslim peers' faith prohibits food waste, the odds of wasting food among Muslim respondents were higher than among Christians. In fact, Muslims are asked to share excess food with the poor. And this is clarified in the following verses of the Holy Quran:

> *O you who believe! Do not make unlawful the wholesome things God has made lawful for you, but commit no excess, for God does not Love those given to excess. [Quran 5:87].*
>
> *It is He Who has brought into being gardens, the cultivated and the wild, and date palms, and fields with produce of all kinds, and olives and pomegranates, similar (in-kind) and variegated. Eat their fruit in season, but give (the poor) their due on harvest day. And do not waste, for God does not love the wasteful. [Quran 6:14].*

On the other hand, in 2013, Pope Francis claimed that "throwing away food" is like "stealing from the table of those who are poor and hungry." Furthermore, in the Bible, Christians were asked not to waste any food, and this was highlighted in the following verse:

> *When they were filled, He said unto His disciples, gather up the fragments that remain, that nothing be lost. [John 6:12].*

This could be explained by religious affiliation being merely a status or social identity; religious beliefs could not determine an individual's involvement level. Even if individuals identify themselves as Muslim, this does not necessarily indicate that they follow that religion. The person might not be following the teaching of the Quran, and the role of religiosity may be more useful in explaining behaviors (Vitell et al., 2005; Ghandour et al., 2009).

Food waste reduction aims to save money or comply with "others" and a moral-driven action based on what individuals consider correct behavior. In the present study, religiosity was a key predictor of food waste generation. Our results underlining the impact of religiosity on food waste generation in restaurants align with Abdelradi's (2018) views, who reported that religious beliefs increase an individual's environmental awareness. Higher religiosity may be accompanied by stronger moral obligations and activism to reduce food waste, which, in turn, affect food waste reduction norms and intentions (Pakpour et al., 2014; Graham-Rowe et al., 2014; Siyavooshi et al., 2019; Elhoushy and Jang, 2020).

Our findings on the role of religiosity in reducing food waste could be used to develop awareness messages about food waste that could be communicated in religious settings (Sunday mass or Friday Mosque prayer) that can be useful platforms to educate people on the consequences of food waste (Elhoushy and Jang, 2020). The religious leader could activate and/or cultivate religious beliefs that motivate food waste reduction, as Siyavooshi et al. (2019) reported. The choice of religious words should be positive for them to be effective; meaning, messages need to highlight "food waste reduction as a virtue" instead of "food waste as a sin."

Despite the fact that it is the first of its kind in Lebanon and the region, our study has its set of limitations. The main one is that the study collected data on the religion and religiosity of the person who ordered the food on the table, while the wasted food reflects collective behavior (meaning, not perhaps, the respondent's behavior). Future studies should explore reasons behind higher food waste generation among Muslim restaurant clients. Same applies for understanding why Christians' level of belief was not found to be related to food waste. In addition, given that data collection took place in 2018 and 2019, the possible effects of subsequent COVID-19 pandemic and unprecedented economic crisis in Lebanon on food waste generation in restaurants are recommended to be assessed. Furthermore, the effect of religion and religiosity in the urban and rural areas outside Beirut must be evaluated for a better understanding of the food waste behavior among restaurant clientele.

To better address the mounting problem of food waste worldwide, it is fundamental to apprehend the behaviors influencing food waste generation. Our results are also based on food ordered and consumed outside the home. As discussed by Biermann and Rau (2020), eating practices at home and out of home differ. Indeed for many, eating out in a restaurant means treating oneself to something special or ordering food in abundance—the latter possibly leading to waste. However, in this study, we did not collect any data on the total volume or value of the ordered food; thus, we could not further investigate the possible drivers for the rates of plate-based food waste and links to religion. Future studies need to consider the reasons for the meal event as linked issues to control for in the statistical analysis, as there may be cultural and religious driving forces linked to eating out (the celebration of special occasions).

Conclusion

In order to address the emergent challenge of food waste worldwide, there is an urgent need to understand the behaviors influencing food waste generation. In this light, the current study highlights the influence of religion and religiosity that can be addressed to decrease food waste. Our results reported that Christian diners generated less plate waste than Muslim/Druze diners. Individuals who reported that their relationship with God is their number one priority in life did not generate less plate waste as compared to people who claimed to have other priorities in life. In addition, it was found that the higher the religiosity level is, the lower the level of plate waste quantity becomes, highlighting the reduced wasteful behavior among highly religious people when eating out. Our findings can be used to design consumer-based interventions that include religious cues through marketing campaigns communicating religious-based messages, rituals, and worship places. Future research is still needed to understand better the religion and religiosity determinants of food waste at the hospitality, household and retail levels among the rural and urban Lebanese communities toward developing proposed intervention strategies and testing their effect on reducing food waste generation.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving human participants were reviewed and approved by Institutional Review Board, American University of Beirut, Lebanon. The patients/participants provided their written informed consent to participate in this study.

Author contributions

HH and PA co-collected, co-analyzed data, and co-wrote manuscript. AC conducted the statistical analysis and co-wrote the manuscript. LG and CR reviewed co-wrote the manuscript. MA conceptualized and oversaw the project and co-wrote the manuscript. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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