

Ground beef waste in Mexican households

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Abstract

Keywords:

Food
Waste
Ground beef
Mexico
Household

Article history:

Received
24.06.2023
Received in
revised form
04.10.2023
Accepted
06.10.2023

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DOI:

10.24263/2304-974X-2023-12-3-6

Introduction. Household food waste is a primary worldwide concern; however, in developing countries, quantitative information on this matter is scarce. This study aimed to provide baseline information on consumer behaviour, practices, beliefs, and attitudes associated with ground beef waste in Mexican households.

Materials and methods. Field data came from a survey of 740 consumers from two major Mexican cities. A survey was administered to consumers willing to answer, and they had five fixed options to select from in the questions related to reasons for awareness and for disposing of minced beef at home. Statistical analysis was performed using Chi-square.

Results and discussion. Consumers were asked to choose from the survey the option closest to their opinion. The results indicate that more than 75% of the respondents were households with 3-5 members, comprising mostly children ≤ 10 years old and a smaller proportion of people aged 70 and over. Only 33% buy ground meat packaged and displayed in open refrigerated cabinets in supermarkets, while the rest, 67%, purchase it from local butchers. The best-before date was considered an important parameter as it reports the level of freshness of the meat and its positive impact on health. In contrast, for $>50\%$ of respondents, meat waste is associated with cleaning activities. Discarding or throwing away ground meat in Mexican households can occur within a few days of purchase, and can also be related to inadequate preservation and refrigeration practices. Major reasons for consumer awareness of household food waste were associated with guilt feelings (73.0%) and damage to the environment (71.6%), whilst rotten meat and leftovers not eaten were linked to discarding ground meat. Household refrigerator malfunctions and buying in excess occasionally influenced perishable food waste. There are significant relationships between food wastage and various activities, such as purchasing practices, preparation methods, attitudes, and lifestyles associated with eating habits. Reasons that could be related to wastage are prolonged storage of raw meat, finished of the expiry date and disgust. In addition, other related aspects focus on compulsive buying, coupled with a need for more planning and prioritizing the purchase of large packages.

Conclusion. Any program related to reducing minced meat waste in households must include the design of governmental and non-governmental policies that impact all links in the supply chain, especially on the final consumer.

Introduction

At least one-third of the world's food production is lost as food waste (Vilariño et al., 2017); so then to feed the growing human population, an increase in food production is not enough, but a significant reduction in food waste has to be addressed as an essential topic in academia. Food discard has been pointed out as a threat to food security, economic losses, increase in carbon footprint, soil erosion, salinization and nutrient depletion and air and water pollution (Buzby et al., 2014; Grizzetti et al., 2013; United Nations, Department of Economic and Social Affairs, 2017). Food waste and loss impact the entire food chain (Mokrane et al., 2023); furthermore, it is essential that links of specific food chains be determined and protocols to avoid or reduce them validated (Elimelech et al., 2018; Parfitt et al., 2010). Households in high-income countries, the last common link in the food chain, have been identified as the link with the highest proportion of food waste (Kummu et al., 2012). In contrast, (FAO, 2011) reports that at the consumer level, food waste is much lower in low-income countries.

Richter and Bokelmann (2018) stated that many consumers do not see food waste as an economic loss or as a negative environmental impact issue; however, a proportion of consumers are aware of food-borne diseases and the negative impacts of food waste on their economy and the increasing damages on the environment (Principato et al., 2021). Consumer experiences and broader distribution of information on food waste impacts might be sources of consumers' decisions on frequency and amount of food purchasing to avoid food waste at home (Farr-Wharton et al., 2014). In this case, the theory of planned consumer behaviour is proposed as a basis for explaining food waste (Ananda et al., 2023). In some low-income countries, substantial food losses and wastes are mostly from primary production and immediate post-harvest links to consumers' homes. Consequently, it leads to the relevance of studying food losses and wastes along all food chain links in different countries (Kummu et al., 2012).

Focusing on household food waste Block et al. (2016) suggested that factors associated with food waste should be grouped into time-purchase, storage, preparation and consumption. In addition to time-grouping, factors related to household food waste should be classified into social, economic, and environmental concerns (Hebrok and Boks, 2017; Dobernig and Schanes, 2019). Household food waste is produced and processed for human consumption; however, once at home, the food is not consumed by humans but thrown away, given to pets, or sent to composting processes (Stancu et al., 2016). It is suggested that best-before dates, over-preparation, food presentation and food preferences directly impact food waste (Mokrane et al., 2023). Another relevant factor is that single people are the ones who waste the most significant amounts of food (Silvennoinen et al., 2014). Additionally, the decision on food destination at home, either human consumption or waste depends on the consumer (Kranert et al., 2012); then, if household food waste is to be reduced or avoided, depth studies should be done on consumers' factors or drivers to discard food (Jörisen et al., 2015). Ananda et al. (2023) argue that households' repetitive and routine patterns of food management, which include the activities related to checking stocks before shopping and meal planning schedules, create a series of habits that directly affect the amount of food waste. Another problem associated with food waste is related consumers' religious values. If religious norms, for example those rules involved in food consumption and fasting are restrictive, they lead to significant food waste (Minton et al., 2020).

The study presented by Schanes et al. (2018) concluded that household food waste reduction starts with prevention, then studies should be addressed to identify household factors drivers of food waste. Among such components there are: household size, with the

largest ones wasting more food (Jörissen et al., 2015); older householders trended to show a lower amount of food waste (Quested et al., 2011); high-income families with children showed more significant amounts of food waste (McCarthy and Liu, 2017; Parfitt et al., 2010); religious beliefs (Abdelradi, 2018); traditional servings at home celebrations (Fajans, 2006; Porpino et al., 2016); and, buying food above the needs (Quested et al., 2011; Stancu and Lähteenmäki, 2022). Some food waste comes from leftovers that are kept under refrigeration for up to four days and then thrown away (Halloran et al., 2014; Stancu et al., 2016). Sustainable food systems depend not only on the production and processing links along the food chain; the reduction and elimination of food waste by final consumers is also an essential link toward this goal (Matzembacher et al., 2020). Therefore, it is crucial to identify in-home food waste drivers and barriers to reducing or eliminating them (Wakefield and Axon, 2020).

The highest proportion of food waste is reported for perishable products such as vegetables and fruits, meat, and fish (FAO, 2019). Ground beef goes through intensive and elaborate food processing and handling without a peel, skin, or any other external protection; then, high hygienic standards, cold chain maintenance and proper packaging should be provided at processing time. The responsibility of the consumer at home when handling ground meat is to apply good preservation practices, avoid overcooking and home storage beyond the "best before" date (Halloran et al., 2014; Milne, 2012; Stefan et al., 2013; Wakefield and Axon, 2020). Consequently, the aim of the study is to provide baseline information on conditions and drivers to ground beef waste in some Mexican households from field research based on the application of a questionnaire to consumers that buy this meat product.

Materials and methods

A survey of ground beef consumers was conducted in two cities in Mexico. At the core of the questionnaire was a set of 14 reasons for awareness and for discarding ground beef at home. The consumer was asked to select one of five options for each cause. The questionnaire was applied through face-to-face questions, and the respondents were approached when leaving the supermarkets. Sampling was non-probabilistic of convenience (Kalton, 2021) since the respondents were those willing to provide all the answers to the questions. Data analysed were the proportion expressed as a percent of respondents in each option within each question/reason. Statistical analysis of ratios within each question was by Chi-square (Stokes et al., 2012) under the null hypothesis that respondents were evenly distributed across all options within each question/reason to declare significant effect p-value was equal to or less than 0.05.

Results and discussion

Questionnaires thoroughly answered came from 740 consumers interviewed, demographic information of them is shown in Table 1. Consumers interviewed were mainly ($p \leq 0.05$) female, between 20 and 40 years old, with at least high school completed and a middle monthly income of \$5,500 or above. In a study conducted in the Czech Republic (Filipová et al., 2017), the food waste rate is related to age, income, and level of education; the latter is associated with the person in charge of the household's food. A relevant finding is that people with a higher level of education, such as students, employees, and

entrepreneurs, tend to waste significant amounts of food. Psychological factors are also pointed out as the leading cause of household food wastage. However, in a Danish consumer survey, Stancu et al. (2016) reported a more significant correlation between consumers' awareness of the economic consequences of food waste than the damage caused to the environment.

Table 1
Demographic indicators of consumers interviewed and fully answered the questionnaire
(n = 740)

Item	Variable	Percentage of responds (% ± SE)*
Gender	Female	69.0± 2.0 ^a
	Male	31.0± 3.0 ^b
Age (years)	Less than 20	7.8± 3.53 ^c
	20	22.8± 3.2 ^b
	30	33.8 ± 2.9 ^a
	40	22.4 ± 3.2 ^b
	50	8.5± 3.5 ^c
	60	3.5±3.6 ^d
	70	1.2± 3.6 ^d
Educational level	Junior high or lower	19.3± 3.3 ^b
	High school	20.1± 3.2 ^c
	Technical degree	37.2± 2.9 ^a
	College degree	23.4± 3.2 ^c
Monthly income (MXN)	Less than 2,700	21.0 ± 3.2 ^b
	2,800 – 5,000	27.3± 3.1 ^a
	5,500 – 8,000	25.7± 3.17 ^a
	8,500 – 10,000	14.3± 3.4 ^c
	10,500 – 15,000	7.8± 3.5 ^c
	15,500 – 20,000	3.6± 3.6 ^d
	More than 20,000	0.3 ± 3.6 ^d
*a, b within item means with one letter in common are not different ($p \leq 0.05$). SE= Standard error		

In addition, in this study, almost 75% of the consumer sample was made up of people of 3 to 5 family members ($p \leq 0.05$); of them 46.8 and 22.4%, first and second places ($p \leq 0.05$) had at least one family member 10 years old or younger or 70 years old or older, respectively. For 67% of the consumers ($p \leq 0.05$), the source of ground beef is local butcher's shops, and grinding is done when buying it, while 33% get the ground beef from supermarkets displayed in open refrigerated displays and already packed (Figure 1; Figure 2; Figure 3). Ground beef was cooked and consumed by 98% of the consumers within the first three days after the purchase of it. When analysing the relationship between food waste and consumption, it can be determined that price has a significant relationship, where age, education and economic activity are directly related (Hazuchova et al., 2020). In contrast, 37% of Egyptian consumers reported being concerned about food waste regularly (Abdelradi, 2018).



Figure 1. Meat on refrigerated shelves in Mexican supermarkets



Figure 2. Different types of meat in a traditional Mexican market



Figure 3. Traditional Mexican food market

Respecting reasons for awareness of meat product waste expressed by the respondents (Table 2) is relevant to indicate that 71.6% agreed or strongly agreed in associating meat waste with the environment, while 73.0% related it to resource waste and feelings of guilt. Concerning the expiry date, respondents strongly agreed and agreed that it is an important parameter; 70.4% specified that respecting the expiry date impacts health, while 60.3% indicated that it represents the level of meat freshness. In contrast, more than 50.0% of the group respondents in this study strongly agreed that wastage of ground meat is not a problem

but rather an act of cleanliness. For example, Alongi et al. (2019) expressed that undisputed the use-by date label represents a factor in consumer decisions to dispose of food. Bosnian households reported a low rate of food waste and paid favourable attention to prevention. Most respondents reported understanding the content of labels and usually scheduled their purchases and consumption due to the pandemic (Vaško et al., 2023). Consumer awareness plays a relevant role in food waste and is aggravated by behavioural patterns (Preka et al., 2020). It is documented that Albanian consumers manage household waste in various ways: more than 86.0% stated that they throw it in the rubbish, 60% use it as food for their pets, and smaller proportions 10.3% channel the waste to needy families and 9.7% use it as compost in the garden. On the other side, American consumers stated that their primary motivations for reducing food were saving money and setting an example to children, and lastly, they placed importance on the environment (Neff et al., 2015a).

Table 2

Sorting (%) of consumers by frequency of reason of awareness wasting ground beef at home

Consumers awareness	Frequency of the reason to be awareness				
	Completely disagree	Partially disagree	Agree	Completely agree	I do not know
Fresher packed minced meat is the one expiring earlier	28.7±3.1 ^a	13.2±3.4 ^b	20.3±3.3 ^b	17.3±3.3 ^b	20.5±3.3 ^b
Expiration date of packed minced meat is a freshness indicator	13.4±3.4 ^a	14.9±3.4 ^a	35.0±3.0 ^b	25.3±3.2 ^a	11.5±3.5 ^a
Expiration date of packed minced meat is useful for health	6.0±3.6 ^a	7.6±3.5 ^a	38.1±2.9 ^b	32.3±3.0 ^a	16.1 ±3.4 ^a
When I throw food away, I feel it like wastage, and I get a bad conscience	9.3±3.5 ^a	7.7±3.5 ^a	35.4±3.0 ^b	37.6±2.9 ^b	10.0±3.5 ^a
When I throw food away, I feel it as cleaning out the refrigerator	26.8±3.2 ^a	13.8±3.4 ^a	18.0±3.3 ^a	25.4±3.2 ^a	16.1±3.4 ^a
If I throw food away, it is not a problem	26.9±3.1 ^b	13.8±3.4 ^a	18.0±3.3 ^a	25.5±3.2 ^b	15.8±3.4 ^a
Food waste make pollution increasing	31.4 ±3.1 ^a	19.1±3.3 ^a	21.8±3.3 ^a	21.1±3.3 ^a	6.8±3.6 ^a
When I throw food away, I think about environment	6.7±3.6 ^b	6.8 ±3.6 ^b	31.5±3.0 ^b	40.1±2.8 ^a	14.9±4.0 ^b
a, b, c,... means within row with at least one letter in common are not different (p>0.05)					

There was a relatively short time between buying and cooking/eating ground beef in Mexican households. Then, the decision to discard ground beef and throw it away could be taken a few days after purchasing. In addition, this short time could lead consumers to overlook basic conservation practices, such as proper refrigeration and clean containers. Table 3 shows the sorting of consumers by frequency of each reason to discard ground beef. In 12 out of the 14 reasons offered, discarding ground beef, it was found that the option never grouped the highest ($p \leq 0.05$) proportion of consumers, and the consumer range was from 24.2 up to 42.7%. Respondents indicated that the two reasons for always discarding ground beef with the highest proportion ($p \leq 0.05$) are related to keeping leftover food in the refrigerator and not eating it, and the other is that it becomes rotted. Similarly, another study reports that the leading causes of food waste are storing food in the refrigerator that is not consumed, removing leftovers from the plate or overcooking food (Abdelradi, 2018). Another essential aspect to consider is food portions, e.g. large quantities have an unfavorable effect on consumption, but at the same time, lead to a large amount of leftovers on the plate (Lorenz and Langen, 2018).

Table 3

Sorting (%) of consumers by frequency of reason to discard ground beef at home

Reason	Frequency of the reason to discard ground beef				
	Never	Seldom	Often	Always	I do not know
Bought in excess	36.4±2.9 ^a	18.8±3.3 ^b	19.6±3.3 ^b	15.6±3.3 ^b	9.6±3.5 ^c
Poor package size diversity	37.3±2.9 ^a	20.8±3.2 ^b	18.8±3.3 ^c	15.9±3.3 ^c	7.2±3.5 ^d
Package difficult to empty completely	37.9±2.9 ^a	18.8±3.3 ^b	18.8±3.3 ^b	12.2±3.4 ^c	12.3±3.4 ^c
Not the right ground beef	42.7±2.8 ^a	19.7±3.2 ^b	13.6±3.4 ^b	14.6±3.4 ^b	9.4±3.4 ^c
Kitchen appliance breakdown	37.0±2.9 ^a	23.4±3.2 ^b	15.5±3.3 ^b	11.4±3.4 ^c	12.7±3.4 ^c
Passed suggested date for consumption	28.4±3.1 ^a	15.9±3.3 ^a	20.2±3.2 ^a	24.6±3.1 ^a	10.9±3.4 ^b
Broken package	35.1±2.9 ^a	20.9±3.2 ^b	16.1±3.3 ^c	14.5±3.4 ^c	13.4±3.4 ^c
Meat rotten	27.8±3.1 ^a	12.6±3.4 ^c	14.2±3.1 ^c	31.9±3.0 ^a	13.5±3.4 ^c
Saving leftovers was not possible	36.8±2.9 ^a	16.3±3.3 ^b	18.9±3.3 ^b	15.7±3.3 ^b	12.3±3.4 ^c
No intention to save leftovers	36.8±2.9 ^a	16.3±3.3 ^c	18.9±3.3 ^b	15.7±3.3 ^c	12.3±3.4 ^c
Dislike	36.5±2.9 ^a	16.1±3.3 ^b	16.6±3.3 ^b	21.2±3.2 ^b	9.6±3.5 ^c
Mistake at cooking	36.1±2.9 ^a	16.9±3.3 ^b	18.2±3.3 ^b	15.7±3.3 ^b	13.1±3.4 ^c
Saved leftovers but not eaten	23.9±3.2 ^b	15.1±3.3 ^c	15.2±3.3 ^c	33.5±3.0 ^a	12.3±3.4 ^d
Meat stored refrigerator but never cooked	24.2±3.2 ^b	14.9±3.3 ^c	20.0±3.2 ^b	28.8±3.1 ^a	12.1±3.4 ^d

a, b, c,... means within row with at least one letter in common are not different ($p > 0.05$)

Another study suggests that three main reasons for food wastage are identified, leaving food in the refrigerator for extended periods (Preka et al., 2020), unpleasant appearance and taste, and mould presented (Vaško et al., 2023). Food spoilage is also another reason that Finnish consumers point to as being of significant importance for food waste. However, at the same time, other important reasons are also the best-before date, dish leftovers and overcooking (Silvennoinen et al., 2014). In addition, Koivupuro et al. (2012) also highlighted the socio-demographic, attitudinal and behavioural factors influencing food waste as relevant parameters. It is noted that household size, gender of the person in charge of food shopping, and frequency of purchase of products with a reduced-price offer were the only factors that recorded a clear correlation with food waste in the household. In contrast, the same study reported no clear correlation with the eldest person in the family, type of residence, education level, shopping habits, food, and food preparation. The purchase frequency was the variable that influenced the amount of food wasted. However, the existence or lack of a ready-to-eat shopping list determined the food wasted (Giordano et al., 2019).

The reason meat rotten showed in this study a high ($p \leq 0.05$) proportion in both frequencies' extremes, never and always, the mean proportion for both frequencies was 29.8%. It is essential to point out that the lowest ($p \leq 0.05$) proportions of consumers in all 14 reasons were found in the lack of knowledge category (Table 3). Concurrently, there are significant relationships between food waste production and consumer purchasing practices, such as the way food preparation, the type of practices used to manage household waste, as well as beliefs, attitudes and lifestyles associated with their eating habits. Mainly related to food waste is the awareness of various aspects of the consumer, such as the correct way of eating and the production of food waste (Parizeau et al., 2015). However, one risk factor of food loss was influenced during COVID-19 because of supply chain disruption and the decrease in demand in many countries. Such phenomena were most problematic in small and medium-sized enterprises in developing countries (Laborde et al., 2020). On the other hand, food consumption practices changed during the Covid-19 pandemic. In Mexico was reflected in cooking habits and household food management changes. For example, Mexican households increased food purchases and decreased food waste (Vargas-Lopez et al., 2022).

However, three additional reasons in this study are also recorded in the always category, with a smaller proportion, such as the fact that raw meat is stored and not cooked on time, the suggested date for consumption has passed and for displeased. Porpino et al. (2015) identified five categories of food waste in Brazilian households: buying and preparing too much food, showing care for pets, lack of knowledge to preserve food, and avoiding having leftovers in the refrigerator. It also goes deeper and reports two interesting subcategories that, at the same time, influence food waste, such as compulsive buying and lack of planning, together with a preference for large packages. Two prominent factors, per capita income and single-person households, report a strong relationship with the amount of food wasted, resulting from an interaction of behaviour that influence the planning of food purchase, preparation, storage, and consumption (Qvested et al., 2011). The relevant reasons American consumers put forward for discarding food focused on concerns about foodborne illness and being fresh food consumers (Neff et al., 2015 b). Concerning Dutch household consumers gave several reasons for discarding food from the refrigerator, firstly the expiry date, followed by product spoilage, excessive food preparation and forgetting the food in the refrigerator (Janssen et al., 2017). A study conducted in eight countries, Germany, Italy, Canada, the UK, China, Russia, Spain, and the USA, concerning the type of diets, showed a difference between smart diets and vegetarian diets, indicating that the former contributes to more food waste (Iori et al., 2022).

Another study also reported that packaging seldom becomes a key factor for discarding ground meat for consumption in the household; however, prevention of food waste also involves proper handling by retail sellers or supermarkets from processing to the selling point (Ali et al., 2022). For example, Neff et al. (2019) detailed that consumers aged 18-34 most frequently eliminate meat foods, and reasons pointing to buying food in more oversized packaging and misunderstanding the meaning of food labels. A study reports that the main drivers of food waste are associated with consumers' shopping routines, the reuse of leftovers, and the food purchase program (Stancu et al., 2016). By consensus, it has been argued that oversized food portions have an unfavorable impact on consumer food consumption because, in most cases, it leads to many leftovers on the plate (Giordano et al., 2019). There are typical characteristics such as the personal dimension associated with socio-demographic factors, the level of food waste knowledge and personal beliefs in each household that impact on food consumption (Schanes et al., 2018), and the influence linked to social norms and the overall cultural context of the consumer (Roodhuyzen et al., 2017).

Then, of the 14 reasons reported in this study to discard ground beef, 12 are avoidable in households if consumers are made aware of the negative impact of food waste. It is also essential to consider the importance of behavioural and attitudinal patterns and general lifestyle in reducing household food waste (Barr, 2007; Parizeau et al., 2021). Once the leading causes of household food waste are found, a sound program addressing the problem should be done (von Massow et al., 2019). This program should consider habits and emotions individually (Russell et al., 2017) and could also work on the guilt feelings of food buyers as a driver to reduce household food waste (Neff et al., 2015a). However, in today's life, consumers' concern for their economy, time and money exerts a distaste for wasting food (Watson and Meah, 2012). Consequently, food waste reduction is most feasible in prevention at the consumption stage because the most significant potential exists (Kummu et al., 2012).

Relating food waste in the meat sector is highly significant, and it is necessary to implement measures to reduce losses of this type of food. Although the consumption of meat and meat products is high, the level of wastage is also significant, both in production and at the consumer level (Karwowska et al., 2021). While the reasons to discard ground beef at home are avoidable, then programs should promote positive consumer behaviour, adopting strategies for saving, storing, and consuming leftover food at home (Jribi et al., 2020). Furthermore, Aydin and Yildirim (2021) stressed the direct and indirect effects of consumers' moral attitudes, as well as their behavioural habits and patterns on food waste and their practical knowledge of how to conserve food at home. Proper management and use of a food shopping list could help make consumers aware of the amount and expense of food wasted in their household, and then be a driver to reduce food waste (Principato et al., 2015). Regarding consumers' attitudes, it is reported that people with higher incomes are the ones who waste the highest proportion of food. In contrast, the retired sector registers lower amounts of wasted food. The same study points out that young people may have better food management because they are frequently in primary contact with social networks and technical devices (Filipová et al., 2017).

Another factor that affects food reduction is associated with religious values of positive influence when messages supporting food consumption are highlighted. In contrast, the opposite occurs when messages restrict food consumption (Minton et al., 2020). This program should consider habits and emotions individually (Russell et al., 2017) and could also work on the guilt feelings of food buyers as a driver to reduce household food waste (Neff et al., 2015a). However, in today's life, consumers' concern for their economy, time and money exerts a distaste for wasting food (Watson and Meah, 2012). Consequently, food waste reduction is most feasible in prevention at the consumption stage because the most

significant potential exists (Kummu et al., 2012). Beef and dairy products are characterized by higher reported resource consumption and adverse environmental effects (Moult et al., 2018). Therefore, there is a need for more information regarding losses and wastage in the meat products sector. Therefore, it is advisable to apply a systematic approach to quantify meat product wastage (Caldeira et al., 2019).

Several studies report waste in a variety of foods, for example high amounts of waste, in most cases avoidable, were recorded in British households and three categories of motivation to reduce waste were identified. These relate to environmental damage, implementation of appropriate action, and the last links to people training (Graham-Rowe et al., 2014). Additionally, Ilakovac et al. (2020) deduced that any food waste reduction program needs to go through household food handling and management because this end link could be responsible for up to 50% of food wasted at home. Other factors as consumer age and income, and the number of children under 18 in the household, could influence the amount of food waste. A study conducted in Turkey by Aydin and Aydin (2022) indicated that meat was the second most wasted. For example, in this case, the effect of food donation behaviour on the intention of not wasting was negligible. It is attributed to the fact that in that country, the concept of food donation is not ingrained in society as an effect on food waste reduction. On the other hand, consumers are also unaware that the temperature for meat products needs to be significantly colder or that freezing is required to avoid decomposition. Other reasons identified focus on confusion or misunderstanding about the meaning of food labels or dishes that did not meet consumer expectations (Lipinski, 2020).

Plazzotta and Manzocco (2019) postulate that there are potential barriers to valorising food waste control strategies. Five main reasons are put forward, the first of which is associated with the characteristics of food waste; another focuses on the lack of information on the components, where the involvement of science and technology plays a predominant role; the next one refers to the response of consumers, especially the level of commercial and marketing knowledge on food waste; the possibility to scale up and standardize the process is also envisaged, the reason being the high investment cost in the valorisation of industrial processes; finally there is the compliance with the regulatory framework, in terms of governmental environmental guidelines and those proposed by the public. It is conclusive that food waste in households is a matter of concern. The most important reasons why consumers resort to food disposal are due to expired food products and purchase lack of planning, inadequate quality, or excessive quantities, not knowing conservation techniques, and inadequate preparation of portions for consumption (Vieira et al., 2021; Żukiewicz et al., 2022).

Conclusions

1. Food waste is currently a significant concern concerning hunger alleviation and negative environmental impact. Our findings show that ground meat is preferably consumed on the same day of purchase or the next day among the Mexican middle-income population.
2. Awareness factors about wasting meat products are related to environmental impact, waste of resources and guilt. The use-by date is related to the wholesomeness and freshness of meat. The main reasons for discarding minced meat are putrefaction and uneaten leftovers.
3. Future initiatives should then focus on helping consumers to cope with current purchasing and handling trends. Thus, implementing programs to reduce product wastage should involve retailers and consumers.

4. Therefore, it is necessary to determine the feasibility of implementing and operability of food waste control strategies, and it is essential to consider economic, social, and environmental factors.
5. Finally, it is necessary to continue this type of research in Latin America since there is a lack of information on the subject. Therefore, it is relevant to point out that this study provides the first data on food waste in Mexico.
6. However, more research is needed on the behaviour of Mexican consumers to address the adverse effects and to pay more attention to the factors that drive food waste, and thus address the problem in a preventive manner in the Mexican population.

Acknowledgment. The authors wish to thank Lara Manzocco of the Dipartimento di Scienze AgroAlimentari, Ambientali e Animali, Università di Udine, Via Sondrio 2/A, Udine, I-33100, Italy, for providing the questionnaire used to collect consumer data about habits of meat consumption after purchase.

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