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Quantifying household food waste in Kuwait: day-of-week patterns, behaviors, and food security implications

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Introduction: Food waste is a modifiable contributor to climate change and food insecurity, yet household-level measurement data in Kuwait remain limited. This study aimed to quantify household food waste during a short monitoring period and identify day-of-week patterns in waste generation.
Methods: Using a 15-day food waste diary, 150 households recorded the weight and composition of daily waste (excess, expired, non-edible) followed by a post-monitoring period questionnaire.
Results: Food waste declined from 12.5 kg per household in week 1 to 11.7 kg per household in week 2. A 5.8% reduction in food waste occurred from week 1 to week 2. Fridays and Mondays recorded the highest waste, while Wednesdays and Saturdays recorded the lowest. Excess food constituted most food waste in both weeks.
Discussion: Findings provide short-term household-level waste estimates and identify temporal patterns and composition of waste discarded. Although these results reflect a short monitoring period, they highlight peak waste days and main behaviors contributing to waste generation, which can help inform initiatives aimed at reducing food waste.

KEYWORDS

day-of-week patterns, food security, food waste diary quantification, household waste, Kuwait

1 Introduction

Food waste is a pertinent environmental concern that undermines the sustainable development of food systems globally (Wani et al., 2024). Food waste represents a dire ethical and environmental concern and a growing food security challenge (Wani et al., 2024). In countries such as Kuwait, which rely almost exclusively on food imports, food security is especially important (UN ESCWA, 2021; World Economic Forum, 2025). Food waste places an added financial strain on efforts toward sustainability, self-sufficiency, and ultimately progress toward Kuwait's 2035 Vision. The complex geopolitical climate of the region has exposed vulnerabilities across global food supply chains, reinforcing the need to reduce food waste and support local production to maintain national food security (Panghal et al., 2022; Fenech et al., 2011).

According to the 2024 United Nations Environmental Program (UNEP) Food Waste Index Report, an estimated 1.05 billion tons of food is wasted annually, yet an estimated 673 million people go hungry daily and 2.33 billion are food insecure (United Nations Environment Programme, 2024; World Health Organization, 2024). Although food waste occurs at every step of the supply chain, 60% of total food waste comes from households (United Nations Environment Programme, 2024).

Turning to Kuwait, the context for this study, the limited data available paints a grim picture of the food waste situation. Recent data from the Kuwait Environmental Public Authority shows that in 2019, 1.4 million tons of waste were generated by households alone (Environmental Protection Authority, 2022). On average, each resident generates 1.6 kg of municipal solid waste per day, close to double the global average of 0.74 kg per day (Environmental Protection Authority, 2022). Organic material accounted for 26% of total household waste, making food and biodegradable materials the largest defined category of waste. Similarly, data from a municipal solid waste characterization study in Kuwait estimates each person generates 1.7 kg of total waste daily and 35.1% of total waste is from food (Alshawaf et al., 2025).

The environmental implications of discarding excessive amounts of organic material are significant. Approximately 88% of total waste ends up in one of six landfills in Kuwait, while only 11% of waste is recycled (Environmental Protection Authority, 2022). The untreated organic waste from only three of these landfills emits an estimated 4.5 million tons of carbon dioxide gas annually (Environmental Protection Authority, 2022). Additionally, liquids from untreated organic waste produce highly toxic leachate, introducing a series of hazards to the environment by contaminating soil and groundwater (Dagwar and Dutta, 2024). However, these statistics should be interpreted cautiously as they are derived from national waste characterizations rather than household data, and therefore may not accurately represent household food waste generation.

Despite the gravity of the waste situation in Kuwait, there's a lack of evidence directly measuring food waste generated at the household level in Kuwait and the Gulf region. The current household waste estimates are based on extrapolations from municipal solid waste or national and regional studies, which limits our understanding of the amount and composition of food waste households typically generate. These estimates fail to capture temporal patterns, such as, day-of-week fluctuations and typical household practices that may contribute to food waste. To address these limitations, this study directly measures food waste at the household level, to provide a locally validated baseline and ultimately, improve understanding of the food waste situation in Kuwait.

Previous international studies measuring household food waste demonstrate how simple behavioral changes can effectively reduce waste. For example, a 6-month field experiment divided 80 Brazilian households into three categories: a meal planning group, a grocery list group, and a control group (Ramos et al., 2023). All groups weighed food waste daily, but only two groups were instructed to make behavioral changes. Interestingly, a progressive decline in waste occurred in all groups. The authors therefore concluded that the "measurement effect" was responsible for the reduction in waste, regardless of whether they meal planned or made grocery lists, i.e., households reduced waste because they started measuring it. This effect is also known as behavioral reactivity commonly associated with diary based food waste studies.

Different methods such as, self-reported surveys, food waste diaries, and waste composition analysis have been implemented to measure household food waste. Each methodological approach has its respective strengths and limitations. While self-reported surveys are cost-effective, they are prone to recall bias and can underestimate waste. On the other hand, food waste diaries paired with direct weighing of food waste provide more detailed information and have been used to generate national estimates of household food waste. Food diaries can also capture day-to-day patterns, which makes them useful to describe temporal patterns and monitor change, although estimates may underestimate quantities. Studies comparing waste composition analysis, which involves physical sorting and weighing of waste, show that diaries may underestimate household food waste by 7% to 40% (Quested et al., 2020). This underestimation may be the result of misreporting, behavioral reactivity during food waste monitoring, and measurement biases. In addition, measurements from diary-based food waste studies are not always comparable with other similar studies. For example, diary-based household food waste estimates in Europe range from 18.2 kg/person/year in Switzerland to 74.5 kg/person/year in Lithuania, but slight differences in methods such as household visits and follow-ups during the study period may have an effect on participant measurements and limit direct comparisons (Eičaite and BaleŽentis, 2024; Ammann et al., 2021; Hartikainen et al., 2025). While waste composition analysis may provide more accurate measurements of waste it is logistically difficult to implement at larger scales, especially for daily measurements over a consecutive period. For this reason, a food diary with direct weighing over a 15-day monitoring period was selected as a practical, cost-effective method that can include a larger number and broader sample of households, however food waste quantities should be interpreted with caution. The 15-day monitoring period was selected to provide repeated measurements on weekdays and weekends. This relatively short duration also helps with participant compliance while also allowing day-of-week comparisons. This study design is also consistent with previous food waste diary studies suggesting that 14-day monitoring periods can capture household food waste patterns (Hartikainen et al., 2025).

Few studies in Kuwait and the Gulf region have directly measured household food waste and identified peak waste days and behaviors that contribute to food waste. This study aims to measure household food waste over a 15-day period and determine when waste peaks and examine if waste decreases over the monitoring period. Findings from this study provide a locally validated household-level baseline that can inform national food waste reduction strategies in Kuwait. Prevention strategies can be tailored and focused around peak waste days, behaviors, and reasons for waste identified in this study during this short monitoring period. It was hypothesized that food waste would progressively decrease as the monitoring period progressed.

2 Materials and methods

A cross-sectional study was designed using household food waste logs collected over a 15-day period in Kuwait. A total of 160 families, each representing a different household, were recruited to measure and record daily food waste. Demographic characteristics were collected prior to the 15-day monitoring period, and a follow-up questionnaire collecting qualitative data was administered after.

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A 15-day monitoring period was selected to provide repeated waste measurements across weekdays and weekends, capturing two full weekly cycles. The short duration ensures participation compliance and reduces dropout, while still allowing day-of-week comparisons during the monitoring period. This method is consistent with previous diary-based household food waste studies that demonstrate a short 14-day period is sufficient to track household food waste trends while limiting participant burden and dropout rates (Hartikainen et al., 2025). Participants with permanent residence in any of Kuwait's governorates were selected using stratified random sampling. A short description of the study was provided to participants with data confidentiality disclaimers and requirements for participation. Items required for participation were access to a 30-gallon bag and a device to weigh trash bags (a luggage scale or similar tool). Participants were explicitly instructed to only measure food waste and exclude any other garbage or recyclable material. Households included in the study provided informed consent and had no anticipated travel plans within the study period. To ensure waste measured would reflect in-home food shopping and preparation behaviors, households were excluded if they dined out more than five times per week or relied exclusively on home catering services. This may skew the sample toward households that cook at home more often and limit generalizability to frequent dining-out households. Participants were required to be available to complete the post-monitoring period survey. All surveys were provided in both English and Arabic to ensure inclusion of a broader sample.

Of the 160 households, 10 were excluded for not completing the survey. An original questionnaire with a combination of both quantitative and qualitative questions was used to measure and understand practices and behaviors contributing to excess food waste. The survey is comprised of three parts, (1) a baseline questionnaire, (2) a 15-day monitoring period, and (3) a post-monitoring period survey. The baseline questionnaire included seven demographic questions, including education status, monthly income, and number of household members. Participants were then given either a paper or electronic copy of a 15-day waste log to record weight, number of bags, and composition of food waste daily. Lastly, 13 items were used to collect qualitative data after the monitoring period.

All participants were instructed to use a luggage scale to weigh waste bags and to use a 30-gallon trash bag when counting the daily number of bags. Each day, participants indicated the type of food waste, specifically if it contained excess or expired food or other unavoidable food waste. Instead of recording exact weight of waste, participants indicated the nearest weight category (<0.5, 1, 2, etc.). All responses were digitized, and the weight categories were converted to kilogram values during the analysis. Using categorical values rather than exact measurements may introduce measurement error and affect the total waste estimates, but day-of-week patterns are less likely to be affected since the same recording method was used throughout the study. The follow-up questionnaire included questions related to food purchasing, preparation, and preservation. Participants identified factors contributing to food waste, such as over-purchasing, over-cooking, and expired foods. Information about the category of food frequently wasted was also collected for each household.

TABLE 1 Demographic characteristics of participating households ($N = 150$).

Demographic characteristic	*N* (%)
Number of household members	
Less than 3	1 (0.67)
3–6	75 (50)
7–13	74 (49.3)
Education level	
Middle school	9 (6)
High school	25 (16.6)
Diploma	1 (0.67)
Bachelor's degree	87 (58)
Master's or Doctorate degree	28 (18.6)
Average monthly income	
Less than 1,000 KWD	6 (4)
1,000–2,000 KWD	60 (40)
2,000–3,000 KWD	46 (30.6)
More than 3,000 KWD	38 (25.3)
Weekly average food budget	
Less than 50 KWD	36 (24)
50–100 KWD	61 (40.6)
100–150 KWD	39 (26)
More than 150 KWD	14 (9.3)
Number of household staff (maids, drivers, cooks)	
None	22 (14.6)
1	38 (25.3)
2	47 (31.3)
3	29 (19.3)
4 or more	14 (9.3)
Weekly frequency of eating out	
None	10 (6.6)
Once a week	48 (32)
Twice a week	48 (32)
Three times a week	33 (22)
4 or more times per week	11 (7.3)
Average number of garbage bags per day	
1 small garbage bag	47 (31.3)
1 medium garbage bag	51 (34)
1 large garbage bag	35 (23.3)
2–3 medium bags	17 (11.3)

Lastly, two questions examined whether participation in the 15-day monitoring period influenced behaviors and attitudes related to food waste.

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3 Results

3.1 Demographic characteristics

Table 1 presents the demographic characteristics of the 150 households included in the analysis. The number of household members was approximately equal; 50% reported 3–6 members and 49.3% had 7–13 members. The remaining household (0.67%) reported less than 3 members. Using mid-point values, the mean household size is estimated to be 7.2 members per household, resulting in an estimated average of 1,079 participants across 150 households.

The majority ($N = 87$, 58%) of participants have a bachelor's degree, followed by 28% with a post-graduate degree, 25% with a high school diploma, 9% with a middle school education. 40% of participants generate a household income between 1,000 and 2,000 KWD, and 40.6% spend between 50 and 100 KWD on food weekly. Most households employed one (25.3%) or two (31.3%) household aid workers, with approximately 30% employing 3 or more. 64% of households reported eating out once or twice per week, and a minority (6.6%) reported rarely or never eating out. 34% of households dispose of 1 medium garbage bag daily, followed by 31.3% estimating 1 small garbage bag daily.

3.2 Comparison of weekly food waste patterns

Food waste trends were similar in Week 1 and Week 2 (Table 2). Households reporting no waste increased from (14.4% to 16.9%, a 17.9% change). The total weight of food waste slightly decreased from an average of 1.79 kg/HH/day in Week 1 to 1.69 kg/HH/day in Week 2. Excess food (57.6% to 60%) accounted for most of the food waste, followed by expired food (13.3% to 14.7%).

3.3 Comparison of household food waste patterns by day of week

Table 3 presents the weight and type of food waste by day-of-week. Peak waste days were Friday followed by Monday, the lowest total waste was observed on Wednesday and Saturday. Friday recorded the highest total waste (1.97 kg) accounting for 16.2% of total waste per week. Mondays were the second highest waste days (1.88 kg) with the least (11.7%) proportion of households generating no waste. No waste peaked on Saturday (18.7%), corresponding to the second lowest total waste weight (1.61 kg or 13.1% of weekly total). Thursday followed closely with (18%) reporting no waste, however, total waste on this day (1.71 kg) did not rank among the lowest. The lowest waste day was recorded on Wednesday (1.59 kg) accounting for 13.1% of weekly total waste generated. Excess food consistently accounted for most food waste ranging from (62.7 to 55.3%) of total waste. Expired and unspecified food waste were smaller contributors to total waste with ranges of 9.7–24% and 11.7–18.7% respectively.

3.4 Self-reported practices and behaviors to limit food waste

Tables 4–6 present results from the questionnaire distributed after the 2-week food waste monitoring period. The most common causes of food waste reported by households were expired food (73.3%) and excess food (62.7%). Most households estimated disposing less than 10% of food purchases (44%), followed by 22.7% estimating discarding 10–20% of food purchases. Fruits and vegetables were the most frequently discarded food items followed by bread or baked goods (19.3%) (Table 4).

Table 5 describes the food planning, preparation, and preservation strategies implemented to reduce food waste. 61% of participants reported that they sometimes plan meals before food purchases, while 18% reported that they never plan meals before grocery shopping to limit food waste. Furthermore, 68% reported always preparing a grocery list while 11% reported they never prepare a list before food shopping. 72% of households reported they sometimes take portion size into consideration during meal preparation while 42% report being always mindful of portion size. Regarding preservation techniques, the majority of households (99%) freeze perishable foods while only 1% of households vacuum-seal perishable items. 87% of participants report always following best before and expiration dates before deciding to discard or use packaged food items.

3.5 Self-reported food disposal and food waste awareness

Table 6 presents disposal practices and attitudes after the 2-week monitoring period. Excess food was most often either donated to food banks (46%) or discarded in garbage (46%), with a smaller percentage of households reporting feeding animals' leftovers (39.3%). Expired food was most often disposed of (39.3%) in garbage, with fewer households reporting feeding it to animals (4.7%), and (22.7%) that use judgment to decide if expired food is edible. Furthermore, 29.3% of households report that they always donate food, followed by 40% reporting they sometimes do, and 20.7% indicating they never do. Interestingly, nearly all households (98%) indicated that the 2-week monitoring period helped them reassess their food waste behaviors.

4 Discussion

4.1 Main findings

It was hypothesized that monitoring food waste daily would increase awareness and lead to a progressive decline of waste during the monitoring period. The study findings are consistent with our hypothesis, a small decline in household food waste from Week 1 to Week 2 (Table 2), which may be consistent with short-term behavioral reactivity during monitoring. Additionally, the increase in households reporting no food waste in Week 2 may further support the possibility of short-term behavior change during monitoring (Table 2). In both weeks, excess food accounted for most of the waste disposed, suggesting that cooking and purchasing

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TABLE 2 Comparison of household food waste (weight and type) in week 1 and week 2.

Waste measure	Week 1 daily average *N* (%) /day kg/HH/day[a]	Week 1 total (kg/HH/wk or N/wk)$_b$	Week 2 daily average *N* (%) kg/HH/day[a]	Week 2 total (kg/HH/wk or N/wk$_b$)	Percent change (%)
Total waste (kg)[c]	1.79	12.5	1.69	11.7	−5.8
No food waste	21.6 (14.4)	151	25.4 (16.9)	178	17.9
Type of food waste					
Excess food	86.4 (57.6)	605	90 (60)	630	4.2
Expired food	19.9 (13.3)	139	22 (14.7)	154	10.8
Non-Edible	22.1 (14.7)	155	12.6 (8.4)	88	−43.2

N = 150.
[a]*N* represents the average number of households per day reporting each variable, the percentage of total households (*N* = 150) in parentheses. kg/HH/day: Kilogram per household per day.
[b]*N* represents the total number of households per week reporting each variable. kg/HH/wk: Kilogram per household per week.
[c]Total Waste (kg) was calculated by converting the reported weight category of each waste bag into kilograms and totaling the values for week/day. 0.5 kg was used to calculate the weight for bags in the less than 1 kg category.

TABLE 3 Daily average household food waste weight (kg/HH/day) and type of food waste by day-of-week (*N* = 150).

Day of week	No Waste *N* (%)	Total Waste (kg/HH/day)[a]	Percentage of weekly total waste (%)	Excess food *N* (%)	Expired food *N* (%)	Non-Edible food *N* (%)
Sunday	20 (13.3)	1.71	14	92 (61.3)	24 (16)	20 (13.3)
Monday	17.5 (11.7)	1.88	15.4	89 (59.3)	19.5 (13)	17.5 (11.7)
Tuesday	18 (12)	1.69	13.9	88 (58.7)	20 (13.3)	21.5 (14.3)
Wednesday	25 (16.7)	1.59	13.1	94 (62.7)	22.5 (15)	25 (16.7)
Thursday	27 (18)	1.71	14.1	84 (56)	22 (14.7)	27 (18)
Friday	25.5 (17)	1.97	16.2	87.5 (58.3)	14.5 (9.7)	25.5 (17)
Saturday	28 (18.7)	1.61	13.3	83 (55.3)	24 (16)	28 (18.7)

[a]kg/HH/day: Kilogram per household per day.

more food than needed were likely the main contributors of household food waste even as total waste declined (Table 2). These findings indicate that food waste reduction efforts should focus on skills such as, portion sizes and meal planning to prevent edible food from ending up in landfills.

In both weeks, food waste was highest on Fridays (295 kg, 16.2% of weekly total) (Table 3). This pattern may be related to routine weekly schedules and social practices in Kuwait, as weekends tend to include more social activities. Food waste prevention strategies can tailor messaging to specifically highlight how weekends and possible social gatherings may lead to excessive amounts of food waste, while also increasing food donation services during these times to distribute leftovers to those in need. Across all days, excess food accounted for most discarded food, while expired and unspecified food waste contributing to smaller portions of waste, further emphasizing that reduction efforts should focus on preventing over-preparation.

The questionnaire distributed after the 15-day monitoring period contextualized the direct measurements collected and allowed participants to reflect on their experience. Interestingly, majority of households reported expired food as the main source of their food waste, while excess food accounted for most of the disposed food during the monitoring period (Tables 2, 4). This observed discrepancy suggests a gap between perceived and actual waste, or that participants were less likely to indicate that excess food was the cause of their food waste.

Participants also indicated fruits and vegetables most frequently discarding, highlighting an opportunity for prevention strategies to focus on produce storage and use. Portion control techniques were inconsistent with 72% reporting they sometimes keep portion control in mind when cooking food, which is consistent with excess food contributing to most of the food waste (Table 5). Food disposal practices revealed that nearly half of households regularly donate excess food to local food banks or community fridges, suggesting that improving food donation services may further reduce national food waste (Table 6). Lastly, the high level of reported awareness after the monitoring period suggests that short-term food waste diaries may increase self-awareness and be a useful tool in food waste prevention and reduction strategies, although longer term studies are needed to observe whether these changes remain long after the monitoring period.

4.2 Comparison to other studies

Comparing findings from this study to similar international household food waste studies revealed that Kuwaiti households generate greater food waste. A study conducted in Ontario, Canada on 100 households during the COVID-19 pandemic found that households discard on average 2.81 kg of food per week, whereas results from this study demonstrate that each Kuwaiti household discarded on average 12.1 kg of waste per week (Table 2) (Everitt

TABLE 4 Self-reported reasons, amount, and types of food waste after the 2-week observation period ($N = 150$).

Question	Response option	*N* (%)
What are the main reasons that lead to food waste in your household?[a]	Expiry or rancidity	110 (73.3)
	Extra food	94 (62.7)
	Not eating leftovers	69 (46.0)
	Lack of meal planning	16 (10.7)
	Buying more than needed	20 (14.7)
	Other	10 (6.7)
Estimate the percentage of food purchases that are disposed?	Less than 10%	67 (44.7)
	10–20%	34 (22.7)
	21–50%	25 (16.7)
	More than 50%	2 (1.3)
	Not sure	22 (14.7)
What were the most common types of produce/food items disposed of?[a]	Fruits	78 (52)
	Vegetables	74 (49.3)
	Dairy products	25 (16.7)
	Meat or poultry	7 (4.7)
	Bread and baked goods	29 (19.3)
	Leftovers	58 (38.7)
	Canned food	10 (6.7)
	Take-out meals	51 (34)
	Other	0 (0)

[a]Multiple-selection allowed.

et al., 2022). The mentioned study measured food waste though direct weighing of garbage bags over a week period a technique similar to the methodology of this study. However, only single-family homes were included in Canadian study, while in Kuwait, multi-generational households are common, contributing to the higher amounts of food waste observed. Additionally, this study was conducted during the height of the COVID-19 pandemic, when quarantines and lockdowns may have influenced food waste related behaviors during this unprecedented time.

Similar studies examined how awareness and measurement techniques influence household food waste behaviors and reporting. In a field experiment on 359 Swiss households, researchers assessed accuracy of food waste measurements by comparing three common methods: a self-reported survey, waste diary, and direct waste collection over a 1–2-week period (Merian et al., 2024). In addition to the different methods used to quantify waste, each group was further divided into participants that were aware of the purpose of the study and those unaware food waste was the focus of the experiment. Their results demonstrate that participants in the unaware direct measurement group generated higher food waste, averaging 0.8 kg per household member per week, while those aware generated lower amounts of food waste, averaging 0.69 kg per household member per week. Findings from this study suggest that when participants are aware, they may modify their behavior and generate less food waste.

In the present sample households had an average of 7.2 members per household, generating on average 1.68 kg of food waste per household member per week (Table 2). Even when using similar waste measurement methods, food waste generation was substantially higher in Kuwaiti households compared to Western and European households. Our findings are also exceed estimated from the EPA, which indicate that each resident generates 1.6 kg of municipal solid waste per day (Environmental Protection Authority, 2022). Overall, these comparisons highlight the substantially higher amounts of food waste generated in Kuwait, although, household size, cultural practices, and measurement methods may explain the striking differences observed.

4.3 Strengths and limitations

To our knowledge this study is the first attempt to quantify and examine household food waste in Kuwait. A major strength of this study is in the design itself; households did not only measure food waste, but qualitative data was collected to identify behaviors and practices causing food waste generation. Additionally, a large sample of households ($N = 150$) were analyzed representing approximately 1,079 participants, which enhances the generalizability of these findings in the context of Kuwaiti society and in the broader Arab gulf-state region. Furthermore, the relatively long monitoring period allowed for both day-of-week and week-to-week analyses. By identifying fluctuations in waste generation, these results can guide and inform public initiatives aimed at reducing household food

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TABLE 5 Self-reported food planning, purchasing, preparation, and preservation strategies to reduce food waste.

Question	Response option	*N*
Do you make an effort to plan meals and food purchases to limit food waste?	Yes, always	45 (30.0)
	Yes, sometimes	61 (40.7)
	No, rarely	26 (17.3)
	No, never	18 (12)
How do you store perishable foods to extend their life[a]	Refrigerate	81 (54.0)
	Freeze	99 (66.0)
	Air-tight container	28 (18.7)
	Vacuum seal	1 (0.7)
	Other methods of food preservation (canning, pickling, etc.)	6 (4)
Do you care about best before or expiration date when deciding to use or store food?	Always	87 (58.0)
	Sometimes	50 (33.3)
	Rarely	10 (6.7)
	Never	3 (2.0)
Do you plan meals in advance?	Daily	61 (40.7)
	Weekly	31 (20.7)
	Monthly	17 (11.3)
	Rarely	30 (20.0)
	Never	11 (7.3)
Do you prepare a grocery list?	Always	68 (45.3)
	Sometimes	53 (35.3)
	Rarely	18 (12.0)
	Never	11 (7.3)
Do you take portion size into consideration to limit food waste?	Always	42 (28.0)
	Sometimes	72 (48.0)
	Rarely	34 (22.7)
	Never	2 (1.3)

$N = 150$.
[a]Multiple-selection allowed.

TABLE 6 Self-reported food waste disposal practices and attitudes after 2-week survey ($N = 150$).

Questions	Response options	*N* (%)
How do you dispose of excess food[a]	Food bank/community fridge	69 (46)
	Garbage	69 (46)
	Feed animals	59 (39.3)
	Other	5 (3.3)
How do you dispose of expired food?[a]	Garbage	59 (39.3)
	Ensure food is edible regardless of expiration date	34 (22.7)
	Feed animals	7 (4.7)
	Depends on type of food	64 (42.7)
Did this experiment help reassess your food waste?	Yes	147 (98)
	No	3 (2)

[a]Multiple-selection allowed.

waste and, in turn, create more sustainable food systems in the country. Additionally, the inclusion of self-reported data on food preparation, purchasing, and preservation strategies further contextualizes the results collected during the food waste monitoring period.

This study, however, is not without limitations. The reliance on self-reported data and short monitoring period limits the accuracy and generalizability of the findings. Although participants were thoroughly instructed on how to measure food waste, including what items to include and size of garbage bag to use, this does not guarantee that participants consistently or accurately followed the methods provided prior to the experiment. A key limitation is due to the measurement bias from the weight recording method. By choosing the nearest weight category rather than recording the exact weights, and later converting categories to kilograms, this may introduce measurement errors and may bias total waste estimates either by over-estimating or under-estimating. In addition, participants may underreport or have different classifications of food waste. Due to these limitations, estimates of waste quantities should be interpreted with caution. However, the day-of-week patterns may be less likely affected by this limitation since the weight recording method remained consistent during the monitoring period.

Variability in bag size, food items included, and weighing procedures further limit the accuracy of the data collected. Additionally, the duration of the experiment may not be sufficient to measure variations and fluctuations in household food waste over time. Therefore, the modest decline in food waste observed should be interpreted as a short-term effect during the monitoring period, rather than a behavior change that lasts beyond this period. Most households in this sample were larger highly educated families, earning middle-high incomes, with more domestic staff that may have different food management practices, reducing the generalizability of these findings to the broader Kuwaiti population.

4.4 Future implications and research directions

On average, each household discarded 1.78 kg of waste per day, most of which was edible food. This relatively high volume of waste highlights the critical need for targeted interventions aimed at reducing household food waste in Kuwait. Public campaigns should focus on promoting portion control, conservative food purchasing, and moderation in meal preparation. Since waste peaked on Fridays, campaigns may be more effective if messaging includes preventing food waste on the weekends when family gatherings and social events are more likely to take place.

Beyond public campaigns, although household donation practices in this sample were high, the existing community fridges located in most residential areas across Kuwait have several operational challenges, specifically, maintenance issues, hygiene, and the quality of donated food. Community-wide efforts or Co-operative society management is needed to help maintain these fridges, ensuring food safety, and reduce disposal of edible food. Additionally, establishing food composting programs within neighborhoods would also help alleviate the household food waste burden, especially since households determined most of food waste as edible. Furthermore, public initiatives need to emphasize the environmental, economic, and food security implications of unsustainable food waste behaviors. Given that Kuwait heavily relies on foreign food imports and in a particularly contentious geopolitical climate, food waste is not only a sustainability burden but a national food security risk as well.

Future research efforts should be directed on quantifying food waste over longer periods of time, including months such as Ramadan, when large meals and communal gatherings are frequent. More research in Kuwait with a broader sample is needed determine if the same day-of-week patterns persist over longer monitoring periods. In addition to households, waste generated by food service establishments should also be investigated to quantify their burden on the national food system. Lastly, innovations in food science, specifically through the development of smart-packaging technologies, are needed to prolong the shelf life of fresh produce and minimize avoidable food waste. The implementation of both technological solutions and culturally tailored public awareness campaigns will be essential for long-term food security and progressing toward halving food waste by 2030 in Kuwait.

5 Conclusions

Despite only a slight reduction in measured food waste observed from Week 1 to Week 2, nearly all participants reported being increasingly mindful of behaviors contributing to the waste burden. This experiment suggests that a short-term monitoring period can increase awareness and be associated with modest short-term reductions in food waste, although this effect may be due to behavioral reactivity during the monitoring period. Analyzing food waste by day-of-week revealed distinct temporal patterns, with Fridays recording the highest amount of waste observed in this sample. This pattern may relate to the religious and social significance of the day, however longer studies with a broader range of households are needed to determine if these day-of-week patterns generalize to the wider Kuwaiti population.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding authors.

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. Written informed consent was obtained from all subjects involved in the study.

Author contributions

SAlA: Supervision, Writing – original draft, Formal analysis, Software, Investigation, Resources, Writing – review & editing, Data curation, Visualization, Methodology, Project administration, Validation, Conceptualization. WA-O: Writing – original draft, Formal analysis, Writing – review & editing, Software, Visualization, Data curation, Resources, Investigation, Conceptualization. SAlt: Writing – review & editing, Writing – original draft, Software, Formal analysis, Investigation, Data curation, Visualization, Validation, Conceptualization. AA: Conceptualization, Writing – review & editing, Investigation, Software, Visualization, Writing – original draft, Resources, Data curation, Formal analysis. BR: Writing – original draft, Resources, Formal analysis, Visualization, Writing – review & editing, Investigation, Conceptualization, Software, Data curation. SAbu: Resources, Conceptualization, Formal analysis, Data curation, Visualization, Writing – review & editing, Investigation, Writing – original draft, Software.

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References

Alshawaf, M., Alwaeli, M., Pikon, K., and Alolayan, M. (2025). The characterization of municipal solid waste in Kuwait: a pathway to reform the waste management sector. *Discover Sustain.* 6:208. doi: 10.1007/s43621-025-01041-y

Ammann, J., Osterwalder, O., Siegrist, M., Hartmann, C., and Egolf, A. (2021). Comparison of two measures for assessing the volume of food waste in Swiss households. *Resour. Conserv. Recycl.* 166:105295. doi: 10.1016/j.resconrec.2020.105295

Dagwar, P. P., and Dutta, D. (2024). Landfill leachate a potential challenge towards sustainable environmental management. *Sci. Total Environ.* 926:171668. doi: 10.1016/j.scitotenv.2024.171668

Eičaite, O., and BaleŽentis, T. (2024). Disentangling the sources and scale of food waste in households: a diary-based analysis in Lithuania. *Sustain. Prod. Consum.* 46, 195–207. doi: 10.1016/j.spc.2024.02.018

Environmental Protection Authority (2022). *Waste Management Atlas of Kuwait*. Kuwait: EPA.

Everitt, H., van der Werf, P., Seabrook, J. A., Wray, A., and Gilliland, J. A. (2022). The quantity and composition of household food waste during the COVID-19 pandemic: a direct measurement study in Canada. *Socio-Econ. Plan. Sci.* 82:101110. doi: 10.1016/j.seps.2021.101110

Fenech, M., El-Sohemy, A., Cahill, L., Ferguson, L. R., French, T.-A. C., Tai, E. S., et al. (2011). Nutrigenetics and nutrigenomics: viewpoints on the current status and applications in nutrition research and practice. *J. Nutrigenet. Nutrigenomics* 4, 69–89. doi: 10.1159/000327772

Hartikainen, H., Kostensalo, J., and Riipi, I. (2025). Tackling the challenges of food waste diary studies — testing strategies with Finnish data. *Waste Manag.* 202:114844. doi: 10.1016/j.wasman.2025.114844

Merian, S., O'Sullivan, K., Stöckli, S., Beretta, C., Müller, N., Tiefenbeck, V., et al. (2024). A field experiment to assess barriers to accurate household food waste measurements. *Resour. Conserv. Recycl.* 206:107644. doi: 10.1016/j.resconrec.2024.107644

Panghal, A., Mor, R. S., Kamble, S. S., Khan, S. A. R., Kumar, D., and Soni, G. (2022). Global food security post COVID-19: dearth or dwell in the developing world? *Agron. J.* 114, 878–884. doi: 10.1002/agj2.20932

Quested, T. E., Palmer, G., Moreno, L. C., McDermott, C., and Schumacher, K. (2020). Comparing diaries and waste compositional analysis for measuring food waste in the home. *J. Clean. Prod.* 262:121263. doi: 10.1016/j.jclepro.2020.121263

Ramos, G. J., Borges, J., Domingues, C., and van Herpen, E. (2023). Reducing food waste by simply measuring it: insights from interventions to reduce household food waste. *Br. Food J.* 126. doi: 10.1108/BFJ-02-2023-0092

UN ESCWA (2021). *Arab Food Security Monitoring Framework — Country Reviews: Kuwait*. Beirut: UN ESCWA.

United Nations Environment Programme (2024). *Food Waste Index Report 2024*. Think Eat Save: Tracking Progress to Halve Global Food Waste. Nairobi: United Nations Environment Programme.

Wani, N. R., Rather, R. A., Farooq, A., Padder, S. A., Baba, T. R., Sharma, S., et al. (2024). New insights in food security and environmental sustainability through waste food management. *Environ. Sci. Pollut. Res. Int.* 31, 17835–17857. doi: 10.1007/s11356-023-26462-y

World Economic Forum (2025). *The GCC imports 85% of its food — here's how it is increasing food security through innovation*. Available online at: https://www.weforum.org/stories/2025/02/gulf-food-security-innovation/ (Accessed October 6, 2025).

World Health Organization (2024). *Hunger numbers stubbornly high for three consecutive years as global crises deepen*: UN report. (Geneva). Available online at: https://www.who.int/news/item/24-07-2024-hunger-numbers-stubbornly-high-for-three-consecutive-years-as-global-crises-deepen--un-report (Accessed October 6, 2025).