

RESEARCH ARTICLE

Household Food Waste and Its Relationship with Consumer Demographics and Behaviour: A Case Study from Kegalle District, Sri Lanka

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Abstract: Household-level food waste presents a growing concern worldwide, contributing substantially to environmental degradation and economic losses. This study aimed to investigate the amount of household food waste generated and examine its relationship with consumer demographic characteristics and behavioural patterns. A total of 75 volunteer households from the Alpitaya Grama Niladhari Division in the Kegalle District, Sri Lanka, were assessed to explore the relationships between food waste generation, socio-economic factors, and consumer behaviour. Data on consumer demographics and behaviour were collected through a structured questionnaire administered to individuals primarily responsible for food preparation and shopping within the selected households. Food waste generated in each household was quantified for three consecutive days at 24-hour intervals. Data analysis revealed that the mean avoidable food waste and unavoidable food waste generated within one household per day were 262.5 ± 207.0 g (mean $\pm$ SD) and 368.7 ± 141.7 g, respectively. Therefore, the total food wastage per household per day was 631.2 ± 286.4 g. The results of the multiple linear regression analysis showed that the amount of household food waste generation significantly differed ($p < .05$) based on several demographic factors: participants' age, number of family members, and income level. With respect to consumer behaviour, household waste generation was significantly impacted by the preparation of a shopping list ($p < .05$). Finally, this study recommends making a

food shopping list before shopping as an effective way to reduce total household food waste generation.

Keywords: food waste, consumer behaviour, consumer demographics, interactions

INTRODUCTION

In recent years, issues related to food waste and losses have gained growing recognition as critical global challenges. In 2022, global food waste from the household, food service, and retail sectors was estimated at 1.05 billion tons. This quantity corresponds to an average of 132 kg per capita annually, with households alone accounting for 79 kg per person (UNEP, 2024). According to recent data from the United Nations, global hunger remains a significant challenge. As of 2023, approximately 733 million people worldwide were chronically undernourished, representing about 9.1% of the global population, marking an increase of 152 million since 2019, impacting food security (FAO et al., 2024). Excessive food wastage during the farm-to-table process is a major global issue, contributing to economic losses and food insecurity. Furthermore, it is reported that food wastage is significantly higher in developed countries compared to developing and underdeveloped countries (Kim, 2014). Losses and waste of food can happen throughout the food supply chain, where waste can be generated from wholesale markets, retail markets, and finally at the consumer level in households and the food service sector (Mirabella et al., 2014).

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Recent data from global organisations emphasise the substantial contribution of households to global food waste. To elaborate, the United Nations Environment Programme's Food Waste Index Report 2024 reveals that households accounted for approximately 60% of the 1.05 billion tons of food wasted globally in 2022 (UNEP, 2024). Therefore, it is important to find proper approaches to reduce food waste generation at the household level. Recent studies revealed that most household food waste is produced due to inappropriate consumer behaviours such as buying poor-quality food, improper storage, not consuming the food within the recommended time period, improper meal planning, aversion to eating leftover food, and lack of awareness about the impact of food waste on the environment and economy (Reich & Foley, 2014).

The behaviour of wasting food may cause large cultural variations across countries, necessitating deeper investigation in different geographic regions (Yildirim et al., 2016). Household food wastage depends on economic growth, urbanization, cultural factors, and socio-demographic factors prevailing in that country or area (McCarthy & Liu, 2017). Findings of a study carried out in Hungary using 100 households showed that the estimated amount of total food waste per capita was 68.04 kg annually (Szabó-Bódi et al., 2018). A similar study carried out using 192 households in eastern Haifa, Israel, showed that the daily generation rate of household waste was 0.573 kg per capita and the average total food waste generation rate was 0.26 kg per capita per day (Elimelech et al., 2018). Another study conducted in Finland using 380 households revealed that the amount of food waste generated ranged from 0 to 160 kg/year, with an average annual food waste being 23 kg per capita, 63 kg per household, and in total about 120 million kg/year (Silvennoinen et al., 2014).

Food waste generation differs across countries and is shaped by factors such as economic development, urbanisation, globalisation, cultural norms, modernisation of societies, and the socio-demographic characteristics of each region (McCarthy & Liu, 2017). According to Schott and Andersson (2015), Langen et al. (2015), Edjabou et al. (2016), and Elimelech et al. (2018), the most wasted global food categories are vegetables and fruit products, bread, and cereal-based products, respectively.

Food waste can be divided into two categories: avoidable and unavoidable, based on its edibility before or at the time of disposal. Avoidable food waste includes food or drinks that were in an edible state at some point before disposal, while unavoidable food waste includes parts of food that are not edible at any given time, for instance, fish bones and the peel of a pineapple. According

to many published studies, a considerable amount of food waste generated in households belongs to the avoidable food waste category. For example, Schott and Andersson (2015) reported that 35% of the food waste generated in Swedish households is avoidable. Similarly, it is reported that in UK households, about 4.2 million tons of avoidable food and drink are wasted each year (WRAP, 2011).

Extending the household food waste generation to Asia, Bhatia and Sharma (2023) conducted a comprehensive study to identify the determinants of household food waste generation in the National Capital Region of India, using data from 372 households and applying structural equation modelling. The study revealed that financial consciousness and effective management of food consumption significantly reduce food waste generation. The COVID-19 pandemic has notably influenced consumer food behaviours, leading to changes in food purchasing and consumption patterns. These shifts have further complicated the dynamics of household food waste generation. Apart from that, a different study by Kuna and Kata (2020), which focused on consumers in Telangana and Andhra Pradesh, in India, found that health concerns and financial uncertainties often prompted more cautious food purchasing behaviours. In addition, food waste was shown to be a major cause of greenhouse gas emissions in Bangladesh, India, and the Maldives (De et al., 2023). These findings highlight the urgent need for South Asian governments to implement food waste reduction strategies as part of their climate action plans.

Similar food waste challenges were reported in Sri Lanka. In 2017, estimates indicated that the Colombo Municipal Council area accounted for around 353 tons of food waste per day, which is nearly half of the total solid waste generated in the area. Households were identified as the primary source of food waste, followed by the food service sector (approximately 110 tons per day) (FAO, 2018). In recent years, Sri Lanka has put a big emphasis on advancing waste management policies. For instance, the National Policy on Waste Management, approved in 2020, offers a comprehensive framework for the management of solid, liquid, and gaseous wastes, with the goal of fostering sustainable practices across multiple sectors (Ministry of Environment, 2020).

A study conducted in the Gampola Urban Council area by Wijerathna et al. (2012) found a proportional relationship between household income and the generation of total household waste, kitchen waste, and soft plastic. This suggests that higher-income households tend to produce more waste across multiple categories. Also, a preliminary assessment conducted by FAO/IWMI

in the Colombo Municipal area in 2017 states that middle to high-income families generate more food waste than low-income households (FAO et al., 2018).

Currently, there is a lack of research findings in the Sri Lankan context that rely on direct household food waste measurements based on standardized methodologies such as the FUSIONS framework (Östergren et al., 2014), to explore the underlying reasons for household food waste generation and the influence of socio-economic and consumer behavioural factors. Therefore, the present study aims to examine food waste generation, consumer demographics, and consumer behaviour related to food preparation, purchasing, and waste disposal in the households in Alpitiya Grama Niladhari Division, Kegalle District, Sri Lanka, to trace demographic and behavioural factors influencing food waste generation.

MATERIALS AND METHODS

This study was conducted in the Alpitiya Grama Niladhari Division in the Warakapola Divisional Secretariat, Kegalle, Sri Lanka, which had 221 households according to Grama Niladhari records obtained in the year 2020. The survey was administered to a sample of 75 households using the convenience sampling method and was conducted between May to December 2022. A convenience sampling approach was adopted due to practical constraints such as limited availability of financial and logistical resources. Our study did not involve any sensitive or high-risk topics, and the participants were generally considered low-risk. Furthermore, all participants provided informed consent prior to their voluntary participation and confidentiality of data was strictly ensured throughout the research process.

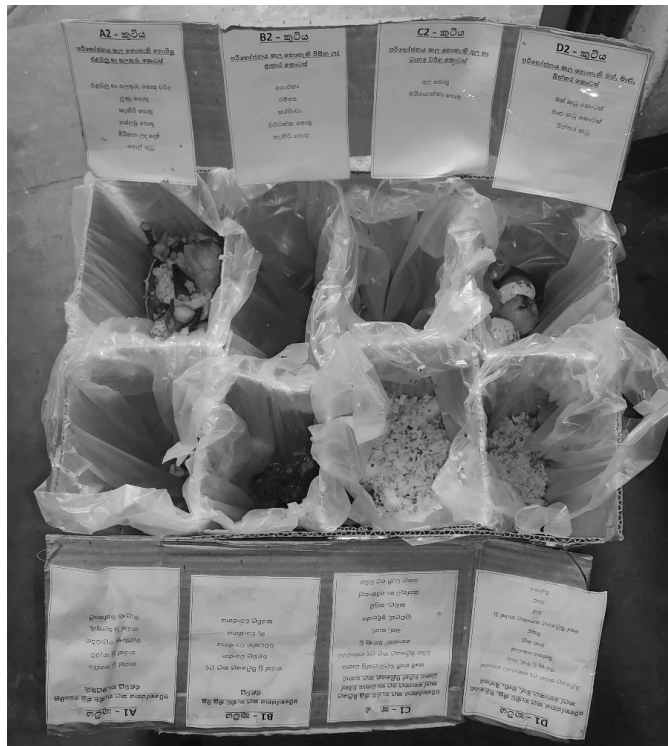
The methodology employed for assessing household food waste in this study was primarily based on the Food Use for Social Innovation by Optimising Waste Prevention Strategies (FUSIONS) framework developed under the European Union's FP7 program. This framework provides a structured and standardized approach for the quantification of food waste, encompassing components such as goal definition, system boundary setting, waste classification, data collection, and data quality assessment (Östergren et al., 2014). However, to enhance contextual relevance and feasibility within the Sri Lankan setting, certain modifications were made. These included the simplification of household waste recording tools to account for varying literacy levels, the use of culturally adapted survey instruments in local languages, and

the consideration of informal waste disposal practices commonly observed in urban, semi-urban and rural households. Additionally, food waste categories were slightly adjusted to reflect local consumption patterns and dietary habits. These adaptations allowed for a more accurate and practical assessment of household food waste in Sri Lanka while maintaining methodological alignment with the core principles of the FUSIONS framework.

A questionnaire was developed by referring to published studies with a similar scope (Edjabou et al., 2016; Stefan et al., 2013; Yildirim et al., 2016). Data were collected using a researcher-administered questionnaire that contained closed-ended questions on two basic areas: participants' socio-economic factors and their behavioural characteristics. Responses were gathered from individuals in each home who are directly involved in food preparation and purchasing. The socio-economic factors examined were gender, age, education level, occupation, monthly household income, number of family members, and number of family members under 18 years of age. Behavioural characteristics were considered as frequency of shopping (for fruits and vegetables, dry foods, and meat and fish), shopping place (for fruits and vegetables, dry foods, and meat and fish), preparation of a shopping list, monthly expenditure on food, and meal ordering frequency from outside.

The generated household food waste was measured by introducing a specially designed waste collecting bin that had eight distinct chambers named as follows: avoidable raw fruits and vegetable waste (A1), unavoidable raw fruits and vegetable waste (A2), avoidable cooked fruits and vegetable waste (B1), unavoidable cooked fruits and vegetable waste (B2), avoidable cereals, grain/flour-based and tuber waste (C1), unavoidable cereals, grain/flour-based and tuber waste (C2), avoidable animal-derived waste (D1), and unavoidable animal-derived waste (D2) with examples in native language. To ensure accurate categorisation, households were verbally educated about each food waste category using clear examples. Additionally, labelled waste collection bins containing sample representations of each category were distributed to facilitate easy identification and accurate segregation (Figure 1).

Food waste generation in each household was measured over three consecutive days, including at least one weekday and one weekend day, with data collected at 24-hour intervals due to constraints in human resources available for data collection and waste quantification.

Figure 1*Waste Collection Bin Used in the Present Study*

Note. Specially designed waste collection bin with eight separate chambers, each labelled for a specific category of food waste and examples of food items corresponding to each category were provided to facilitate easy and accurate waste separation.

For every household, the number of cases (incidences) where avoidable food waste was generated was noted, and the reasons for generating such waste were identified by following a brief interview with the participants.

In this study, household food waste generation was assessed based on waste produced within the home. Food waste generated by family members who travel outside for work and consume meals elsewhere (e.g., packed food or dining out) was not included in the analysis due to data collection limitations.

The software packages R and R Studio were used to statistically analyse all the data collected. Descriptive statistics and inferential statistics were used to define and explain the socio-economic and consumer behaviour factors of the sample. The mean weight and standard deviation were calculated for the eight food categories and for the total amount of avoidable, unavoidable, and overall food waste.

Multiple linear regression analysis was carried out to develop a model for total food wastage (including both avoidable and unavoidable food waste) based on socio-economic and consumer behaviour factors (independent variables) under 95% confidence level. The assumptions of multiple regression analysis were checked, including multivariate normality, independence of residuals, constant variance (homoscedasticity), and absence of multicollinearity.

RESULTS AND DISCUSSION

Demographic information of the participants

Table 1 shows the demographic information gathered from 75 households that participated in the study. The majority of the respondents were females (90.7%) and predominantly between 31–40 years of age (30.7%). The size of the families ranged from one to six members. Based on the income level, about 44.0% of the participants

represented the income range of 50,001-75,000 LKR, and with respect to occupation, 49.3% of the respondents

were unemployed. Furthermore, 41.3% of families did not have any children under the age of 18 years.

Table 1

Demographic Information of the Participants

Demographic information	Category	%	Demographic information	Category	%
1.Gender	Male	9.3	5.Income (LKR)	<25,000	2.7
	Female	90.7		25,000-50,000	30.7
2.Age (years)				50,001-75,000	44.0
	20-30	6.7		75,001-100,000	17.3
	31-40	30.7		> 100,000	5.3
	41-50	16.0	6.Family members	1	8.0
	51-60	22.7		2	22.7
	61-70	21.3		3	32.0
3.Education	> 70	2.7		4	26.7
	O/L	37.3	7.Family members <18 years age	5	9.3
	A/L	26.7		6	1.3
	Diploma	16.0		0	41.3
	Graduate	17.3		1	29.3
4.Occupation	Higher Degree	2.7		2	28.0
	Entrepreneur	5.3		3	1.3
	State jobs	18.7			
	Private sector jobs	6.7			
	Retired	20.0			
	Unemployed	49.3			

Consumer behavioural characteristics of the participants

It is reported that consumer behaviour has a great influence on the amount of food waste generated (Aschemann-witzel et al., 2015; Jörissen et al., 2015). Therefore, the main objective of this part of the survey was to identify and analyse some selected behavioural characteristics related to food purchasing, preparation, and discard by the participants that may have impacts on household food waste generation, to study interactions between those behaviours and household food waste generation. The behaviours that were considered in the study were identified by referring to previously published studies with a similar scope (Elmenofi et al., 2015; Stancu et al., 2015; Yildirim et al., 2016) and closely observing the general lifestyle of the people in the study area.

With respect to food purchasing frequency, the majority of the participants purchased fresh fruits and vegetables (58.6%) and meat and fish (50.6%) once a week, while their most commonly reported frequency for purchasing dry food was once a month (49.3%) (Table 2). The most commonly consumed dry foods by the people in this area include rice, red lentils, mung dhal, curry powders etc. When the participants were asked about the most frequently visited place to purchase their food needs, the majority (61.3-73.3%) reported that small retail shops were the most common source for most of their food needs. About 58.7% of the participants reported that they prepare a shopping list by considering the food already available at home before going to the market. The amount of money spent on food during a month by a family varied drastically within the study group, where 26.7% reported spending more than 25,000 LKR per month.

Another behaviour that was identified as a potential to impact household food waste generation is the purchasing frequency of cooked meals from outside. While in many developed countries eat out is common, the trend in Sri Lanka varies notably between urban and rural areas. According to previous studies, the young urban population (aged 18–29 years) shows a relatively high tendency to eat out and urban households spend approximately 18% of their total food expenditure on processed or outside foods (Weerahewa et al., 2018). However, the findings of this study conducted in a rural context show a different pattern: 52% of participants reported never purchasing cooked food from outside, while only 28% and 12% reported doing so once a month or several times a month, respectively.

Storing leftover cooked food in the refrigerator for future use is one of the most commonly practised habits to avoid unnecessary food wastage by people around the world (Stancu et al., 2015). In this study, over 85% of the participants reported having a refrigerator at home. Even though 85% of the participants who own a refrigerator store raw food in the refrigerator, only 5% of them reported storing cooked leftover food in it.

When respondents were asked about their meal preparation frequency in a typical day, 69% of them reported cooking two times per day, while 29% reported cooking three times per day. Moreover, during face-to-face interviews held with the participants, it was revealed that most of them prepare breakfast and lunch together in the morning and then prepare dinner later in the afternoon, as most of their family members prefer to consume warm meals at night. To determine whether meal preparation frequency has any significant effect on household food waste generation, a Kruskal–Wallis rank sum test was performed. The test yielded a p -value of .158, indicating that meal preparation frequency does not have a statistically significant impact on the amount of food waste generated ($p > .05$).

Another consumer behaviour that can significantly affect the amount of food waste generated in a household is the way of handling leftover food. In Sri Lanka, it is a common practice to give any excess food to domestic cats, dogs, and birds as feed. This was evident in the data collected during this study, where over 97% of the participants reported giving excess food to animals. Therefore, it can be assumed that the actual amount of avoidable food waste generated in these households is greater than the values reported during this study. Upcycling leftover food is another commonly practiced habit in Sri Lankan households, where snacks and sweets are prepared from leftover food. As an example, it is very popular in Sri Lanka to sun-dry leftover rice and make a sweet called “Aggala” that can be consumed as a snack. However, in this study group, only 40% of the participants reported upcycling leftover food. About 32% of participants reported using leftover food in composting. Notably, 65.3% of the participants mentioned that they throw away leftover food.

This study also focused on evaluating whether self-cultivation of foods such as rice, fruits, and vegetables has an impact on household food waste generation. About 38.7%, 13.3% and 16% of the participants reported they cultivate rice, vegetables, and fruits for their consumption, respectively. However, the analysis indicated that cultivation practices did not have

Table 2*Information on Behaviours Related to Food Purchasing, Preparation, and Waste Handling of the Participants*

1.	Food purchasing frequency	Daily	Several times a week	Once a week	Several times a month	Monthly
	Fruits and vegetables (%)	2.6	33.3	58.6	5.3	0
	Fish and meat (%)	0	28.0	50.6	10.6	10.6
	Dry food (%)	0	8.0	24.0	18.6	49.3
2.	Place of food purchasing	Small retailer shop	Weekly fair	Supermarket	Mobile vendors	
	Fruits and vegetables (%)	61.3	0	5.3	32.0	
	Fish and meat (%)	61.3	9.3	16.0	13.3	
	Dry food (%)	73.3	0	26.7	0	
3.	Preparation of a shopping list	Yes	No			
	%	58.7	41.3			
4.	Monthly expenditure on food in LKR	5,000-10,000	10,001-15,000	15,001-20,000	20,001-25,000	> 25,000
	%	5.3	22.7	25.3	20.0	26.7
5.	Purchasing frequency of cooked food	Weekly	Several times a month	Monthly	Not at all	
	%	8.0	12.0	28.0	52.0	
6.	Use of a refrigerator	Yes	No			
	%	85.3	14.7			
7.	Nature of food stored in the refrigerator*	Raw	Cooked			
	%	100	5.0			
8.	Cooking frequency per day	One time	Two times	Three times		
	%	1.0	69.0	29.0		
9.	Waste/leftover handling method*		Given for animal food	Upcycling	Compost making	Thrown away
	%		97.3	40.0	32.0	65.3

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10. Self-cultivation of food*	Rice	Vegetables	Fruits		
	%	38.7	13.3	16.0	
11. Determination of food spoilage* (used parameter)	Colour	Appearance	Smell	Taste	Label
	%	29.3	17.3	98.7	22.7
				77.3	

Note. * Multiple responses were allowed per participant.
LKR- Sri Lankan rupees.

a statistically significant impact on food waste generation in households within the study area. A Mann–Whitney U test was conducted to assess the difference in food waste generation between households that practice cultivation and those that do not, yielding a *p*-value of .067 for vegetables, .2248 for fruits, and .6674 for rice.

Another consumer behaviour that was studied during this research was how participants identify or decide whether food is spoiled. It has been reported that consumers sometimes discard quality food due to poor judgment (Neff et al., 2019), and they should use multiple methods, such as checking smell, colour, appearance, and storage conditions, before discarding any food. According to the data obtained in this study, it was revealed that the majority of participants (98.7%) rely solely on smell to decide whether to discard non-labelled raw or cooked foods. Similarly, Charbel et al. (2016) reported that about 54% of the participants (*n*=215) reported using the smell of food as an indicator to decide whether the food is spoiled in their study.

In this study, a portion of the consumer behaviour data, especially regarding shopping habits and reasons for food waste generation, was self-reported and might be susceptible to response bias, as participants may unintentionally overestimate or underreport their behaviours. This could potentially affect the reliability and validity of these findings and should be considered when generalising the findings. Future research should consider employing observational or experimental approaches to mitigate self-reporting bias and enhance the validity of consumer behavioural data. However, a comprehensive and understandable description was given at the beginning of the survey to make the objective of this study clear, assuming it can help strengthen the reliability of the data collected.

Quantities and composition of food waste generated in households

The food waste generated in the selected households was divided into four categories based on its nature. The

average weight of food waste generated under different waste categories is shown in Table 3. Based on the data obtained, the mean avoidable food waste and unavoidable food waste generated (under multiple categories) within one household per day were 262.5 ± 207.0 g (mean $\pm$ SD) and 368.7 ± 141.7 g, respectively. Therefore, the total food wastage (avoidable food waste + unavoidable food waste) generated within one household per day was 631.2 ± 286.4 g.

Based on the daily household waste generation, the mean avoidable food waste per year can be calculated as 95.63 ± 75.55 kg (including multiple categories). This amount is lower than the amounts observed in previous studies conducted in different countries. For example, in the UK, 210 kg per household per year (WRAP, 2011), in the United States, 124 kg per person per year (Koester, 2013) and in Canada, 117 kg per person per year (Parizeau et al., 2015) were reported. This difference may have occurred due to the differences in culture, eating patterns, and household earnings between developed and developing countries. Notably, the Food Waste Index 2021 report published by the United Nations Environment Program (UNEP) presents food waste generation figures similar to our research findings for South Asian countries, with India reporting 50 kg, Afghanistan 82 kg, and Pakistan 74 kg of household food waste per person per year.

However, a key limitation of the qualitative data in this study is the relatively small and non-random interview sample, which may not fully represent the diversity of household behaviours and perceptions. This could influence the generalizability of the findings to the broader population.

According to the observations made during quantification of food waste, the most frequently wasted avoidable food belonged to the cereals, tubers, and grain/flour-based food waste category, while the least wasted food belonged to the animal-derived food waste category. This finding is somewhat different from previous studies

reported by Schott and Andersson (2015), Langen et al. (2015), Edjabou et al. (2016), and Elimelech et al. (2018) where vegetables and fruit products have been reported as the most wasted food category at the household level. This difference may be due to the difference in the nature of food consumed in these regions of the world. In Sri Lanka, most commonly consumed foods include rice, tubers, and cereal and therefore most wastage under this category can be expected.

During household visits for food waste quantification, instances of avoidable food waste generation were reported, along with the reasons provided by participants for discarding those items. To minimise potential biases arising from human error or subjective interpretation during household visits, a standardised questionnaire

was used, providing participants with six common, pre-identified reasons for food waste generation relevant to the Sri Lankan context. A total of 394 such cases were observed during the study, and the data collected are summarised in Table 4. The three most commonly reported reasons for discarding avoidable raw fruits and vegetables were spoilage (40.2%), quality loss (30.3%), and pest damage (29.5%). Based on their responses, it can be assumed that in the selected households, most of the raw fruits and vegetables are discarded because they are not consumed before the food gets spoiled. In all the other food categories, the most commonly reported reasons to discard avoidable food waste are over preparation, not preferred by family members, and improper cooking. With reference to the results of several published studies on food waste, the most common reasons leading to

Table 3*Food Waste Generated Under Different Waste Categories*

Food waste category	Mean (g)	Median (g)	SD
Avoidable raw (unprocessed) fruits and vegetable food waste (A1)	86.5	60.0	91.2
Unavoidable raw (unprocessed) fruits and vegetable food waste (A2)	304.5	296.3	116.8
Avoidable cooked (processed) fruits and vegetable food waste (B1)	40.1	21.3	54.1
Unavoidable cooked (processed) fruits and vegetable food waste (B2)	13.8	8.3	18.4
Avoidable cereals and tubers and grain / flour-based food waste (C1)	128.4	85.3	139.4
Unavoidable cereals and tubers and grain / flour-based food waste (C2)	33.6	11.6	44.7
Avoidable animal-derived (meat, fish, and eggs) waste (D1)	7.5	0	12.7
Unavoidable animal-derived (meat, fish, and eggs) waste (D2)	16.6	13.3	11.2

Table 4*Analysis of Reasons for Avoidable Food Waste Generation*

Reason	Raw fruits/ vegetables		Cooked fruits/ vegetables		Cereals, tubers, grain/ flour-based food		Animal-derived food waste	
	Number of cases	% cases	Number of cases	% cases	Number of cases	% cases	Number of cases	% cases
Pest damage	39	29.5	NR	—	NR	—	NR	—
Quality loss	40	30.3	NR	—	NR	—	NR	—
Spoilage	53	40.2	NR	—	13	9.6	NR	—
Over preparing	NR	—	80	85.1	110	81.5	15	45.5
Improper cooking	NR	—	9	9.6	12	8.9	7	21.2
Not preferred	NR	—	5	5.3	NR	—	11	33.3
Total per category	132	33.5*	94	23.9*	135	34.3*	33	8.4*

Note. NR- Not reported, * calculated based on grand total of cases (394).

avoidable food wastage are buying too much and/or managing food storage (foods in refrigerator) carelessly, which leads to food to spoilage before consumption, due to exceeding the expire date mentioned on the label, developing bad smell or taste, having been forgotten in the fridge and cooking/serving more than needed (EPA, 2012; WRAP, 2007; WRAP, 2008).

Overall, observations made during this study reveal that participants do not pre-plan and estimate the quantity of food needed for their households. Further, based on these results, it can be suggested that by estimating the needed food amount for the household prior to cooking, inquiring about the preferences of family members for the dishes that are planned to be prepared, and using proper cooking techniques, a considerable amount of avoidable food waste can be prevented within the study group.

These findings highlight the need for targeted interventions to focus on household cooking habits, storage improvements, and food preference management to reduce overall food waste in the Sri Lankan context. Complementing this perspective, Damayanthi (2021) conducted a qualitative study involving 30 participants

from Central, Provincial, and Local government institutions, academic researchers, and recycling professionals in Sri Lanka. Their findings revealed that cultural norms and traditional practices play a significant role in shaping household food waste-generating behaviours. Specifically, customs such as preparing excess food to accommodate guests and avoiding the reuse of food at social events contribute to increased food waste generation.

Regression model for food waste generation and its predictors

At the beginning of the regression model development, the assumptions pertaining to multiple regression analysis were checked. Multivariate normality was checked using normal Q-Q plots; independence of residuals was checked by the Durbin-Watson test statistic; constant variance assumption (homoscedasticity) was checked by observing the pattern of the residual versus fitted value plot; and absence of multicollinearity was checked using VIF (variance inflation factor) values.

The regression model developed for this study is shown below.

$$\text{Total food waste} = 544.24 - 165.94 (\text{Shopping list preparation} - \text{Yes}) + 335.04 (\text{Income } 75001-100000) - 331.16 (\text{Age } 31-40) - 312.45 (\text{Age } 51-60) + 77.27 (\text{Number of family members})$$

The summary of the regression model for the total food waste generation is shown in Table 5. The results indicate that 40.23% (adjusted $R^2 = .4023$) of the variance of food waste generation in one household per day can be explained by the independent variables included in the model. Moreover, the p -value of the model suggests that the estimated model is significant ($p < .05$, $p = 4.147e-06$).

The results of this study suggest that the total food waste generation is significantly different according to the income level, the number of family members, and the age of participants ($p < .05$). Similarly, the total food waste generation within one household per day is significantly different across two groups, whether they prepare a shopping list or not ($p < .05$). Similar findings are also reported in previous studies by Schott and Andersson (2015), Edjabou et al. (2016), Yildirim et al. (2016), Akerele et al. (2017).

According to the multiple linear regression analysis, the expected food waste generation for a household/

person who has a 25,000-50,000 LKR income level, two family members, and an age between 20 and 30, with no previously prepared shopping list, is 544.24 g. While holding other factors constant, if one other family member is added to the family, food waste is expected to increase by 77.27 g. Food waste is expected to decrease by 165.94 g if a person/household prepares a shopping list. Also, the food waste is expected to increase by 335.04 g if the household has an income of 75,000–100,000 LKR compared to the reference group. The food waste generated is expected to decrease by 331.6 g if the person's age is between 31-40 and the food wastage is expected to decrease by 312.45 g if the person's age is between 51-60 compared to the reference group.

The higher food waste levels observed in households with higher income (LKR 75,000–100,000) may be due to greater purchasing power, leading to over-purchasing and less concern over leftover food. In contrast, lower-income households may practice more cautious food use due to budget constraints.

Table 5*Model Summary of Total Food Waste Generation*

Variable	Coefficients			
	Estimate	SE	t value	p value
(Intercept)	544.24	139.52	3.901	.000235 ***
Shopping list preparation - Yes	-165.94	55.98	-2.964	.004277 **
Income 50,001-75,000	78.58	65.24	1.205	.232881
Income 75,001-100,000	335.04	87.04	3.849	.000279 ***
Income less than 25,000	127.22	168.77	.754	.453774
Income more than 100,000	107.92	133.93	.806	.423380
Age 31-40	-331.16	114.68	-2.888	.005312 **
Age 41-50	-62.25	124.02	-.502	.617445
Age 51-60	-312.45	120.29	-2.598	.011674 *
Age 61-70	-229.39	119.42	-1.921	.059282 .
Age more than 70	-215.11	192.71	-1.116	.268846
Number of family members	77.27	28.90	2.674	.009547 **

Note. Significant codes: p value < .001 – ‘***’, $.001 \leq p$ value < .01 – ‘**’, $.01 \leq p$ value < .05 – ‘*’, $.05 \leq p$ value < .1 – ‘.’, p value $\geq .1$ – ‘.’.

Residual SE: 221.4 on 63 df.

CONCLUSION

According to the findings of this study, within the study area, cereals, tubers, grains, and flour-based foods are wasted more than the other food categories. Avoidable foods are wasted mainly due to over-preparation. The study on the behavioural characteristics of the participants revealed that storing cooked leftover food in the refrigerator for future use and making a shopping list prior to shopping should be encouraged among the study group as attempts to reduce food waste. Furthermore, the analysis of reasons for avoidable food wastage suggested estimating the needed amount of food quantities for the family prior to cooking, asking about the preferences of family members for the planned dishes before cooking, and using proper cooking techniques as attempts to reduce avoidable food wastage. Finally, the result of multiple linear regression analysis recommended making a shopping list by considering already available food at home prior to shopping as an effective way to reduce household food waste.

LIMITATIONS AND RECOMMENDATIONS

The findings of this study suggest several practical recommendations for reducing household food waste. Emphasis should be placed on promoting accurate portion estimation, planning meals based on household preferences, and creating shopping lists that reflect

available food stocks. Additionally, encouraging proper storage and reuse of leftovers, along with improving cooking skills, can significantly reduce avoidable food waste. These strategies can be effectively integrated into community awareness campaigns and local policy initiatives. The findings of this study offer valuable insights for policymakers, local authorities, and awareness campaign developers aiming to reduce household food waste. By identifying over-preparation and inadequate meal planning as key drivers of avoidable waste, interventions can be designed to promote practical behaviours such as portion estimation, preference-based meal planning, and shopping list preparation. These findings can inform community-level education campaigns and national policies targeting household food waste reduction. Additionally, local authorities can integrate these strategies into public awareness programs to foster sustainable consumption habits and improve household waste management efficiency. Furthermore, while this study relied mainly on quantitative data to explore household food waste and its demographic and behavioural influences, future research should incorporate qualitative approaches, such as key informant interviews and focus group discussions, to gain deeper insights into the underlying motivations and social factors that drive food waste generation. These approaches could potentially enrich the findings of the study by capturing multiple consumer perspectives and experiences that quantitative methods alone could not captured.

It should be acknowledged that household members who travel outside for work and return home during evening/night or on weekends might contribute less to food waste generation at the household level. This variation in presence at home and food consumption patterns can influence the overall amount of food waste produced. While this study focused on average household behaviour, such differences represent an important limitation. Future research could benefit from considering time-use patterns or the daily presence of individuals at home to assess household food waste patterns more accurately.

CONFLICT OF INTEREST

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

REFERENCES

- Akerele, D., Afolayan, S., Oyawole, F., & Sanusi, R. A. (2017). Socioeconomic determinants of food waste among households in Abeokuta, Ogun State, Nigeria. *Nigerian Journal of Agricultural Economics*, 7(1), 25–35. <http://dx.doi.org/10.22004/ag.econ.268440>
- Aschemann-Witzel, J., De Hooge, I., Amani, P., Bech-Larsen, T., & Oostindjer, M. (2015). Consumer-related food waste: causes and potential for action. *Sustainability*, 7(6), 6457–6477. <https://doi.org/10.3390/su7066457>
- Bhatia, A., & Sharma, S. (2023). Identifying determinants of household food waste behavior in urban India. *Cleaner Waste Systems*, 6, Article 100105. <http://dx.doi.org/10.1016/j.clwas.2023.100105>
- Charbel, L., Capone, R., Grizi, L., Debs, P., Khalife, D., El Bilali, H., & Bottalico, F. (2016). Preliminary insights on household food wastage in Lebanon. *Journal of Food Security*, 4(6), 131–137. <http://pubs.sciepub.com/jfs/4/6/2>
- Damayanthi, M. K. N. (2021). Cultural practices on food waste generation: Sri Lankan experiences. *Abstract from ISWA World Congress-2021, Greece*. <https://iswa2021.com/wp-content/uploads/2021/10/book-of-abstract-all.pdf>
- De, B., Hussain, I., & Das, R. C. (2023). Environmental implications of food waste: A study on South-Asian countries. In H. Dinçer, & S. Yüksel (Eds.), *Renewable energy investments for sustainable business projects* (pp. 45–58). Emerald Publishing Limited. <https://doi.org/10.1108/978-1-80382-883-120231004>
- Edjabou, M. E., Petersen, C., Scheutz, C., & Astrup, T. F. (2016). Food waste from Danish households: Generation and composition. *Waste Management*, 52, 256–268. <http://dx.doi.org/10.1016/j.wasman.2016.03.032>
- Elimelech, E., Ayalon, O., & Ert, E. (2018). What gets measured gets managed: A new method of measuring household food waste. *Waste Management*, 76, 68–81. <https://doi.org/10.1016/j.wasman.2018.03.031>
- Elmenofi, G. A. G., Capone, R., Waked, S., Debs, P., Bottalico, F., & El-Bilali, H. D. (2015). An exploratory survey on household food waste in Egypt. *Book of Proceedings, Sixth International Scientific Agricultural Symposium "Agrosym 2015", Jahorina, Bosnia and Herzegovina*, 1298–1304. Retrieved September 10, 2024, from https://www.academia.edu/38550258/An_exploratory_survey_on_household_food_waste_in_Egypt
- Environment Protection Authority. (2012). *Food waste avoidance benchmark study*. New South Wales. <https://www.lovefoodhatewaste.nsw.gov.au/sites/default/files/2018-06/Report%20-%20Benchmark%20Survey%202009.pdf>
- Food and Agriculture Organisation, Consultative Group on International Agricultural Research, International Water Management Institute, & RUAF Foundation. (2018). *Food waste management in city region food system – Colombo, Sri Lanka [Policy brief]*. Food and Agriculture Organisation. <https://openknowledge.fao.org/handle/20.500.14283/call10en>
- Food and Agriculture Organisation. (2018). *Assessing and planning city region food system: Colombo (Sri Lanka) Synthesis report*. <https://www.fao.org/3/CA1159EN/ca1159en.pdf>
- Food and Agriculture Organization, International Fund for Agricultural Development, United Nations Children's Fund, World Food Programme, & World Health Organization. (2024). *The state of food security and nutrition in the world 2024 – Financing to end hunger, food insecurity and malnutrition in all its forms*. Food and Agriculture Organization. <https://doi.org/10.4060/cd1254en>
- Jörissen, J., Priefer, C., & Bräutigam, K.-R. (2015). Food waste generation at household level: Results of a survey among employees of two European research centers in Italy and Germany. *Sustainability*, 7(3), 2695–2715. <http://dx.doi.org/10.3390/su7032695>
- Kim, J. Y. (2014, March 21). Food waste -- a bigger problem than you thought. *World Bank Blogs*. <https://blogs.worldbank.org/voices/food-waste-bigger-problem-you-thought>
- Koester, U. (2013). Total and per capita value of food loss in the United States – Comments. *Food Policy*, 41, 63–64. <http://dx.doi.org/10.1016/j.foodpol.2013.04.003>
- Kuna, A., & Kata, L. (2020). Impact of Covid-19 on food purchasing, eating behaviors and perceptions of food safety in consumers of Telangana and Andhra Pradesh of India. *International Journal of Agriculture, Environment and Biotechnology*, 13(4), 395–402. <http://dx.doi.org/10.30954/0974-1712.04.2020.3>
- Langen, N., Göbel, C., & Waskow, F. (2015). The effectiveness of advice and actions in reducing food waste. *Proceedings of the Institution of Civil Engineers - Waste and Resource Management*, 168(2), 72–86. <http://dx.doi.org/10.1680/warm.13.00036>
- McCarthy, B., & Liu, H. B. (2017). Food waste and the 'green' consumer. *Australasian Marketing Journal*, 25(2), 126–132. <http://dx.doi.org/10.1016/j.ausmj.2017.04.007>
- Ministry of Environment. (2020). *National policy on waste management*. Environment Pollution Control and Chemical Management Division, Ministry of Environment. https://www.env.gov.lk/web/images/pdf/policies/National_

- Policy_on_Waste_Management_English.pdf
- Mirabella, N., Castellani, V., & Sala, S. (2014). Current options for the valorization of food manufacturing waste: a review. *Journal of Cleaner Production*, 65, 28–41. <http://dx.doi.org/10.1016/j.jclepro.2013.10.051>
- Neff, R. A., Spiker, M., Rice, C., Schklair, A., Greenberg, S., & Broad Leib, E. (2019). Misunderstood food date labels and reported food discards: A survey of U.S. consumer attitudes and behaviors. *Waste Management*, 86, 123–132. <http://dx.doi.org/10.1016/j.wasman.2019.01.023>
- Östergren, K., Gustavsson, J., Bos-Brouwers, H., Timmermans, T., Hansen, O., Möller, H., Anderson, G., O'Connor, C., Soethoudt, H., Quested, T., Eastel, S., Politano, A., Bellettato, C., Canali, M., Falasconi, L., Gaiani, S., Vittuari, M., Schneider, F., & Redlingshöfer, B. (2014). *FUSIONS definitional framework for food waste*. FUSIONS EU. Retrieved September 10, 2024, from https://www.researchgate.net/publication/319272558_FUSIONS_definitional_framework_for_food_waste_Full_report
- Parizeau, K., von Massow, M., & Martin, R. (2015). Household-level dynamics of food waste production and related beliefs, attitudes, and behaviours in Guelph, Ontario. *Waste Management*, 35, 207–217. <http://dx.doi.org/10.1016/j.wasman.2014.09.019>
- Reich, A. H., & Foley, J. A. (2014). Food loss and waste in the US: The science behind the supply chain. Food Policy Research Center, University of Minnesota. <https://conservancy.umn.edu/server/api/core/bitstreams/5c6857de-b4af-4908-84c6-28e6ed1dcea4/content>
- Schott, A. B. S., & Andersson, T. (2015). Food waste minimization from a life-cycle perspective. *Journal of Environmental Management*, 147, 219–226. <https://doi.org/10.1016/j.jenvman.2014.07.048>
- Silvennoinen, K., Katajajuuri, J., Hartikainen, H., Heikkilä, L., & Reinikainen, A. (2014). Food waste volume and composition in Finnish households. *British Food Journal*, 116(6), 1058–1068. <http://dx.doi.org/10.1108/BFJ-12-2012-0311>
- Stancu, V., Haugaard, P., & Lähteenmäki, L. (2015). Determinants of consumer food waste behaviour: Two routes to food waste. *Appetite*, 96, 7–17. <https://doi.org/10.1016/j.appet.2015.08.025>
- Stefan, V., van Herpen, E., Tudoran, A. A., & Lähteenmäki, L. (2013). Avoiding food waste by Romanian consumers: The importance of planning and shopping routines. *Food Quality and Preference*, 28(1), 375–381. <http://dx.doi.org/10.1016/j.foodqual.2012.11.001>
- Szabó-Bódi, B., Kasza, G., & Szakos, D. (2018). Assessment of household food waste in Hungary Barbara. *British Food Journal*, 120(3), 625–638. <https://doi.org/10.1108/BFJ-04-2017-0255>
- United Nations Environment Programme. (2021). *Food waste index report 2021*. <https://www.unep.org/resources/report/unep-food-waste-index-report-2021>
- United Nations Environment Programme. (2024). *Food waste index report 2024. Think eat save: tracking progress to halve global food waste*. <https://wedocs.unep.org/20.500.11822/45230>
- Waste and Resources Action Programme. (2007). *Food storage and packaging*. <https://wrap.org.uk/resources/report/food-storage-and-packaging-2007>
- Waste and Resources Action Programme. (2008). *The food we waste*. <https://www.lefigaro.fr/assets/pdf/Etude%20gaspillage%20alimentaire%20UK2008.pdf>
- Waste and Resources Action Programme. (2011). *Estimates for household food and drink waste in the UK 2011*. <https://wrap.org.uk/resources/report/estimates-household-food-and-drink-waste-uk-2011>
- Weerahewa, J., Korale Gedara, P., & Wijetunga, C. S. (2018). Nutrition transition in Sri Lanka: A diagnosis. *Annals of Nutrition and Food Science*, 2(2), Article 1020. <https://www.remedypublications.com/annals-of-nutrition-food-science-abstract.php?aid=286>
- Wijerathna, D. M. C. B., Lee, K., Koide, T., Jinadasa, K. B. S. N., Kawamoto, K., Iijima, S., Herath, G. B. B., Kalpage, C. S., & Mangalika, L. (2012). Solid waste generation, characteristics and management within the households in Sri Lankan urban areas. *Proceedings of International Conference on Sustainable Built Environment*. <https://dl.lib.uom.lk/items/cd749812-86b7-4ca7-811b-8afb8d580f7f>
- Yildirim, H., Capone, R., Karanlik, A., Bottalico, F., Debs, P., & El Bilali, H. (2016). Food wastage in Turkey: An exploratory survey on household food waste. *Journal of Food and Nutrition Research*, 4(8), 483–489. <http://pubs.sciepub.com/jfnr/4/8/1>