

FOOD WASTE MANAGEMENT IN MALAYSIAN SUBURBAN FOOD PREMISES: CHALLENGES AND PRACTICES FOR SUSTAINABILITY

Mohd Syazwan Mohd Ghazali^{1*}, Muazzin Mupit², Edyazuan Azni³,
Zaihar Yaacob⁴ & Zulkeflee Sabri⁵

***Corresponding Author**

^{1,2,3,4}Section of Food Engineering Technology, Universiti Kuala Lumpur,
Malaysia Institute of Chemical and Bioengineering, 78000 Alor Gajah,
Melaka, MALAYSIA

⁵Section of Bioengineering Technology, Universiti Kuala Lumpur,
Malaysia Institute of Chemical and Bioengineering, 78000 Alor Gajah,
Melaka, MALAYSIA

msyazwan@unikl.edu.my^{1*}, muazzin@unikl.edu.my²,
edyazuan@unikl.edu.my³, zaihar@unikl.edu.my⁴,
mzulkeflee@unikl.edu.my⁵

Received: 28 April 2025

Accepted: 02 October 2025

Published: 31 March 2026

ABSTRACT

Food waste is a growing challenge in the food service industry, particularly in suburban areas with limited waste disposal infrastructure. This study aims to assess food waste management practices and identify key food premises in Alor Gajah, Melaka. A mixed-method approach is employed, combining surveys, interviews, and field observations to analyze food waste generation, disposal methods, and operational challenges across 18 food premises. Surveys were conducted to gather quantitative data on waste types and disposal practices, while interviews and field observations provided qualitative insights into the challenges and strategies used by businesses. The findings showed that leftover food (77.8%), food scraps (61.1%), and dishwashing wastewater (55.6%) are the primary sources of waste. While some premises implement prevention strategies—such as meal planning, proper storage, and repurposing leftovers—these efforts remain limited. The study reveals minimal engagement with other tiers of the Waste Hierarchy with landfilling still the dominant disposal method. Key challenges include



pest infestations, unpleasant odors, clogged drains, and insufficient waste collection services. Although economic and hygiene concerns drive some waste management actions, particularly the pursuit of cost savings and profit margins, significant barriers persist. These include limited resources, poor infrastructure, and a lack of technical knowledge. These constraints, in line with the Theory of Planned Behavior, contribute to low perceived responsibility and hinder the adoption of sustainable practice. Finally, suburban food premises in Malaysia continue to rely on traditional waste systems, with sustainability delayed by limited infrastructure and passive attitudes. Strengthened support and enforcement are essential for progress.

Keywords: Food waste, Suburban, Waste management, Waste hierarchy, Theory of planned behavior

INTRODUCTION

Food waste refers to food materials that are left uneaten, either discarded or lost at various stages of the food supply chain, from early production to final consumption (Bashir et al., 2018). It also includes food for human consumption that was diverted for non-consumption purposes, such as feeding animals or being thrown away, even when still edible (Gonçalves et al., 2023). It has been rising significantly. This increase is driven by rapid urbanization and global population growth, which contribute to the growing generation of waste (Mohd Ghazali & Syed-Hassan, 2024). The situation has become a critical global issue, with the United Nations targeting a 50% reduction by 2030 under Sustainable Development Goal (SDG) 12.3 (Gonçalves et al., 2023).

In Malaysia, food waste accounts for a huge portion of municipal solid waste, posing serious challenges for waste management systems. With a population of approximately 31 million, Malaysia discards more than 39,000 tons of municipal solid waste daily, with over 30% being food waste (International Trade Administration, 2024). It is estimated that 3,000 tons of this waste are still edible, which further highlights the magnitude of its value (Zainal & Hassan, 2019). For instance, while thousands of people need nutritious food, households and restaurants continue to discard large amounts of edible food waste every day, as stated by Jereme (2017).

In response, Malaysia has introduced several policies and strategies over the years to tackle food waste management. Notable efforts include the National Solid Waste Management Plan (2002-2020), the National Recycling Program (2000-2005), and the Waste Minimization Master Plan (2005). Additionally, the Solid Waste and Public Cleansing Management Act 2007 (Act 672) was revised during the Eleventh Malaysia Plan (2016-2020) to enhance waste management practices (Ghafar, 2017; Hashim et al., 2021). National strategic plans have been developed to reduce food waste, minimize landfill use, and negative environmental effects through recycling, reusing, and reducing waste at its source (Jereme, 2017). Despite these efforts, the existing systems and current strategies are not always sustained or fully effective. The rate of food waste generation continues to rise, and if not managed effectively, it will be a severe problem in the future (Lim et al., 2016).

This waste contributes to greenhouse gas emissions and resource wastage: water and energy in food production (Al-Rumaihi et al., 2020; Rohini et al., 2020; Skawińska et al., 2022). Additionally, improper food waste disposal can lead to public health concerns: pest infestations and contamination of water sources (Al-Rumaihi et al., 2020; Padfield R. & Zakaria Z., 2014; Van der Fels-Klerx et al., 2018). Food waste is considered a part of municipal solid waste, and its management involves methods such as incineration, landfilling, and decomposition, as outlined in the Solid Waste and Public Cleansing Management Act 2007 (Act 672) (Lim et al., 2016). According to Hashim et al. (2021), the country still lacks a dedicated system for managing food waste. Up till now, most food waste has been treated as part of municipal solid waste. Of the 302 landfills in Malaysia, only 161 landfills are still in operation, and just 14 are classified as sanitary landfills. With food waste steadily increasing, Malaysia faces a growing environmental crisis if more efficient and sustainable waste management strategies are not implemented.

Food premises are among the largest sources of food waste generation, yet they also hold significant potential for implementing effective measures of preventing food waste (Papargyropoulou et al., 2019). Therefore, the Waste Hierarchy Framework provides a structured approach to food waste management by emphasizing prevention, reduction, reuse, recycling, and disposal (Stirnimann & Zizka, 2022) and is adopted. It serves as a reference

to align and categorize the current waste management practices of suburban food premises. Additionally, the Theory of Planned Behavior helps to explain how attitudes, subjective norms, and perceived behavioral control influence the owners' waste management decisions (Coşkun & Özbük, 2020).

While food waste has been extensively studied in urban centers, less attention has been paid to suburbs and small towns. Like rural areas, these regions are often characterized by smaller food establishments, local markets, and a lack of sophisticated waste management facilities (Markley & Olivelli, 2022). Studies have shown that suburban areas in Malaysia contribute significantly to national food waste generation (Kasmuri et al., 2023; Zakarya et al., 2021). However, there is a gap in understanding how food waste is managed in these locations.

This research paper aims to fill this gap by evaluating food waste management practices in Malaysian food premises located in suburban areas. Through a case study approach, 18 food premises were identified to examine their motivations and the specific practices they adopted. The study creates opportunities for improving and promoting sustainable waste management practices within the food service industry.

METHODOLOGY

This study employs a mixed-method approach to evaluate food waste management strategies in Alor Gajah. It is a small and quaint town located in the northern parts of Melaka State, Malaysia. The research integrates surveys, interviews, and a field observations approach to gain an understanding of food waste generation, management practices, and the challenges faced by various food premises.

Premise Type Selection

The study focuses on 18 food premises, selected to ensure diversity in business type, cuisine, ownership model, location, and capacity. The sample size was determined based on feasibility, resource constraints, and the need for in-depth qualitative analysis while still allowing for meaningful statistical patterns. Given the study's focus on suburban areas, 18 premises provide

a reasonable representation of food businesses in Alor Gajah, capturing variations in operational scale and waste management practices.

A diverse random sampling method was used to capture variations in food service establishments while minimizing selection bias. The premises were categorized based on service type (casual dining, fast food, food stalls), cuisine (Malay, Western, Thai, dessert), ownership (franchise, privately owned, owner-operated), and location (commercial units, hypermarkets, stalls, or isolated municipal premises). This method helped minimize selection bias and ensured a balanced mix of food service establishments. Table 1 provides details on the information related to the food premises.

Table 1. An Overview and Information of Food Premises

Premise	Type			Dining Area		Location	Capacity
	Service	Cuisine	Ownership	Indoor	Outdoor		
1	Casual Dining	Variety	Privately	/	/	Commercial unit	>50
2	Fast food	Western	Franchise	/		Hyper market	>10
3	Casual Dining	Malay	Owner operated	/	/	Commercial unit	<50
4	Casual Dining	Western	Owner operated		/	Social service premises	<30
5	Casual Dining	Malay	Owner operated	/	/	privately owned	<50
6	Casual Dining	Thai	Privately	/	/	privately owned	<50
7	Casual Dining	Malay	Owner operated	/	/	Commercial unit	<50
8	Casual Dining	Variety	Privately	/	/	Commercial unit	>50
9	Casual Dining	Malay	Privately		/*	Isolated -municipal premise	>50
10	Casual Dining	Malay	Owner operated	/	/	Social service premises	<30
11	Fast food	Dessert	Franchise	/		Commercial unit	>10
12	Casual Dining	Thai	Owner operated	/	/	Commercial unit	>50
13	Casual Dining	Malay	Owner operated	/	/	Commercial unit	<30

14	Casual Dining	Malay	Owner operated	/		Privately owned	<30
15	Fast food	Burger	Owner operated		/	Stall	>10
16	Casual Dining	Malay	Privately	/	/	Commercial unit	>50
17	Casual Dining	Malay	Owner operated		/	Privately owned	<50
18	Casual Dining	Malay	Privately	/	/	Commercial unit	>50

*Outdoor - with roofed coverage

Source: Author

Data Collection

a. Surveys

Structured questionnaires were designed to collect quantitative data from food business operators, focusing on (i) types of food waste generated, (ii) current waste management practices and disposal methods, and (iii) challenges in implementing sustainable waste practices.

The questionnaire was developed and modified based on established literature on food waste management by Kaur et al. (2020) and Pirani & Arafat (2015) to enhance its validity and reliability. Clarity and consistency were maintained by using well-structured questions. The final surveys were then administered to the 18 randomly selected food premises in the study area.

b. Interviews

In-depth interviews will be conducted with food business owners and workers to gain qualitative insights into the challenges and strategies used to manage food waste. These semi-structured interviews will provide flexibility to explore topics in detail, such as awareness of food waste issues, challenges and limitations, and attitudes towards alternative waste management practices, including composting and donation programs. Interviews were recorded and analyzed to identify recurring patterns in responses.

c. Field Observations

Field visits will be conducted to observe food waste handling practices at food premises. This will help identify gaps in existing waste disposal

systems and opportunities for improvement.

Limitations

The study is limited to selected suburban areas (Alor Gajah, Melaka) and may not fully represent food waste management practices in Malaysia. The self-reported nature of surveys may introduce bias in participant responses. Combining multiple data collection methods (surveys, interviews, and field observations) enhances the study's reliability and provides a comprehensive understanding of food waste management challenges in small-town food service establishments.

RESULT AND DISCUSSION

Categories of Food Waste Discarded

Figure 1 shows the types of food waste discarded at the premises. The findings showed that leftover food is the most commonly discarded type of waste, identified by 77.8% of the premises. This is in line with Gonçalves et al. (2023), whose findings highlight that leftover food is a major contributor in the food service sector, as high as 72.6% based on the leftover index. This is likely due to excess food from customers, its direct link to food portions, and consumption patterns. Large food waste generation is closely related to consumer behaviour and has been identified as a critical determinant of restaurant food waste (Coşkun & Özbük, 2020). According to Jereme (2017), customers often leave food uneaten, with many responding that they cannot finish it but feel indifferent because they have already paid for it. This reflects a negative attitude toward food waste, whereby individuals perceive food primarily in terms of monetary value, disregarding the implications of excess and uneaten portions. Since food waste is closely linked to human behavior, particularly during these situations (Romani et al., 2018). Within the Theory of Planned Behavior, this reflects low perceived responsibility, which declines consumers' intention to reduce food waste.

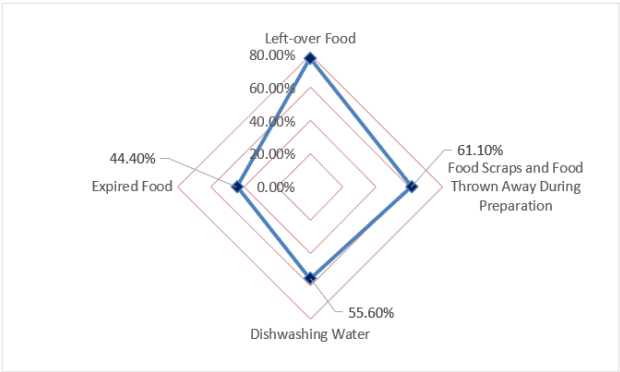


Figure 1. Disposed Food Waste at Premise

Soure: Author

The second-largest component of food waste comes from food scraps during preparation, with 61.1% of premises reporting this issue. Keegan & Breadsell (2021) found that 70% of respondents dispose of food scraps, with 58% during meal preparation. While slightly higher, these findings align with the results of this study. This includes vegetable peelings, meat trimmings, and unused ingredients. High food waste generation is due to ineffective waste management, limited composting, a lack of repurposing skills, and proper food scrap handling mechanisms. This aligns with Lin et al. (2013), highlighting technological limitations, inadequate processing knowledge, and insufficient legislative and infrastructure support for efficient waste conversion.

Additionally, 55.6% of premises produce dishwashing wastewater due to the constant cleaning of equipment, dishes, and cooking utensils. This wastewater often contains oil, fat, and detergent, making it difficult to reuse without an adequate treatment process. Expired food is another significant waste source, reported by 44.4% of premises. This occurs in two main scenarios: first, excess food from overproduction that remains unsold and spoils over time. Second, cooking ingredients that become stale, damaged, or reach their expiration date.

Motivation and Importance of Effective Food Waste Management across Food Premises

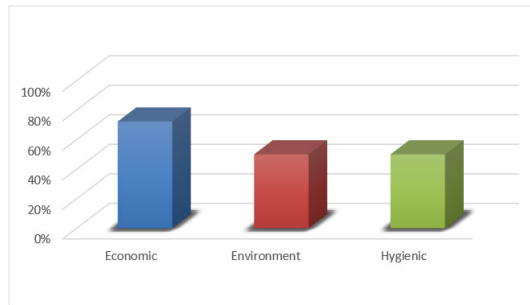


Figure 2. The Factors Influencing Food Waste Management in Premises

Source: Author

The findings report that food waste management in premises is influenced by three key factors: economic, hygiene, and environmental concerns. Based on Figure 2, out of the 18 premises, 72% cited economic factors, while 50% highlighted environmental and hygienic considerations as significant drivers for their waste management efforts.

Economically, the premise highlighted that reducing food waste leads to significant cost savings. The findings align with the report by Zainol et al. (2017). According to the report, most managers acknowledged awareness of cost control measures based on routine operational experience; however, the implementation of these control procedures remains inconsistent. Fundamentally, the main cost savings come from reducing over-preparation of food, which in turn enhances procurement planning. This includes minimizing the volume of unused or discarded materials, optimizing inventory management, and gaining economic benefits, such as reducing operational costs (Gonçalves et al., 2023). Food is discarded due to overproduction, which directly impacts the business's profitability by turning potential revenue into losses.

The results reveal that hygiene and environmental concerns motivate food waste management in 50% of the surveyed premises. This finding is lower than that of Zakarya et al. (2021), who reported that 82% of participants agreed that food waste poses environmental and hygiene risks. Nevertheless, the study still presents a strong case for the need for proper

management. Proper waste management helps these premises avoid issues like pest infestations, foul odors, and the spread of bacteria (Trematerra & Fleurat-Lessard, 2015). The relationship between hygiene and the environment is reciprocal because good hygiene practices help protect and preserve the environment, while a clean and healthy environment supports better hygiene.

Environmental concern reflects a growing awareness of the sustainability aspect of food waste management and the environmental implications of improper disposal. From the perspective of the premises, food waste is primarily viewed as a source of pollution. However, observations indicate that they do not fully recognize its broader environmental impact. From a broader perspective, food waste contributes to greenhouse gas emissions and wasted natural resources (Keegan & Breadsell, 2021). Poorly managed food waste, particularly in landfills, leads to leachate pollution, affects underground water, and causes health risks such as respiratory and skin ailments. Hence, proper food waste management is crucial to minimizing these environmental and health impacts (Jereme, 2017).

Method for Disposal

Table 2 provides an overview of the various methods of food waste disposal and water management practices. It highlighted a range of practices, such as discarding in a municipal waste bin, and to more sustainable options, such as composting and donation. The use of municipal waste bins is the most regularly used method across the premises. According to the Malaysian Local Government Act 1976 (By-Laws), the premise owner is required to provide suitable and sufficient dustbins with secure lids. This practice leads to food waste being mixed with domestic or municipal solid waste. As highlighted by Hashim et al. (2021), the country still lacks a dedicated system for managing food waste, which leads most premises to heavily depend on this method as their primary means of handling food waste. Hence, the reliance on conventional disposal methods remains concerning, as waste is ultimately disposed of in landfills.

Less than 50% of premises have taken proactive steps to manage waste through initiatives such as composting, donation, repurposing waste as animal feed, or selling it to third parties for the same purpose. The practice

of donating or selling surplus food is notably rare, with only Premise 6 and Premise 13 engaging in these activities. Animal feed as a disposal method is done by only two premises (Premises 4 and 18). The burning of food waste is observed at Premise 14; it is imperative to note that open burning is prohibited in Malaysia under Section 29A of the Environmental Quality Act 1974. This regulation explicitly bans open burning due to its negative impact on air quality and the environment. As stated in Table 1, Premise 13 is located on privately owned land. Due to this, there is a complete absence of municipal waste bins and collection services from local authorities, so the premises resort to burning their waste.

Table 2. Methods of Food Waste Disposal across 18 Food Premises

Premise	Method of Managing Food Waste (Solid)						Used water	
	Waste Bin	Compost	Selling	Burning	Donation	Animal Feed	Authorise Sewerage System	Non-sewerage system
Premise 1	/		/					
Premise 2	/					/		
Premise 3	/							
Premise 4	/							
Premise 5	/							
Premise 6	/				/			
Premise 7	/		/					
Premise 8	/							
Premise 9	/							
Premise 10	/							
Premise 11	/							
Premise 12	/							
Premise 13	/							
Premise 14	/			/		/		/
Premise 15	/	/						
Premise 16	/		/					
Premise 17	/							
Premise 18	/							

Source: Author

Only Premise 15 is committed to composting, although composting is an economical and feasible method for managing food waste disposal (Hashim et al., 2021). Recent zero-waste approaches, such as pyrolysis and anaerobic digestion for energy generation (Mohammadi, 2022), have been proposed to address food waste. However, the findings indicate that most premises are still far from adopting these advanced technologies.

It is clear that the food waste management system in suburban areas still relies on conventional methods, with no immediate drive to change or reduce the amount of waste going to landfills. This situation highlights a significant shortfall in adherence to the Food Waste Management Development Plan for the Industrial, Commercial, and Institutional Sectors (2016-2026). Despite the mandate from the Ministry of Housing and Local Government to reduce landfill waste by 20%, the data reports that all premises are failing to meet this requirement, sending their food waste to landfills. This reflects a troubling gap between policy objectives and actual waste management practices.

More than 90% of premises discharged their waste into drains that lead to the sewerage system, managed by an authorised body. However, this is only applicable to premises connected to public sewage systems, typically found in commercial units and residential areas. Premise 14 manages its wastewater independently by discharging it into a nearby pond. This is because the premises are located on privately owned land and lack proper facilities. This ultimately leads to inadequate wastewater management. This situation has led to subsequent problems related to poor wastewater handling.

Based on the findings, although some premises engage in composting and donation activities aligned with the waste hierarchy, these efforts remain minimal. Unfortunately, some premises continue to engage in practices that violate existing regulations.

Challenges Due to Food Waste

Figure 3 summarizes the common problems encountered by various food premises regarding food waste management. The majority of premises (50%) indicate odor is the most prevalent issue they encounter. This is due to

improper or delayed disposal of food waste, which is a significant concern, as decomposing organic matter can lead to unpleasant smells, affecting the ambiance of the premises and potentially driving away customers. Failing to translate awareness into practical waste management applications, as noted by Mahayuddin (2016), premise owners struggle to implement effective solutions.

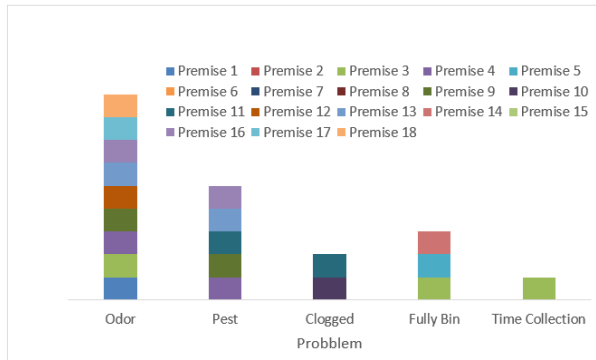


Figure 3. Common Problems Encountered by Various Food Premises

Source: Author

Pest-related issues were reported by Premises 2, 5, 9, 10, 12, and 17. The presence of pests such as rodents, flies, and cockroaches is a direct consequence of improper food waste management, particularly when waste is left exposed or bins are not adequately sealed. These pests pose a serious health risk, as they can contaminate food and spread diseases. Premises 6 and 13 reported clogged drainage systems, which are often a result of improper disposal of food waste, such as fats, oils, and grease (FOG), being washed down drains. Clogged drains can lead to sanitation issues, unpleasant odors, and even flooding in food preparation areas (Vinck et al., 2019). Regular maintenance of drainage systems and the use of grease traps can help prevent such issues. Some premises have cited the council as responsible, while others focus solely on cleanliness within their premises, neglecting the maintenance of external drainage. This lack of clarity and responsibility has led to persistent clogging issues outside the premises, exposing serious deficiencies in the overall waste management strategy.

Premises 6 and 9 reported issues with filled bins, indicating that waste collection schedules may not be frequent enough to meet the waste output of these premises. Overfilled bins can lead to spillage, which exacerbates

hygiene concerns and can attract pests. Premise 3 identified issues with the timing of waste collection, which can lead to a backlog of waste at the premises, further contributing to odor, pest, and sanitation problems. Ensuring timely and regular collection schedules is crucial to maintaining cleanliness and preventing waste from accumulating.

Inadequate infrastructure and structured systems in suburban areas limit individuals' perceived behavioral control, as findings highlight restricted access to resources and technical knowledge for sustainable waste practices, leading them to rely primarily on traditional methods.

Practices for Overcoming Food Waste Management Problems

Based on the findings, premise operators employ two primary approaches to handling food waste. The first approach involves impact mitigation measures, which focus on reducing the negative effects of food waste. The second approach is food waste prevention, which aims to decrease the overall amount of food waste produced. These approaches align with the Waste Hierarchy Framework, which prioritizes prevention as the most effective strategy for sustainable management of food waste.

Table 3 illustrates the various practices adopted by food premises to manage the impact and amount of food waste. Cleaning is a mandatory practice, as operators are required to maintain cleanliness in their premises to be registered with the Ministry of Health. This registration permits the issuance of an ABC Grade Rating Certificate, which acknowledges the cleanliness of the premises and includes waste management practices. A significant number of premises (premises 5, 6, 8, 9, 10, 12, 16, and 18) prioritize regular cleaning and monitoring as a crucial element of their practices. This practice and behavior are also shaped by subjective norms, where customer expectations and compliance with health regulations exert social pressure on operators to maintain high standards of cleanliness and food safety. This approach helps prevent the accumulation of waste, reduces the risk of pest infestations, and ensures overall hygiene within the premises. Pest control measures are another common practice, evident in Premises 12, 15, and 16. These premises recognise the direct correlation between food waste and pest problems, such as rats, cockroaches, and flies. By controlling pests, these premises minimize health hazards and ensure

compliance with food safety regulations. Premises 7 and 15 have taken their own initiative to increase the availability of bins as a practical waste management solution. By providing more bins, these premises effectively prevent garbage overflow, which helps maintain hygienic conditions.

Table 3. Impact Mitigation and Prevention Measures for Food Waste Management

	Impact Mitigation Measure			Prevention Measure			
	Cleaning	Pest Control	Increase Bin	Planning	Proper storing	Leftover	Food Label
Premise 1	/			/	/		
Premise 2	/				/		
Premise 3	/			/			
Premise 4	/			/			
Premise 5	/				/		
Premise 6	/			/			
Premise 7	/		/		/	/	
Premise 8	//			/		/	
Premise 9	/			/	/		
Premise 10	//			/			/
Premise 11	//						
Premise 12	//	/		/			
Premise 13	//						
Premise 14	/						
Premise 15	/	/	/	/	/		
Premise 16	//	/		/	/		
Premise 17	//				/		
Premise 18	/			/	/		/

(// - more than normal routine)

Source: Author

On the other hand, to minimize food waste, premises also adopt practices such as strategic planning, proper food storage, managing leftovers, and utilizing food labels. Effective planning is one of the most frequently implemented practices, with 11 out of 18 premises focusing on minimizing food waste through better forecasting of consumer volume and menu planning. This approach aligns smart purchasing and preparation of the right amount, reducing overproduction and potential wastage (Woolley et al., 2023), and is driven by economic factors.

Proper food storage is another key practice that helps prevent food spoilage. Half of the premises emphasize correct storage techniques to extend the shelf life of ingredients, including temperature control and the use of suitable storage containers (Mohammad et al., 2018). Managing leftovers is practiced by premises like 7 and 8, which reuse or repurpose leftover food to minimize waste. This can involve offering smaller portion sizes, redistributing excess food, or incorporating leftovers into new dishes. However, fewer premises are actively managing leftovers, indicating an area for potential improvement. Premises such as 11 and 16 have adopted this practice to track the shelf life of their products and reduce waste from expired items. Proper labelling ensures that food is used in the correct order, minimizing spoilage and unnecessary disposal (Zainal & Hassan, 2019).

CONCLUSION

This study highlights the critical challenges and gaps in food waste management among suburban food premises in Malaysia. The study found that food waste is primarily generated from leftover food (77.8%), food scraps during preparation (61.1%), and dishwashing wastewater (55.6%). These findings indicate a heavy reliance on traditional waste disposal methods, with only a minimal adoption of sustainable practices such as composting and food donation. Additionally, key challenges in food waste management in suburban areas include pest infestations, foul odors, clogged drains, and insufficient waste collection systems.

Despite recognizing economic, hygiene, and environmental concerns as key drivers for waste management, the study found that 70% of premises identified cost savings and profit margin as the primary motivators. While

some premises adopt both impact mitigation practices and preventive measures to manage the amount and impact of food waste, significant barriers remain. These include limited resources, inadequate infrastructure, and insufficient technical knowledge, which impede effective waste management practices.

Premises generally implement preventive measures such as planning, proper storage, and repurposing leftovers, reflecting the adoption of prevention strategies in line with the Waste Management Framework. However, alternative practices within the hierarchy, such as energy recovery, composting, and feeding animals, are rarely implemented. These findings align with the Theory of Planned Behavior, which states that low perceived responsibility and limited resources hinder the adoption of sustainable waste management practices.

Ultimately, the findings suggest that suburban food premises show substantial gaps in sustainable food waste management, driven in part by limited infrastructure and indifferent attitudes. Improving support systems and strengthening regulations are key to fostering more responsible and sustainable practices.

ACKNOWLEDGEMENT

The authors express their sincere gratitude for the diverse forms of assistance provided by Universiti Kuala Lumpur.

DECLARATION OF AI-GENERATED CONTENT

AI tools (e.g, ChatGPT, Grammarly) were used for drafting, assistance, paraphrasing and grammar checking. All content was critically reviewed and edited by researcher.

FUNDING

This research was conducted using facilities provided by the University of Kuala Lumpur. Although no external funding was received, the available

resources and institutional support have contributed significantly to the success of this project.

AUTHOR CONTRIBUTIONS

Mohd Syazwan Mohd Ghazali: Investigation, formal analysis, visualization, writing the manuscripts. Muazin Mupit, Edyazuan Azni, Zaihar Yaacob, Zulkeflee Sabri: validation, writing – review & editing.

CONFLICT OF INTEREST

The authors declare that they have no known conflicting financial interests or relationships that might have influenced the work presented in this study.

REFERENCES

- Abd Ghafar, S. W. (2017). *Food waste in Malaysia: trends, current practices and key challenges*. Centre of promotion technology, MARDI, Persiaran MARDI-UPM. http://ap.fttc.agnet.org/ap_db.php?id=774.
- Al-Rumaihi, A., McKay, G., Mackey, H. R., & Al-Ansari, T. (2020). Environmental impact assessment of food waste management using two composting techniques. *Sustainability*, 12(4), 1595. <https://doi.org/10.3390/su12041595>.
- Bashir, M., et al. The role of environmental knowledge and mediating effect of pro-environmental attitude towards food waste reduction. *Int. J. Acad. Res. Bus. Soc. Sci* 8.3 (2018): 60-72. DOI: 10.6007/IJARBSS/v8-i17/5146.
- Coşkun, A., & Özbük, R. M. Y. (2020). What influences consumer food waste behavior in restaurants? An application of the extended theory of planned behavior. *Waste Management*, 117, 170-178. <https://doi.org/10.1016/j.wasman.2020.08.011>.
- G Gonçalves, C., Saraiva, S., Nunes, F., & Saraiva, C. (2023). Food waste in public food service sector—Surplus and leftovers. *Resources*, 12(10),

120. <https://doi.org/10.3390/resources12100120>.
- Hashim, A. A., Kadir, A. A., Ibrahim, M. H., Halim, S., Sarani, N. A., Hassan, M. I. H., & Hissham, N. F. N. (2021, May). Overview on food waste management and composting practice in Malaysia. *AIP Conference Proceedings*, 2339(1), 020004. <https://doi.org/10.1063/5.0044206>
- International Trade Administration. (2024). *Malaysia Waste Management*. <https://www.trade.gov/market-intelligence/malaysia-waste-management>.
- Jereme, et al. (2017). Food wastes and food security: The case of Malaysia. *International Journal of Advanced and Applied Sciences*, 4(8), 6–13. <https://doi.org/10.21833/ijaas.2017.08.002>.
- Kasmuri, N., Razak, S. N. A., Yaacob, Z., Miskon, M. F., Ramli, N. H., & Zaini, N. (2023). Waste segregation through recycle and composting activities in urban and suburban areas. *IOP Conference Series: Earth and Environmental Science*, 1135(1), 012059. <https://doi.org/10.1088/1755-1315/1135/1/012059>
- Kaur, P., Dhir, A., Talwar, S., & Alrasheedy, M. (2020). Systematic literature review of food waste in educational institutions: setting the research agenda. *International Journal of Contemporary Hospitality Management*, 33(4), 1160–1193. <https://doi.org/10.1108/IJCHM-07-2020-0672>.
- Keegan, E., & Breadsell, J. K. (2021). Food waste and social practices in australian households. *Sustainability (Switzerland)*, 13(6). <https://doi.org/10.3390/su13063377>.
- Lim, W. J., Chin, N. L., Yusof, A. Y., Yahya, A., & Tee, T. P. (2016). Food waste handling in Malaysia and comparison with other Asian countries. *International Food Research Journal*, 23(Suppl.), S1–S6.
- Lin, C. S. K., Pfaltzgraff, L. A., Herrero-Davila, L., Mubofu, E. B., Abderrahim, S., Clark, J. H., Koutinas, A. A., Kopsahelis, N., Stamatelatos, K., Dickson, F., Thankappan, S., Mohamed, Z., Brocklesby, R., & Luque, R. (2013). Food waste as a valuable resource for the production of chemicals, materials and fuels. Current situation

- and global perspective. *Energy and Environmental Science*, 6(2), 426–464. <https://doi.org/10.1039/c2ee23440h>.
- Mahayuddin, S. A. (2024). Assessing the Level of Knowledge and Hygienic Practices Among. *Malaysian Journal of Sustainable Environment*, 11, 281–296. <https://doi.org/10.24191/myse.v11i2.1719>.
- Mohammad, A. M., Chowdhury, T., Biswas, B., & Absar, N. (2018). *Food poisoning and intoxication: A global leading concern for human health. In Food safety and preservation* (pp. 307–352). Academic Press. <https://doi.org/10.1016/B978-0-12-814956-0.00011-1>
- Mohammadi, S. (2022). *Decentral Energy Recovery Potential of Black Water and Kitchen Refuse using Anaerobic Co-digestion in Eco-Districts 92* (Doctoral dissertation, Concordia University Montréal, Québec, Canada).
- Mohd Ghazali, M. S., & Syed Hassan, S. S. A. (2024). Characterization of sewage sludge for sustainable urban environments: Assessing heavy metal enrichment, thermal decomposition, and pyrolysis behavior. *Malaysian Journal of Sustainable Environment*, 12(1), 119–134. <https://doi.org/10.24191/myse.v12i1.1383>
- Padfield R, P. E., & Zakaria Z, R. P. (2014). Towards Sustainable Resource and Waste Management in Developing Countries: The Role of Commercial and Food Waste in Malaysia. *International Journal of Waste Resources*, 04(03). <https://doi.org/10.4172/2252-5211.1000151>.
- Papargyropoulou, E., Steinberger, J. K., Wright, N., Lozano, R., Padfield, R., & Ujang, Z. (2019). *Patterns and Causes of Food Waste in the Hospitality and Food Service Sector: Food Waste Prevention Insights from Malaysia*.
- Pirani, S. I., & Arafat, H. A. (2015). Reduction of food waste generation in the hospitality industry. *Journal of Cleaner Production*. <https://doi.org/10.1016/j.jclepro.2015.07.146>.
- Rohini, C., Ps, G., Vijayalakshmi, R., Ml, M., & Pasupathi, E. (2020). *Global effects of food waste*. 9(2), 690–699.

- Romani, S., Grappi, S., Bagozzi, R. P., & Barone, A. M. (2018). Domestic food practices: A study of food management behaviors and the role of food preparation planning in reducing waste. *Appetite*, 121, 215–227. <https://doi.org/10.1016/j.appet.2017.11.093>.
- Skawińska, E., & Zalewski, R. I. (2022). Combining the water–energy–food and food waste–food loss–food security nexuses to reduce resource waste. *Energies*, 15(16), 5866.
- Stirnimann, A., & Zizka, L. (2022). Waste not, want not: Managerial attitudes towards mitigating food waste in the Swiss-German restaurant industry. *Journal of Foodservice Business Research*, 25(3), 302–328. <https://doi.org/10.1080/15378020.2021.1942749>.
- Trematerra, P., & Fleurat-Lessard, F. (2015). Food industry practices affecting pest management. *Stewart Postharvest Review*, 11(1), 1–7. <https://doi.org/10.2212/spr.2015.1.2>.
- van der Fels-Klerx, H. J., Camenzuli, L., Belluco, S., Meijer, N., & Ricci, A. (2018). Food Safety Issues Related to Uses of Insects for Feeds and Foods. *Comprehensive Reviews in Food Science and Food Safety*, 17(5), 1172–1183. <https://doi.org/10.1111/1541-4337.12385>.
- Vinck, K., Scheelen, L., & Bois, E. Du. (2019). *Design opportunities for organic waste recycling in urban restaurants*. <https://doi.org/10.1177/0734242X18817714>.
- Woolley, E., Jellil, A., & Simeone, A. (2023). *Wasting less food: Smart mass customisation of food provision*. *Procedia CIRP*, 96, 189–194. <https://doi.org/10.1016/j.procir.2021.01.073>
- Zainal, D., & Hassan, K. A. (2019). Factors Influencing Household Food Waste Behaviour in Malaysia. *International Journal of Research in Business, Economics and Management*, 3(3), 56–71. www.ijrbem.com.
- Zainol, N. A., Ahmad, R., Rashid Radha, J. Z. R. R., & Ideris, M. S. K. (2017). Examining food wastage, cash handling and cost control practices: The case of food and beverage outlets in Malaysia. *International Journal of Business and Management*, 1(2), 182–188. <https://doi.org/10.26666/rmp.ijbm.2017.2.28>.

Zakarya, A., Yabainus, A. F., Halis, R., & Beson, M. R. (2021). A comparative study on generation and composition of food waste in Kundasang, Sabah. *IOP Conference Series: Earth and Environmental Science*, 920(1), 012026. <https://doi.org/10.1088/1755-1315/920/1/012026>.