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# KNOWLEDGE, ATTITUDE AND PRACTICES OF FOOD WASTE MANAGEMENT AMONG FOODSERVICE OPERATORS IN PETALING JAYA UTARA (PJU) 9 AND 10, SELANGOR

NOOR NAZURAH ZAINAL ABIDIN[1,2], MUHAMMAD AFIQ ZAKI[1] AND FARAH AYUNI SHAFIE[1]*

[1]*Centre of Environmental Health and Safety, Faculty of Health Sciences, Universiti Teknologi MARA Selangor, Puncak Alam Campus, 42300 Puncak Alam, Selangor, Malaysia.* [2]*Institut Latihan Kementerian Kesihatan Malaysia (ILKKM) Sungai Buloh, Selangor, Malaysia.*

**Corresponding author: farahayuni@uitm.edu.my*
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**Abstract:** Malaysia generated about 17,000 tonnes of food waste daily in 2021 and 24% of this waste was still edible. Wasting food is not only just an economic or humanitarian concern but it also affects the environment and can increase carbon footprint and biodiversity losses. Although many food waste campaigns have been launched in Malaysia recently, there is still a gap of adequate knowledge and practices as well as the right attitude in local communities especially among foodservice workers, towards food waste prevention. Therefore, the level of knowledge, attitude and practices (KAP) on food waste among foodservice operators were assessed in this study to identify the factors that contribute to food waste generation among foodservice operators so that effective corrective methods could be developed to address this problem. A self-administered questionnaire surveying 136 respondents of foodservice operators in PJU 9 and 10, Petaling Jaya, Selangor using convenience sampling were conducted. The results showed that the respondents had a good level of knowledge (86%) while attitudes were at a moderate level (76.5%) and practices of food handling were identified to be at a low level (48.5%). The evaluation of the relationship between the three elements of KAP on the generation of food waste revealed that there was a weak positive relationship between knowledge and attitude ($r = 0.26$, $p < 0.05$) as well as between knowledge and practices ($r = 0.21$, $p < 0.05$). However, a weak negative relationship ($r = - 0.22$, $p = 0.01$) was noted in the relationship between attitude and food handling practices. These results indicate that high knowledge of food waste generation as a factor may not help change the attitude patterns and practices of foodservice operators in food waste mitigation. In this regard, positive and negative reinforcements may be one of the best approaches for sustainable food waste management among foodservice operators, for example, offering incentives to those who produce less food waste and levying a penalty to those who produce more may act as a deterrent.

Keywords: Food waste knowledge, behaviours, practical application, foodservice premises.

## Introduction

Food wastage, as defined by the High-Level Panel of Experts on Food Security and Nutrition are foods initially intended to be consumed by humans that are then discarded or left to deteriorate and are contaminated (HLPE, 2014). Food waste often occurs at the consumer level out of all the food chain stages from harvest to consumption. Food waste is usually organic waste left uneaten such as vegetables, meat and fish waste, bones, shells, fruits, and leftover skin like bananas, oranges, potatoes, legumes, etc. Food waste can also originate from the lack of appropriate planning in food preparation, for example purchasing in bulk foods where a part of them will not be used before their expiry. Most of the food waste produced can be composted by anaerobic digestion process rather than being discarded which can result in negative consequences to the environment (Orhorhoro *et*

*al*., 2017). The increase in food waste is gaining widespread attention around the world because of the implications on society, economic activity and the environment. Garbage dumping related to food waste is seen to be the highest in developed countries and is one of the important factors to be addressed when dealing with waste problems (Jeswani *et al*., 2021). Moreover, in the field of effective waste management, the type of waste that gets high consideration to be managed is food waste. Good food waste management has been identified as one of the more sustainable solutions for global waste disposal matters (Papargyropoulou *et al*., 2014).

Numerous studies have been conducted to understand and enhance public awareness of food waste and its association with food safety and security, sustainable development, environmental effect and diminished resources (Canali *et al*., 2016; Pinto & Cordovil, 2018; Lang *et al*., 2020). In Malaysia, it has been reported that there are 16,688 tonnes of food waste dumped by Malaysians every day (Zainol *et al*., 2017). It was also reported that among the municipal solid waste (MSW) generated, the percentage of food waste category was the highest, comprising of 49.3%, followed by paper at 17.1%, plastic and iron waste at 9.7% and 1.6% as well as the waste from other sources was as much as 22.3% (Ali *et al*., 2018). Abd Kadir *et al*. (2017) also reported that the amount of waste generated in Malaysia, organic waste is the highest type of waste accumulated which covers 50% of the total waste generated.

The environmental consequences emanating from food waste production have caused the latter to become one of the major global sustainability problems, drawing concerns from policymakers, researchers, society and corporations (Liu *et al*., 2021). Therefore, an exceptional understanding of the accessibility and quality of food waste information may be able to track the effectiveness of the mitigation targets, analyse the environmental consequences and investigate the reduction procedures for food waste (Xue *et al*., 2017). Previous studies have focused on the producers or consumers when finding the underlying cause of food waste along the food supply chain process (Katajajuuri *et al*., 2014; Stancu *et al*., 2016; Richter, 2017). However, there is a lack of data related to the KAP of food waste prevention among the local foodservice operators, KAP on food waste may vary in different sociodemographic settings and thus may have different outcomes and approaches to create awareness towards food waste reduction (Szakos *et al*., 2020). Therefore, this study aims to evaluate food waste awareness among foodservice operators in Petaling Jaya, Selangor where the main elements evaluated were related to the knowledge, attitudes and practices followed while preparing and handling food to choose the best approaches to reduce food wastage in this industry.

## Materials and Methods

### *Study Sample and Preparation*

A random sampling technique was applied in this study, in which different types of eateries such as restaurants, food courts, cafes and bistros with different operating hours were included. All foodservice operators who were working in the selected public food establishment including the servers, chefs and restaurant owners in the towns of Sri Damansara (PJU 9) and Damansara Damai (PJU 10), Petaling Jaya were the study population. These towns were selected as there are strategic locations in the heart of Petaling Jaya city, surrounded by various economic and commercial activities. Rapid development and urbanization are underway such as the increase in apartment and condominium housing projects, the expansion of Mass Rapid Transit (MRT) rail system projects and various other industrial activities, making these areas the most populous areas in the Petaling Jaya district. In general, the greater the economic growth and the higher the level of urbanization, the greater the amount of solid waste generated in the area (Yatim & Arshad, 2010; Chen, 2018; Han *et al*., 2020).

The group of respondents were between the ages of 18 and 50 years old and were fluent in Malay or English language. The respondents

for this study were obtained from the issuance of the Food Establishment License for 2021 retrieved from Petaling Jaya Municipal Council, Selangor. PJU 9 and PJU 10 had 95 and 41 eateries, respectively, making the total sample size of this study 136 eateries. Each restaurant was represented by one participant.

### *Study Design*

Assessment of foodservice operators' knowledge of food waste was performed through questionnaires adapted from Jarjusey and Chamhuri (2017) and Juliana *et al*. (2020). For the attitudes of foodservice operators towards food waste, the questionnaires were adapted from Meo *et al*. (2018) and Juliana *et al*. (2020). As for practice, the questionnaires developed were adapted from Lang *et al*. (2020) as well as Juliana *et al*. (2020). This study involved assessing the foodservice operators' knowledge, attitude and practices on food waste, and the practice implies reducing the production of food waste. The knowledge category included general knowledge of food waste, awareness of the types of waste and sources of information. The attitude section included statements taken based on existing knowledge on information and concepts about food waste. Behavioural categories addressed the knowledge and attitudes towards food waste that have affected the practices among foodservice operators, and how their knowledge and attitudes have influenced the decision-making in reducing food waste production. This was a cross-sectional study. Quantitative data analysis was used to determine the relationship between variables involved in the study. The variables were about foodservice operators' awareness (KAP) towards food waste generation. Moreover, this quantitative research aimed to describe the relationship between foodservice operators' knowledge and attitude towards food handling practices.

### *Study Instrument*

The instrument used in this study was a self-administered questionnaire that was distributed to the respondents in Malay and English. Questionnaire forms are among the most frequently used data collection method in research studies for input analysis and evaluation. It is a reliable and useful instrument principally used in studies involving economics, sociodemographics and even awareness of assessing relevant KAP (Knowledge, Attitude and Practice) (Singh, 2017).

The questionnaires in this study was divided into four sections.

i. Section A - sociodemographic characteristic (6 questions).

   The questions mainly focused on the personal information of the respondents which were essential like age, gender, educational level, types of foodservice establishment, work experience in the foodservice sector and food waste composting activities at foodservice premises.

ii. Section B - knowledge of food waste generation in the foodservice establishments (11 questions).

   The knowledge section was divided into general information on the characteristics as well as the types of food waste available. These questions required the respondent to answer close-ended questions ('Yes', 'No' or 'Not Sure') based on each statement. Each question was awarded 1 mark to the respondent who answered 'Yes' and 0 for the answer 'No' or 'Not Sure'. Meanwhile, for the marks of knowledge questions, the scores were obtained by making the total number of respondents answer choices 100%.

iii. Section C - attitudes of foodservice operators towards food waste (10 questions).

   This section assessed the attitude of foodservice operators in managing food waste and food that still could be used during food preparation and serving. The level of the agreement required the respondent to answer the Likert Questions through 5-point Likert Scale ranging from 1 as 'Strongly Disagree' to 5 as 'Strongly

Agree'. In this Likert Scale score, the scores for 'Strongly Disagree' and 'Disagree' were combined with Disagree/Strongly Disagree while the scores for 'Agree' and 'Strongly Agree' were combined with Agree/Strongly Agree. The marks for all questions obtained were calculated by making the total number of answer choices 100%. The higher score on the scale the higher the commitment of attitudes among foodservice operators in handling food well and effectively to avoid generating avoidable food waste.

iv. Section D - practices and behaviours of foodservice operators towards food waste management (8 questions).

There are two parts to this section: The prevention of waste and recycling of avoidable food waste, and food waste disposal. For the first part, the questions were to evaluate the practices of foodservice operators in managing waste effectively and applying the concept of use and recycling in reducing the amount of food waste produced during the food handling process. The second part of this section aimed to evaluate food waste disposal practices among foodservice operators by looking at some of the factors that lead to food waste disposal. These questions require the respondent to answer close-ended questions ('Do', 'Do Not Do' or 'Not Sure') based on the statements. Each question was scored one mark for respondents who answered 'Do' and zero for those that answered 'Do Not Do' or 'Not Sure'. For the marks of practice questions, the scores were obtained by making the total number of respondent's answer choices equal to 100%.

The overall scores for the level of knowledge, attitudes and practices of food waste management of the respondents were classified into three parts: Less than 50% = low (poor), 50% - 75% = moderate/(average) and more than 75% = high (good) according to the method proposed and employed by Barloa *et al*. (2016).

### *Reliability Testing*

The reliability of the questionnaire was established through a pilot study conducted among foodservice operators in the study locations, namely PJU 9 and PJU 10, Petaling Jaya. The internal consistency of the pilot study was assessed using Cronbach Alpha's Statistical Package for Social Sciences (SPSS) Statistics Version 26.0. It is suggested that the acceptable Cronbach Alpha values (α) internal consistency range between 0.70 and 0.95. The pilot test in this study involved 136 out of a total of 3,280 food establishments where convenience sampling using an inclusion criterion was done. Based on the Cronbach Alpha results for a set of questionnaires about food waste awareness among foodservice operators, it was found that this study was at an acceptable level with a value of 0.77.

## Results and Discussion

### *Sociodemographic Profile of Respondents*

Table 1 shows the sociodemographic profiles of the respondents. Male respondents slightly outnumbered the female respondents comprising of 52.9% (n = 72) versus 47.1% (n = 64) and most of the respondents were in their 20s and 30s (78.7%). Most of them had tertiary education with less than five years of working experience in the foodservice sector. The majority of the respondents were working at restaurant-type outlets and most of them only had general rubbish bins for waste disposal. Furthermore, most food establishments did not carry out any composting activity involving food waste.

It has been demonstrated that a foodservice operators' motivation, opportunity or ability to act in specific ways may be affected by sociodemographic factors (National Academies of Sciences, Engineering and Medicine, 2020). However, routines, norms and beliefs related to food may vary significantly based on the culture at each socioeconomic level; thus, sociodemographic variables could be poor indicators of behaviour.

Table 1: Sociodemographic profile of respondents

| Characteristics | n | Percentage (%) |
|---|---|---|
| **Age** | | |
| 18 – 20 years | 3 | 2.2 |
| 21 – 30 years | 56 | 41.2 |
| 31 – 40 years | 51 | 37.5 |
| 41 – 50 years | 26 | 19.1 |
| **Gender** | | |
| Male | 72 | 52.9 |
| Female | 64 | 47.1 |
| **Educational level** | | |
| No formal education | 4 | 2.9 |
| Primary school | 2 | 1.5 |
| Secondary school | 32 | 23.5 |
| University/college/institution | 98 | 72.1 |
| Others | - | - |
| **Types of foodservice establishment** | | |
| Restaurant | 63 | 46.3 |
| Food court | 31 | 22.8 |
| Café and bistro | 42 | 30.9 |
| **Work experience in the foodservice sector** | | |
| < 5 years | 100 | 73.5 |
| 5 – 10 years | 28 | 20.6 |
| > 10 years | 8 | 5.9 |
| **Types of bins available at foodservice premises** | | |
| General waste bin | 132 | 97.1 |
| Recycle bin | 4 | 2.9 |
| **Food waste composting activities at premises** | | |
| Yes | 17 | 12.5 |
| No | 119 | 87.5 |

### *Knowledge of Food Waste Generation among Respondents of Foodservice Operators*

Table 2 shows the knowledge of food waste generation among the foodservice operators. The results show that the respondents of this study have a "good" level of knowledge regarding food waste (9 out of 10 respondents scored over 75%).

It is known that any "waste" will have a negative impact on things related to it and that holds true even when it comes to food waste. Therefore, it is in line with the results of this study, which has found most respondents, covering 92.6% (n = 126), answered correctly that the reduction of food waste can reduce pollution and danger to the environment. Most of them have a basic knowledge when saying food

Table 2: Knowledge of food waste generation in the foodservice establishments

| | Statement (N = 136) | Number of Responses, n (%) | | |
|---|---|---|---|---|
| | | Yes | No | Not Sure |
| 1. | Reducing food waste can reduce pollution and danger to the environment. | **126 (92.6) *** | 2 (1.5) | 8 (5.9) |
| 2. | Food waste occurs due to the individual's own choices. | **122 (89.7) *** | 8 (5.9) | 6 (4.4) |
| 3. | Food waste consists of avoidable and unavoidable types. | **103 (75.7) *** | 9 (6.6) | 24 (17.6) |
| 4. | Food waste can be recycled like making it into pet food (e.g., cats, dogs, chickens, etc.). | **120 (88.2) *** | 6 (4.4) | 10 (7.4) |
| 5. | Food waste can be composted and used as fertilizer for plants. | **121 (89.0) *** | 3 (2.2) | 12 (8.8) |
| 6. | An organized storage system for perishable and non-perishable types of food to avoid wastage. | **126 (92.6) *** | 4 (2.9) | 6 (4.4) |
| 7. | There is a difference between 'best before' and 'use-by' dates on expiration date stickers of food products. | **95 (69.9) *** | 16 (11.8) | 25 (18.4) |
| 8. | Food items should be used in the order of expiration dates that will expire first. | **129 (94.9) *** | 3 (2.2) | 4 (2.9) |
| 9. | Dry food storage stores should be free from any moisture to prevent foods from being easily damaged. | **132 (97.1) *** | - | 4 (2.9) |
| 10. | Society lacks understanding of the impact of food waste because no strict regulations are implemented. | **120 (88.2) *** | 5 (3.7) | 11 (8.1) |

**Responses in bold are correct answers to knowledge*

waste occurs due to the individual's own choice (89.7%, n = 122) as well as the types of food waste consisting of avoidable and unavoidable wastage (75.7%, n = 103). This indicates most respondents are aware of the negative effects of food waste produced and that it is their personal choice to properly manage it. However, about 17.6% (n = 24) of the respondents were unsure of the types of food waste while 6.6% (n = 9) of them did not know about the types of food waste. Unfortunately, this study did not record if respondents had attended seminars or had undergone training on food handling and food waste prior to this survey or account for the respondent's job categories too; hence, the study could not ascertain the relationship between individuals with low to moderate scores in the knowledge assessment and the reasons behind it. One recent study on food waste knowledge among university students suggested knowledge may not always lead to action while another study showed unintentional and careless food wasters demonstrate a lower level of information whereas guilty food wasters already possess a high level of knowledge (Richter, 2017; Alattar *et al.,* 2020). On average, about 80% of respondents chose the correct answer for the questions involved. However, the question of the difference between the "best before" and "use by" dates on food product expiration date stickers was less well-known among foodservice operators. Moreover, according to Richter (2017), various factors can cause food waste production and one of them is the expiration of best-before dates. Therefore, it should be noted that many foodservice operators are still unaware of the differences in the date notations which could contribute to the generation of food waste.

***Attitudes Towards Food Waste among Respondents of Foodservice Operators***

Attitude refers to emotions, beliefs and behaviours toward a particular thing. Usually, this is the result of previous experience or training, which can strongly influence a person's behaviour (Maio *et al*., 2018). Table 3 shows the attitudes of foodservice operators towards food waste. The results show about half of the respondents disagree to strongly disagree with the statement "food wastage is not anything that I ever consider" (55.2%, n = 75) while about 31.6% (n = 43) of them agree or strongly agree with that statement.

This shows that most of them were aware of the impact and consequences of food waste produced, either the impact on themselves or related to the foodservice business they are in. This is because apart from the wastage of food, which is deemed inappropriate, it can also indirectly affect the foodservice businesses bottom line where food waste also means wasting money. However, some of them agreed with the statement assuming they may regard food wastage as something that inevitably occurs naturally, so, they assume it is relatively normal (Parizeau *et al*., 2015; Stangherlin & Barcellos, 2018). Furthermore, this can also be linked to a study by Grandhi and Singh (2015) which has revealed that there is a possibility of untrue ideology or misunderstanding where there is a group of individuals who are mostly aware of the impact on the environment but have felt food waste is a biodegradable waste, thus, it eventually becomes harmless. Therefore, it is not a concern that affects the environment as they assume it will disappear naturally.

Table 3: Attitude of foodservice operators towards food waste

| | Statement (N = 136) | Number of Responses, n (%) | | |
|---|---|---|---|---|
| | | Agree/ Strongly Agree | Neutral | Disagree/Strongly Disagree |
| 1. | Food wastage is not anything that I ever consider. | 43 (31.6) | 18 (13.2) | 75 (55.2) |
| 2. | I store and reuse the leftover food. | 53 (39.0) | 39 (28.7) | 44 (32.3) |
| 3. | I throw away a fruit or vegetable if it is a little bit damaged. | 47 (34.5) | 39 (28.7) | 50 (36.8) |
| 4. | If today is the expiration day of a certain food product, I do not use it for cooking. | 76 (55.8) | 20 (14.7) | 40 (29.4) |
| 5. | I will throw away food whose pack is already opened. | 61 (44.8) | 39 (28.7) | 36 (26.4) |
| 6. | Before I go shopping, I will check what food items aren't enough in the kitchen. | 124 (91.2) | 10 (7.4) | 2 (1.5) |
| 7. | I will buy stocks of food items that are offered cheaply, even though I know they may not need to be used in restaurants. | 34 (25.0) | 27 (19.9) | 75 (55.1) |
| 8. | I stock up on food items according to the amount needed in the restaurant only. | 108 (79.4) | 18 (13.2) | 10 (7.4) |
| 9. | I will store food items by type in an orderly manner so that they are not easily damaged to avoid wastage (e.g., vegetables, fruits, dried foods, spices, etc.). | 124 (91.2) | 6 (4.4) | 6 (4.4) |
| 10. | I am not worried about the cost of food that I throw away. | 26 (19.2) | 29 (21.3) | 81 (59.5) |

Most of them agree or strongly agree that the practice of storing food (91.2%, n = 124) and making an initial check on the lack of food items in the kitchen that is not enough before going shopping (91.2%, n = 124) for fresh stock. This assumes most foodservice operators in this study have realized the importance of having an orderly food storage system to manage food spoilage. This is because, according to Jeswani *et al*. (2021), food waste falls into the following two categories, namely avoidable and unavoidable food waste. Hence, adopting good food storage practices can prevent avoidable food spoilage. Moreover, respondents may also feel the need to prepare before shopping to avoid excessive spending, which eventually will result in food wastage from surplus food items. This implies they understand spending on food items needs planning to know what items need to be purchased (Richter, 2017). Furthermore, according to a study by Parizeau *et al*. (2015), among the causes of food waste that often occur is due to the habit of buying excessive amounts of food.

In addition, most respondents agreed/strongly agreed not to use certain food products for cooking if the day is the expiration date (55.8%, n = 76) while 29.4% (n = 36) of them disagreed/strongly disagreed and around 14.7% (n = 20) were neutral about it. Here it can be concluded that it is important for foodservice operators to know wisely the differences between the expiration dates noted on the labels of food items. This is because, according to Calvo-Porral *et al*. (2017), among the other important causes of food waste is the shelf life of perishable food products. These food products have been capped by category, consisting of the best-before date which reflects the quality of the product or use-by date which reflects the safety of the product. Therefore, it is important to know the differences between these dates because some types of food that can still be used even after the prescribed date has passed, depending on the conditions and previous storage methods. This is because through good storage methods if the food that has been opened does not pass the expiration date, it can still be used if the condition is still good and safe to eat.

### *Practices and Behaviours Towards Food Waste Management among Foodservice Operators*

Table 4 shows the results of the analysis of data obtained regarding the practices and behaviours of foodservice operators on food waste management. In this section, two elements of practices have been studied, namely related to the prevention of avoidable food waste and recycling as well as practices in the disposal of food waste.

The results show most respondents have good practices and behaviours in the context of prevention of avoidable food waste and recycling. The study also found most of them (91.2%, n = 124) separated the cooking ingredients by type to prevent them from mixing for a long time and getting spoiled, as well as cooked the amount of food only according to customer needs and demands at a particular time. Most respondents are aware and believe these practice while handling food can help to avoid unwanted wastage. Isolating different types of cooking ingredients and their uses is one of the effective measures in ensuring that cooking ingredients are in good condition and can be used when needed (Betz *et al*., 2015). In fact, according to Goggins and Rau (2016), the practice of separating food ingredients during the food preparation process is a discipline that must be instilled among food handlers to ensure the quality of food produced.

In addition, many respondents practised packing up to take it home for personal consumption or giving it to employees whenever they are unable to sell off all the food, they will always (85.3%, n = 116). Even so, 8.1% (n = 11) of the respondents were unsure about it and the remaining 6.6% (n = 9) did not do this. A practice like this depends on one's beliefs and perceptions of the food leftovers. It also involves ethics and depends on the condition of the food, whether it is still good and edible. Moreover, it was found that there was a relatively balanced

Table 4: Practices and behaviours of foodservice operators towards food waste management

| | Statement (N = 136) | Number of Responses, n (%) | | |
|---|---|---|---|---|
| | | Do | Do Not Do | Not Sure |
| | ***Prevention of avoidable food waste and recycling*** | | | |
| 1. | The cooking ingredients are separated by type to prevent them from mixing in a long time and becoming spoiled. | **124 (91.2) *** | 6 (4.4) | 6 (4.4) |
| 2. | The amount of food cooked is only according to the needs and demands of the customer at a certain time. | **124 (91.2) *** | 6 (4.4) | 6 (4.4) |
| 3. | Every time I cannot finish a food sale, I always pack to take it back or give it to another employee. | **116 (85.3) *** | 9 (6.6) | 11 (8.1) |
| 4. | The food waste that can no longer be eaten, I take to make compost for crops. | **58 (42.6) *** | 61 (44.9) | 17 (12.5) |
| | ***Disposal of food waste*** | | | |
| 5. | I rather discard the foods than keeping it in the fridge. | 44 (32.4) | **74 (54.4) *** | 18 (13.2) |
| 6. | Before throwing away any food, I will make sure the food has spoiled and can no longer be used. | **125 (91.9) *** | 8 (5.9) | 3 (2.2) |
| 7. | I will separate wet and watery food waste into different garbage plastics before disposing of it. | **98 (72.1) *** | 31 (22.8) | 7 (5.1) |
| 8. | I will continue to throw away food that is past the expiration date without looking at its condition first. | 81 (59.6) | **44 (32.4) *** | 11 (8.1) |

**Responses in bold are correct answers to good practices*

percentage of respondents' opinion on the statements relating to food waste management:

"The food waste that can no longer be eaten, I take to make compost for crops".

From the results obtained, about 44.9% (n = 61) of respondents did not practice composting food waste and continued to simply dispose of food waste while 42.6% (n = 58) of respondents practiced composting food waste. Meanwhile, the remaining 12.5% (n = 17) of the respondents were unsure about the practice. From the feedback received, this practice will be implemented if they have more time and a suitable place for composting. For those who practise composting, it has become a habit to perform this activity in person and they prefer to do it at their private residence rather than at the foodservice premises.

Most respondents also have good practices in disposing of spoiled food. It was found that most of them would first make sure that the food was spoiled and could no longer be used before disposal (91.9%, n = 125). This proved most of the respondents in this study employed good practices to reduce avoidable food waste if they carry out proper and effective waste handling practices. Moreover, the results of good practice have also been recorded in the behaviour of segregating wet and watery food waste into different garbage bags before disposal. These results are consistent with studies by Pinto *et al*. (2018) where according to the study, one of the good food handling practices is that food handlers segregate food waste by type, as well as separate the waste according to its condition whether it is wet or dry waste.

### *The Relationship between Respondents' Knowledge and Attitude on Food Waste among Foodservice Operators*

To evaluate the direction and strength of the relationship between respondents' knowledge and attitude toward food waste was by Pearson

correlation coefficient. The Pearson correlation coefficient (r- values can lie between 0 and -1 or 0 an+1. The closer "r" is to zero, the weaker the relationship between the variables. Table 5 shows the strength value of Pearson's correlation coefficient, "r" obtained through the analysis.

From the results obtained, this study shows a positive relationship with a significant correlation between knowledge and attitudes towards food waste by the respondents ($r = 0.26$, $p < 0.05$). Based on the specified Pearson's correlation strength range, the relationship between these two rank scores are weakly positively correlated. This shows that a high level of knowledge possessed by the respondents does not always come with good and positive attitudes towards food waste as exhibited by a previous study on Indian men and women (Gupta, 2022). However, two studies proposed knowledge and awareness of individuals operating the food preparation process influence the attitudes of such individuals in limiting or avoiding the production of food waste during the food preparation process (Bashir *et al.,* 2020; Jeswani *et al*., 2021). In our case, having a good knowledge of food waste may not be sufficient to influence foodservice operators' attitudes towards preventing and controlling food waste generation. The reason behind this could be that some of the knowledge questions are more towards perception rather than knowledge, for example, "food waste occurs due to the individual's own choices" and "society lacks the understanding of the impacts of food wastage because no strict regulations are implemented". Knowledge is gained through learning and experience whereas perception is how we think about something and the idea of what it is like (Rock, 1985). Perhaps, the lack of experience and learning about food wastage could not solidify an individual's attitude towards food waste; hence, the weak association between foodservice operators' knowledge and attitude in this study.

### *The Association between Sociodemographic Characteristics with Level of Knowledge and Attitude Towards Food Waste among Respondents of Foodservice Operator*

The association between sociodemographic characteristics with the level of knowledge and attitudes toward food waste among foodservice operator respondents was studied using the Chi-Square test. To test the relevance of this study, the level of knowledge and attitude were classified into three groups, specifically high, moderate and low. The association between sociodemographic variables and knowledge or the attitudes of foodservice operators toward food waste is shown in Table 6.

Overall, the statistical analysis did not show any association between sociodemographic data and the respondents' knowledge levels and attitudes towards food waste. Therefore, the association between sociodemographic characteristics with the level of knowledge and attitudes of foodservice operators towards food waste was not studied further. Nevertheless, the results of the study contradicted previous studies mainly involving educational data, where according to Kasavan *et al*. (2019), the drivers of food waste in the foodservices industry are divided into three categories: Internal factors, external factors and intermediate factors (internal and external). Lack of education and awareness related to food wastage are among the important components included in the intermediate factors contributing to food waste generation.

Table 5: Relationship between scores of respondents' knowledge and attitude on food waste of foodservice operators

| Parameter | Value r | Value p |
|---|---|---|
| Knowledge and attitude | 0.26 | 0.04 |

**Pearson's correlation test with value of $p < 0.05$, $N = 136$*

Table 6: The association between sociodemographic characteristics with the knowledge and attitudes of foodservice operators toward food waste

| Variable (N = 136) | | Food Waste Knowledge | | Food Waste Attitude | |
|---|---|---|---|---|---|
| | n (%) | $\chi^2$ (df) | *P* value | $\chi^2$ (df) | *P* value |
| **Age** | | 5.56 (6) | 0.47 | 2.00 (6) | 0.92 |
| **Gender** | | | | | |
| Male | 72 (52.9) | 2.37 (2) | 0.31 | 1.88 (2) | 0.39 |
| Female | 64 (47.1) | | | | |
| **Educational level** | | | | | |
| Primary education | 6 (4.4) | 7.91 (6) | 0.25 | 3.68 (6) | 0.72 |
| Secondary education | 32 (23.5) | | | | |
| Tertiary education | 98 (72.1) | | | | |
| **Types of food premises** | | | | | |
| Restaurant | 63 (46.3) | 4.85 (4) | 0.30 | 1.86 (4) | 0.76 |
| Food court | 31 (22.8) | | | | |
| Café and bistro | 42 (30.9) | | | | |
| **Work experience in foodservice** | | | | | |
| < 5 years | 100 (73.5) | 6.72 (4) | 0.15 | 2.93 (4) | 0.57 |
| 5 – 10 years | 28 (20.6) | | | | |
| > 10 years | 8 (5.9 | | | | |
| **Food waste composting activities** | | 3.16 (2) | 0.21 | 3.59 (2) | 0.17 |
| **Type of bins available** | | 1.08 (2) | 0.58 | 0.08 (2) | 0.96 |

### *Relationship of Knowledge and Attitudes of Foodservice Operators with Practices during Food Handling*

Pearson's correlation was used to assess the direction and strength of the relationship between the knowledge and attitudes of foodservice operators with the current food handling practices. Logistic regression cannot be used for further analysis in this KAP relationship because in Pearson Correlation test results, the value of coefficient "r" obtained was low which negated the applicability of the logistic regression analysis test (Menard, 2002). The strength values of Pearson's correlation coefficient, "r" obtained through the analysis are in Table 7.

There was a statistically significant weak positive relationship (r = 0.21, p = 0.02) between

Table 7: Relationship between knowledge and attitudes of foodservice operators with practices during food handling

| Parameter | Value r | Value p |
|---|---|---|
| Knowledge and practices | 0.21 | 0.02 |
| Attitude and practices | - 0.22 | 0.01 |

**Pearson's correlation test with value of p < 0.05, N = 136*

the respondents' knowledge and practices on food handling while the results of the respondents' attitude and practices test showed a weak negative relationship with a significant correlation ($r = - 0.22$, $p = 0.01$). The level of knowledge may weakly influence the pattern of handling practices among respondents but this does not translate to having high knowledge that contributes to good practices. This coincides with previous studies by Zainal *et al*. (2019) and Adeyemo *et al*. (2013) which showed no association between knowledge and practice of food waste management among the Malaysian and Nigerian communities. Besides, Ajzen (1991) stated that the general favourable and unfavourable evaluation of performing a behaviour is demonstrated by the attitude of an individual towards that behaviour, whereby in this study, poor attitude translates into weaker intention to reduce food waste. Moreover, motivational factors including social norms, have been demonstrated to drive and maintain behaviours more effectively than knowledge (National Academies of Sciences, Engineering and Medicine, 2020). Interestingly, Russell *et al.* (2017) demonstrated that negative emotion is positively associated with the intent to mitigate food waste.

Meanwhile, according to a study by Chekol *et al*. (2019), the generation of food waste that occurs because of contaminated food is due to poor food handling practices which are associated with work experience, good attitude, level of education, usage of three compartment dishwashing systems and refrigerator. Interestingly, in this study, good attitudes among foodservice operators are weakly negatively correlated with good handling practices. This could mean that the good practices factor depends on the individual's personal choice whether to make the right moves or not. However, the practice of food waste management can also be influenced by various other aspects. For example, Thi *et al*. (2015) demonstrated that economic, socio-cultural and lack of infrastructure in the aspect of food waste management potentially affects the generation of food waste in the whole food supply chain where food handling activities are performed according to the suitability and normality that has become common practice. Thus, it is difficult to change if no encouragement or stimulus is given to foodservice operators to help them understand proper food waste management method in controlling the production of food waste.

Based on the survey, most of the respondents in the study areas of PJU 9 and 10 were aware of the importance of good food service management during food handling activities and were well aware of the disadvantages that can occur as a consequence of generation food waste. However, due to some limitations and constraints, besides carrying out wrong practices that have become a habit, they have a difficulty in handling food as it should be, resulting in food wastage eventually. In this regard, it is very important to restructure the kitchen with modern refrigerators, as suggested by a recent study in Northwest Ethiopia (Chekol *et al.,* 2019). Additionally, Limon and Villarino (2020) proposed that a mandatory food waste recycling system, requiring policy amendments and cooperation of multiple sectors and stakeholders in society, could be another solution to this global issue. Importantly, one recent study revealed that routines and behavioural patterns towards food waste could be shaped via childhood education and awareness, with proper messages and impulses (Szakos *et al.,* 2020). Perhaps, this way, the attitudes and practices of foodservice operators towards food waste management will advance in tandem with their knowledge. There are also regulatory initiatives that can be undertaken to tackle food waste such as tax deductions for food redistribution and "pay as you throw" schemes that charge food waste producers more, whereas at the organisation level, the implementation of software solutions in commercial kitchens could decrease wastage (World Biogas Association, 2018). Therefore, it involves all parties, especially foodservice operators, in making the necessary efforts to address food waste problems.

## Conclusion

Awareness of food wastage in the food service sector is highly dependent on the awareness of each individual, especially those directly involved in the food handling process. Therefore, genuine solutions and approaches should be sought to mitigate and control the amount of food waste generated. In this study, it has been shown that knowledge plays a minor role in contributing to the production of food waste, having good knowledge of proper food management may not prevent the generation of food waste among Malaysian food service operators due to their poor attitude towards food wastage management practices. The level of knowledge has little influence on the attitudes of foodservice operators in managing food waste. The moderate and low levels recorded in the results of this study show no significant positive relationship between the two elements. This suggests that food handling practices are not influenced by the foodservice operators' attitudes and behaviours where situations are viewed subjectively, in which good attitudes come from the individual's own choices and perceptions to practice the behaviours as they should. Previous studies suggested food waste is very closely related to the methods and ways of handling food items, which start in the early stages of the food handling process. Thus, other initiatives such as integration of commercial kitchen solutions, tax deductions for food redistribution and penalties being levied to food waste producers should be undertaken so that every food service operator will make attitude changes to normalise good and appropriate practices to control and minimise food waste. If these efforts can be implemented, the goal of controlling and reducing food waste in the food industry in general will be achieved. Importantly, future studies shall consider conducting open-ended questionnaire as well as recording the job category of each participant in the food service operators so that accurate reasons behind the outcomes of KAP towards food waste can be found.

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