



## Quantifying Avoidable Food Waste and Identifying Its Underlying Causes: A Case Study of a University Dormitory in Thailand

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### Abstract

To develop well-planned and effective policies and programs for reducing avoidable food waste, it is important to quantify the actual food waste level in particular settings and assess relationships among consumers' awareness, attitudes, and behaviors. Recognizing these considerations, this paper measured avoidable food waste generated by university students living in dormitory buildings and identified its underlying causes in the case of Kanchanaburi campus, Mahidol University, Thailand. The study applied a food waste composition survey 18 times between January and May 2019 while administering questionnaires in October 2019 to the dormitory students. Based on these measures, the study identified 1,417 instances of avoidable food waste. Approximately half of the avoidable food waste had not even been eaten. Most of this waste was generated by female students. Some factors in terms of motivation, opportunity, and ability using a Motivation, Opportunity, Ability framework were found to have induced more food waste among female students. Due attention to the effect of avoidable food waste reduction includes educating dormitory students about food waste as well as more space and increased visibility of stored food in shared refrigerators. Targeting university students for reducing avoidable food waste in the setting of everyday life in dormitories is needed rather than simply focusing on the food service sector on campus.

**Keywords:** Avoidable food waste; Food waste composition; Food waste behavior; Thailand; University dormitory

### Introduction

Globally, food waste is a growing concern that can occur anywhere along the entire food chain—from production to retail and consumer levels. It poses some important contemporary

challenges not only in terms of ethics but also with respect to food security, economy, and environmental sustainability [1]. At the worldwide level, nearly one-third of the global food produced is lost or wasted, and this amounts to around 1.3

billion tons of food per year [2]. In medium- and high-income countries, food is wasted to a significant extent at the consumption stage [2], requiring actions for reducing food waste, which is defined as “food that is produced or processed originally for human consumption but is not consumed by a person” [1]. While some food waste, such as peels and bones, is unavoidable, a considerable amount of food could have been eaten if it had been planned, stored, and managed better. Such avoidable food waste can be defined as “*products that are still fit for human consumption at the time of discharging or products that would have been edible if they had been eaten in time*” [3].

One challenge with regard to developing well-planned and effective avoidable food waste-related policies and programs is measuring food waste [1]. Some attempts to identify the volume and types of food waste have been made through waste composition analyses [4–7], questionnaires or interviews [5, 9–13], and food waste diaries [8–10, 14–15]. Out of these three methods, most studies on food waste have tended to rely on self-reported amounts from consumers (questionnaires or interviews and food waste diaries) [16]. However, the latter two methods could underestimate the actual food waste. For example, Ventour [7] reported that even surveyed households that insisted they did not generate any food waste actually discarded nearly 90 kg per year of avoidable food waste. Likewise, the quantities of food waste recorded in the diaries were around 40% lower than those obtained from analyses of waste streams [17]. Waste composition analyses are expected to produce more accurate results.

In addition to quantifying the level of food waste, elaborations with regard to food waste reduction at the consumption level are needed to understand why food is thrown away, learning about who is doing what in the form of a particular setting. Food waste behavior contexts consist of the circumstances within which food

is consumed that characterizes the point at which food becomes waste, which can be differentiated between settings [18]. These contexts include factors outside of people’s control such as food prices and changes to the packaging of food products in addition to settings of everyday life that impact food waste (e.g., work patterns, family structure, or household traditions around meals) [19]. In addition, earlier studies have reported that age and gender influenced food waste behaviors: older people waste less food than do younger people and women waste more than men [3, 16, 20–21]. Other factors that may help to explain variations in quantities of household food waste generated include awareness and attitudes. Consumers’ awareness and attitudes as concerns about food waste in terms of environment, economic, and moral aspects may determine their intention not to waste food as expected based on theories derived from social psychology such as the Theory of Planned Behavior [22] and the Norm Activation Model [23].

Recognizing these considerations, this paper presents a case of measuring avoidable food waste generated by dormitory students and identifying its underlying causes at the Kanchanaburi campus of Mahidol University in Thailand, which can be considered a medium-income and developing country. Compared to developed countries, there are few studies on measuring food waste at the final stage of the food supply chain in developing countries. Although several earlier studies on this topic from universities have been conducted even in developing countries such as Ethiopia [24], Indonesia [25], Jordan [26], Thailand [27], and Turkey [28], as well as developed countries such as the UK [18, 29] and the US [30], these studies have been done in the food service sector (e.g., dining halls and canteens), not focusing on the setting of everyday life in university dormitories. University students are forming habits that may persist through adulthood [5]. Therefore, research on avoidable food waste generated within this setting is crucial to make better use

of food that is wasted in the long term through initiatives of the higher education sector, which is expected to play a leading role in the attainment of sustainable development.

This paper is structured as follows. Section 2 introduces the case study site and presents two research questions. It then details the study research methods. Section 3 evaluates the quantity and quality of food waste in the selected dormitories by applying food waste composition analysis. Section 4 explores individuals' food-related awareness, attitudes, and behaviors in the context of the dormitory setting. The discussions that consider the two research questions are presented in Section 5. Finally, this paper provides several implications for avoidable food waste reduction in university dormitories.

## Material and methods

### 1) Study site

The selected research site was the Kanchanaburi campus university dormitories at Mahidol University in Thailand. This institution is located in the Sai Yok District of Kanchanaburi Province. University students other than first-year undergraduates were studying at the campus during the study duration and most of them were staying in the dormitories.

The campus had five dormitories (three for female students and two for male students). The female dormitories were four-story buildings, while the male dormitories were two-story buildings. In 2019, 501 female students and 141 male students were living in these dormitories. Groups of five people were housed in individual rooms, and occupants in each building shared toilets and showers.

Because there was no dining kitchen, the dormitory students went to the university canteens or outside the campus to have or buy food. The dormitory students were able to store their purchased food in shared refrigerators installed on each floor. To ensure cleanliness and proper maintenance of these stored food items, the

cleaning staff would check and dispose of these items every Friday if their quality was poor in terms of smell, appearance, and feel. This setting may result in a higher possibility of food waste generated by dormitory students.

### 2) Research questions

In this study, avoidable food waste in the dormitories occurred if the quality of the participants' stored food in the shared refrigerators exceeded edibility of food in terms of smell, appearance, and feel, which was judged by the cleaning staff. In this study, the research questions investigated are as follows:

RQ1. Who generated what volume and types of avoidable food waste in the dormitories?

RQ2. What are the underlying causes of avoidable food waste in the dormitories?

With regard to RQ1, many waste composition analyses [4, 6, 31–32] have dealt with the disposal stage of municipal waste, where food waste was mixed with other waste; this caused difficulties in terms of sorting avoidable food waste. Thus far, the few studies that have focused on understanding the extent to which different types of food are being wasted in the household sector have especially considered developing countries. This study was able to identify the location, quantity, and quality of avoidable food waste generated from each shared refrigerator, which will contribute to develop in-depth understandings of the situation related to avoidable food waste generated by dormitory students. With regard to RQ2, this paper applied a Motivation, Opportunity, and Ability (MOA) framework, developed by MacInnis et al. [33], as a model of information processing of advertising. Geffen et al. [34] applied this framework and demonstrated that the ways in which consumers handle food are the result of a balancing act between multiple competing goals in light of available opportunities and abilities. The MOA framework is expected to be useful for disentangling various factors contributing to the

avoidable food waste generated by dormitory students.

### 3) Methods

To explore the above research questions (RQ1 and RQ2), this study used food waste composition analyses and questionnaires to target the participating dormitory students. The analyses were utilized between January 26 and May 31, 2019, and the survey was administered 18 times in total. Each food waste item generated from each shared refrigerator was collected every Friday with the support of the cleaning staff and then assessed on the basis of several indicators including date, building and floor, types, weight, condition, packaging, price, and food remains. The food types included rice-related foods, bakery foods, noodles, curry (including rice), soups, meat, fishery products, vegetables, fried potatoes, eggs, dairy products, fruits, snacks and sweets, drinks, flavoring items, and some unknown items. The condition of the purchased foods was divided into five categories in terms of smell, appearance, and feel: fermented, rotten, moldy, ripe, and having a bad odor. Food packaging<sup>1</sup> was based on eight categories: plastic bags, plastic packages, plastic bottles, food trays, paper,

leaves, aluminum foil, and other (see Figure 1). The food remains were identified as untasted or unfinished foods.

A questionnaire survey targeting the dormitory students was conducted in October 2019. A total of 337 samples were collected, accounting for 52% of the dormitory students. The questionnaire contains 16 questions consisting of basic information, perceived awareness and attitude about food waste, food consumption behaviors, and food waste behaviors (see Table 1 and Supplementary Material 1<sup>2</sup>).

From the viewpoint of the MOA framework, the questions on perceived awareness and attitudes about food waste (Q3–Q6) and reasons for avoidable food waste behaviors (Q15) were linked to their motivations for taking action on avoidable food waste. Data from food consumption behavior (Q7–Q10) were used to identify factors in the form of opportunity. The questions on food waste behaviors (Q11–Q16) largely corresponded to ability.

The above data, which were collected from both the food waste composition analyses and the questionnaire, were analyzed in IBM SPSS Statistics 23.



**Figure 1** Examples of types of food packaging.

<sup>1</sup> Some foods were wrapped or packaged in multiple types of packaging (e.g., plastic bags and plastic packages). In the above cases, the survey or chose only one category on the basis of identifying the wrapping or surface packaging material.

<sup>2</sup> The questionnaire written in Supplementary Material 1 was first translated into the Thai language after which the respondents answered the questions.

**Table 1** List of questions

Basic information	(Q1) Age (ratio scale)/(Q2) Gender (nominal scale)
Perceived awareness and attitudes about food waste	(Q3) Purchase intention toward food waste reduction (five-point ordinal scale)
	(Q4) Consumer food waste situation in Thailand/ (Q5) Guilty feelings about leftover food/ (Q6) Feelings of monetary loss with regard to food disposal (four-point ordinal scale)
Food consumption behaviors	(Q7) Place where meals were taken (nominal scale)/ (Q8) the frequency of meals in the dormitories (ordinal scale)/ (Q9) Purchase place for dietary intake (nominal scale)/ (Q10) Numbers around meals in the dormitories (ordinal scale)
Food waste behaviors	(Q11) The frequency of producing leftovers (ordinal scale)/ (Q12) Memory retention of foods in shared refrigerators (ordinal scale)/ (Q13) The frequency of leaving foods in the refrigerator for a long time (ordinal scale)/ (Q14) Experience of food disposal by the cleaning staff (nominal scale)/ (Q15) Reasons for avoidable food waste behaviors (nominal scale)/ (Q16) Free remarks about food waste

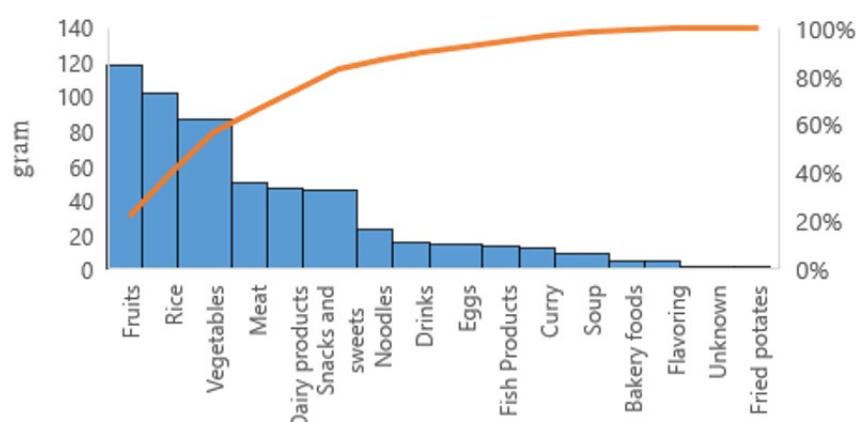
### Food waste composition survey results

The survey, which was administered 18 times, collected 1,417 avoidable food waste samples from the dormitory buildings. Findings revealed that 349 kg of avoidable food waste was generated from the shared refrigerators, and the per capita avoidable food waste consisted of 2.2 items, which amounted to approximately 0.54 kg in total. Analysis of the samples for which prices could be identified<sup>3</sup> (N=898) revealed that the dormitory students expended 21,304 Thai Baht or 682 USD<sup>4</sup> on food that they wasted.

Figure 2 indicates avoidable food waste composition by food type. Fruits accounted for the

largest amount of avoidable food waste (21.6%) in terms of weight, followed by rice (18.8%), vegetables (15.9%), meat (9.2%), dairy products (8.6%), snacks and sweets (8.3%), noodles (4.1%), drinks (2.8%), eggs (2.5%), fishery products (2.4%), curry (2.3%), soups (1.5%), bakery foods (0.8%), flavoring (0.8%), unknown items (0.2%), and fried potatoes (0.2%).

Per-capita food waste generated by female and male participants were 2.9 items (0.68 kg) and 0.54 items (0.07 kg), respectively. A Wilcoxon rank sum test showed a significant difference in terms of food waste weight ( $z = -4.360, p < 0.01$ ).

**Figure 2** Avoidable food waste composition in dormitories from January 26 to May 31, 2019.

<sup>3</sup> The price was calculated on the basis of commercial price in the retail shops.

<sup>4</sup> The exchange rate from Thai Baht to USD was calculated as 0.032.

Most of the food waste (96.5%) was wrapped or packaged. Food items packaged in plastic bags (73%) were the most common type, followed by those in plastic packages (12%), plastic bottles (4%), food trays (3%), papers (1%), leaves (1%), aluminum foil (1%), and others (2%). In terms of food visibility, some food waste items were unclear in nature (9%) or somewhat clear in nature (5%). Plastic packages (31%) formed the largest proportion of unclear food waste items, followed by plastic bags<sup>5</sup> (19.8%), food trays (19%), leaves (7.1%), and plastic bottles (6.3%).

It is noteworthy that approximately half of the avoidable food waste had not even been eaten (49%). In particular, bakery foods and dairy products (73.3%), eggs (71.4%), snacks and sweets (61%), and vegetables (59.5%) were discarded without being consumed. Variables related to packaging, food visibility, and remaining food waste did not differ significantly by gender according to a chi-squared test.

This study also revealed the various reasons for food disposal by the cleaning staff: rotten foods (28.1%), ripe foods (17.0%), fermented foods (14.4%), moldy foods (13.6%), and foods with a bad odor (26.9%). Figure 3 indicates the overall food condition in the top six food waste categories (fruits, rice, vegetables, meat, snacks and sweets, and dairy products). Ripening-related conditions were largely responsible for the dis-

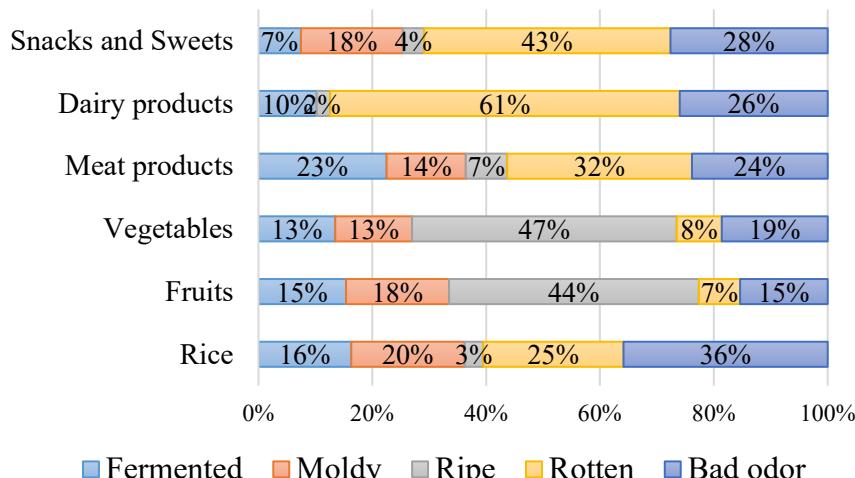
posal of fruits and vegetables. To some extent, the reasons for disposal of rotten foods corresponded to those for meat, snacks and sweets, and dairy products, while rice was disposed of because of factors such as rotten condition, fermented condition, moldy condition, and foods with a bad odor. Results of the chi-squared test showed no significant gender-based differences in terms of the condition of the food waste.

### Questionnaire survey results

The respondents were students living in the dormitories. Out of 346 respondents, 246 were female (73.2%) and 90 were male, which is similar to the actual female ratio of dormitory students (78.0%). The majority were aged 19 to 22 years, accounting for 91.0% of the total.

#### 1) Awareness of and attitudes toward food waste

Table 2 shows students' awareness of and attitudes toward food waste. Overall, 56.4% of respondents considered food waste minimization always or very often when purchasing foods, whereas 13.4% answered "rarely" or "never". The perceived purchase intention with the aim to reduce food waste was significantly higher among male students than among female students ( $z = -1.980, p < 0.05$ ) according to the Wilcoxon rank sum test.



**Figure 3** Reasons of food disposal in the top six food waste types.

<sup>5</sup> There were several types of plastic bags, including non-transparent ones, which made it difficult to identify their stored foods in the shared refrigerators.

**Table 2** Awareness of and attitudes toward food waste by gender

Question items	Median (Interquartile range)		Z-value
	Female	Male	
Q3: Purchase intention toward food waste reduction	4 (3-4)	4 (3-5)	-1.980*
Q4: Consumer food waste situation in Thailand	3 (1-4)	4 (3-4)	-2.812**
Q5: Guilty feelings about leftover food	2 (2-3)	3 (2-3)	-2.361*
Q6: Feelings of monetary loss with regard to food disposal	2 (1-3)	2 (1-3)	-1.252

\*p < 0.05, \*\*p < 0.01

**Note:** The results are based on a five-point Likert scale (Q3: Never to Always) and a four-point Likert scale (Q4: Strongly agree to Strongly disagree, Q5: Very severe to Not very severe, Q6: Very serious to Not very serious). Q6 further added a “Don’t know” option.

Altogether, 53.4% of respondents perceived food waste generated by consumers in Thailand as a very serious or serious issue, while 19.0% did not know whether it was a matter of grave concern. Furthermore, half of the respondents did not feel guilty about their leftover food. From a monetary viewpoint, 68.3% of all respondents did not perceive any monetary loss originating from the food disposal activities of cleaning staff. According to the Wilcoxon rank sum test, there were also significant differences between genders in terms of the perception of the severity of the consumer food waste situation in Thailand ( $z = -2.812, p < 0.01$ ) and feelings of guilt ( $z = -2.361, p < 0.05$ ): Female students felt less risk perception of consumer food waste and less guilty about their leftover food compared to their male counterparts.

## 2) Food consumption behaviors

This study's respondents usually ate food at canteens (breakfast: 60.8%; lunch: 77.2%; and dinner: 40.9%) or in their rooms (breakfast: 32.6%; lunch: 11.0%; and dinner: 21.2%). Regarding dinner, there was increased eating behavior outside the campus in places such as restaurants (breakfast: 6.5%; lunch: 12.2%; and dinner: 38%). By gender, there were significant differences of

ratio of eating places in breakfast and dinner:  $\chi^2 (2) = 17.26, p < 0.01$  (breakfast) and  $\chi^2 (2) = 8.47, p = 0.014$  (dinner) as shown in Table 3. Female students often chose to have breakfast (38.1%) and dinner (23.8%) in their own rooms, while the corresponding figures for male students were almost the same (breakfast: 12.5%, lunch: 13.9%, and dinner: 11.1%).

The students purchased the foods that they ate in their rooms in various ways. Irrespective of gender, retail stores located inside the campus formed the highest percentage of such food sources (39.6%), followed by convenience stores located outside the campus (36.4%), food stalls (17.1%), and shopping courts (6.9%). The respondents usually ate alone in their rooms (31.8%), with two to five friends (58.5%), or with more than six friends (9.8%). Significant gender-based differences were also observed in the numbers of eating companions ( $z = -2.409, p < 0.05$ ); female participants tended to eat food along with their friends. It is noteworthy that around half of the respondents did not usually consider food waste minimization when purchasing foods, although perceived preparedness with regard to purchasing food with the aim to reduce food waste was significantly higher among male students than among female students ( $z = -1.980, p < 0.05$ ).

**Table 3** Ratio of eating places based on gender and time

Place	Time	Male	Female	$\chi^2$
Morning	Rooms (dormitory)	12.5%	38.1%	
	Canteens (on campus)	80.6%	55.5%	17.26**
	Restaurants (off campus)	6.9%	6.4%	
Lunch	Rooms (dormitory)	13.9%	9.8%	
	Canteens (on campus)	80.6%	76.2%	4.31
	Restaurants (off campus)	5.6%	14.0%	
Dinner	Rooms (dormitory)	11.1%	23.8%	
	Canteens (on campus)	54.2%	37.4%	8.47*
	Restaurants (off campus)	34.7%	38.9%	

**Note:** \* $p < 0.05$ , \*\* $p < 0.01$

This study revealed that the frequency of not finishing food in their rooms was high among both male and female students. They left food unfinished one to two days per week (43.9%), three to four days per week (21.1%), five to six days per week (4.2%), or every day (7.1%). The relationship between female and male students in this regard differed significantly ( $z = -2.338$ ,  $p < 0.05$ ); male students tended to leave food unfinished more often than female students. For male students, the everyday percentages of unfinished and finished food were 15.3% and 13.9%, respectively, compared to 5% and 26.4% among female students. Furthermore, the frequency of storing food in the shared refrigerators for long periods was also high; 19.9% of respondents answered that the frequency of storing food in the shared refrigerators for long periods was very often and 30.0% reported that the frequency was sometimes.

Consequently, 35.0% of respondents answered that they have experienced their stored food being disposed of by the cleaning staff. These variables did not differ significantly between female and male students. The main reasons for such food disposal were forgetting about the stored food (36.6%), followed by deterioration in food quality (28.7%), the condition of the unfinished food (19.1%), unmatched taste (13.9%), and others (1.7%). Significant difference was observed only

with regard to unmatched taste between female (45%) and male (20%) students ( $\chi^2 (1) = 4.69$ ,  $p = < 0.05$ ).

## Discussion

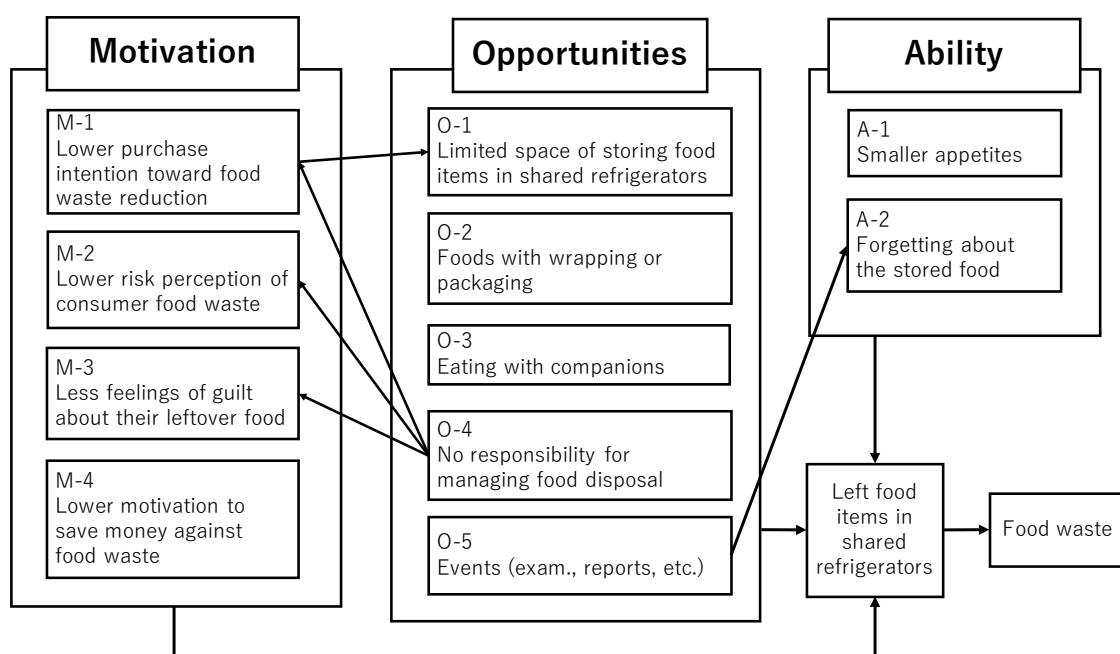
In order to explore the two research questions (RQ1 and RQ2), this study measured avoidable food waste generated by university students living in dormitory buildings and then identified the reasons the avoidable food waste was disposed of. From the viewpoint of RQ1, 18 food waste composition surveys found 349 kg of avoidable food wasted from the shared refrigerators in total. With regard to food types, fruits, rice, and vegetables represented the highest weight of wasted foods, which similarly corresponded to the data from Indonesia's university canteens [25]. Approximately half of avoidable food waste had not even been eaten, though all sampled foods were in an edible state when the dormitory students stored them in the shared refrigerators. Of particular note is that female students generated around ten times the avoidable food waste as did male students. Similar results, that women generated more food waste than did men did, have been reported elsewhere [35–36]. Hence, appropriate measures targeting female dormitory students in particular for reducing the amount of fruits, rice, and vegetables are required to tackle the food waste generated at the study site.

With regard to RQ2, Figure 4 shows a diagram of food waste generated by female dormitory students using the MOA framework. As shown in Section 4.2., the female students' awareness of toward food waste was low. Many of the participants were not motivated to take actions for minimizing food waste before food purchases (M-1). They often purchased too much food and consequently stored the unfinished or untasted food in the shared refrigerators, which might affect the extent of the space limit for storing food items in them (O-1).

Likewise, the female students felt less risk perception of consumer food waste (M-2) and guilty about their leftover food (M-3) compared to their male counterparts. Having a higher level of concern for the negative consequences of food waste was one important motivation for reducing food waste in the home [37-38]. In addition, the respondents, irrespective of gender, expressed the lowest degree of agreement with the statement linking saving money to avoidable food

waste generated from the shared refrigerators (M-4). The desire not to waste money could be a powerful motivating factor in food waste reduction, as suggested by earlier papers [19, 37]. These attitudinal variables should be taken into account in order to reduce avoidable food waste.

From the viewpoint of opportunity, food waste behavior generated by the dormitory students was embedded within the local setting. There was no dining kitchen in the dormitory buildings, but they were able to store their purchased food in shared refrigerators installed on each floor. They share a limited space for storing food items in the refrigerators (O-1), which might impact the extent of avoidable food waste. Indeed, obvious gender-based differences were observed between the volumes of food items stored in the shared refrigerators: the female students tended to store more food items in them compared to male students when the food waste composition survey was being conducted (see Figure 5).



**Figure 4** Diagram of the underlying causes of avoidable food waste using the MOA Framework.



**Figure 5** Examples of storing foods in the shared refrigerators by gender (left: female participants and right: male participants)

In addition to O-1, food with wrapping or packaging might make it difficult to find one's own stored food in the shared refrigerators. In Thailand, food is often packaged or wrapped at the time of purchase. Among 1,417 samples of avoidable food waste, this study found that 14% of food items could not be easily identified from the outside due to these wrappings or packaging materials. In addition, the limited space for storing food items in the shared refrigerators might be influenced by not only the poor planning for purchased food but also the participants' eating habits. Female students often ate food with their friends in their rooms (O-3). This situation might increase the likelihood of purchasing too much food without thinking or people wanting to enhance their public image by having more food than necessary, as suggested by Liu et al. [39].

It is also important to note that the responsibility for managing food disposal in the shared refrigerators (O-4) might contribute to avoidable food waste. In the university dormitories, food waste disposal was managed by the cleaning staff, where the dormitory students could benefit from the desire to pursue convenience. This setting might have negative impacts on lowering their motivation toward food waste reduction, particularly M-1, M-2, and M-3.

As for ability, many female students tended to have smaller appetites (A-1), so they might have found it difficult to consume all of their leftover food. Although male students had a higher frequency of storing leftover food in the shared refrigerators compared to female students, they were able to consume the food before it spoiled. Apart from this, forgetting about the stored food (A-2) was the highest reason for food disposal. This is likely to be influenced by not only poor motivation toward food waste reduction but also the settings of their everyday life on campus. Some students reported that, when they were too busy preparing for exams or reports (O-5), they often left their food items in the shared refrigerators, which resulted in food disposal by the cleaning staff.

## Conclusions

This study aimed to measure avoidable food waste generated by university students living in dormitory buildings and identify its underlying causes in the case of Kanchanaburi campus, Mahidol University. Food waste issues have received widespread attention all over the world, but limited data are available on avoidable food waste in developing countries. Outside of the food service sector, food loss resulting from the setting of everyday life in university dormitories

has not been measured for international journals so far. Although the study focused only on avoidable food waste resulting from shared refrigerators, 1,417 items of wasted food were identified. The study confirms that female students generated around ten times as much avoidable food waste as did male students. Shockingly, approximately half of avoidable food waste had not even been eaten. The study also showed that the participants' perceived awareness and attitudes toward food waste reduction were low, especially for female students. Elaborations are needed to target university students for reducing food waste in the setting of everyday life in the dormitories. The underlying causes of avoidable food waste in the dormitories were determined by complex factors in light of motivation, available opportunities, and abilities, as shown in Figure 4. Due attention to the effect of avoidable food waste reduction includes educating dormitory students about food waste as well as providing more space and increased visibility of stored food in the shared refrigerators. Our findings can be used to develop appropriate measures targeting dormitory students to help reduce avoidable food waste.

Putting this all together, targeting university students for reducing avoidable food waste in the setting of everyday life in the dormitories, not only focusing on the food service sector in the campus, is recommended. In this regard, however, there are many research questions that remain unaddressed in the study. For example, this study did not measure food waste by focusing on the relationship between food waste behavior and opportunities, such as the space of storing food in the shared refrigerators or events (e.g., examinations, parties, date of move-in and move-out). Hence, further long-term monitoring using food composition analyses is needed. The study raises further questions over the food waste behavior in different settings such as canteens and restaurants as well as how different

settings influence individuals' food waste behavior and food waste. It is also important to address that interventions reducing avoidable food waste in the dormitories need to be put into practice. Several articles have targeted food waste prevention and the possible measures that could be taken at the consumption level [5]. Future studies should continue investigating avoidable food waste in the dormitories and implementing and analyzing appropriate measures on the basis of lessons learned from such research.

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