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RESEARCH PAPER

Factors influencing food waste behavior: A study on college students in Medan City, Indonesia

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Abstract. One of the world's environmental problems is food waste. This problem is closely related to Sustainable Development Goals (SDGs), particularly the goal on sustainable production and consumption. Food waste affects not only environmental aspects but also the social and economic aspects, it is often driven by individual behavior. This study aims to calculate the percentage of food waste based on nutrition classification and to analyze factors influencing the food waste behavior. A survey was conducted through face-to-face interviews with 134 college students. The variables examined included socioeconomic and behavioral factors. Binary logistic regression was applied for data analysis. This results show carbohydrates-rich foods such as rice, noodles and bread were the most commonly wasted items among college students in Medan. Furthermore, the factors influencing food waste behavior were dining out behavior, promotions or discounts, food expenditure, diet programs and eating frequency. Taking leftovers home and reheating them were the most common practices used by students to reduce food waste. In addition, the government should formulate policies and regulations on food waste management to help reduce food waste in Medan City.

Keywords: Responsible consumption; sustainability; sustainable development; waste management.

1. Introduction

Indonesia annually generates 20.93 million tons of food waste ([The Ministry of Environment and Forestry, 2018](#)). It is equivalent to 44% of country's total waste. Consequently, Indonesia ranks first in Southeast Asia and the second in the world as a food waste contributing country ([UN, 2021](#)). The issue of food waste is directly linked to Sustainable Development Goals (SDGs) #12, which addresses responsible production and consumption. Food waste affects all three pillars of sustainable development, economy, social and environment (Blakeney, 2019). Economically, it results in a loss equivalent to 4 – 5% of the national gross domestic product. Socially, the wasted food could potentially feed 61 – 125 million people. Environmentally, it contributes to 7.29% of greenhouse emissions and accelerates natural resource depletion and environmental degradation

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([The Ministry of Planning and National Development, 2021](#)). Given these impacts, urgent action is needed to reduce food waste.

The problem of food waste is largely stimulated by the individual behavior. Therefore, this study attempts to identify the factors influencing the food waste behavior. Previous studies on this topic have been conducted in several developed countries, such as in China ([Tsai et al., 2020](#)), the United State ([Zepeda & Balaine, 2017](#)), Australia ([Farr-Wharton et al., 2014](#)), Europe ([Grasso et al., 2019](#)) and Qatar ([Abdelaal et al., 2019](#)).

Food waste is defined as food intended for consumption that is lost, damaged, discarded, or wasted for various reasons ([Bond et al., 2013](#)). It refers food that is still fit for consumption but is not eaten and instead discarded for certain reasons. Food waste can also result from changes in the decisions and behaviors of retailers and consumers. Also, it is described as a reduction in the amount of food occurring at the end of the food supply chain, related to actions of sellers and consumers ([Parfitt et al., 2010](#)). Therefore, it could be summarized that food waste can occur at every stage of supply chain including production, distribution, marketing, and consumption, and is closely linked to human behavior.

This research investigates the food waste behavior of college students in Medan, as such behavior is influenced by some driving factors. [Wu et al. \(2019\)](#) found that the factors influencing the food waste behavior among students in Beijing, China, were gender, preferences, and dietary program. A study reported that social demographics, attitudes, and self-control influenced food waste behavior among students at the University of Arkansas, USA ([Wright, 2022](#)). Furthermore, research in the USA indicated that awareness and culture were the main factors influencing food waste behavior among students of Portland State University, USA ([Alattar et al., 2020](#)). Hereinafter, a study Croatia found that environmental awareness and health concern significantly influenced food waste behavior among students ([Knezevic et al., 2019](#)).

Furthermore, COVID-19 has also been identified as a factor influencing food waste behavior ([Burlea-Schiopoiu et al., 2021](#)). This can be observed through government policies related to pandemic, such as social distancing and work-from-home arrangements, which have altered individuals' food consumption behaviors. Changes in consumption pattern influences students' food waste behavior ([Qian et al., 2021](#)). In addition, product attributes such as taste, portion size, and other characteristics also influence students' food waste behavior ([Wang et al., 2023](#)). Dietary programs are likewise considered a factor affecting food waste behavior ([Qian et al., 2022](#)). Moreover, among students in Germany, environmental knowledge and self-assessment have been found significantly influence food waste behavior ([Gabriel et al., 2021](#)).

However, the research on this topic is rarely conducted in the developing countries specifically in Indonesia. Hence, this study was conducted in Medan offers novelty in its focus. Medan is the third largest metropolitan city in Indonesia and the largest capital city in Sumatra. This also aims to contribute to local government policy development and the achievement of the Sustainable Development Goals (SDGs).

The aims of this study are twofolds, calculate the percentage of food waste based on nutrient classification, and to analyze the factors influencing food waste behavior among college students in Medan. The findings are expected to contribute an empirical portrait of community behavior in Medan, serving as both evidence and a basis for policy implication and government strategies to reduce food waste.

2. Methodology

2.1. Data collection

The data were collected through a survey, which allowed the investigate of the observed variables for each individual respondent. A face-to-face interview was conducted to obtain the primary data. The sampling method used was unproportioned convenience random sampling, chosen to account for distribution and variability. A total of 134 students participated in this study, randomly selected from three public universities and three private universities in Medan, namely

the University of North Sumatra (USU), Medan State University (UNIMED), Islamic State University of North Sumatra (UINSU), Muhammadiyah University of North Sumatra (UMSU), University of Medan Area (UMA), and the Indonesia Oil Palm Institute of Technology (ITSI). [Figure 1](#) shows the study location, and [Table 1](#) presents the distribution of respondents.

A questionnaire was used as the data collection tool, containing questions related to the observed variables. The variables applied in this study were age, sex, residency, weekly expenditure, dining out, work from home, promotion, diet program, and eating frequency. These variables were adapted from established empirical and theoretical foundations, such as [Bittner et al. \(2025\)](#), [Gamboa-Delgado et al. \(2024\)](#), [Miśniakiewicz et al. \(2024\)](#), [Palmieri & Boccia\(2025\)](#), [Radhakrishnan & Sk \(2024\)](#), and [Sánchez et al. \(2021\)](#).

The observed variables were classified into two types, independent variables (x) and the dependent variable (y). The independent variables included sex, residency, and diet program, measured as nominal data: age, weekly expenditure, and eating frequency, measured as interval data, and dining out, work from home, and promotion, measured as ordinal data. The ordinal independent variable (x) used a Likert scale ranging from 1 to 5 to capture respondents' perceptions. The binary dependent variable (y) was food waste behavior, classified into two categories. The description of variable scales is displayed on [Table 2](#).

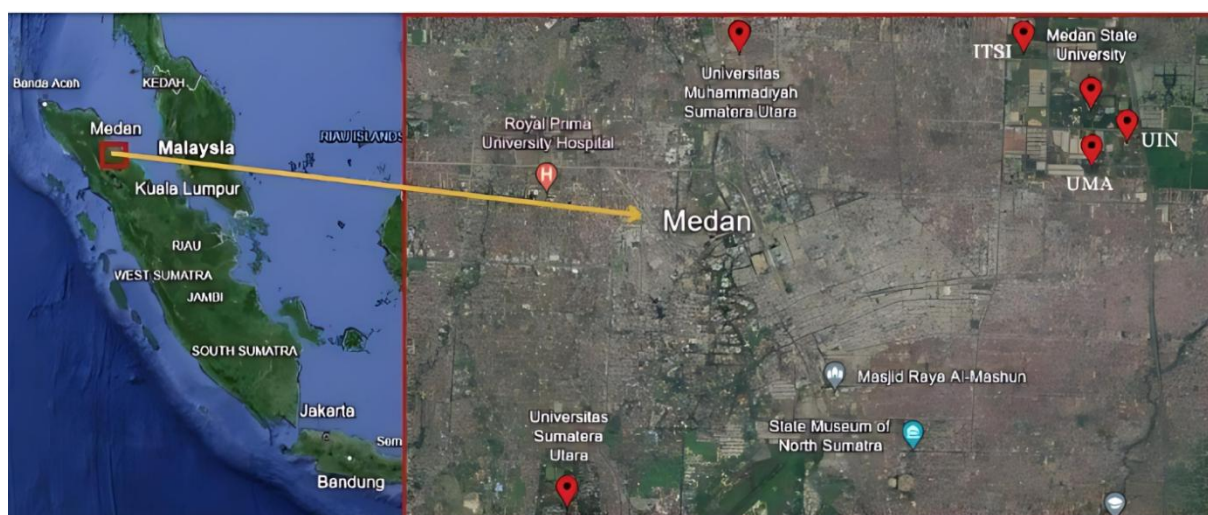


Figure 1. Location of study

Table 1. Distribution of respondents

University	Status	Number of respondents	Percentage (%)
University of North Sumatra (USU)	Public	27	20.15
Medan State University (UNIMED)	Public	22	16.42
Islamic State University of North Sumatra (UINSU)	Public	18	13.43
Muhammadiyah University of North Sumatra (UMSU)	Private	28	20.90
University of Medan Area (UMA)	Private	17	16.42
Indonesia Oil Palm Institute of Technology (ITSI)	Private	22	12.69
Total		134	100

Table 2. Description of variables

Variable	Value	Interpretation
Ordinal independent variable (X)	1	Strongly disagree
	2	Disagree
	3	Neutral
	4	Agree
	5	Strongly agree
Dependent variable (Y)	1	Consuming the food
	0	Otherwise

2.2. Data analysis

The data analysis for calculating the percentage of food waste based on the nutritional classification employed descriptive statistics, illustrated using bar charts. The analysis was based on students' responses, where they identified the most frequently wasted food items according to nutritional categories. In addition, a binary logistic regression model was used in this research. This model is applicable when the response variable has two categories, coded as 0 and 1. In such cases, the response variable follows a Bernoulli distribution (Agresti, 2013), as shown in Equation (1).

$$f(y_i, \pi_i) = \pi_i^y (1 - \pi_i)^{1-y_i}; y = 0 \text{ or } 1 \quad (1)$$

Where, π_i = probability for observation i , y_i = random variable for observation i , if $y = 0$, then $f(y) = 1 - \pi$ and if $y = 1$, then $f(y) = \pi$. The formulation of the binary logistic regression model with multiple predictor variable is presented in Equation (2).

$$\pi(x) = \frac{\exp(\beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \dots + \beta_i x_i)}{1 + \exp(\beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \dots + \beta_i x_i)} \quad (2)$$

For parameter estimation, Equation 2 can be transformed into its logit form, as shown in Equation (3).

$$g(x) = \ln \left[\frac{\pi(x)}{1 - \pi(x)} \right] = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \dots + \beta_i x_i \quad (3)$$

Furthermore, the G -test (or simultaneous test) was carried out to examine the joint effect of all predictor variables on the response variable. This test, also known as the chi-square model test (Peng et al., 2002), evaluate the following hypothesis:

$H_0: \beta_1 = \beta_2 = \beta_3 = \dots = \beta_i = 0$

H_1 : at least one $\beta_i \neq 0$

The formula for the G -test or likelihood ratio test, is presented in Equation (4).

$$G = -2 \ln \left[\frac{\left(\frac{n_1}{n} \right)^{n_1} \left(\frac{n_0}{n} \right)^{n_0}}{\prod_{i=1}^n \pi_i^y (1 - \pi_i)^{1-y_i}} \right] \quad (4)$$

Where, n_1 = the number of observations for category of 1, n_0 = the number of observations for category of 0.

The G -test follows a chi-square distribution. The null hypothesis is rejected if $G > \chi_{(v, \alpha)}^2$ or if $p\text{-value} < \alpha$. A partial test or W -test is used to evaluate the individual significance of each β_i in the model. The Wald test determines whether a predictor variable should be retained in the model (Sperandei, 2014). The hypothesis for each variable are:

$H_0: \beta_i = 0$

$H_1: \beta_i \neq 0$

The W Statistic is calculated by using [Equation \(5\)](#).

$$W = \frac{\beta_i}{SE(\beta_i)} \quad (5)$$

Where the standard error of β_i is given by [Equation \(6\)](#).

$$SE(\beta_i) = \sqrt{\sigma^2(\beta_i)} \quad (6)$$

Here, β_i represents the parameter estimate, and $SE(\beta_i)$ is its standard error. The W -test follows a standard normal (Z) distribution. The null hypothesis is rejected if $W > z_{\alpha/2}$ or if the p -value $< \alpha$. All statistical analyses were conducted using the Statistical Package for Social Science (SPSS) version 25.

3. Result and discussion

3.1. Characteristic college students in Medan city

The characteristics of college students in Medan were categorized into age, sex, residency, expenditure, dining out, work from home, promotion, diet program, and eating frequency. These characteristics also reflect the socioeconomic conditions of the respondents. Factors affecting food waste behavior include individual, social, and environmental factors ([Martins et al., 2020](#)). Table 3 presents the socioeconomic characteristics of the college students in Medan.

As shown in [Table 3](#), the students' aged ranged from 18 to 23 years, with the majority of being 20 years old. The number of female students exceeded that of male students. Similarly, in a study of food waste in the United Arab Emirates, female respondents also outnumbered male respondents ([Yagoub et al., 2022](#)).

Regarding residency, most students in Medan lived with their parents, followed by those living in rented rooms, dormitories, or lodging, and those living with siblings or relatives. Weekly food expenditure for students ranged from IDR 400,000 to 800,000, which influenced their food consumption and food waste behavior. Moreover, approximately 40% of students reported following a calorie-deficit diet program, such as zero-carbohydrate diets, intermittent fasting, and majority reported an eating frequency of three to four times per day.

3.2. Food waste based on nutrient classification

The most frequently wasted type of food nutrient among college students in Medan (> 50%) was carbohydrates. [Figure 2](#) presents the distribution of the food waste classified by nutrient type. The carbohydrate-rich foods wasted included rice, noodles, bread and similar items. The second most wasted nutrient category was fats, with examples including meat, chicken innards, and other fatty foods. From a health perspective, eating patterns are closely linked to eating frequency, the quantity of food consumed, and nutrient type. Carbohydrates and fats sometimes avoided to prevent obesity ([Ichsan & Febriyanti, 2024](#)).

On the other hand, protein-rich foods and additional items such as fish, eggs, vegetables, and fruit accounted for the lowest proportion of food waste, at less than 15%. Students cited several reasons for discarding food, including feeling full, taking inappropriate portion sizes, disliking the taste, and experiencing poor service quality ([Ferreira et al., 2013](#)). These findings align with [Qian et al. \(2022\)](#) who reported that approximately 46% of food waste consisted of rice and bread, both high in carbohydrates, followed by vegetables at 18%. Similarly, in Turkey, the most wasted foods were carbohydrate-based product such as rice, pasta, bulgur, bread, and other bakery products. Over 30% of respondents reported discarding between 1 and 3 kg of food per month month ([Bozdog & Cakiroglu, 2021](#)). Therefore, consumption patterns play a significant role in determining the types of food that are wasted.

Table 3. The characteristics of respondents

Socioeconomic characteristics	Frequency	Percentage (%)
Age (years old)		
18	8	5.97
19	33	24.63
20	43	32.09
21	21	15.67
22	16	11.94
23	7	5.22
Sex		
Male	57	42.54
Female	77	57.46
Residency		
Living with parents	81	60.45
Living with siblings or relatives	8	5.97
Rented room, dormitory or lodgment	45	33.58
Weekly expenditure (IDR)		
200,000 – 400,000	32	23.88
> 400,000 – 600,000	46	34.33
> 600,000 – 800,000	45	33.58
> 800,000 – 1,000,000	9	6.72
> 1,000,000	2	1.49
Dining out		
Strongly disagree	7	5.22
Disagree	3	2.24
Neutral	15	11.19
Agree	45	33.58
Strongly disagree	64	47.76
Work from home		
Strongly disagree	4	2.99
Disagree	14	10.45
Neutral	58	43.28
Agree	39	29.10
Strongly disagree	19	14.18
Promotion		
Strongly disagree	1	0.75
Disagree	3	2.24
Neutral	6	4.48
Agree	82	61.19
Strongly agree	42	31.34
Diet Program		
Yes	55	41.04
No	79	58.96
Eating Frequency		
1 to 2 times	16	11.94
3 to 4 times	112	82.58
> 4 times	6	4.48

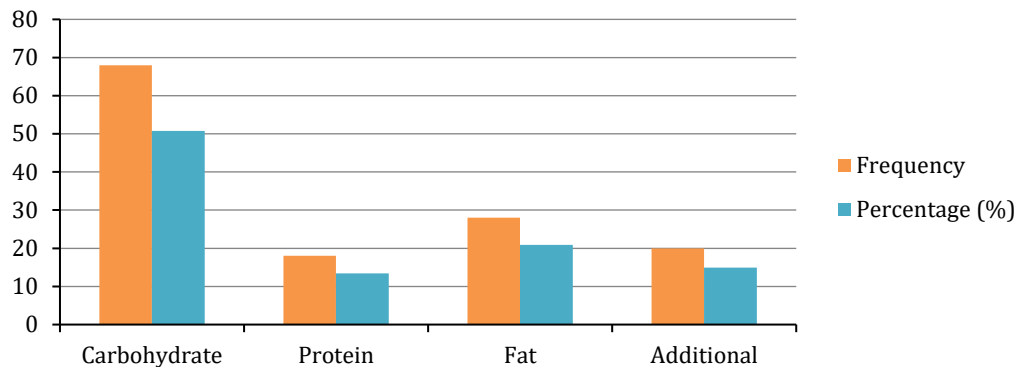


Figure 2. Classification of food waste based on the food nutrition

3.3. Statistics criteria and goodness of fit

The binomial logistic regression analysis identified the factors influencing food waste behavior among college students in Medan. The variables used in this study were socioeconomics and behavioral factors: sex, residency, expenditure, dining out, work from home, promotion, diet program, and eating frequency. [Table 4](#) presents the result of the omnibus test (*G*-test). The chi-square value was 19.507 with significance level of 0.021 (< 0.05), indicating that all variables collectively influenced food waste behavior among the students. The model's -2 log-likelihood value was 148.674, which was lower than 160.915, suggesting that the model was a good fit for the data on the independent variables.

The Hosmer and Lemeshow test was conducted as the first stage in the logistic regression analysis. [Table 5](#) exhibits the test results, where the chi-square value was 10.887 with a significance value of 0.208. This indicates that the model was acceptable and that hypothesis testing could proceed, as there was no significant difference between the econometric model and the fieldwork observations.

The goodness of fit of the logistic regression model was further assessed using the classification table, as shown in [Table 6](#). The table indicates that 11 students were correctly classified as wasting food, and 32 students were incorrectly classified as not wasting food but possibly wasting food. Additionally, 84 students were correctly classified as wasting food, while 7 students were incorrectly classified as not wasting food. A model is considered robust if its overall classification accuracy exceeds 50% ([Henseler & Sarstedt, 2013](#)). The overall percentage in this study was 70.9%, confirming that the binary logistic regression model for food waste behavior is robust and suitable for prediction purposes.

Table 4. Result of G test

Chi-Square	-2 loglikelihood	df	Significance
19.507	148.674	9	0.021

Table 5. Result of Hosmer and Lemeshow test

Chi-Square	df	Significance
10.887	8	0.208

Table 6. Classification Table

Observed	Predicted		Percentage correct (%)
	Not waste food	Waste food	
Not waste food	11	32	25.6
Waste food	7	84	92.3
Overall percentage (%)			70.9

3.4. Factors influencing the food waste behavior

The causes of individual food waste behavior can be attributed to socio-demographics and psychographics factors, which influence both cognitive reasoning and affective responses ([Aschemann-Witzel et al., 2015](#)). [Table 7](#) presents the results of the Wald test. The analysis revealed that weekly expenditure, dining out, and diet program significantly influenced the food waste behavior of college students in Medan ($p < 0.01$). Furthermore, promotion and eating frequency had p values of < 0.05 and < 0.10 , respectively. It indicates that these factors were also significant predictors of food waste behavior.

This finding is consistent with [Ananda et al. \(2021\)](#), who reported that dining out behavior increases the likelihood of food waste. Similarly, dining out has been identified as a driving factor for food waste in the USA, UK, and Canada ([Hengi & House, 2022](#)). Consumers, however, can reduce food waste by taking leftovers home after dining out ([Talwar et al., 2021](#)). Moreover, religious values can serve as a catalyst for norms that contribute to reducing food waste ([Filimonau et al., 2023](#)).

Furthermore, several previous studies have shown that promotions and discounts are driving factors of food waste ([Porpino et al., 2015](#); [Delley & Brunner, 2017](#); [Ponis et al., 2017](#)). This finding is supported by [Mallinson et al. \(2016\)](#), who identified a new consumer group characterized by a “buy a lot, waste a lot” behavior pattern. Individuals who purchasing food on promotion or at a discount also tend to waste more food ([Koivupuro et al., 2012](#)). Promotions and discounts can trigger over-purchasing, which may consequently lead to food waste ([Aschemann-Witzel et al., 2023](#)). In addition, personal habits such as lack of planning, shopping behavior, improper storage, poor cooking skills, and misinterpretation of expiry dates also contribute to the amount of food waste ([Lanfranchi et al., 2014](#)).

Similar findings have indicated that the increased food expenditure encourages people to generate more food waste ([Principato et al., 2015](#)), a behavior driven by individual consumption patterns and linked to irresponsible consumption. Food expenditure is also associated with shopping frequency, which can promote food waste behavior. Shopping routines have been identified as factors affecting food waste in Malaysia ([Zainal & Hassan, 2019](#)) and Italy ([Di Talia et al., 2019](#)).

This research also found that diet program were a significant factor influencing food waste behavior among college students in Medan. Students following a diet program were able to arrange their consumption or plate portions more effectively. Determining the appropriate portion size could reduce food waste ([Wansink & van Ittersum, 2013](#)). A subsequent study also found that diet programs are associated with food waste ([Quested et al., 2013](#)). People who consume healthy foods such as organic vegetables, fruits, and other health-oriented products, and who have health concerns are generally willing to buy food at a higher price ([Mijares et al., 2021](#)).

Table 7. Result of Wald test

Variable	Exp (B)	Std. Error	Wald	Significance
Constant	1.947	0.112	4.541	0.042**
Age	0.683	0.271	1.978	0.159
Sex	0.705	0.256	1.862	0.172
Residency	1.184	0.252	0.299	0.584
Weekly expenditure	2.621	0.278	8.928	0.002***
Dining out	2.574	0.324	8.511	0.004***
Work from home	1.349	0.248	1.455	0.228
Promotion	2.155	0.215	6,377	0.032**
Diet Program	2.472	0.337	8.052	0.004***
Eating Frequency	1.678	0.287	3.261	0.071*

Note: *** = significant at level 1%; ** = significant at level 5%; * = significant at level 10%

Furthermore, eating frequency had a significant effect on the food waste behavior. Similar findings were reported by [Zhang et al. \(2024\)](#) who verified that higher eating frequency stimulate food waste.

This study confirmed that age was not a factor influencing food waste behavior. This finding was supported by previous study demonstrating that age was not a significant factor influencing food waste behavior among young people in England, Spain, and Italy ([Bravi et al., 2020](#)). [Tonini et al. \(2023\)](#) also explained that age is a weak predictor of food waste behavior in Spain. Nevertheless, as the respondents of this study were students or young people, results align with previous studies revealed that young generations or student tend to waste more food compared to older generations ([Przezbórska-Skobiej & Wiza, 2021](#); [Stacchini et al., 2024](#)).

This study also found that gender was not a significant factor influencing food waste behavior. [Memon et al. \(2020\)](#) reported no association between gender and food waste behavior in Malaysia, and similar results were found in Italy, where no differences between male and female were observed ([Catalano et al., 2024](#)). Notwithstanding, both male and female students should be provided with environmental education to improve their attitudes and reduce food waste ([Feijoo & Moreira, 2020](#)).

Furthermore, government policies during the COVID-19 era such as the work from home arrangement, did not significantly influence food waste behavior. Working from home stimulated individuals to improve food stock management, which helped reduce excessive food consumption ([Jribi et al., 2020](#); [Roe et al., 2021](#)). It is also increased awareness and encouraged lifestyle changes towards consuming food in appropriate and sufficient portions ([Amicarelli et al., 2022](#)).

Food waste can be reduced by raising awareness about the issue. Subjective norms and perceived behavioral control have been shown to significantly influence the intention to reduce food waste ([Schränk et al., 2023](#)). Likewise, the combined effects of attitude, intention, and behavior can contribute to food waste reduction ([Purwanto et al., 2023](#)). Practically, students can create a shopping list to avoid over purchasing which often leads to food waste. Over purchasing, lack of expiry-date awareness, and inadequate shopping planning are among the main factors contributing to food waste ([Jungowska et al., 2021](#)).

Residency was not a significant factor in the food waste behavior. However, reheating or reusing leftover food is a relevant strategy to minimize food waste, especially for student living in rented accomodations ([Alsawah et al., 2022](#); [Ozanne et al., 2022](#)). Collaboration actions from both governmental and societal stakeholders are essential to address the food waste problem. Furthermore, technology can play a role in reducing food waste, such as through food waste processing technologies that recycle it into organic fertilizer, livestock feed, and other products ([Al-Qamari et al., 2019](#); [Boakye et al., 2023](#); [Siddiqui et al., 2021](#)).

4. Conclusion

According to this study, rice, noodles, bread, and other carbohydrate-rich foods were the most food wasted by college students in Medan. Dining out, promotions, food expenditure, diet programs, and eating frequency were identified as the main factors influencing food waste behavior. This research also suggests the college students make shopping lists and reheat leftover food, as these could be simple strategies to reduce food waste. Advanced technology should be utilized for food waste recycling. Furthermore, string government commitment is needed to formulate policies and strategies to reduce food waste in Medan. Future research on willingness to pay to waste management technology is recommended to provide a comprehensive understanding and strngthen the findings of this study.

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