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Assessing the Level of Food Waste Awareness Among Senior High School Students at Mapúa University, Intramuros

Jomar U. Apao[1], Judiel Charl B. Del Rosario[2], Jeanne Clio E. Guiyab[3], Aleah Nicole D. Jarquio[4]

[1,2,3,4]Senior High School Student, Senior High School Department, Mapúa University

Abstract

Food waste has become a global crisis threatening environmental sustainability and food security. In the Philippines, households generate millions of tons of food waste annually, significantly contributing to greenhouse gas emissions. While studies exist on general waste management in educational settings, there is limited research examining food waste awareness among senior high school students in Philippines. This study aimed to evaluate the level of awareness concerning food waste among senior high school students at Mapúa University, Intramuros by assessing their awareness of food waste concepts, environmental, and social impacts, and analyzing awareness levels across demographic characteristics. Using descriptive quantitative, the study employed a survey questionnaire administered to 190 senior high school students selected through purposive sampling. The instrument measured awareness across four dimensions: food waste concepts, environmental impacts, social impacts, and demographic factors. Moreover, data were analyzed using descriptive statistics to identify patterns and relationships. The findings revealed that students possessed a solid conceptual understanding of food waste (mean = 4.10) and strong awareness of both environmental (mean = 4.15) and social impacts (mean = 4.24). Respondents have particularly high recognition of impacts on resource depletion, malnutrition, and community food access. Notable demographic patterns also emerged: female students (mean = 4.31-4.43) demonstrated higher awareness than males (mean = 3.91-4.05); awareness increased with age such as those in 18-20 years of age (mean = 4.16-4.29) and in Grade 12 (mean = 4.26-4.37); frequent users of campus food facilities showed heightened understanding (mean = 4.27-4.54); and participation in sustainability programs was associated with comprehensive awareness across all dimensions (mean = 4.28-4.41). This study provides insights for developing targeted educational programs and awareness campaigns at Mapúa University, potentially serving as a model for other Philippine educational institutions seeking to enhance food waste awareness and foster sustainable practices among students.

Keywords: Food Waste Awareness, Environmental Sustainability, Senior High School Students

1. Introduction

Food waste has become a global crisis, threatening environmental sustainability and food security on an unprecedented scale. According to the United Nations Environment Programme (UNEP) and the UN Food and Agriculture Organization (FAO), 13.2% of food is lost between harvest and retail, while 19%

of total food production is wasted across households, service sectors, and retail combined (United Nations [UN], 2024). In the Philippines, households alone generate 9.4 million tons of food waste annually, which shows a significant increase from the daily 2,000 tons reported by the Philippine Institute for Development Studies (PIDS) in 2017 (Cos, 2022). This waste significantly contributes to global greenhouse gas emissions, accounting for 8-10% of the total and generating substantial methane emissions (United Nations Environment Programme [UNEP], 2023). In higher education institutions, the role of different academic communities in reducing food waste has become increasingly significant. More so, recent studies have emphasized the vital role of awareness in addressing food waste issues, particularly among students who stand in for the next generation of consumers and decision-makers. A study have shown that students' awareness and understanding of food waste impacts can significantly influence their behavior and waste management practices (Pandey et al., 2023). It indicated that increased awareness of food waste issues among students can lead to more responsible consumption patterns and better waste management practices.

In the Philippines, there is a notable lack of studies addressing food waste awareness among senior high school students and faculty. While some studies examine waste management practices in educational institutions (Barloa et al., 2016; Gequinto, 2017), they rarely focus on the specific awareness levels in terms of food waste among senior high school students. Additionally, while studies exist on general waste management awareness in various settings (Palijon et al., 2017; Buhion et al., 2024), there is limited research examining the implications of the students' and faculty's awareness of food waste generated within these academic institutions.

Given the scarcity of studies on food waste in Philippine universities, this study sought to address this gap. Specifically, the paper evaluated the level of awareness concerning food waste among senior high school students of Mapúa University. This study aimed to contribute to the developing literature on food waste awareness in Philippine educational institutions, providing significant insights for developing effective educational programs and awareness campaigns. Following this section, this paper examined the role of awareness in food waste at Mapúa University, Intramuros by reviewing and synthesizing relevant literature and by presenting the methods, results, and discussions.

2. Review of Related Literature

2.1.Food Waste as a Significant Global Challenge

Food waste, a global concern, accounts for approximately one-third of all food produced worldwide (Makanjuola et al., 2020). This issue, prevalent in both developed and developing nations, extends from production to disposal. While existing research primarily focuses on energy production from food waste, a significant research gap remains in addressing the pandemic-induced surge in waste and developing comprehensive management strategies. Makanjuola et al. (2020) aim to bridge this gap by providing a comprehensive overview of food waste throughout the supply chain, from farm to fork. Additionally, the study explores potential strategies for effective food waste management in various regions. Through a literature review and analysis of FAO statistics, the authors emphasize the urgent need for sustainable food waste management practices. These practices offer multifaceted benefits, including social, economic, and environmental advantages. By redistributing surplus food, utilizing food waste for biofuels and other valuable products, and promoting public awareness, sustainable strategies can mitigate the global challenges associated with food waste, especially during crises like pandemics. The study also highlights

the potential of biotechnology in transforming food waste into valuable resources, reducing reliance on landfills and incineration, and contributing to a more sustainable future.

The studies by Makanjuola et al. (2020) and Ghosh et al. (2015) underscore the global importance of addressing food waste. They highlight the detrimental environmental, social, and economic impacts of food waste, particularly in developed nations. Both studies emphasize the need for improved data collection, standardized approaches, and comprehensive strategies to reduce food waste effectively. They advocate for global initiatives to raise awareness, develop policies, and support developing countries in tackling this pressing issue. By implementing sustainable food waste management practices, the negative consequences of this critical problem and create a more sustainable future can be mitigated.

Sarker et al. (2024) highlight the global challenge of food waste and its potential for valorization. They emphasize the need for sustainable food waste management strategies, especially in developing nations. The study explores innovative biorefinery approaches to convert food waste into valuable products, contributing to sustainability goals. Through a comprehensive review, the authors conclude that food waste valorization offers significant environmental, social, and economic benefits. However, greater global efforts are required to standardize waste management strategies and incorporate sustainable technologies for a circular bioeconomy.

2.2. Student Awareness and Food Waste

2.2.1. Global Awareness in Student

Academic institutions globally are increasingly adopting food waste reduction strategies as part of their sustainability initiatives. These programs are essential, considering the significant food waste generation within university environments. According to Fanelli and Di Nocera (2017), various countries have implemented policies promoting proper waste management in educational settings, with a particular focus on food waste reduction strategies.

Leal Filho et al. (2024) identified considerable variation in food waste (FW) production across institutions, with levels ranging from 0.12 to 50 kilograms per person daily. This waste stems from multiple sources, including excess food preparation, uneaten portions, suboptimal food management, insufficient awareness of waste reduction, and student consumption patterns. Among these, awareness, or the lack thereof, is particularly critical, as it influences the behaviors and decisions contributing to waste generation. Moreover, Leal Filho et al. (2024) argue that raising awareness through active education and experiential learning is essential to creating environmentally sustainable campuses. For instance, studies by Eugenio-Gozalbo et al. (2021), Duram and Klein (2015), Leal Filho et al. (2024), and Mulyana et al. (2020) exemplify how university gardens and composting programs effectively enhance awareness, helping students understand the cyclical nature of waste and its potential as a resource.

The substantial variation in waste quantities points to the importance of contextual factors. Multiple studies have documented waste volumes across different geographical regions to demonstrate the scope of this challenge. For example, research in Chinese universities revealed an average food waste generation of 61.03 grams per student per meal (Qian et al., 2021). The study stressed the need for greater awareness to address waste generation, noting that their existing university campaigns had limited success in reducing food waste despite lowering the probability of plate waste. Furthermore, the study emphasized the importance of integrating hands-on educational initiatives into its curricula (e.g. food-related workshops, food recovery programs, or incentives for reducing waste in university canteens) to

build deeper awareness of the consequences of food waste; further addressing not only the behavioral gaps but also instill a culture of sustainability that reinforces the value of mindful consumption.

Consistent with the previous findings, a study conducted by Abdelaal et al. (2019) in a selected Middle Eastern university emphasized the importance of food quality and suggested solutions like a tiered cost system based on food quantity, offering more a la carte options, and introducing preordering systems to help chefs accurately predict food quantities. It also highlighted how educational efforts aimed at increasing awareness, whether through modifying food-related choices or providing feedback mechanisms, are essential in mitigating food waste in university settings.

Furthermore, according to Wang et al. (2024), in a university setting, young adults are among the most wasteful demographic groups. Factors such as family wealth, peer influence, and cultural norms shape food waste, with students in economically developed regions, like East China, exhibiting higher waste due to less ingrained habits of frugality. Wealthier students globally also display greater indifference to food conservation. Moreover, female students, influenced by appearance concerns and dietary adjustments, waste more food than males. However, females show greater responsiveness to food-saving campaigns, indicating the need for adaptable approaches (Kuo & Shih, 2016; Wang et al., 2024). Given these instances, studies by Amicarell et al. (2021), Fraj-Andrés et al. (2022), Ozcicek-Dolekoglu and Var (2019), and Wang et al. (2024) emphasized how educational initiatives, including group-based interventions and labor education, have been proven effective in cultivating awareness, leveraging peer influence, and reshaping attitudes toward food waste.

Despite growing awareness of the factors contributing to food waste, institutional responses remain limited. According to Leal Filho et al. (2021), only about one-third (35%) of universities worldwide have developed specific food waste policies, while 15% have no waste prevention measures at all. This stresses a vital gap in awareness, both within the academic staff and the student body. The study emphasizes the importance of enhanced awareness programs, educational initiatives, and concrete waste reduction actions. This lack of awareness remains one of the key barriers to effective waste management, reinforcing the need for more comprehensive education and engagement at all institutional levels.

As food waste is a complex issue influenced by various social, cultural, and economic factors, the inconsistency of awareness and action across institutions suggests a broader global challenge. While some countries have introduced public education campaigns and regulatory frameworks to tackle food waste, many still struggle with insufficient awareness among the public, further exacerbated by economic disparities, social inequalities, and political instability (Yin, 2023, as cited in Dwyer, 2023). This uneven approach emphasizes the necessity for a unified global strategy that prioritizes awareness as a foundational step in combating food waste, particularly within educational institutions.

2.2.2. Student Awareness and Food Waste in the Philippines

In the context of the Philippines, while agricultural food waste is documented, there is a lack of data on waste in food services, supermarkets, and households (Barrion et al., 2023), suggesting that Philippine academic institutions may not have sufficient awareness to address this issue effectively. This limited data on food waste highlights the need for greater awareness, especially within schools and universities; hence, focusing on elements such as food management, portion control, and proper storage could help reduce waste at its source.

For instance, the study on school waste in select public schools in Makati City suggests that while food waste accounts for less than 5% of total waste, there remains a critical need for heightened awareness, particularly among students and staff (Apolonio, 2019). Despite the implementation of practices such as

a "measured serving" system to minimize food waste, the study indicates that other types of waste, such as paper and plastics, still dominate. This highlights the importance of educational programs on waste management, which could be further emphasized in a university setting.

Consistent to the findings in the previous study, while some Filipino university students demonstrate awareness of biodegradable waste, their overall understanding of proper waste classification remains inadequate (Dolipas et al., 2020). This lack of awareness is reflected in their low compliance with waste segregation practices; consequently, even with existing waste segregation systems, students' limited knowledge and awareness undermines their effectiveness.

This is further exemplified by the study conducted by Barloa et al. (2016), wherein majority of Filipino students reported disposing of food scraps indiscriminately, indicating a low level of awareness or concern for proper food waste management at home. This behavior may carry over into their practices at school, where proper waste disposal, including food waste segregation, could be similarly neglected. In an academic setting, this implies that if students are not accustomed to sorting food waste at home, they may also lack the awareness or motivation to do so within the school environment (Boulet et al., 2022). While students may exhibit satisfactory knowledge and attitude toward waste management, their actual behavior (e.g. minimizing or properly disposing of food waste) may not align with this awareness. Moreover, the study found that even when students had satisfactory knowledge and a positive attitude towards recycling and waste management, their practices were still inadequate. The study also notes that students from wealthier backgrounds might have better access to information and resources to properly handle waste, including food waste. On the other hand, students from lower-income families may face challenges in accessing or practicing proper food waste management due to resource constraints or lack of exposure to awareness programs.

Despite studies on waste management, there is a notable gap in the literature regarding food waste awareness, particularly among senior high school students in a university setting. Nonetheless, in the Philippines, there is still limited research on how food waste awareness plays out, indicating how food waste in food services and households has not been thoroughly documented–further extending to academic environments as well (Barrion et al., 2023). Hence, studies such as those by Árnadóttir et al. (2018) and Dolipas et al. (2020) suggest that, like general waste management, students' awareness of food waste remains insufficient and requires stronger educational interventions.

3. Research Objectives

The study focuses on describing the level of awareness among Senior High School (SHS) students at Mapúa University in Intramuros regarding food waste. By employing a structured survey questionnaire, the research aims to provide a descriptive analysis of students' awareness of food waste.

The specific objectives of the study are listed below:

- To assess the overall level of awareness among SHS students at Mapúa University regarding the concept of food waste, including its definition and common causes.
- To determine SHS students' awareness of the environmental and social impacts of food waste.
- To summarize food waste awareness levels based on demographic characteristics (e.g. age, grade level, gender) among SHS students.

4. Scope and Delimitation

The study aimed to evaluate food waste practices at Mapúa University, Intramuros, focusing on awaren-

ess within senior high school students. The study aimed to assess the level of awareness in terms of these practices among senior high school students and faculty using purposive sampling to ensure a balanced representation of each group. The gathering of data was conducted during the academic year 2024-2025, focusing on the current practices and awareness related to food waste.

The study however has certain delimitations. Potential limitations included varying response rates or participant willingness, particularly from students who may have time constraints. Additionally, the study was limited to examining food waste practices within Mapúa University, excluding other types of waste, such as recyclables and hazardous materials. The study also did not consider waste initiatives from other institutions outside the university. These exclusions are intended to maintain the study's focus on food waste awareness and its relation to sustainability.

5. Conceptual Framework

Figure 1 presents the conceptual framework of this study, illustrating the relationships among the key variables. The framework highlights the key food waste awareness dimensions, which serve as the independent variable, encompassing the (i) definition of food waste; (ii) common causes of food waste; (iii) environmental impacts; and (iv) social impacts. These variables directly interact with the demographic characteristics of senior high school students, which act as mediating variables and consists of (i) age; (ii) gender; and (iii) grade level. The interactions between the independent variables and the demographic characteristics collectively influence the food waste awareness levels of senior high school students, which is the dependent variable.

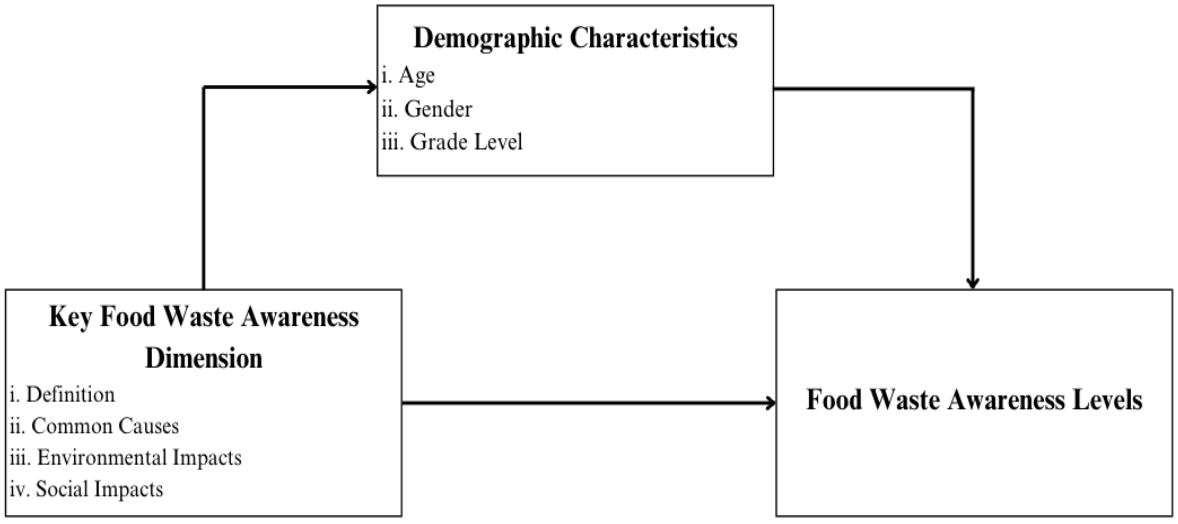

Figure 1: Research Paradigm

6. Methods

6.1. Research Design

This study used a descriptive quantitative research design to assess food waste awareness among Senior High School (SHS) students at Mapúa University, Intramuros. Descriptive quantitative research aims to provide an accurate description of a specific phenomenon or population (Miksza et al., 2023). In this case, the study focused on the level of food waste awareness within SHS students. Quantitative methods were used to collect numerical data that can be analyzed statistically, ensuring objectivity and reliability

in the findings (Miksza et al., 2023). The primary data collection tool was a survey with closed-ended questions to gather easily quantifiable responses (Deckert & Wilson, 2023).

This research design is appropriate as it will describe and quantify variables related to food waste awareness without manipulating them (Miksza et al., 2023). The study measured students' awareness of food waste, effective for capturing a snapshot of the current state of food waste awareness among SHS students, providing insights into the strengths and weaknesses of existing awareness levels (Dong, 2023).

By using descriptive quantitative research, the study generated data that were analyzed to determine the overall level of food waste awareness within SHS students. This approach allowed for comparisons between different groups (e.g., grade levels, gender) and highlighted areas where awareness can be improved. The findings collected offered actionable recommendations to enhance food waste awareness initiatives at Mapúa University.

6.2. Setting

The study took place at Mapúa University, Intramuros, an engineering and technological institution known for its curriculum centered in technical expertise, problem-solving, and innovation (Mapùa University, 2024); these qualities are essential for addressing real-world challenges like food waste. Moreover, Mapua University's environment encourages practical application of knowledge, which made it an ideal setting for examining how respondents from various disciplines, such as senior high school students, perceive and engage with food waste awareness. Overall, the university's commitment to sustainability and its diverse academic community offer a well-rounded perspective on this pressing issue.

6.3. Sampling Technique

This study utilized a purposive sampling technique, a non-probability sampling method that deliberately selects participants based on specific criteria, including specialist knowledge of the research issue and the capacity and willingness to participate in the research (Roi & Thapa, 2015; Oliver, 2006). Following this approach, the study involved samples from one group: senior high school students–all of which are currently studying or working at Mapúa University. The sample size was determined using Slovin's Formula as seen in Equation 1. Using a margin of error of 6.6%, the researchers calculated the sample sizes for a population consisting of 1,089 senior high school students. The resulting sample size was 190 senior high school students.

The senior high school students were selected based on the following criteria: (a) consumption of food within campus food facilities; and (b) involvement in food waste reduction practices or sustainability initiatives implemented by the campus.

$$n = \frac{N}{1+Ne^2} \quad (1)$$

6.4. Data Gathering Tools

A set of close-ended questions were prepared to measure and compare the current level of awareness of the Mapúa University community toward food waste management. To ensure the reliability of the data-gathering tool, a pilot test was conducted with 30 randomly selected students from the university. The pilot testing allowed the researchers to refine the survey instrument before full-scale implementation and assess its internal consistency.

Following the pilot test, Cronbach's alpha was calculated to evaluate the internal consistency of the survey items (Tavakol & Dennick, 2011). A Cronbach's alpha value of 0.70 or higher was considered acceptable, indicating satisfactory reliability of the instrument (Nunnally, 1978). T

he survey questions were created by the researchers and consisted of four sections designed to comprehensively assess the Mapúa University community's awareness of food waste: The first section, Identifying Data, gathered basic demographic and institutional information, such as respondents' age, gender, frequency of meal consumption on campus, and participation in sustainability initiatives. This section aimed to provide insights into the characteristics of respondents and enable comparisons between different demographic groups within the university.

The second section, Awareness of Food Waste as a Concept, evaluated respondents' awareness of food waste, focusing on its definition, causes, and their ability to identify wasteful practices within the university setting. The Cronbach's alpha value for this section was 0.79, indicating good reliability.

The third section, Environmental and fourth section, Social Impact Awareness Survey, assessed the senior high school (SHS) community's awareness of food waste's impact on environmental sustainability and social welfare to measure their understanding of its effects on the climate, resource consumption, and social inequality. The Cronbach's alpha value for this section was 0.92 and 0.91 respectively, demonstrating excellent internal consistency.

All questions in the questionnaire were measured using a 5-point Likert scale, which enabled rich answers while also making the data amenable to statistical analysis. Based on the pilot test results and the high Cronbach's alpha values across all sections, the survey instrument was deemed reliable and appropriate for the full-scale study.

6.5. Data Analysis

The data collected from the survey questionnaires were coded and analyzed using statistical software such as Microsoft Excel and JAMOVI. Descriptive statistics were applied to address the research objectives. To assess the central tendency of the responses, the mean was calculated for each section of the questionnaire, providing an overall measure of the average awareness level among respondents. For instance, the mean score for Section 2, "Awareness of Food Waste as a Concept," reflected the average level of knowledge about food waste among the senior high school community. Additionally, the median was used to identify the middle value in the distribution of responses, offering a measure that is less influenced by extreme scores, especially when analyzing Likert scale data that may be skewed.

To evaluate the variability in awareness levels, the standard deviation was calculated, measuring how much responses deviate from the mean. A higher standard deviation indicates greater variability in awareness. Finally, frequency distributions summarized the number and percentage of respondents who selected each response option for each survey item, providing a clear picture of the distribution of responses and helping to highlight common trends in food waste awareness among the participants.

7. Results

Table 1: Demographic Profile of the Respondents

Characteristics	Level	f	%
Age	15-17 years old	116	61.1
	18-20 years old	74	38.9
Gender	Female	94	49.5
	Male	95	50.0

	Non-binary	1	0.5
Grade Level	11	91	47.9
	12	99	52.1
Academic Strand	STEM	168	88.4
	ABM	10	5.3
	HUMSS	10	5.3
	GAS	1	0.5
	Arts and Design	1	0.5
How often do you dine in using campus food facilities?	Never	26	13.7
	1-2 times a week	134	70.5
	3-5 times a week	29	15.3
	More than 5 times a week	1	0.5
I have been participating in campus sustainability initiatives.	Yes	116	61.1
	No	74	38.9

Table 1 shows the demographic profile of the senior high school students surveyed at Mapúa University, Intramuros. The respondent pool is primarily composed of younger students (15-17 years old), predominantly enrolled in the STEM strand (88.4%). Notably, a majority (over 85%) dine on campus at least 1-2 times per week, making their awareness and potential behaviors directly relevant to the university's food waste situation. Furthermore, a significant proportion (61.1%) actively participate in campus sustainability initiatives, suggesting a potentially pre-existing engagement with environmental issues among this group.

Table 2: Awareness of Food Waste as a Concept

Facet	**SDA**		**D**		**N**		**A**		**SA**		**Mean**	**Median**	**SD**	**Remarks**
	f	**%**	**f**	**%**	**f**	**%**	**f**	**%**	**f**	**%**				
1. I can clearly define what constitutes food waste.	7	3.7	3	1.6	26	13.7	64	33.7	90	47.4	4.19	4.00	0.986	Aware

2. I can identify specific areas in school where food waste commonly occurs.	7	3.7	10	5.3	31	16.3	66	34.7	76	40.0	4.02	4.00	1.05	Aware
3. I understand the factors that lead to food waste in schools.	8	4.2	1	0.5	19	10.0	80	42.1	82	43.2	4.19	4.00	0.948	Aware
4. I can recognize food waste in portion sizes and serving practices.	6	3.2	6	3.2	24	12.6	82	43.2	72	37.9	4.09	4.00	0.955	Aware
5. I can recognize the difference between preventable and non-preventable food waste	8	4.2	8	4.2	30	15.8	72	37.9	72	37.9	4.01	4.00	1.04	Aware

Note. *SDA - Strongly Disagree *D - Disagree *N - Neutral *A - Agree *SA - Strongly Agree

Table 2 presents data on respondents' awareness of food waste as a concept, which addresses the first research objective by gauging students' fundamental understanding of food waste. The findings reveal a consistently strong level of awareness (all means between 4.01 and 4.19, classified as "Aware") across all conceptual aspects—from defining food waste and identifying its causes in schools to recognizing wasteful practices and differentiating preventable waste. This uniform high awareness suggests that the basic educational messages regarding the what and why of food waste have effectively reached this student cohort, establishing a solid foundation of conceptual knowledge.

Table 3: Environmental Impacts of Food Waste

Facet	**SDA**		**D**		**N**		**A**		**SA**					
	f	**%**	**f**	**%**	**f**	**%**	**f**	**%**	**f**	**%**	**Mean**	**Median**	**SD**	**Remarks**
1. I understand how food waste affects greenhouse gas emissions.	8	4.2	3	1.6	29	15.3	69	36.3	81	42.6	4.12	4.00	1.01	Aware
2. I understand how food waste impacts climate change.	8	4.2	6	3.2	24	12.6	68	35.8	84	44.2	4.13	4.00	1.03	Aware
3. I am aware about the energy costs of food waste.	7	3.7	10	5.3	15	7.9	75	39.5	83	43.7	4.14	4.00	1.02	Aware
4. I am aware of how food waste affects environmental resources.	7	3.7	2	1.1	17	8.9	66	34.7	98	51.6	4.29	5.00	0.947	Extremely Aware
5. I am aware of the amount of carbon footprint associated with food waste.	6	3.2	10	5.3	23	12.1	73	38.4	78	41.1	4.09	4.00	1.01	Aware

Note. *SDA - Strongly Disagree *D - Disagree *N - Neutral *A - Agree *SA - Strongly Agree

Table 3 addresses the second research objective by detailing awareness of the environmental impacts of food waste. Respondents were generally "Aware" of impacts such as greenhouse gas emissions and climate change. A statistically significant finding was the "Extremely Aware" classification (Mean = 4.29) regarding the general impact of food waste on environmental resources.

Table 4: Social Impacts of Food Waste

Facet	SDA (2)		D		N (3)		A (4)		SA (5)		Mean	Median	SD	Remarks
	f	%	f	%	f	%	f	%	f	%				
1. I am aware of how food waste affects community access to food.	6	3.2	3	1.6	22	11.6	61	32.1	98	51.6	4.27	5.00	0.953	Extremely Aware
2. I recognize that reducing food waste could help address malnutrition in disadvantaged communities.	6	3.2	6	3.2	18	9.5	59	31.1	101	53.2	4.28	5.00	0.982	Extremely Aware
3. I know how food waste demonstrates inefficiencies in global food systems.	6	3.2	5	2.6	25	13.2	68	35.8	86	45.3	4.17	4.00	0.974	Aware
4. I understand how food waste affects local community food distribution systems.	8	4.2	7	3.7	14	7.4	69	36.3	92	48.4	4.21	4.00	1.02	Extremely Aware
5. I know that addressing food waste could contribute to solving social welfare challenges.	7	3.7	5	2.6	17	8.9	66	34.7	95	50.0	4.25	4.50	0.985	Extremely Aware

Table 4 presents respondents' awareness of the social impacts of food waste. The results indicate a generally high level of awareness, with four out of five items reaching the "Extremely Aware" category (Mean = 4.21–5.00). Notably, the strongest levels of awareness were observed in the recognition of the role of food waste reduction in addressing malnutrition (Mean = 4.28) and improving community access to food (Mean = 4.27). These findings suggest that respondents are particularly attuned to the broader social consequences of food waste, including its link to food security and social welfare.

Table 5: Awareness of Food Waste as a Concept Based on Demographic Profile

Category	Group	Level	Mean	Remarks
	Age	15-17	4.01	Aware
		18-20	4.25	Extremely Aware

Awareness of Food Waste as a Concept	Gender	Female	4.29	Extremely Aware
		Male	3.91	Aware
		Non-binary	4.20	Aware
	Grade Level	11	3.93	Aware
		12	4.26	Extremely Aware
	Frequency of Campus Food Facility Usage	Never	4.35	Extremely Aware
		1-2 times a week	4.01	Aware
		3-5 times a week	4.27	Extremely Aware
		>5 times a week	5.00	Extremely Aware
	Involvement in Campus Sustainability Programs	Yes	4.28	Extremely Aware
		No	3.83	Aware

Table 5 presents the levels of awareness regarding food waste as a concept across various demographic groups. The results show that awareness was highest among respondents aged 18–20 (Mean = 4.25), those in Grade 12 (Mean = 4.26), and individuals involved in campus sustainability programs (Mean = 4.28)—all of whom were classified as "Extremely Aware." In terms of gender, females recorded the highest mean score (Mean = 4.29), followed by non-binary respondents (Mean = 4.20), while males had the lowest (Mean = 3.91), indicating a notable disparity in awareness levels. Furthermore, awareness tended to increase with the frequency of campus food facility usage. Those who used these facilities more than five times a week demonstrated the highest awareness (Mean = 5.00), followed by those who never used them (Mean = 4.35). This suggests that both direct engagement with food services and complete disengagement may heighten consciousness about food waste. Overall, the findings highlight that age, academic maturity, gender, and active involvement in sustainability efforts significantly contribute to heightened awareness of food waste issues.

Table 6: Environmental Impacts of Food Waste Based on Demographic Profile

Category	Group	Level	Mean	Remarks
Environmental Impacts of Food Waste	Age	15-17	4.15	Aware
		18-20	4.16	Aware
	Gender	Female	4.31	Extremely Aware
		Male	**4.00**	**Aware**
		Non-binary	**4.60**	**Extremely Aware**
	Grade Level	**11**	**4.01**	**Aware**
		12	**4.28**	**Extremely Aware**
	Frequency of Campus Food Facility Usage	Never	4.42	Extremely Aware
		1-2 times a week	4.03	Aware
		3-5 times a week	4.45	Extremely Aware
		>5 times a week	4.80	Extremely Aware
	Involvement in Campus Sustainability Programs	Yes	4.30	Extremely Aware
		No	3.93	Aware

Table 6 illustrates food waste awareness levels across different demographic groups. Both the 15–17 (Mean = 4.15) and 18–20 (Mean = 4.16) age groups are classified as "Aware," indicating consistent awareness among youth. Females (Mean = 4.31) and non-binary respondents (Mean = 4.60) are "Extremely Aware," while males (Mean = 4.00) are "Aware," suggesting higher awareness among females and non-binary individuals. Grade 11 students (Mean = 4.01) are "Aware," whereas Grade 12 students (Mean = 4.28) show "Extremely Aware" levels, indicating growth in awareness with academic progression. Food facility usage and involvement in sustainability programs show strong links to awareness. Respondents who never use campus food facilities (Mean = 4.42), those using them 3–5 times a week (Mean = 4.45), and more than 5 times a week (Mean = 4.80) are "Extremely Aware," while occasional

users (1–2 times a week, Mean = 4.03) are simply "Aware." Additionally, those engaged in sustainability programs (Mean = 4.30) are "Extremely Aware," compared to those not involved (Mean = 3.93), who are only "Aware." These findings highlight the positive influence of campus engagement and habits on food waste awareness.

Table 7: Social Impacts of Food Waste Based on Demographic Profile

Category	Group	Level	Mean	Remarks
Social Impacts of Food Waste	Age	15-17	4.21	Extremely Aware
		18-20	4.29	Extremely Aware
	Gender	Female	4.43	Extremely Aware
		Male	**4.05**	**Aware**
		Non-binary	**4.00**	**Aware**
	Grade Level	**11**	**4.09**	**Aware**
		12	**4.37**	**Extremely Aware**
	Frequency of Campus Food Facility Usage	Never	4.56	Extremely Aware
		1-2 times a week	4.10	Aware
		3-5 times a week	4.54	Extremely Aware
		>5 times a week	5.00	Extremely Aware
	Involvement in Campus Sustainability Programs	Yes	4.41	Extremely Aware
		No	3.97	Aware

The results in Table 7 reveal data in food waste awareness levels regarding the social impacts across various demographic characteristics. For age, respondents in the 15-17 age group (Mean = 4.21) are classified as "Extremely Aware," while those in the 18-20 age group (Mean = 4.29) also fall under the "Extremely Aware" category, showing a high level of awareness. Regarding gender, females (Mean = 4.43)

are considered "Extremely Aware," while males (Mean = 4.05) fall into the "Aware" range. Non-binary respondents (Mean = 4.00) also fall under the "Aware" category. In terms of grade level, Grade 11 students (Mean = 4.09) are classified as "Aware." with Grade 12 students (Mean = 4.37) showing a higher awareness level being classified as “Extremely Aware.” Moving on, those who never used campus food facilities (Mean = 4.56) are categorized as "Extremely Aware." Respondents using the facilities 1-2 times a week (Mean = 4.10) are "Aware," while those using them 3-5 times a week (Mean = 4.54) are "Extremely Aware." The highest level of awareness is found among those who use food facilities more than 5 times a week (Mean = 5.00) are also in the "Extremely Aware" range. Lastly, regarding involvement in campus sustainability programs, participants who are involved (Mean = 4.41) are categorized as "Extremely Aware," while those not involved (Mean = 3.97) fall under the "Aware" category. Females, older students, and those actively involved in sustainability programs or who use food facilities more frequently demonstrate higher levels of awareness regarding the social impacts of food waste.

Table 8. Interpretation Table

Mean Range	Interpretation
1.00-1.80	Not Aware
1.81-2.60	Slightly Aware
2.61-3.40	Moderately Aware
3.41-4.20	Aware
4.21-5.00	Extremely Aware

Table 8 provides the interpretation guide for the mean scores presented in Tables 2, 3, 4, 5, 6, and 7. This table categorizes awareness levels based on the corresponding mean ranges: Not Aware (1.00-1.80), Slightly Aware (1.81-2.60), Moderately Aware (2.61-3.40), Aware (3.41-4.20), and Extremely Aware (4.21-5.00). This guide helps interpret the mean scores of each question, allowing for a clearer understanding of respondents' awareness levels regarding food waste and its impacts.

8. Discussion

8.1. Conceptual Awareness

The survey results demonstrate a consistently high level of awareness among students regarding various aspects of food waste. Specifically, students can clearly define food waste, identify where it occurs, understand its causes, recognize wasteful practices, and distinguish between preventable and non-preventable waste. These findings align with several studies that report widespread self-reported awareness of food waste issues, especially in developed contexts. For instance, a nationally representative U.S. survey found that most consumers were aware of food waste as a problem, knowledgeable about reduction strategies, and engaged in some waste-reducing behaviors (Neff et al., 2015). Moreover, research among Italian university students revealed a strong baseline awareness of food waste, with students able to articulate definitions and identify causes and consequences (Catalano et al., 2024).

8.2. Environmental and Social Impact Awareness

8.2.1. Environmental Impact Awareness

The students demonstrated a solid awareness of key environmental impacts, such as food waste's contribution to greenhouse gas emissions and climate change. This aligns directly with the paper's emphasis on food waste as a significant global environmental challenge, responsible for 8-10% of total greenhouse gas emissions (UNEP, 2023) and substantial methane production (USDA, 2022). The high awareness reflects an understanding of the detrimental environmental consequences discussed by Makanjuola et al. (2020) and Ghosh et al. (2015).

Furthermore, the students were "Extremely Aware" of how food waste affects environmental resources. This finding resonates strongly with the paper's discussion of food waste leading to the inefficient use and depletion of resources like water, land, and energy throughout the food supply chain (Awasthi et al., 2019). Their awareness suggests they grasp the concept presented by Cerda et al. (2018) that reducing food waste represents a significant opportunity to mitigate resource loss and address climate change.

8.2.2. Social Impact Awareness

Awareness of the social impacts was particularly high. Students showed strong recognition of the link between food waste and community food access and its potential role in addressing malnutrition. This high level of awareness directly reflects the social dimensions discussed in the RRL, such as the paradox of massive food waste occurring alongside widespread hunger (UN, 2024; Cos, 2022) and the potential for waste reduction strategies, like redistributing surplus food, to offer social benefits (Makanjuola et al., 2020).

The students' awareness also extended to understanding how food waste impacts local distribution systems and demonstrates inefficiencies in the global food system. This aligns with the RRL's broader discussion of food waste occurring throughout the supply chain (Makanjuola et al., 2020) and the need for comprehensive strategies to improve system efficiency and sustainability (Ghosh et al., 2015). Their understanding that addressing food waste contributes to solving social welfare challenges underscores the multifaceted nature of the problem as presented in the literature.

8.3. Variations in Food Waste Awareness Across Student Demographics

8.3.1. Gender

Gender differences emerged in the levels of food waste awareness among respondents, particularly across all three dimensions: conceptual, environmental, and social. The researchers found that female participants consistently exhibited greater awareness of food waste issues compared to male and non-binary participants. This finding aligns with results from a study conducted at Tamilnadu University in Indonesia, where female students exhibited higher knowledge levels and more positive attitudes toward food waste reduction (Radhakrishnan & Manivannan, 2025). This earlier study noted that female students tend to be more attuned to environmental issues potentially due to gender socialization, considering that females are often influenced by norms centered on responsibility and care, particularly in environmental and social contexts (Alattar et al., 2020).

Similar patterns of gender-differentiated awareness were observed in Philippine contexts by Limon and Villarino (2020), who found that women typically possessed greater food waste-related knowledge and awareness. The WWF-Philippines' (2022) report on waste management further supports this trend, noting that women often hold disproportionate responsibility for household waste handling, which likely contributes to their enhanced awareness of waste-related issues. Hence, these findings collectively sug-

gest a consistent pattern where female respondents demonstrate higher awareness across multiple dimensions of food waste understanding.

While the primary focus of this study is targeted on awareness levels rather than behaviors, it is worth noting that awareness differences do not always translate into corresponding behavioral differences. Studies by Kuo and Shih (2016) and Cantaragiu (2019) found that despite higher awareness levels, female participants did not necessarily generate less food waste than their male counterparts. This observation mirrors the relationship between awareness and action, suggesting that awareness alone, while important, may be insufficient to overcome structural and practical barriers to waste reduction.

8.3.2. Age

With age put into the discussion, the data from the surveys indicates high awareness among the youth, with older students exhibiting higher awareness levels across the conceptual, environmental, and social dimensions of food waste. This finding provides an interesting counterpoint to the study of Department of Science and Technology – Food and Nutrition Research Institute (2023), which examined awareness across broader age ranges and found more complex patterns of food waste awareness. Their research suggested that while older individuals might possess greater theoretical knowledge about food waste issues, this awareness did not consistently translate into higher levels of practical knowledge about food management strategies.

The age-related awareness differences identified in this study study also add distinction to existing literature on youth awareness of food waste issues because while Karunasena et al. (2021) and Zero Waste Scotland (2019) both noted gaps in the awareness of youth, between 18 and 34 years of age, regarding practical aspects of food waste management, the findings in our study suggest that even within younger (between 15-20 years old) demographic groups, meaningful differences in awareness exist across age brackets. These variations in awareness may reflect differences in educational exposure, personal interest in environmental issues, or developmental stages of environmental consciousness. Hence, this finding suggests that awareness is not solely determined by generational grouping, but is also shaped by context-specific factors such as grade level, curriculum exposure, and developmental maturity (Mariam et al., 2022). For instance, older students may have encountered more environmental education content, participated in relevant school campaigns, or developed stronger critical thinking skills that help them be aware of the broader implications of food waste (Catalano et al., 2024). These variations may also reflect an increasing personal sense of responsibility, which tends to develop with age, or a greater interest in sustainability topics due to social influences or academics (Wang et al., 2023).

8.3.3. Grade Level

Moving on, the findings of this study also found a pattern between age, grade level, and food waste awareness, considering that older students and those in higher grade levels demonstrate greater awareness across conceptual, environmental, and social dimensions. Specifically, Grade 12 students and those aged 18-20 years old exhibited higher awareness of food waste issues than Grade 11 students and those aged 15-17 years old, suggesting that educational level plays an important role in developing environmental consciousness. This finding aligns with a study at Union Christian College in the Philippines, which found that both Grade 11 and Grade 12 students were highly aware of the economic and environmental impacts of food waste, but the overall trend indicated that awareness and responsible behaviors increased with grade level (Cariaga et al., 2025).

The pattern evident in age, grade level, and awareness can be attributed to several factors since those students in their senior years have had more exposure to educational content related to sustainability and

environmental issues throughout their curriculum (Busse, 2018). Second, as students progress through their education, they develop more sophisticated critical thinking skills that enable them to better comprehend complex environmental challenges, such as food waste, compared to those who received less education (Bittner, 2025). Data from a 2024 field study of senior high school students in China confirmed that awareness and behaviors around food waste are influenced by factors such as age, educational exposure, and school-based interventions, with understanding becoming stronger as students progress to higher grades since these educational experiences collectively contribute to deeper awareness and sensitivity toward food waste issues among higher-grade students (Zhang et al., 2024).

8.3.4. Frequency of Food Facility Usage

The study revealed a nuanced relationship between the frequency of food facility usage and students' food waste awareness. Those who regularly utilized campus food facilities displayed notably higher awareness across the conceptual, environmental, and social dimensions compared to those who used them infrequently or not at all.

Frequent users are more likely to observe and experience the outcomes of food consumption and waste firsthand, which may heighten their sensitivity to the issue. A related study conducted at Bina Nusantara University (Wijaya & Marpaung, 2024) supports this finding, revealing that students who regularly dine at campus food stalls develop stronger awareness of food waste practices and associated environmental consequences. The daily interaction with food services often includes visual exposure to leftover food and disposal processes, which can serve as informal but impactful educational moments.

In contrast, those who bring food from home or eat off-campus may not witness institutional food waste to the same extent, which could explain lower awareness levels. Moreover, campus food facilities are often tied to sustainability initiatives such as waste segregation and composting programs. These initiatives, when present and well-communicated, reinforce students' understanding of food waste's broader implications (WWF-Philippines, 2023).

However, while frequency of usage correlates with awareness, it does not automatically translate into responsible behavior. As pointed out by Principato et al. (2020), exposure must be paired with active education and engagement to foster lasting behavioral change. Thus, schools must ensure that their food service areas not only function as providers but also as platforms for sustainability advocacy..

8.3.5. Involvement in Sustainability Programs

Students involved in sustainability-focused programs—such as environmental clubs, eco-campaigns, and community clean-ups—exhibited the highest levels of food waste awareness across all dimensions. This finding underscores the strong link between experiential learning and environmental consciousness. This aligns with the experiential learning theory, which posits that active engagement fosters deeper understanding and retention of knowledge (Kolb, n.d.). Students who participate in sustainability initiatives often receive direct exposure to the causes and consequences of waste, along with practical tools for mitigation. A study by Florencio et al. (2021) on Metro Manila youth confirmed that student participants in green school programs displayed enhanced awareness and more sustainable behaviors compared to their peers.

Additionally, involvement in these programs builds a sense of environmental stewardship and social responsibility. According to the Department of Education's "Eco-Schools" framework (DepEd, 2023), embedding sustainability in school culture—through co-curricular and extracurricular activities—significantly boosts both awareness and action among students. In our study, students active in such programs scored particularly high on the social dimension of food waste awareness, suggesting a deeper

understanding of the societal impacts of overconsumption and inequitable food distribution. These findings further highlight the importance of integrating sustainability initiatives within the educational system, not only as occasional projects but as sustained, structured components of school life. When students are directly engaged, they become more conscious not only of their individual practices but also of their role within the larger environmental ecosystem

9. Conclusion

Food waste among university students stands as a critical challenge with far-reaching implications for nutrition, food security, budgets, environmental sustainability, and social well-being. This study, among the first to systematically assess food waste awareness at Mapúa University, offers evidence that senior high school students possess a strong conceptual grasp of food waste and its environmental and social impacts. Notably, students recognize the potential for food waste reduction to combat malnutrition and improve community access to food-a finding that aligns with broader global priorities for responsible consumption and sustainability. Demographic patterns revealed in this research highlight important opportunities for intervention: awareness is higher among females, increases with age and academic standing, and is particularly pronounced among those who frequently use campus food facilities or participate in sustainability programs. These insights suggest that multifaceted, targeted educational strategies-rather than one-size-fits-all messaging-could be especially effective in further elevating awareness and translating it into meaningful behavioral change. Although the university's engineering-focused and urban context may limit the broad generalizability of these findings, they point to the premise of student-led, data-driven initiatives and the importance of ongoing measurement to track progress and refine strategies over time. Ultimately, the results in this study echoes that Mapúa University's students are not only aware of the stakes but are also positioned to lead in advancing campus sustainability. By building on this strong foundation of awareness and strategically addressing behavioral barriers, the university community can make significant strides toward reducing food waste, conserving resources, and fostering a culture of social responsibility.

10. Recommendations

10.1. Recommendations for Future Research

Future studies should expand beyond the current sample of 150 senior high school students to include at least 300 participants across Mapúa University's entire population, ensuring greater representation of gender diversity by including non-binary individuals alongside male and female respondents. This expansion would provide a more comprehensive understanding of food waste management behaviors throughout the university community. Research should specifically examine the unique cultural factors affecting food waste behaviors among Filipino youth at Mapúa, particularly investigating how family dining traditions, "clean plate" expectations, and communal eating practices influence students' waste behaviors on campus. A comparative analysis of Mapúa University's food waste management systems against other leading Philippine educational institutions would identify regional best practices and opportunities for institutional collaboration. Additionally, controlled studies should be designed to quantitatively measure the effectiveness of different educational interventions, including classroom integration, campus campaigns, and peer education programs, by tracking measurable food waste metrics in Mapúa's canteens before and after implementation. Future research should also investigate student receptiveness to digital tools for tracking personal food waste, such as mobile applications that could be implemented

within the Mapúa senior high school environment, considering technology accessibility among the student population.

10.2. Recommendations for Practice

Based on the findings of insufficient awareness regarding food waste management among Mapúa's senior high school population, the university should develop and implement comprehensive multimedia awareness campaigns specifically designed for the Filipino youth demographic, utilizing platforms frequently used by students. These campaigns should emphasize the environmental, social, and economic consequences of food waste and highlight the importance of adopting sustainable practices among students, faculty, and staff.

To address inconsistencies in current practices, Mapúa should establish and enforce a comprehensive "Zero Food Waste" policy that includes clear protocols for food waste separation at source, designated composting areas for all campus buildings, mandatory food waste audit reporting each semester, and integration of waste reduction metrics into the university's sustainability performance indicators. This policy would promote coordinated efforts across all sectors of the campus community.

Given the inadequate integration of food waste management into daily student routines, specific curriculum modifications should incorporate food waste management modules into required senior high school courses by adding a food sustainability component and offering workshops to reinforce practical involvement in sustainability. To further encourage participation, Mapúa should implement an eco-point program that rewards students who consistently demonstrate proper food waste management practices, which can be exchanged for academic privileges such as priority enrollment, discounts at campus establishments, or recognition during school events.

Finally, the university should form strategic partnerships with local composting facilities within Metro Manila, nearby community gardens that can utilize compost from the university, and the Department of Environment and Natural Resources (DENR) for technical assistance on waste management systems appropriate for educational institutions in urban Philippine setting.

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