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Results Quantity Amount of Food Recording Expenditures on Food Waste Behavior in Households in North Bekasi, Bekasi City

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A B S T R A C T

In addition to the food waste environment, this can also waste energy in meeting daily needs. The aim of this study is to understand the magnitude of waste from food waste behavior generated by households in urban areas. Based on the data results in daily waste disposal, it was found that vegetables constitute a significant portion of food waste. Meanwhile, in the waste generated from food storage, fruits were found to be the largest contributor. This disposal can occur due to the process of declining freshness in food, which leads to spoilage and ultimately ends up in the trash. The conclusion of this analysis found that there is a relationship between food purchasing and food storage with the occurrence of food waste.

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INTRODUCTION

The 21st century has seen an increase in waste levels. This can happen due to a large amount of spoiled food or food that is often unused. Food law relates to food waste, and the issue is not only at the European level. Waste occurs at all levels of the food chain and has a significant impact on many areas of life. Food waste, or food wastage, is increasingly on the rise, especially in "prosperous" countries, where consumers have a plethora of food choices. Furthermore, it is clear that this is a global issue that is becoming increasingly political and social. According to Gustavsson et al. (2011), each year, one third of the food produced for human consumption is not used properly for various reasons. The food products are discarded, transformed into animal feed or other non-food needs. Because food waste is organic waste that decomposes easily, many people believe that it does not harm the environment. (Seberini, 2020). In fact, food waste itself has an impact that can cause problems for the environment. Throwing away food is the same as throwing away all the energy and water needed to grow, harvest, transport, and package it. When food is thrown into the trash and undergoes the process of decomposition, this decomposition produces a reaction that generates methane gas (a gas in the atmosphere that can trap sunlight, referred to as greenhouse gases like carbon dioxide (CO2), nitrous oxide (N2O), methane (CH4), and freon (SF6, HFC, and PFC)). About 6% -8% of all human-caused greenhouse gas emissions could be reduced if we stop wasting food. (WWF, n.d.). Food waste that is simply discarded can leave a carbon footprint on the environment, which is a trigger for global warming. The occurrence of food waste happens due to wasteful behavior towards food, discarded because it does not last long and food that becomes leftovers. (Katajajuuri et al., 2014). Data released by Bappenas (2021) indicates that food waste generated in Indonesia from 2000 to 2019 reached 23-48 million tons per year, equivalent to 115-184 kg per capita per year. During the same period, this accumulation also produced Greenhouse Gas (GHG) emissions of 1,702.9 Megatons of CO2-equivalent, which is equivalent to 7.29 percent of Indonesia's average annual GHG emissions. According to the Waste Source data from 2021, based on the composition of waste types, food waste holds the top position with a percentage of 40.9% of the total waste.

Food waste that is simply discarded can leave a carbon footprint on the environment, which is a trigger for global warming. Meanwhile, the occurrence of food waste happens due to the behavior of wasting food, which is discarded because it does not last long and is leftover food. (Katajajuuri et al., 2014). Data released by Bappenas (2021) indicates that food waste generated in Indonesia from 2000 to 2019 reached 23-48 million tons per year, equivalent to 115-184 kg per capita per year. During the same period, this accumulation also produced Greenhouse Gas (GHG) emissions amounting to 1,702.9 Megatons of CO2-equivalent, which is equivalent to 7.29 percent of Indonesia's average annual GHG emissions.

In addition to the environmental impact, other effects can occur on the humanitarian front. The issue of food waste is related to the fact that many people are still struggling to obtain adequate food supplies. According to

Renzaho et al. (2017), they explain that an abundance of food volume leads to a high level of food waste. Although developed countries have good handling and per capita income, there are still developed countries that face hunger issues. (Grainger et al., 2018). If food that is still fit for consumption could be given to those in need, it would help alleviate hunger and reduce the level of food waste produced. According to data released by Bappenas (2021), the waste generated represents a loss of energy content that should have been consumed but instead is lost as food waste. This loss of energy is equivalent to the food portions for 61-125 million people per year. The data found that food loss and waste (FLW) occurs from the accumulation of waste originating from rice, corn, wheat, and similar products, while the type of food that is lost during the least efficient part of the process is vegetables, which account for a loss of 62.8 percent. (Bappenas, 2021).

The differences between this research and previous studies are the variables, respondents, location, and research time. The purpose of this research is to determine the amount of waste from food waste behavior generated in households, with the research conducted in the city of Bekasi, focusing on several sub-districts within the Bekasi district.

LITERATURE REVIEW

Food waste is food that should still be edible but is simply thrown away, either by consumers, restaurants, shops, or producers. This includes food that is damaged because it is stored for too long, not finished, or thrown away because its appearance is considered unattractive (although still edible).

METHODOLOGY

In this study, it is a unit study within another study using the diary recording research method with an observational approach and a cross-sectional study design, which measures the relationship between population and time. Notoatmodjo (2002; 2010) explains that cross-sectional research is conducted to study the dynamics of correlation between risk factors and effects, using either an observational approach or data collection at a specific point in time, conducting observations only once, and measurements are made on the subject variables at the time of the study.

The sampling technique used is simple random sampling, where samples are taken randomly with a sample size of 100 respondents from a population of 99,988 families. With the criteria that respondents have resided for more than 6 months in North Bekasi District, Bekasi, respondents must be able to communicate well, be able to read and write, be housewives aged 23 to 59 years, and belong to households consisting of one kitchen or where only one family resides in a household. With the exclusion criteria of withdrawing in the middle of the research, unwilling to be a respondent.

The data collection technique for this research involves primary data by gathering respondent characteristics and filling out questionnaires. The data analysis in this study is based on the cumulative recording of daily food expenditures in households and the recording of food inventory storage.

RESEARCH RESULT

Food waste in daily waste generation comes from uneaten food or avoidable food waste (edible food waste) and food that is purchased, stored, and discarded even though it is still edible. Every food has its own nutritional value; when food waste is discarded, it means that nutritional value is being wasted.

Table 1. shows the expenditure on edible food waste derived from the daily recording of the food waste diary.

Types of Food	Heavy	Energy	Protein	Fat	Carbohydrates
	Gr/cap/jam	kkal/kap/hr	Gr/cap/jam	Gr/cap/jam	Gr/cap/jam
Staple Foods	15,43	27,00	0,62	0,00	6,17
Protein hewani	1,64	2,34	0,27	0,12	0,00
Protein nabati	0,70	1,05	0,07	0,04	0,10
Fruit	4,44	2,22	0,00	0,00	0,53
Vegetable	6,91	1,73	0,07	0,00	0,35
Entire	29,12	34,34	1,03	0.16	7,15

(Table: Daily Food Waste Recording)

Based on Table 4.3, it shows that almost every day a household disposes of food waste from various types of food, ranging from staple food waste (rice), animal protein (fish, chicken, meat), plant protein (tempe or tofu), fruits, and vegetables (in the vegetable group B). The amount of food waste per type of food per household per day is 15.43 grams/capita/day for staple food, 1.64 grams/capita/day for animal protein (fish, chicken, meat), 0.70 grams/capita/day for plant protein (tempe or tofu), 4.44 grams/capita/day for fruits, and 6.91 grams/capita/day for vegetables (in the vegetable group B). Households can generate waste daily with an energy value of 34.34 kcal, protein 27.41 grams, fat 1.03 grams, and carbohydrates 7.15 grams.

Food waste in waste generation in this storage comes from uneaten food or edible food waste that is stored without checking the food storage conditions and ultimately gets thrown away even though it is still consumable or can be processed into food.

Table 2. Expenditure on edible food waste through storage cleaning from the Food Waste Diary records.

Types of Food	Heavy	Energy	Protein	Fat	Carbohydrates
	Gr/cap/hr	kkal/kap/hr	Gr/cap/hr	Gr/cap/hr	Gr/cap/hr
Fruit	12,97	6,49	0,00	0,00	1,56
Vegetable	11,00	2,75	0,11	0,00	0,55
Vegetable Fish	1,81	2,49	0,17	0,10	0,23
Animal Side Dishes	0,20	0,25	0,04	0,01	0,00
Dry Food	1,10	3,85	0,12	0,02	0,80
Total	27,08	15,82	0,43	0,13	3,14

Based on table 4.2, it shows that each household disposes of waste from food storage during cleaning. This disposal occurs due to food items that can no longer be used. The table explains that households in this area have the highest waste disposal in the first position for fruits, followed by vegetables, plant-based side dishes, dry food, and animal-based side dishes. The recording results explain that the amount of food waste is 12.97 grams per capita per day for fruits, 11.00 grams per capita per day for vegetables, 1.81 grams per capita per day for plant-based side dishes, 0.20 grams per capita per day for animal-based side dishes, and 1.1 grams per capita per day for dry food. Meanwhile, in terms of the number of calories and nutrients wasted, it shows that the largest contributor to food waste is fruit, with an energy loss of 6.49 kcal/capita/day, while the least wasted is animal-based dishes, with a loss of 0.25 kcal/capita/day. The total energy wasted amounts to 15.82 kcal/capita/day. Regarding protein, the most wasted comes from plant-based dishes, totaling 0.17 grams/capita/day. For fats, the highest waste also comes from plant-based dishes, at 0.10 grams/capita/day. As for carbohydrates, the most wasted comes from fruit, amounting to 1.56 grams/capita/day.

DISCUSSION

In the research, it was found that in the daily household activities in this area, food is wasted, and the three types of food that are most commonly discarded are rice as a staple food, vegetables, and fruits. Meanwhile, the disposal of waste during the cleaning of storage areas, which is usually done monthly, leads to the wastage of several types of food. The types of food that are most commonly discarded are two types: fruits and vegetables. The foods

that are most often thrown away during cleaning are bananas and papayas, which dominate the waste, while the discarded vegetables are of type B. This occurrence aligns with the research conducted by Philippidis et al. (2019), which found that food waste in households is dominated by vegetables, followed by fruits, and lastly, meat.

From the results of the recording on edible food waste derived from the daily food waste diary, it was found that the waste generated per type of food per household per day in this area amounts to 15.43 grams per person per day, which is roughly equivalent to 1 tablespoon of staple food, 1.64 grams per person per day of animal protein (fish, chicken, meat), 0.70 grams per person per day of plant protein (tempeh or tofu), 4.44 grams per person per day or equivalent to ½ teaspoon of fruit, and 6.91 grams per person per day equivalent to ½ teaspoon of vegetables. (pada golongan sayuran B).

Based on the results of the recording of edible food waste through the cleaning of storage from the Food Waste Diary, the research findings indicate that the most food waste is generated in households from staple foods, particularly rice. The second position is found in vegetable food types, the third in animal-based dishes, the fourth in plant-based dishes, and the last in fruits. Overall, based on the analysis of the food waste diary recorded daily during regular days, it can be concluded that households waste a total of 29.12 grams per capita per day, which is equivalent to 2-3 tablespoons of total nutrients that become waste, 34.34 kcal per capita per day of energy wasted, equivalent to 3-4 tablespoons, 27.41 grams per capita per day of protein, equivalent to 2 tablespoons, 1.03 grams per capita per day of fat, and 7.15 grams per capita per day of carbohydrates, equivalent to 1 teaspoon. It can be concluded that the food that is most often wasted comes from staple foods (rice).

Based on the results of food waste recording during the food storage cleaning phase, it was found that the most discarded food was fruits at 12.97 grams per capita per day, followed by vegetables at 11.00 grams per capita per day, and plant-based side dishes at 1.81 grams per capita per day. In terms of calories and nutrients wasted, fruits accounted for 6.49 kcal and carbohydrates at 1.56 grams per capita per day, while vegetables accounted for 2.75 kcal, protein at 0.11 grams per capita per day, and carbohydrates at 0.55 grams per capita per day. Followed by vegetable dishes, meat dishes, and dry food. Thus, the average food waste indicates that almost every discarded meal has at least 1 teaspoon thrown away, equivalent to 5-7 grams, and at most about 3-4 tablespoons, equivalent to 25-30 grams.

Overall, households in Bekasi City waste food daily at a rate of 1-2 tablespoons per capita at most. Cumulatively, over the course of a year, the expenditure on edible food waste derived from daily food waste diary records resulted in waste amounting to an energy value of 12,534 kkal, equivalent to the daily needs of 6-7 active adults, protein of 375 grams, equivalent to the daily needs of 5-6 people, fat of 59 grams, equivalent to the daily needs of 1 person, and carbohydrates of 2,609 grams, equivalent to the daily needs of 6-7 people.(AKG,2019).

Cumulatively, the food waste generated from the edible food waste output through storage cleaning recorded in the Food Waste Diary over a year results in waste equivalent to 5774 kkal of energy, sufficient to meet the daily needs of 2-3 active adults, 157 grams of protein equivalent to the daily needs of 1-2 people, 47 grams of fat equivalent to the daily needs of 1 person, and 1146 grams of carbohydrates equivalent to the daily needs of 2-3 people. (AKG,2019). Meanwhile, the average food waste globally reaches 121 kg per capita per year, with 61% of it (74 kg per capita per year) generated by households. Southeast Asia, which represents 8.5% of the world's population and had a population of 664 million in 2020, inevitably leads to a significant amount of food waste generated by the residents living in Southeast Asia. (Diana et al., 2023). Globally, in 2011, 727 kcal per day per capita was wasted in the food supply chain. Another finding by Kummu et al. (2012) revealed the value of food waste in 2003 in Southeast Asia, specifically in the Philippines (32 Kcal/day/capita) and in Indonesia, particularly in the city of Bekasi, which contributed 56 Kcal/day/capita from two occurrences: daily consumption and food storage.

In this area, daily records of staple food items show that rice is the largest contributor, with 1 tablespoon equivalent to 15 grams. Vegetables and fruits significantly contribute to food waste, as noted in household food storage records. This aligns with the fact that many people still do not consume enough fruits and vegetables. According to the Basic Health Research data (2018), it was found that 95.5% of Indonesians still do not consume sufficient vegetables and fruits. The food items that are often wasted are fruits and vegetables, while in Southeast Asia, staple foods like rice contribute the most to waste. (Santos, J., et all., 2022, Ramlan et al., 2023).

The contribution of food waste can worsen hunger by disrupting the food supply chain and reducing the availability of nutritious food. The nutritional potential of nutrients such as protein, fats, and carbohydrates that are wasted can, if conditioned properly, be reused to create additional food and reduce the occurrence of malnutrition and hunger. (Tchonkouang et al., 2023). Food waste has a significant impact on global hunger by reducing the availability of nutritious food. However, the repurposing of food waste through reuse and recycling can enhance food security and contribute to sustainable development. Addressing the challenges of food waste management, particularly in developing countries and the tourism sector, is crucial for reducing hunger and achieving food security for all. (Joardder & Masud.,2019, Mejjad et al.,2023).

The economic impact of food waste in Asia is significant and varied, affecting not only individual livelihoods but also broader economic growth and environmental sustainability. Globally, food waste is estimated to be worth around $2.6 trillion each year, with Asia contributing the majority of this figure. In Southeast Asia alone, food waste accounts for about 25% of the global total, indicating a significant economic loss that could have been used to reduce hunger and improve food security. (Routledge, 2020).

CONCLUSIONS AND RECOMMENDATIONS

This study was conducted on 100 household respondents in North Bekasi City. The results of the study show that food waste (leftover food) is still a real problem at the household level, both in the form of poorly managed monthly food storage and in the form of daily food disposal. The types of food that are most often wasted are vegetables and fruits, both those purchased daily and those stored for a certain period of time.

Although the amount of food wasted every day seems small, the accumulation of this food waste has a significant impact on the environment. One of them is an increase in greenhouse gas emissions, such as methane, which is produced from the decomposition process of organic waste, which contributes to ozone damage and climate change.

These findings confirm that household food consumption and storage practices are still not optimal, so awareness and behavioral changes are needed in food management to prevent continuous food waste.

To reduce food waste at the household level, consistent and sustainable preventive efforts are needed. One of the main steps that can be taken is to plan shopping in a more structured way, for example by compiling a shopping list based on a weekly menu. This will help households buy food according to their needs and avoid overbuying. In addition, proper food storage is also very important, especially in maintaining the freshness of vegetables and fruits that are easily damaged. Storage techniques such as separating ingredients by type, using closed containers, and implementing the First In, First Out (FIFO) principle will greatly help in minimizing the risk of food being wasted.

Routine checks on stored food also need to be carried out periodically, accompanied by labeling the purchase or expiration date so that household residents can know the priority of use. In addition, education about the impact of food waste on the environment and economy needs to be continuously improved. Awareness of the importance of managing food wisely must be instilled through various media, social campaigns, or community activities. Finally, managing household organic waste can be a long-term solution, for example by processing leftover food into compost. By implementing these steps, it is hoped that the community can contribute to reducing food waste and creating more responsible and environmentally friendly consumption patterns.

ADVANCED RESEARCH

There are still many households that do not take into account the need to consume purchased food. Not checking food storage regularly can lead to food waste. not providing food labels for purchased food or stored food. This is what triggers the occurrence of food waste in that place.

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The limitation of this study is that it does not add criteria to the inclusion criteria for housewives regarding food purchases made by housewives who shop in online or offline shops.

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