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Article

Food Waste Management Strategies suitable for households as sustainable food

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Abstract: Lack of knowledge, attitude, and behavior in managing leftover foods in households impacts the natural ecosystem and food chain, particularly in developing countries. This research aims to analyze appropriate methods for reducing and processing food waste produced in household areas. This research method uses qualitative research with operational research methods carried out for 6 months on 25 housewives in Pondok Labu Village in South Jakarta, Indonesia. The research was carried out in 3 stages, the first stage before the intervention, the second stage providing the intervention, and the third stage after the intervention. Results showed that before the intervention, on average each respondent produced 351 g of food waste each day. This amount decreased to 8.43 g/day after respondents participated in socialization to reduce food waste and training to manage food waste. The concluded that a combination of education and training improves knowledge, attitude, and behavior in household food waste management and helps moderate food waste generation.

Keywords: attitude; behavior; food waste; knowledge; sustainable

1. Author summary

Food waste is generally generated from household waste. The inability of household actors to manage food waste is a major problem to date. Many efforts have been made through government and environmental community programs. However, there has been no significant change. The research we do is one way to find out the main problems that occur among the households themselves. Prior to conducting the research, we have conducted several surveys and it can be concluded that not all people understand very well how big the impact of the food waste they produce is. Therefore, we decided to assess the knowledge, attitudes and behavior of household actors through our observations and training on how to manage and treat food waste through the Takakura and Microorganism local compost (MoL) composting process. In addition, it also looks at the environmental conditions around household actors (respondents) which in fact greatly influences their habits. The results obtained are quite good but still need continuous control and support from all stakeholders.

2. Introduction

The food system has complex mechanisms. Environmental, social and economic problems are obstacles in achieving food sustainability (Reisch and Gwozdz, 2011; Vinnari and Tapio, 2012). Globally, almost one billion people are suffering from starvation. Ironically, approximately one-third or about 1.3 billion tons of all foods produced for human consumption is lost or wasted each year (FAO, 2019). Half of the global food waste occurs due to excessive consumption habits and poor planning

(Hebrok and Boks, 2017). A high quantity of food waste will lead to an imbalance in the food supply chain and impact social welfare (Gunders, 2012).

Food waste is very closely related to consumers in their daily behavior (Garnett, 2011). According to Newsome et al. (2014), food waste can occur in various channels of the food supply chain with the majority of food waste coming from packaged products. However, most of the losses occurred at the consumer level, especially households. This is because half of the world's food waste is caused by consumption habits and activities (Hebrok and Boks, 2017). A strategy to extravagance food waste by placing consumers at the beginning and end of food waste management activities (Jörissen and Bräutigam, 2015). Based on a survey of 921 respondents in England, it is 27% of respondents understand it. Consumers' inability to read the information on product packaging labels influences respondents to immediately throw away food products without paying attention to whether they are still suitable for consumption or not (Grunert et al., 2010). According to Williams et al. (2020) it is estimated that 1 household throws away 1.9 kg per week or around 40 kg of waste food per year and only 57.4% understand the differences in information on the labels, and because they don't understand, these respondents immediately throw them away even though consumption is still appropriate. Thus, socialization is needed on various elements such as consumer knowledge, socio-cultural factors and the use of appropriate communication media (Chapman et al., 2010).

Based on the Food Sustainability Index (2019), Indonesia resulted in a 61.40% loss of food and food waste from the sum of waste (Center, 2019). This food waste phenomenon is getting worse with the condition of the Indonesian population suffering from hunger amounting to 13.5% of the total population of 269 million people (Central Bureau of Statistics Indonesia, 2019). Efforts to process waste are not only the responsibility of the government but need to be carried out jointly by all groups. We need to preserve and keep the earth a comfortable place to live not only for our current needs, but for future generations. Based on Ministry of National Development Planning of the Republic of Indonesia (2020), Indonesia generated 23–48 million tons of food waste annually in 2000–2019 or 115–184 kg per capita per year. The country lost Rp 213–551 trillion or around 4–5 percent of Indonesia's gross domestic per capita to manage food waste per year.

Food waste originating from households is influenced by the role of housewives. Women tend to produce more food waste than men. This is because women are responsible for shopping and managing food for the family (Koivupuro et al., 2012). The family that having children results in higher food waste (Cappellini and Parsons, 2013). This problem has led to the emergence of an environmental movement caused by the widespread environmental crisis accompanied by growing public awareness of the importance of protecting the environment (Rochwulaningsih, 2017). One of the cities in Indonesia that produces the largest food waste is Jakarta South. South Jakarta is ranked second as the largest waste producer in DKI Jakarta. Cilandak District is one of the sub-districts in South Jakarta has many programs that support reducing waste in the household sector. One of them is Pondok Labu Village which is often used as a training area by other institutions. There are several programs such as the waste bank program, smiling village program and others. However, programs to reduce food waste have not yet been implemented comprehensively. Thus, there is a need for

research regarding appropriate strategies for managing food waste among households.

3. Materials and methods

3.1. Study area

In 2018, Indonesia was ranked the second-largest producer of food waste after Saudi Arabia, with a food waste composition of 61.40% of the total waste (Hossain, 2017). One of the cities in Indonesia that produces the highest quantity of food waste is South Jakarta. In the Special Capital Region of Jakarta, South Jakarta is the second-largest producer of waste at 1600 tons/day; from this amount, 44% of the waste generated as a whole is composed of food waste (Ministry of Environment and Forestry Indonesia, 2018). This condition was the reason the conducted this study in South Jakarta.

There are quite a number of waste banks that have collaborated with the South Jakarta government. However, one that still active is Berseri Waste Bank. The Berseri Waste Bank is a private waste bank that was established by Mrs. Nyai since 2014. Mrs. Nyai started this waste bank activity starting from her own environment in the Rengas area of East Ciputat. This waste bank activity was so successful. However, during the course of the establishment of the Berseri Waste Bank, South Jakarta was a city that had a higher awareness of waste management to protect and preserve the environment. This Waste Bank has collaborated with various sub-districts in South Jakarta. The best district is Cilandak District. Waste Bank in Cilandak District often attract the attention of the public with a lot of coverage related to waste banks which are covered directly by several television stations. Pondok Labu Village is one of the model villages in protecting the environment in Cilandak District. This condition makes Pondok Labu Village as the research location. The research location is divided into 3 hamlets.

3.2. Study design

What are the Food Waste Management Strategies that are suitable for households as sustainable food? Before conducting this research, the researcher first conducted observations and in-depth interviews with stakeholders in the research area. What is analyzed is what programs exist, how the program works, the advantages and disadvantages of the program and the resulting benefits. This process took about 2 months each hamlet because this research took place at the beginning of the 2019 COVID pandemic. The research was conducted from July–December 2019. The population of the Beseri Waste Bank consists of 68 people as active members. However, participants were selected based on the hamlet category with the highest to lowest ratings in producing recycle able waste based on observations and interviews with the founder of Berseri Waste Bank. The rating order is determined based on the results of direct interviews with the owner of the Berseri Waste Bank. The order is as follows hamlet 1 is the with the highest rating, hamlet 3 has a medium rating and hamlet 2 has the lowest rating. In this way, all participants can represent the influence of knowledge, attitudes and behavior in managing household food waste. The sampling technique used is a non-probability saturated technique. In this way, informants were obtained from 25 households from all members of the Waste Bank in

hamlet 1, 2, 3.

This research involves surveys of human participants, our research may be exempt from ethical clearance based on the "Indonesia Institute of Sciences Regulation on ethical clearance No. 1528/2019". This research poses low or minimal risks to human participants due to the nature of the research insensitive research (article 18). Based on the results of the analysis conceptual framework (**Figure 1**). The conceptual framework describes this research with initial assumptions, namely firstly the amount of food waste will be different before and after education and training, secondly knowledge, attitudes and behavior are interconnected with socio-demographics in managing food waste and thirdly the strategies provided provide changes to the amount of household food waste. This aims to find contextual factors surrounding food waste in the household environment. This research is qualitative research and adopts operational research. This method consists of three data collection tools, namely questionnaires, food waste diaries, and in-depth interviews. These tools are empathetic (Kouprie and Visser, 2009; Schanes and Dobernig, 2018). This research consists of 3 stages. The initial stage (pretest) was carried out for 7 days, the second stage provided intervention in the form of education and training for 1 month and the final stage (post-test) was carried out for 7 days each hamlet.

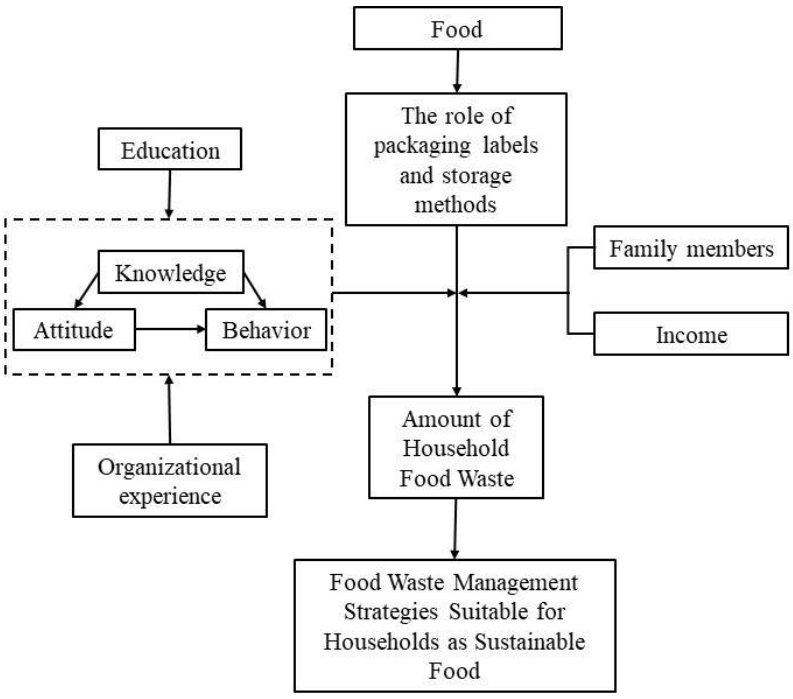

Figure 1. Conceptual framework.

a. Pre-test and post-test questionnaires

The steps taken to obtain questions were based on a literature review (Jörissen and Bräutigam, 2015; Conrad et al., 2018; Schanes and Dobernig, 2018; etc.) and a preliminary meeting, from which a conceptual framework was made (**Figure 2**). The first question contains data on the demographic characteristics of the respondents in the form of educational background, income, family members, organizational experience, and husband's occupation. Furthermore, the second question is in the form of information related to the knowledge, attitudes, and behavior of respondents as

consumer actors and how to process food waste that has been produced so far. These questions will be asked during the research process before and after intervention. These questionnaires addressed the following questions are: (1) Do you know the composition of the product at the time of consumption or purchase? (2) Do you know the difference between "best before" and "expired date"? (3) Do you know what are liquid compost and solid compost? (4) Do you know how to make are liquid and solid compost? (5) Do you find product composition important when consuming or buying food products? (6) Do you check the expiration date when consuming or buying food products? (7) Do you motivate yourself and your family members to reduce food waste? (8) Do you work with your family to reduce food waste? (9) Do you read about product composition and expiration date on various media? (10) Do you immediately cook and consume food if its expiration date is only a few days away? (11) Do you separate food waste from its packaging during disposal? (12) Do you compost your food waste?

b. First stage

In the first stage (pre-test) respondents will be taught how to calculate the daily data system for food waste. What type of waste will the researcher calculate. In the process of recording food waste diaries, researchers will calculate the food waste produced for 7 consecutive days at the initial stage of 25 housewives respondents who are members of the serial waste bank. After that, there will be questions and answers from 12 questionnaires given by means of interviews related to the knowledge, attitudes and habits of the respondents. During those 7 days, researchers will also make observations by asking questions about environmental conditions and what efforts have been made to reduce food waste that is produced every day.

c. Second stage

The second stage (intervention) is carried out after the first stage ends. At this stage, each respondent will be given education about reading packaging labels, how to store them, and life hacks on perishable foods. The provision of education about food is carried out for 1 week. In this education provision, a forum group discussion was also conducted by playing a role. This is so that researchers can assess the way respondents respond to problems related to food waste, while it was continued with the second intervention, namely a food waste treatment system with a recycle system with training on how to make Takakura compost and MoL compost (local microorganisms) to respondents.

d. Third stage

The third stage (post-test), the treatment is generally the same as the first stage. Pre-test and post-test questionnaires were given in session one and session three to analyze discrepancies in respondents' knowledge, attitude, and behavior after education and training were conducted in session two in depth-interview. Researchers in the process of recording food waste diaries, will record food waste produced for 7 days after the intervention phase ends. This qualitative research was conducted with observation and in-depth interviews with Berseri Waste Bank (Bank Sampah Berseri) members in Pondok Labu Sub-District, South Jakarta to acquire data about respondents' knowledge, attitude, and behavior in minimizing food waste. Education and training were given as intervention scenarios to influence respondents' knowledge, attitude, and behavior.

Non-probabilistic sampling was conducted to study waste bank members who

have been actively participating in activities for five years or more. From a population of 68 active members, 37 respondents fit the sampling criteria; however, due to large-scale limitation (Pembatasan Sosial Berskala Besar, PSBB) in response to the COVID-19 pandemic, there were several hamlets that could not be accessed, thus limiting the number of respondents to 25 people. In this study, the availability of participants involved in this study has obtained their consent in the form of a letter of agreement with the related articles in it and signed by both parties, namely the respondent as the object of the researcher and the author of this article as the researcher.

4. Results and findings

4.1. Overview of the surveyed households

Respondents in this study were 25 women, aged 41–55 years old commonly, who were homemakers and active participants of Berseri Waste Bank from three community units. A majority (56%) of respondents received a high school education. Moreover, most of the respondents (72%) made less than Rp 2,500,000 per month that compared to the DKI Jakarta provincial minimum wage set by the government (Rp 4,416,186 per month) (Ministry of Manpower of the Republic of Indonesia, 2020); whereas in-depth interviews revealed the other 28% of the respondents made above this amount (Rp 4,700,000/month). Monthly income was also influenced by respondents' husbands' occupations; in-depth interviews revealed those who worked as private employees and merchants had lower incomes. 36% have been participating in waste bank activities for 5–15 years (**Table 1**).

Table 1. Demographical characteristics of respondents.

Characteristics	Groups	Response frequency
Highest education	Elementary school	2
	Junior high school	7
	Senior high school	13
	Vocational school	3
Income per month	< Rp 2,500,000	14
	Rp 2,500,000–Rp 5,000,000	11
	> Rp 5,000,000	0
Number of household members	1–3 people	8
	4–6 people	15
	7–9 people	2
Age	≤ 25	0
	26–40	3
	41–55	15
	> 55	7
Organizational experience	< 5 years	12
	5 years	9
	> 10 years	4
Respondent spouse's job	Government employees	2
	Entrepreneur	7
	Pensioner	4
	Lecture	3
	Etc.	4
		5

4.2. Initial conditions of respondents

On average, each respondent produced 351 g of food waste per day. **Figure 2** shows a comparatively high amount of recorded food waste from respondent. Food waste composition was dominated by fruits for both respondents. Diet preference is closely related to the information obtained; more informed and educated consumers can decide what is best for their health (Schanes and Dobernig, 2018). However, education on food waste management can be obtained formally or informally. Respondent 6 was a high school graduate, but she had 23 years of experience in neighborhood association and was a former community unit leader. Therefore, she was well-informed about the importance of fruit for health. Respondent 6 showed this trait through her statement, *"I really like fruits because it is healthy and I'm old, so I'd rather eat fruits."* Nevertheless, respondent 6 had never participated in composting training, so she was not experienced in composting.

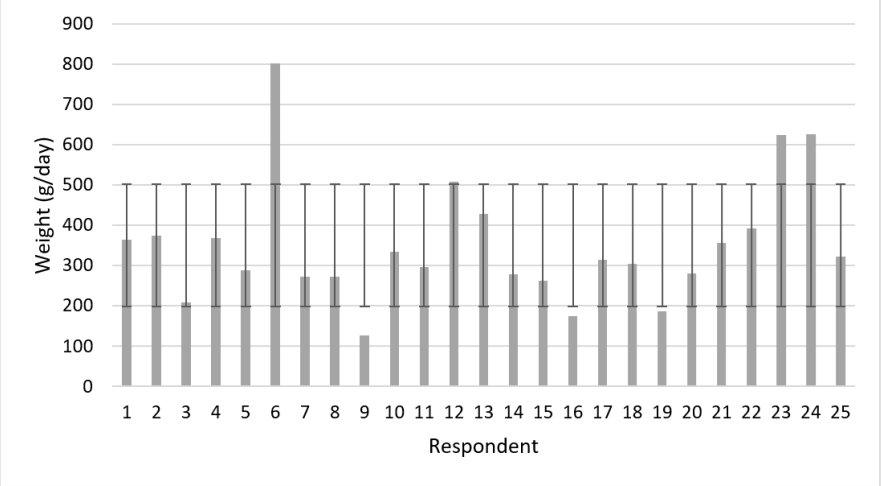

Figure 2. Measured food waste in session one.

Comparatively, respondent 23 had received composting training in 2019. However, due to several factors, she did not apply the acquired knowledge from training to compost her food waste. First, since respondent 23 did not receive individual training, she found the general knowledge difficult to apply. Second, she had to purchase compost starters repeatedly, which was not economically feasible, since her household's monthly income from her husband's retirement funds was less than Rp 2.5 million. Therefore, respondent 23 prioritized fulfilling her household need for food over purchasing compost starter. Based on Danil (2013) That consumers with lower income prioritize spending on food over other purchases.

> *"I like to participate in training related to composting. I also understand how to compost, but there was no individual training and I have to buy the (compost starter) liquid."* (Respondent 23).

Figure 2 shows that respondent 9 produces the least amount of food waste. Respondent 9 was also very knowledgeable of food waste management; further in-depth interview revealed that her husband was a lecturer and had previously taught her about composting, so most of their household's food waste was buried under the soil for composting, leaving only large food waste for disposal.

"I like to dispose (food) waste (by burying) into our plant soil. The (food) waste will decompose on its own; however, the particularly big ones are disposed into the garbage bin. Nonetheless, until now there is no composter in my house." (Respondent 9).

Results of in-depth interviews and observations revealed that many participants did not comprehend the difference between "best before" and "expired date", thus causing them to throw away foods and leftovers (Respondents 2, 13 and 24).

"I have taught the children not to be wasteful with food, but children love to snack after all. I also don't really understand what is meant by 'best before' and 'expired date'; since I am worried (that it will cause harm) I throw them away." (Respondent 2).

"I have a lot of grandchildren, so there is a lot of waste; if (the leftover) has been around for a while, I just throw it away." (Respondent 13).

"I don't understand it (best before and expired date) so I just leave it (the food) be. Also, the kids love to snack." (Respondent 24).

This result is consistent with Jarjusay (2017), which reveals that many respondents do not comprehend variations of labeling terms. This is due to the lack of information that consumers receive. Socialization regarding the role of packaging labels is also very rare. Thus, few consumers can tell whether a food product is still safe to consume.

Our findings also revealed that respondents with multiple children in their households generally produce more food waste. This aligns with a study by Cappellini and Parsons (2012), which shows that families with children generate more food waste. In addition, research also found our respondents tended to avoid using leftovers for cooking for their family members. This is consistent with a study by Evans (2012), which indicates women homemakers' preference for serving freshly cooked foods.

Respondents who never checked the composition of the food they purchased generally had low income. According to Porpino (2015), previous research may explain this phenomenon; filial affection may drive respondents to purchase and prepare more food than is necessary, as well as to stock up on food for their household members. From in-depth interviews with respondents 2, 4, and 12, research also found that respondents with lower income prioritized purchasing food products that were preferred by their family members. However, it is important to note that these preferred foods did not necessarily their primary needs.

"I like to buy (food products that) my husband and children like, since it is futile if I cook and they do not like it. Sometimes (I) do not get the essential food items, but the important thing is that they are happy." (Respondent 2).

"I just cook what (the family members) like, I am worried that (the cooked foods) will be wasted." (Respondent 4).

"I have a lot of children, sometimes they like to buy snacks; they are not a necessity, but the important thing is they like it." (Respondent 12).

Several psychographic factors can hinder efforts to reduce food waste. Buying too much food is strongly associated with food waste and impulsive behavior (Stancu et al., 2016). Therefore, an individual's tendency for impulsive purchase can act as a barrier to minimizing food waste.

Checking the expiration date when purchasing food was a common attitude and

it was observed in almost all respondents. This was because one of the main motivations for minimizing household food waste was to prevent wasting money. This is consistent with research by Graham-Rowe et al. (2014), explains that consumers with low income have to ensure that the food products they purchase are edible for the long term.

Even though there were still participants who bought food products based on their preferences and not their needs, all participants tried to motivate themselves and cooperated with their family members to reduce their household's food wastes. Several psychographic factors (i.e., attitudes, interests, or lifestyle) possessed by individual consumers have been shown to influence food waste (Aschemann-Witzel et al., 2020). According to Ajzen (1991), theory of planned behavior, which proposes that the main determinant of a consumer's behavior is the intention to engage in the behavior. Consumer identity (i.e., how people see themselves) motivates people to act according to their perception of who they are. Further, community values related to self-identity ultimately motivate people to perform behaviors that are in line with their values (Van der Werff et al., 2013). This theory explains the attitude of the studied respondents since all of them are members of Berseri Waste Bank with 5–15 years of organizational experience. This social environment allows the emergence of a motivational and cooperative attitude within each individual.

In-depth interview results showed only three respondents (Respondents 1, 8, and 9) read information related to product composition and expiration date on various popular media. These participants were well known among Berseri Waste Bank members and had important roles in their communities.

> *"I like to read, especially since (my husband is) a lecturer, so sometimes he likes to tell stories about various things. Besides that, I also have a business, so I have to be diligent reading about food."* (Respondent 9).
>
> *"I like to read a lot of articles, I happen to like snacking, so sometimes I about food."* (Respondent 8).

Participant 9 and participant 8 had comparatively better behavior about food planning than the other participants. This was also due to her (Respondent 9) husband's habit of conversing about general knowledge. In addition, respondents 1, 8, and 9 were active in various organizational activities, which required them to learn and read a lot. Thus, they acquired more information compared to other participants. These three participations also produced less food waste than the others (**Figure 2**).

One approach to minimize food waste can be done through the willingness to eat leftovers or food products that were almost spoiled. Stancu et al. (2016) emphasizes the importance of reusing leftovers to minimize food waste. Almost all respondents were found to immediately process food products that were almost spoiled except three respondents (Respondents 5, 11 and 24), since they rarely cooked at home and generally preferred to buy cooked foods outside as stated by respondent 11, *"I rarely cook, I buy it every day; it is futile to cook since sometimes no one eats."* On the other hand, respondent 24 had three young children, so this condition might influence her household's food waste.

Discrepancies in perceptions about one's decision to consume leftover foods are ultimately settled by feelings of aversion such as signs of spoilage. This may contribute to one's aversion to eating foods that are perceived to be lacking in quality

(Hartmann and Siegrist, 2018). Therefore, this tendency may act as a barrier to minimizing food waste for some consumers or may act as a factor that drives consumers to waste food. Therefore, the practices and skills possessed by homemakers to make use of leftover food products contribute to minimizing food waste (Aschemann-Witzel et al., 2020).

All respondents separated their food waste from its packaging. All participants were active members of Berseri Waste Bank who were used to separating food waste from its packaging as stated by respondent 15, *"In our waste bank, there are 32 types (of packaging) items that can be sold, so it is a given that research will separate the packaging to earn some money"*. Out of all respondents, only four had prior experience processing their food waste into compost since they were required to participate in sub-district activities that were carried out by influential environmental cadres.

4.3. Efficiency and effective intervention

In the reduce intervention, respondents were given education regarding information on reading packaging labels based on Government Regulation Number 69 of 1999 concerning food labels and advertisements, what factors damage food products, the difference between best before and expired date, information related to product layout in the refrigerator. appropriate, instructions regarding the characteristics of food products that are not suitable for consumption and information related to taglines in several advertisements so as not to misinterpret the intent of the advertisement.

According to UNEP (2014), efforts in developing and implementing programs to prevent and reduce household and consumer food and drinking waste require 2 (two) main keys, namely as follows:

1) Campaign

The involvement of household members is very important to the awareness that encourages the behavior of household members to prevent and reduce food waste. Efforts to develop a campaign should develop with a simple message or key to communicate, and also identify what tools and guidelines support this message.

2) Understanding the role of products, packaging and labels

The symbols or descriptions on the product need to be understood by consumers. This makes it easier for consumers to buy the right amount of food and use what they buy thereby helping them to prevent and reduce food and beverage waste. In general, more consumers buy packaged food products, because they are more efficient and durable. By conducting campaigns and introducing the role of products, packaging and labels, it can be prevented at the beginning of the food consumption chain process. Based on these 2 (two) main keys, which can only be seen in terms of knowledge and attitude, to optimize habits in processing food waste, compost training is held.

3) Compost training

The training process for making Takakura and MoL compost is carried out not only 1 day but once a week in stages by providing individual training. Respondents' enthusiasm was higher than when socializing the role of packaging product labels and storage methods. Participants were given the opportunity to ask questions about

anything related to food and food waste to researchers via online messages (WhatsApp).

> *"I really like this training compared to the previous one, but I like both, but composting is new to me."* (Respondent 7).
>
> *"I like gardening but I didn't know that food waste could actually be used as compost."* (Respondent 22).

We found that the combination of education and training was very effective in reducing food waste (**Figure 2**). In session three, each respondent's remaining food waste was weighed after they participated in education and training. On average, each respondent produced 8.43 g of food waste per day compared to 351 g per day before the intervention. After participating in education and training, respondents' attitudes towards food waste management improved. Moreover, the studied respondents, who were women homemakers, were able to change their family member's attitudes and behavior by involving their cooperation to reduce food waste (Vermeir and Verbeke, 2006; Graham-Rowe, 2014).

Respondent's behavior also improved after participating in education and training. Respondents' behavior will change by itself due to changes in knowledge and attitude since they are a unified whole (Verplanken and Herabadi, 2001). After socialization and training, there were three respondents (Respondents 18, 19, and 20) with remaining food waste (**Figure 3**). Their food waste was composed of wet rice, which was known to prolong the composting process. Nevertheless, during the training (session 2) research, many respondents put wet rice into the composter. Since this did not affect the resulting compost significantly, the suggested the respondents to include wet rice as a compostable material. After 75 days, the composter was opened. **Figures 4** and **5** shows the resulting compost.

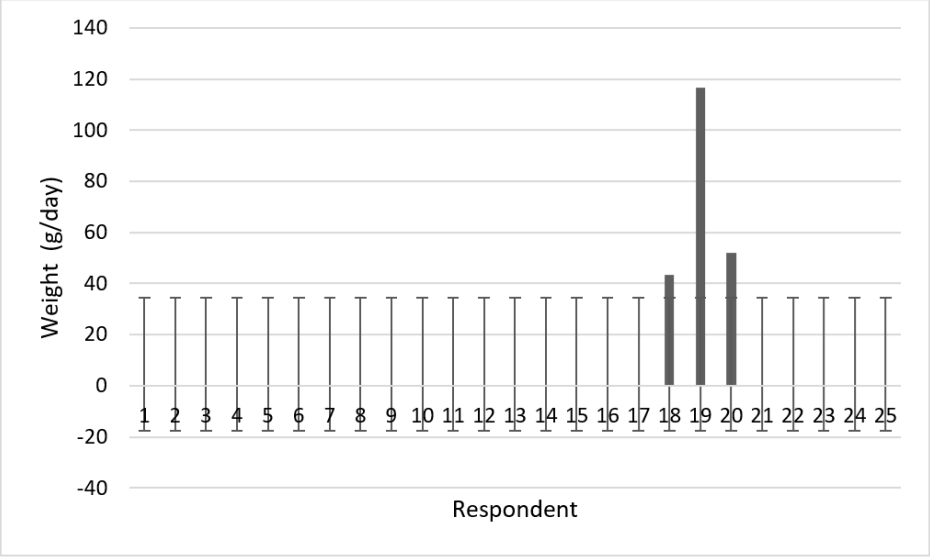

Figure 3. Measured food waste in session 3.

Figure 4. The resulting Takakura compost.

Figure 5. The resulting rice microorganism local compost.

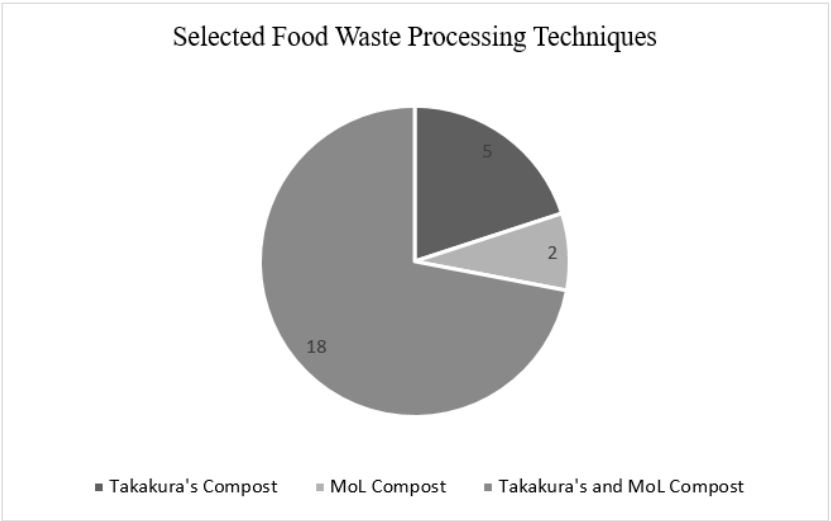

Figure 6. Selected food waste treatment techniques.

The composting training revealed several important lessons learned. Respondent learned that besides nitrogen-carbon balance, they also had to maintain balanced compost moisture and humidity to support successful composting and to yield high-quality compost. Excessive water content in compost allows nitrogen to be converted

to ammonia, which is released into the air and causes odor. Therefore, compost that smelled was dried out under the sun to reduce the odor. On the other hand, too little water content hinders the substrate from undergoing the composting process. Air humidity also affects microorganism activity and the decomposition process. This troubleshooting method not only allowed respondents to experience hands-on exercise to manage food waste through composting, but also to gain an understanding of how to make the process socially acceptable through odor control. As a result, this training also primed respondents to sustain the social aspect of composting in their neighborhood. Based on the results of research from 2 composting. The responses of the different respondents can be seen in **Figure 6**.

"If I prefer MoL, my house is prone to flooding, so I'm afraid to just wash away the compost bin." (Respondent 2).

"I prefer MoL because it's easier and doesn't take up much space, besides that, because my house likes to flood, it's possible to just MoL." (Respondent 4).

"I'm worried that the MoL won't be mixed, I hope the solid compost just needs to be poured and it's ready." (Respondent 12).

"I'm disgusted if I have to make another MoL, seeing the color, it's green and green, I'm sorry." (Respondent 20).

5. Discussion

In the research process, it is known that in general respondents have poor knowledge regarding of packaging label information, as well as attitudes and behaviors that are lacking in handling preventing and reducing food waste in their homes even though in fact they are members of the waste bank community, which is one of the communities that engaged in environmental protection. After going through the intervention process in the form of education and training, the responses to knowledge, attitudes and respondents changed. The intervention process provides increased knowledge of the respondents. Knowledge of food can reduce the risk of buying foods that are not useful and directly influence purchasing decisions (McCarthy, 2007). In addition, all participants already know how to make compost so that the amount of waste produced can be directly composted.

The complexity of attitudes and behavior that may affect the amount of food waste at home makes it very difficult to make a change (Quested, 2013). On the other hand, the role of the family in the house is able to provide changes to the attitudes and behavior of family members to jointly reduce food waste (Graham-Rowe, 2014) The role of the family here is the housewife who is the respondent. Knowledge, attitude and behavior are a unified whole so that behavior will change automatically due to changes in knowledge and attitudes (Vermeir and Verbeke, 2006).

There are several factors that do not all participate to retry. Takakura compost has a fairly large container for families living in flood-prone areas which will make it easier for respondent to move more freely, this is because Takakura compost has a larger size. While many MoL find it difficult at the stage of the process of changing the color of rice from white to green or black due to the activity of the fungus Trichoderma harzianum. After researching this is because the container used incorrect.

This strategy can be developed further if there is a clear commitment from each

stakeholder. The results of compost products developed by researchers can be the forerunner of a circular economy in food waste processing. The circular economy concept is guided by the principle of reducing waste and maximizing existing resources. This circular economy approach is different from the traditional linear economy which uses a take-use-disposal model. In a circular economy system, the use of technological innovation is very necessary. If Takakura and MoL compost can be managed properly (upcycling) by making commercial compost products and becoming a new livelihood for housewives and creating prosperity. Based on this, the researcher has calculated the process of making Takakura compost and MoL on a commercial scale by calculating the cost of goods sold.

6. Conclusion

Education and training moderated the amount of daily food waste generated at the household level. The efficacy of this intervention design was observed from the respondents' enthusiasm to participate in education and training. In addition, respondents also expressed their desire to keep in touch with the authors after the research term. Women who identified themselves as the homemakers of their families had an imperative role to minimize food waste in households. In addition, they can change the paradigm of their families about the environment. The conclude that positive changes in knowledge, attitude, and behavior in food waste management can be optimally and sustainably accommodated through adequate infrastructure and support from various stakeholders. Further, reidentifying factors that reduce food waste and providing a platform to market the economic value of recycled food waste as compost may help scale up household food waste management and support its sustainability. I realize that due to the limited number of respondents in this research, further research is needed by increasing the number of respondents to strengthen the conclusions.

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