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Influence of Food Choices, Shopping Routines, Food Handling, and Waste Prevention Behaviors on Food Waste Behavior in Bandung City

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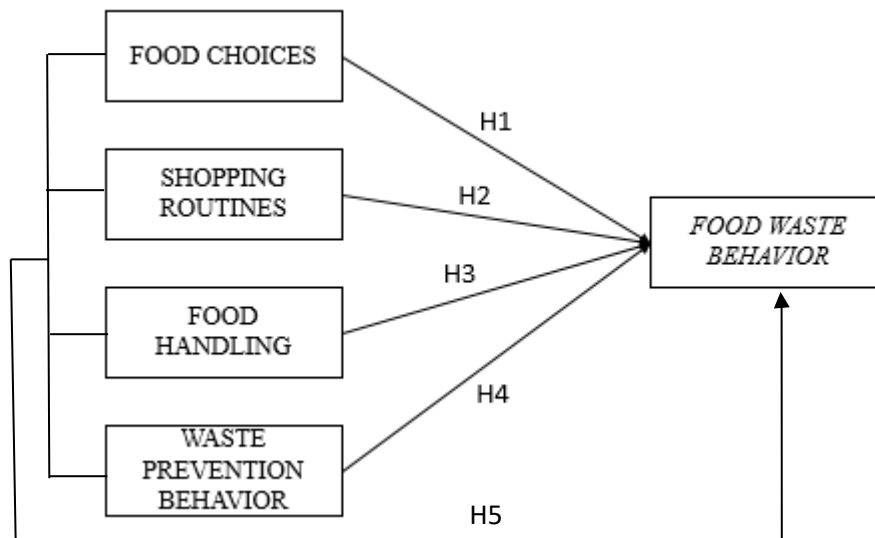| A R T I C L E I N F O	A B S T R A C T
  	This research aims to examine the influence of food choices, shopping routines, food handling, and waste prevention behavior on food waste behavior in the city of Bandung. The population in the study were people who live in the city of Bandung and have thrown away food waste 3 times in the last month. The number of samples in this research was 50 respondents using convenience sampling techniques . The type of data used in this research is primary data collected using a survey approach via questionnaires distributed online with the time horizon used in this research being cross-sectional. This research uses analytical tools in the form of validity and reliability tests of instruments, classical assumption tests, hypothesis tests using multiple linear regression tests, and simultaneous tests. This research was assisted by statistical software program of social science (SPSS) version 26. Of the five proposed research hypotheses, all hypotheses are supported by empirical data. These findings indicate that food choices have a negative and significant effect on food waste behavior , shopping routines have a negative and significant effect on food waste behavior , food handling has a negative and significant effect on food waste behavior , and waste prevention behavior has a negative and significant effect on food waste behavior . This assessment also found that there is a simultaneous influence between food choices, shopping routines, food handling, and waste prevention behavior on food waste behavior.

INTRODUCTION

Food waste is becoming an increasingly significant global issue along with the problem of world hunger. Definitions relating to food waste include those put forward by the FAO, the European Parliament's Commission on Agriculture and Rural Affairs, the United States Environmental Protection Agency (EPA), and the California Department of Resources Recycling and Recovery (CalRecycle). FAO (2011) states that Food Loss (FL) is a decrease in the quantity or quality of food that occurs along the food supply chain and specifically targets food that can be consumed by humans. Generally, food loss occurs at the production, post-harvest and processing stages in the food supply chain (Parfitt et al., 2010). Meanwhile, food waste is defined as part of food loss that occurs at the end of the food supply chain (both retailers and final consumers) which is related to retail behavior and consumer behavior.

A study of food waste in the UK (Waste Resources and Actions Programme , WRAP, 2008) shows that consumers throw away 31% of the food they have purchased. One third of the total food produced globally or around 1.3 billion tons of consumable food including fresh vegetables, fruit, meat, bread and dairy products is lost along the food supply chain every year (FAO, 2011; Goebel et al ., 2015; Graham-Rowe et al., 2014). The cost of food loss reaches around US$ 680 billion in industrialized countries and US$ 310 billion in developing countries. The food waste phenomenon occurs in both developed and developing countries. The research results show that 28% of food waste occurs in industrialized Asian countries, 23% in South Asia and Southeast Asia, 14% in North America and Oceana, 9% in Sub-Saharan Africa, and 7% in North Africa, West Africa and Central Asia (Lipinski et al., 2013).

In Asian countries, the amount of urban food waste is estimated to increase from 278 to 416 million tons from 2005 to 2025 (Melikoglu, Lin, and Web, 2013). According to the Economist Intelligence Unit (2016), Indonesia is the country with the second largest contribution to food loss and waste in the world, with 300 kg of food per capita per year. The amount of food waste that occurs in Indonesia is quite high. Mark Smulders, FAO's chief representative for Indonesia and Timor Leste, stated that 13 million tonnes of food waste occurs in Indonesia every year. This amount is equivalent to the food needs of 11 percent of Indonesia's population or around 28 million people. This figure is almost the same as the number of poor people in Indonesia in 2015 (BPS, 2015). Most of this food waste comes from households, hotels, restaurants, catering, supermarkets and retail outlets. Bandung City Government data states that Bandung City's waste generation is 1,594.18 tons per day. As much as 44-52 percent is dominated by food waste.

Based on previous research conducted by Buzby & Hyman (2012); Parfitt et al. (2010); WRAP (2007); Stefan et al. (2013) which states that food choices, shopping routines, and food handling have a negative influence on food waste behavior . According to Ruiz et al. (2015) stated that waste prevention behavior has a negative effect on food waste behavior. The description of previous research shows the importance of topics related to food waste . If through research conducted by Mulyo (2016) the amount of food waste that occurs in

Indonesia is known, then in this study researchers will analyze the influence of factors that influence household consumer behavior towards food waste. Based on the background above and previous research, researchers were interested in finding out more so they decided to conduct research with the title "The Influence of Food Choices, Shopping Routines, Food Handling, and Waste Prevention Behavior on Food Waste Behavior in Bandung City". Based on previous research regarding food waste which has been described above, the paradigm in this research is as follows:

Figure 1.
Research Paradigm on the Influence of Food Choices, Shopping Routines, Food Handling, and Waste Prevention Behavior on *Food Waste Behavior* in Bandung City

Based on the paradigm above, the hypothesis in this research is as follows:
H1 : Food choices has a negative effect on food waste behavior
H2 : Shopping routines has a negative effect on food waste behavior
H3 : Food handling has a negative effect on food waste behavior
H4 : Waste prevention behavior has a negative effect on food waste behavior
H5 : Food choices, shopping routines, food handling, and waste prevention behavior has an effects on food waste behavior

THEORETICAL REVIEW
Definition of Food Waste
　　In general, the meaning of Food Loss and Waste (FLW) cannot be separated. Some professional associations, including international organizations, and some countries have different definitions of FLW. Definitions relating to food waste have been put forward by the FAO, the European Parliament's Commission on Agriculture and Rural Affairs, the United States Environmental Protection Agency (EPA), and the California Department of Resources Recycling and Recovery (CalRecycle) . FAO (2011) states that Food Loss (FL) is a decrease in the quantity or quality of food that occurs along the food supply chain and specifically targets food that can be

consumed by humans. Generally, food loss occurs at the production, post-harvest and processing stages in the food supply chain (Parfitt et al., 2010).

Meanwhile, food waste is defined as part of food loss that occurs at the end of the food supply chain (both retailers and final consumers) which is related to retail behavior and consumer behavior. Furthermore, the European Parliament's Commission on Agriculture and Rural Affairs defines food waste as all products discarded from the food supply chain. These products may be discarded for reasons of economics, aesthetics/appearance, or approaching their expiry date, even though the product is still suitable and has the potential for human consumption. These products are simply wasted and lost without any alternative use and produce negative effects on the environment, economic costs, and loss of income for companies (European Parliament, 2011). Meanwhile, the United States Environmental Protection Agency (EPA) identifies food waste as uneaten food and processed food leftovers from residential or commercial establishments, such as wholesalers, restaurants, bars and cafeterias. (FAO, 2014). According to the California Department of Resources Recycling and Recovery (CalRecycle), the definition of food waste is any wasted food, including excess production, food waste, unsold food, and leftover food on plates (CalRecycle, 2009).

This last definition specifically includes food that is still fit for consumption which becomes waste because it is not used by the final consumer (food waste that can be avoided from the food consumed), and food waste that is not suitable for consumption (food waste that cannot be avoided from the food eaten such as bones, coffee grounds, and vegetable/fruit skin). Based on the definitions above, food waste referred to in this research is leftover food or food that can still be consumed but is not eaten or wasted. Food waste suitable for consumption can actually be avoided because it is food that is wasted either due to buying too much or poor storage. Meanwhile, the food referred to is all types of food in the form of ready-to-eat food, packaged food, snacks and fresh food ingredients that have not undergone any processing.

Factors that Influence Food Waste Decisions

There are several factors that influence food waste decisions at the consumer level. Various previous studies related to food waste behavior used the Theory of Planned Behavior (TPB) (Barr, 2007a; Godfrey et al.., 2012; Karim et al.., 2013; Russell et al., 2017). However, this research was only able to explain part of the estimated model, while around 70-80% was unexplained. This is because the food waste problem is multidisciplinary in nature (Marangon at et al.., 2014). Several previous studies show that food waste is not only influenced by a single behavioral dimension but arises from various action and motivation factors (Evans, 2011; Quested et al.., 2013; Secondi et al.., 2015; Setti et al., 2016; UNEP, 2014). Quested et al. (2013) and WRAP (2011) show that food loss and food waste are not only food problems but are also related to waste management skills factors. Diaz-Ruiz et al. (2015) have developed a conceptual model by taking into account six different factors that influence food waste , including environmental awareness, metarealism, purchasing behavior, food

choices, waste recycling behavior, and waste prevention. Abdelradi (2017) added several other factors, namely knowledge about food waste problems , belief/religion, and personality. In this study, researchers used five factors that influence food waste . The factors used in this research are the results of studies from previous research. These five factors are food choices, shopping routines, food handling, waste prevention behavior, and recycling behavior.

METHODOLOGY

This research uses a quantitative approach with associative methods carried out in the city of Bandung. This research involved samples from the population of Bandung City residents, who met the requirements of having thrown away leftover food > 3 times in the last month. This research uses a *convenience sampling technique* where researchers have the opportunity to collect data directly from respondents who meet the criteria as a data source without considering anything else. The number of samples in this study was set at 50 respondents and can be said to be appropriate because it has exceeded the minimum number of samples if referring to the *rules of thumb* proposed by Roscoe (1975) which is supported by Sekaran & Bougie (2017) which states that the minimum sample must be used in multivariate research such as multiple regression, it must be at least 10 times larger than all the variables to be studied. The data analysis used consists of validity testing, reliability testing, multiple linear regression testing, and hypothesis testing. This research determined 10 times the number of variables studied, namely food choices, shopping routines, food handling, waste prevention behavior, and *food waste behavior.* The type of data used in this research is primary data obtained from questionnaires distributed and filled in by each individual as a unit of analysis which has been categorized according to the characteristics of the sample in this research. The following is a table of operationalization of research variables:

Table 1. Variable Operationalization

Variable	Operational definition	Indicator	Code	Source
Food Choices (X1)	Food quality attributes that are considered important to respondents	Consuming vitamin-rich foods is important to me.	X1.1	Diaz-Ruiz, et al. (2017)
		Eating low-fat foods is important to me	X1.2	
		Eating food that is free from harmful ingredients (like pesticides) is important to me.	X1.3	
Shopping Routine (X2)	Respondents' habits of planning and discipline in shopping activities	I only buy things I need	X2.1	Ritchter (2017)
		Before shopping, I make a shopping list according to the items I need	X2.2	
		I plan my consumption for the next few days so I can	X2.3	

Food handling (X3)	Respondents' skills in treating leftover food both in the storage and processing processes	shop efficiently	
		I ate the leftovers the next day	X3.1
		I turn leftovers into new dishes	X3.2
		I store leftover food in good condition so that it can be reused	X3.3
Waste Prevention Behavior (X4)	Behavior to prevent and minimize the amount of waste produced	I use my own shopping bag when shopping	X4.1
		I avoid using plastic bags when shopping	X4.2
		I buy reusable products rather than disposable ones	X4.3
		I try to repair things before buying new ones	X4.4
Food waste behavior	Leftover food that can be avoided and is fit to be eaten but is deliberately thrown away for some reason	In my trash can there is a lot of food waste	Y.1
		The food I throw away is food that has expired	Y.2
		The food I throw away is food that I forget to consume until the product spoils	Y.3
		The food I throw away is more food than I need	Y.4
		The food I throw away is leftover food that I don't consume again at a later date	Y.5
		The food I throw away is a stockpile that I saved but didn't eat	Y.6

The references column: Stancu, *et al.* (2015) for Food handling; Diaz-Ruiz, *et al.* (2017) for Waste Prevention Behavior; Richer, (2017) and Diaz-Ruiz, *el al.* (2017) for Food waste behavior.

Source: Processed data, 2024.

RESULTS AND DISCUSSION

Table 2. Validity Test Results

Variable	*Items*	R-Table	R-Count	Information
Food Choices (X1)	X1.1	0.2353	0.867	Valid
	X1.2	0.2353	0.845	Valid
	X1.3	0.2353	0.817	Valid
Shopping Routine (X2)	X2.1	0.2353	0.948	Valid
	X2.2	0.2353	0.956	Valid
	X2.3	0.2353	0.922	Valid
Food Handling (X3)	X3.1	0.2353	0.755	Valid

	X3.2	0.2353	0.851	Valid
	X3.3	0.2353	0.837	Valid
Prevention Behavior	X4.1	0.2353	0.767	Valid
Waste (X4)	X4.2	0.2353	0.762	Valid
	X4.3	0.2353	0.858	Valid
	X4.4	0.2353	0.879	Valid
Food waste behavior (Y)	Y1	0.2353	0.813	Valid
	Y2	0.2353	0.761	Valid
	Y3	0.2353	0.752	Valid
	Y4	0.2353	0.783	Valid
	Y5	0.2353	0.732	Valid
	Y6	0.2353	0.837	Valid

Source: Processed data, 2024.

Based on Table 2, the results of the validity test show that all statements in the questionnaire are declared valid because the r-count for each statement in the questionnaire is greater than the r-table, namely 0.2306. This means that the instruments used to collect data in this research can measure what should be measured.

Table 3. Reliability Test Results

Reliability Statistics	*Cronbach's Alpha*	*N of Items*	**Information**
Food Choices (X1)	0.796	3	Reliable
Shopping Routine (X2)	0.934	3	Reliable
Food Handling (X3)	0.735	3	Reliable
Waste Prevention Behavior (X4)	0.831	4	Reliable
Food Waste Behavior (Y)	0.870	6	Reliable

Source: Processed data, 2024.

Based on Table 3, the results of reliability testing, it is known that the value of *Cronbach's alpha* is declared reliable because the value is greater than 0.6 based on the ideas put forward by Sekaran & Bougie (2017) so that the research instrument can guarantee consistent measurements if carried out over different periods of time.

Tabel 4. Hasil Uji Normalitas

One-Sample Kolmogorov-Smirnov Test		
		Unstandardized Residual
N		50
Normal Parameters[a,b]	Mean	.0000000
	Std. Deviation	1.56556845

Most Extreme	Absolute	.076
Differences	Positive	.056
	Negative	-.076
Test Statistic		.076
Asymp. Sig. (2-tailed)		.200[c,d]

a. Test distribution is Normal.
b. Calculated from data.
c. Lilliefors Significance Correction.
d. This is a lower bound of the true significance.

Source: Processed data, 2024.

The results of normality processing via *Kolmogorov Smirnov* in Table 4 show a significance of 0.200 > 0.05. So, it can be concluded that the data is normally distributed.

Table 5. Multicollinearity Test Results

		Collinearity Statistics	
Model		**Toleranc e**	**VIF**
1 (Constant)			
Food Choices (X1)		,169	4,448
Shopping Routine (X2)		,156	7,823
Food Handling (X3)		,156	6,398
Waste Prevention Behavior (X4)		.109	5,197

a. Dependent Variable: *Food waste behavior* (Y)

Source: Processed data, 2024.

Based on Table 5, the results of the Multicollinearity test show that the variables Food Choice (X1), Shopping Routines (X2), Food Handling (X3), and Waste Prevention Behavior (X4) have a value of > 0.1 and a VIF value of < 10. This can be interpreted in terms of The regression model does not have multicollinearity or correlation between the 4 independent variables.

Table 6. Heteroscedasticity Test Results

Coefficients [a]

	Model	Sig.
1	(Constant)	,355
	Food Choices (X1)	,120
	Shopping Routine (X2)	,233
	Food Handling (X3)	.141

Waste Prevention Behavior (X4)	,151	

a. Dependent Variable: *Food waste behavior* (Y)

Source: Processed data, 2024.

Based on the results of the heteroscedasticity test in Table 6, it shows that each variable has a significance value (sig) > 0.05, which means that the regression model is free from heteroscedasticity or that there is not a single independent variable that influences the absolute residual value.

Table 7. Multiple Linear Regression Test Results

Coefficients [a]					
	Unstandardized Coefficients		Standardized Coefficients		
Model	B	Std. Error	Beta	Q	Sig.
1 (Constant)	6,495	2,832		4,004	,000
Food Choices (X1)	-.115	,043	-.200	-3,201	,001
Shopping Routine (X2)	-.409	,051	-.330	-3,902	,006
Food Handling (X3)	-.317	,036	-.327	-4,727	,009
Waste Prevention Behavior (X4)	-.258	.117	-.433	-3,372	,000

a. Dependent Variable: *Food waste behavior* (Y)

Source: Processed data, 2024.

From Table 7 above, the results obtained show a constant (a) value of 6,495. Meanwhile, the value (b/regression coefficient) of Food Choice (X1) is (-0.115), Shopping Routine (X2) is (-0.409), Food Handling (X3) is (-0.317), and Waste Prevention Behavior (X4) is (-0.258). From these results, the regression equation can be entered as follows:

$$Y = a + b1X1 + b2X2 + b3X3 + b4X4$$
$$Y = 6.495 - 0.115X1 - 0.409X2 - 0.317X3 - 0.258X4$$

1. A constant value of 3,495 means that if the values of X1 ,
2. Food Choice (X1) has a negative coefficient value of 0.115, meaning that if Food Choice (X1) increases by 1, then Food waste behavior (Y) will decrease by 0.115. This means that there is a negative relationship between Food Choice (X1) and Food waste Behavior (Y), the higher the Food Choice, the lower the Food waste Behavior.
3. Shopping Routine (X2) has a negative coefficient value of 0.409, meaning that if Shopping Routine (X2) increases by 1, then Food waste Behavior (Y) will decrease by 0.409. This means that there is a negative relationship between Shopping Routine (X2) and Food waste Behavior (Y), the higher the Shopping Routine, the lower the Food waste Behavior.
4. Food Handling (X3) has a negative coefficient value of 0.317, meaning that if Food Handling (X3) increases by 1, then Food waste behavior (Y) will

decrease by 0.317. This means that there is a negative relationship between Food Handling (X3) and Food Waste Behavior (Y), the higher the Food Handling, the lower the Food Waste Behavior.

5. Waste Prevention Behavior (X4) has a negative coefficient value of 0.258, meaning that if Waste Handling Behavior (X4) increases by 1, then Food waste Behavior (Y) will decrease by 0.258. This means that there is a negative relationship between Waste Prevention Behavior (X4) and Food waste Behavior (Y), the higher the Waste Prevention Behavior, the lower the Food waste Behavior

Table 8. Partial Test Results (t Test)

Coefficients ᵃ					
	Unstandardized Coefficients		Standardized Coefficients		
Model	B	Std. Error	Beta	Q	Sig.
1 (Constant)	6,495	2,832		4,004	,000
Food Choices (X1)	-.115	,043	-.200	-3,201	,001
Shopping Routine (X2)	-.409	,051	-.330	-3,902	,006
Food Handling (X3)	-.317	,036	-.327	-4,727	,009
Waste Prevention Behavior (X4)	-.258	.117	-.433	-3,372	,000

a. Dependent Variable: *Food waste behavior* (Y)

Source: Processed data, 2024.

1. Influence of Food Choices (X1) on Food waste behavior (Y)
   The results of the t test on the influence of food choice variables on food waste behavior obtained a t-count of -3.201 < from the t-table of 2.0153 and a significance value of 0.001. The significance value is smaller than 0.05 (<α =0.05), then H1 is accepted. This means that food choices have a negative and significant effect on food waste behavior .
2. Influence of Shopping Routine (X2) on Food waste behavior (Y)
   The results of the t test on the influence of shopping routine variables on food waste behavior obtained a t-count of -3.902 < from t-table 2.0153 and a significance value of 0.006. The significance value is smaller than 0.05 (<α =0.05), then H2 is accepted. This means that shopping routines have a negative and significant effect on food waste behavior .
3. Influence of Food Handling (X3) on Food waste behavior (Y)
   The results of the t test on the influence of food handling variables on food waste behavior obtained a t-count of -4.727 < t-table 2.0153 and a significance value of 0.009. The significance value is smaller than 0.05 (<α =0.05), then H3 is accepted. This means that food handling has a negative and significant effect on food waste behavior .
4. Influence of Waste Prevention Behavior (X4) on Food waste behavior (Y)
   The results of the t test on the influence of the waste prevention behavior variable on food waste behavior obtained a t-count of -3.372 < from the t-

table 2.0153 and a significance value of 0.000. The significance value is smaller than 0.05 (<α =0.05), then H4 is accepted. This means that waste prevention behavior has a negative and significant effect on food waste behavior.

Table 9. Simultaneous Test Results (F Test)

ANOVA [a]					
Model	Sum of Squares	df	Mean Square	F	Sig.
1 Regression	17,150	4	7,538	4,427	,000 [b]
Residual	128,030	45	2,623		
Total	198,180	49			

a. Dependent Variable: *Food waste behavior* (Y)
b. Predictors: (Constant), X4, X3, X2, X1

Source: Processed data, 2024.

The results of the simultaneous test show that the calculated F value is 4.427 > from F table 2.41 and the significance value is 0.000. Therefore the significance is smaller than 0.05 (<α = 0.05), then H5 is accepted. So it can be concluded that the regression coefficients for the variables Food Choice (X1), Shopping Routine (X2), Food Handling (X3), and Waste Prevention Behavior (X4) simultaneously or together have a significant effect on *food waste behavior.*

Table 10. Test Results Coefficient of Determination (R ^{2})

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	,854	,729	0.789	.02622	1,913

Source: Processed data, 2024.

Based on Table 10, the calculation results show that the coefficient of determination (*adjusted*) is 0.789. This means that the variability of the dependent variable that can be explained by the independent variable is 78.9% and the remaining 21.2% is explained by other variables that are not included in the regression model. Furthermore, the coeffecient of corellation is 0.854 is explained for the variables Food Choice (X1), Shopping Routine (X2), Food Handling (X3), and Waste Prevention Behavior (X4) has a relation very high on food waste behavior.

CONCLUSIONS AND RECOMMENDATIONS

Based on the research results, it can be concluded that: (1) Food choices have a negative effect on food waste behavior . This means that the higher the quality of the food chosen, the less food waste is wasted; (2) Shopping routines have a negative effect on food waste behavior . This means that the higher the

level of public discipline in shopping activities, the less food waste is wasted; (3) Food handling has a negative effect on food waste behavior. This means that the higher people's skills in storing and reprocessing food, the less food waste is wasted; (4) Waste prevention behavior has a negative effect on food waste behavior. This means that the better the behavior of minimizing the amount of waste, the less food waste is wasted; (5) Food choices, shopping routines, food handling, and waste prevention behavior have a significant influence on food waste behavior. This means that a preference for high-quality food, good shopping routines, food handling skills, and awareness of waste prevention can together reduce food waste.

1. Scientific Implications

   The results of this research provide a significant contribution to the understanding of the factors that influence food waste behavior. Elaboration of the relationship between food choices, shopping routines, food handling, and waste prevention behavior makes a positive contribution to the development of knowledge in this area. Limitations in this research relate to determining the sample using a convenience sampling technique which means that the results of this research cannot be generalized to the population. Therefore, it is recommended that future research adopt probability sampling techniques so that it can be generalized to the population.

2. Managerial Implications

   This research aims to provide a solution to the level of food waste behavior in Bandung City. Therefore, it is important for the Bandung City government to understand the factors that can reduce food waste behavior . The research results show that food waste behavior is influenced by food choices, shopping routines, food handling, and waste prevention behavior. Thus, it is recommended that the Bandung City government design social marketing programs that are relevant to food choices, shopping routines, food handling, and waste prevention behavior. The recommended programs to be designed by the Bandung City government include:

   a) Nutrition Education Campaign

      The Nutrition Education Campaign is a strategic initiative carried out to increase public awareness of the importance of consuming foods rich in vitamins and low in fat. This program consists of various activities, including media campaigns, seminars and workshops, designed to provide in-depth and detailed information about the positive impacts of healthy eating. By involving nutrition experts and health workers, this campaign aims to support a deeper understanding of the health benefits associated with consuming quality food.

   b) Smart Consumption Campaign: Healthy and Efficient Shopping Plan

      This program aims to create smarter and more sustainable consumption behavior among the public. The main focus of this program is to encourage people to make shopping plans before shopping.

   c) EcoCompose Campaign : Turning Food Waste Into Quality Compost

This program reflects its aim to encourage people to be active in making compost from food waste, with a focus on ecological aspects and the quality of the final compost product. This program invites the public to contribute to efforts to reduce organic waste and create a more sustainable environment.

d) EcoShop Campaign : Sustainable Shopping Practices

The program reflects a focus on environmentally supportive practices, such as using your own shopping bags, avoiding plastic bags, choosing reusable products, and supporting the repair of items over the purchase of new items. This program aims to encourage people towards more sustainable and environmentally responsible shopping behavior.

FURTHER STUDY

Furthermore, the results of this research can benefit the community by increasing awareness of food choices, shopping routines, food handling, and waste prevention behavior to reduce food waste . In addition, the government can use the results of this research as a basis for designing more targeted and efficient policies in overcoming the issue of food waste , with the potential to reduce the environmental and economic burden related to food waste management.

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