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Original Research Article

Assessing Households' Willingness to Pay for Compost Attributes from Food Waste

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Abstract: The production of solid waste continues to increase, and food waste is the most significant portion of solid waste. Given its negative impact on the environment, food waste has received attention and concern from many parties. This is because food waste increases costs associated with managing food waste in Malaysia and the emission of greenhouse gases that contribute to global warming. Compared to other solid trash, food waste has a low recycling percentage rate. Converting food waste into compost could be one of the solutions to reduce the generation of solid waste. To ensure that the compost made from food waste is marketable, it is essential to determine the household's willingness to pay (WTP) and its determinants. Therefore, this study aims to determine the households' WTP for compost attributes from food waste and to identify socio-demographic factors that can influence households' WTP for compost attributes. The data was collected among the households in Klang Valley, Malaysia, using a purposive sampling method, and 201 respondents completed the survey. A discrete choice experiment determined the households' WTP for compost attributes from food waste. The results suggested that the households would pay more for certified compost than uncertified compost. The findings also indicated that households' WTP for compost attributes from food waste varied by gender and income level. Since the households were willing to pay more for compost attributes, this suggests that this product can be marketed, and this can be translated into business opportunities if the producers or marketers can respond to the demand of the households. The findings from this study can be used to design appropriate marketing strategies to promote compost from food waste.

Keywords: food waste; discrete choice experiment; compost; willingness to pay; households

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1. Introduction

The solid waste generation is showing an increasing trend in Malaysia. According to Hassan et al. (2021), there has been an upward trend in Malaysia's solid waste production from 36,843 tonnes per day in 2018 to 38,669 tonnes per day in 2021, and over 17,000 tonnes

of the total's solid waste was made up of food waste (SWCorp, 2022). About 31% of the solid waste was from food waste (SWCorp, 2022). Malaysia's population is projected to increase to 37.4 million in 2030. The increase in population may contribute to the generation of food waste and may add to the difficulty of managing trash (Ghafar et al., 2017).

Food waste contributes to the release of greenhouse gases, which exacerbates the environmental impact (Phooi et al., 2022). About 2.5 kilograms of greenhouse gases are released from one kilogram of food thrown away in a landfill (Mokhtar, 2022). These emissions lead to the acceleration of climate change and global warming. Additionally, the decomposition of food waste produces methane and other greenhouse gases, which worsens the issue (Nattassha et al., 2020). Methane is a potent greenhouse gas with a greater capacity to trap heat than carbon dioxide (Howarth, 2014). Food waste has adverse effects on the environment, and proper management of food waste is considered an effort to improve nutrition and food security (Shafiee-Jood & Cai, 2016). Effective management and food waste reduction are essential to maximise resource allocation, boost agricultural output, and ensure food security for expanding populations (Ghosh et al., 2016).

Food waste can be converted into valuable bioproducts, such as fertilisers, energy sources, and chemicals (McCarthy et al., 2019; Nattassha, 2020). Composting food waste is an alternative and helpful application to reduce food waste (Keng et al., 2020) and generate new economic opportunities (Hao et al., 2020). The circular economy provides a methodical and all-encompassing strategy for minimising food waste by implementing several techniques such as waste prevention, reuse, recycling, and energy recovery (Rashid et al., 2021).

Nevertheless, to ensure the sustainability of the transition to a circular economy, the participation of the people is still posing significant challenges (Bornello et al., 2016). Generally, the demand for a product must be researched to guarantee that it can be marketed. According to Danso et al. (2017), farmers frequently worried about the nutrients in compost and sometimes the information provided was incomplete. Farmers may be reluctant to use compost due to concerns about its potential impact on crop quality, and the cost is relatively higher than chemical fertiliser (Nattasha et al., 2020). According to Darnall et al. (2017), this lack of trust may be caused by inaccurate information or an overall mistrust of environmental claims. Additionally, they may be unaware of compost's advantages and usefulness in boosting soil fertility and crop yields; farmers may perceive it to be less successful than chemical fertilisers (Majbar et al., 2021).

Households engaged in home gardening tend to place greater value on composting and are more inclined to support sustainable agricultural practices than conventional farmers. Most conventional farmers are reluctant to switch to compost-based products due to the perceived risks associated with large-scale plantations and the lack of guaranteed yield outcomes (Darnall et al., 2018). In contrast, households are generally more open to adopting new types of fertilisers considered safer for human health and the environment (Thomas et

al., 2020). Since the primary goal of home gardening is personal consumption, selecting safe and non-toxic fertilisers is of utmost importance. To ensure compost food waste can be marketable and accepted in the market, it is essential to determine the compost attributes preferred by the households and their willingness to pay. Thus, this study aims to determine households' preferences and willingness to pay for compost attributes from food waste and to choose the socio-demographic factors that can influence the WTP in Klang Valley.

2. Literature Review

Waste produced in agro-food systems can be converted into valuable bioproducts, improving resource efficiency, environmental sustainability, and lowering the amount of trash dumped in landfills (Stillitano et al., 2021). Recycling food waste involves using waste from a single activity as valuable resources to create new value instead of throwing it away (Nattasha et al., 2020). This concept emphasises how important it is that waste can be converted into resources used by society. Composting is one of the solutions to food waste since it ends the material recycling cycle, reduces problems with waste management, raises income, and enhances GDP (Rashid & Shahzad, 2021).

Identifying the attributes of compost plays a key role in understanding households' preferences for fertiliser. According to a prior study, several attributes are frequently shown to significantly impact consumer WTP for fertiliser, such as certification, ingredient and nutrient label, form, brands, and price. According to research by Gavertson et al. (2018), farmers prefer to purchase certified compost and compost with clear labelling. Farmers tend to value this attribute due to the certified and precise detail of compost, which can guarantee the safety and quality of fertiliser. Farmers may be uncertain about the fertiliser's ingredients and the appropriate application rates for their crops without clear information about the product. These details and certifications directly increase households' confidence in purchasing compost from food waste. Findings from Lang and Rodrigues (2022) also supported that demand for organic products will increase if the product has certification and a clear label. This is because certificates and labelling can influence consumer perceptions and purchase behavior. According to Mancuso et al. (2024), businesses should emphasize organic practices through clear labelling and offer competitive prices aligned with the demand for organic products while supporting organic farming. Similarly, brand was also identified as an attribute that significantly influenced consumers' WTP for fertiliser. Daadi et al. (2022) state that farmers are likelier to trust fertilisers from well-known brands that have established their credibility. Apart from a good quality fertiliser, certification, and attractive packaging, brand is also thought to be one of the essential attributes for fertiliser (Campbell et al., 2020).

Furthermore, the form of fertiliser also plays a key role in consumers' choosing fertiliser. The correct form of fertiliser will improve the productivity of farm practice, including ease of use and how long the fertiliser can release the nutrients. According to a study by Agyekum

et al. (2014), the pelletized form of fertiliser is preferred among Ghanaian farmers because it is easier to apply. This study also supported the findings from De Silva et al. (2018), where farmers preferred forms of fertiliser in solid fractions due to their ease of transport and effectiveness. This indicates that compost attributes are similarly influenced by comparable attributes such as certification, labelling, brand, form, and price. Producers and markets should meet consumer needs to build trust and confidence to purchase this product.

Previous studies have used various approaches to determine consumer WTP for compost. One of the practical approaches for examining people's preferences over several hypothetical alternative circumstances is the discrete choice experiment (DCE) (Cantillo et al., 2020; Hoyos, 2010). The DCEs are becoming increasingly common since they mimic actual market environments for decision-making (Ankamah-Yeboah, Jacobsen, & Olsen, 2018). Furthermore, Zander et al. (2018) and Louviere et al. (2000) also agreed that DCEs are a well-established technique for assessing consumer preferences because they are similar to actual purchasing choices and, as a consequence, provide findings that accurately represent customers' actual purchasing behaviour. Adamoricz et al. (1994) state that DCEs are made up of multiple-choice sets, each of which has a set of hypothetical options that are mutually exclusive and from which respondents are asked to select their preferred one. This approach makes it possible to identify customer preferences and determine which features are most important to them when purchasing. Bronnmann and Hoffmann (2018) also agreed that DCEs are now widely used to identify the factors influencing customers' purchasing decisions and enable researchers to calculate the WTP for a particular product feature. When the program's cost or price is considered as an attribute, it is simple to translate marginal utility estimates into WTP estimates for modifications to the attribute levels. Welfare measures may be derived by combining various attribute adjustments (Cantillo et al., 2020). This DCE has been utilised in several prior studies to ascertain consumer preferences. Cantillo et al. (2020) used DCE to assess consumer preferences for finfish items, and this helped the researchers to uncover key insights on how consumers behave towards these products. On the other hand, Nainggolan et al. (2019) adopted the DCE method to examine the trade-offs households make between different garbage sorting methods' attributes. DCE is a valuable technique for extracting preferences for outcomes that fit into a set of attributes.

Several studies have indicated that socio-demographic factors can influence consumers' WTP for compost. For instance, Paul et al. (2016) employed a logit regression model and found that their experience and education levels positively impacted the adoption of compost among farmers. Similarly, Zhou et al. (2018) found that a farmer's education level and age positively impacted their willingness to pay for compost. Higher education levels may contribute to a better understanding of compost's environmental benefits and value, while younger farmers may be more receptive to innovative and sustainable practices. Regarding household preferences, Daadi et al. (2022) discovered that higher-income households were more inclined to purchase compost than lower-income families. This could be attributed to the perception that compost is a premium product associated with

sustainability and environmental consciousness, which higher-income households may prioritise and be willing to invest in.

Furthermore, Majbar et al. (2021) found that their age significantly influenced farmers' desire to produce and use compost. This suggests that younger farmers may be more enthusiastic about adopting compost as they are more likely to be open to sustainable practices and new technologies. Overall, these studies highlight the influence of socio-demographic factors, such as education, age, income, and experience, on consumers' willingness to pay for compost.

3. Methodology

3.1. *Survey Design*

The data was collected from households that practice urban agriculture in Klang Valley, Malaysia. The purposive sampling method was used to select the respondents, and 201 respondents have completed the survey. The respondents were presented with several choice sets consisting of attributes and levels that were orthogonal and efficient to elicit their preferences and WTP for compost attributes. Four (4) attributes were considered in this study, such as ingredient label, certification, form and price, and each of the attributes varied at several levels. Table 1 below presents the attributes and levels considered in this study.

Table 1. Attributes and the attribute levels.

Attribute	Attribute Level	Description
Ingredient Label	Labelled bag	Have the ingredient label
	Unlabeled bag	Did not have an ingredient label
Certification	With certification	With MyOrganic certification
	Without certification	Did not have MyOrganic certification
Form	Pelletised	Compost is pelletised and easy to apply in the crop field
	Unpelletised	Compost in powder form
Price	RM13.00/pack	The price per pack (800g)
	RM10.00/pack	The price per pack (800g)
	RM7.00/pack	The price per pack (800g)

In DCE, the design of the choice question is vital. A reasonable number of attributes is needed when building a choice experiment. The next stage is to create a collection of potential alternatives with various attribute levels, which are then paired to make choice sets. This is done after choosing the attributes and their levels. The efficient design generated 12 scenarios of compost attribute combinations using the number of attributes and attribute

levels in Table 1. The choice sets were constructed by randomly assigning scenarios as options to each choice set without repetition. Each set of options has three choices: options A, B and C. Option A and B offer different levels of attributes that describe compost, whilst option C is a "pull out" option. Table 2 presents an example of the choice set included in the study.

Table 2. Example of a choice set.

Option	A	B	C
Ingredient label	Labelled	Unlabeled	Neither A nor B is preferred
Certification	With certification	Without certification	
Form	Pelletised	Unpelletised	
Price (RM)	13.00	7.00	
I would choose…		X	

3.2 Model Development

Given a set of choices, each respondent faced 12 choice sets. The model assumed respondents faced i=1, 2, and N and faced discrete choices between several alternatives. A random utility function may be defined by a deterministic$V_{ji}$and stochasticε_{ji} Component:

$$\text{Uji=Vji + εji} \quad (1)$$

Where Uji is the j^{th} Respondent's utility of selecting option i, which is either option A, B or C, Vji is the systematic portion of the utility function determined by attributes of the alternative i and the respondent's respondent-specific characteristics, and ε_{ji} It is a stochastic element.

Model 1 determined the households' preferences and WTP for compost attributes. Model 1 can be specified as follows:

$$U_{ij} = \beta_{oi} + \beta_{1i}\boldsymbol{IL\_L}\mathbf{B} + \beta_{2i}\boldsymbol{C}\mathbf{ertification\_WC} + \beta_{3i}\boldsymbol{F}\mathbf{orm\_}\boldsymbol{Pelletised} + \beta_{4i}\boldsymbol{Price} + \varepsilon ij \quad (2)$$

where, U_{ij} is the utility of individual i, j is option A, B, C, β_{oi} is an alternative specific constant (ASC) referring to the 'neither' option. The β_1 to β_4 The parameters used to determine the impact of a one-unit change in an attribute on the preference for a particular choice relative to the baseline option. By analysing these betas, researchers can determine which attribute most strongly influences households' preferences for compost made from food waste. IL_LB is dummy variable that represent the ingredient label: IL_LB = 1 if the household choose unlabeled ingredient packaging, 0 for otherwise. Certication_WC = 1 if the consumer choose compost with certificate packaging, 0 for otherwise. Form_$Pelletised$ is the dummy variable that represent the form of compost with two different levels:

$Form\_Pelletised$ = 1 if the consumer choose compost in palletised form, 0 for otherwise. Finally, price refers to the market price of compost (RM/unit).

The household's WTP, or marginal value, may be calculated by dividing its estimated coefficient by the price coefficient. For instance, in equation (2), the coefficient for the Price attribute isβ_{4i} . To achieve the second goal of the study, households' WTP for a basic model may be calculated using the following formula:

$$WTP_k = -\beta_k \ / \ \beta_{4i} \quad (3)$$

where, β_k refers to the coefficient of k^{th} Attributed andβ_{4i} Refers to the coefficient of price.

Model 2 was established based on the socio-demographic variables that can influence households' WTP for compost. Model 2 can be specified as follows:

$$\text{Uij}= \beta_{0i} + \beta_{ij}\boldsymbol{X} + \alpha(X_{ij}\times \textbf{Gender}) + \alpha\ (X_{ij}\times \textbf{Education Level}) + \alpha\ (X_{ij}\times \textbf{Income Level}) \quad (4)$$

where Uij is the utility of individual i, j is option A, B, C, β_0i is an alternative specific constant (ASC) referring to the 'neither' option. X is a vector of compost characteristics listed in Model 1. β and α refer to the coefficients to be estimated. To achieve this objective, dummy variable was created for two gender groups as well (Gender_Female = 1 if the respondent is female, otherwise Gender_Female = 0; three education levels (primary education =1 if the respondent is from primary education background, 0 otherwise ; secondary education =1 if the respondent is from secondary education background, 0 otherwise; terttiary education =1 if the respondent is from tertiary education background, 0 otherwise); three income groups (Low Income = 1 if the respondent's monthly income is less than RM3000, 0 otherwise ; Median Income = 1 if the respondent's monthly income is between RM3001 to RM7000, 0 otherwise; and High Income = 1 if the respondent's monthly income is more than RM7001, 0 otherwise). Low income (less than RM3000) was used as the reference.

Equation (5) below was used to determine the WTP of households based on different socio-demographic characteristics.

$$\text{Categorical } WTP_{kx} = -\ (\beta k+\beta x)/\ \beta_{4i} \quad (5)$$

where, βk refers to the coefficient of k^{th} Attributes and βx refer to the coefficient of x^{th} Interacted category.

4. Results and Discussion

The socio-demographic profiles of the respondents are shown in Table 3. Based on the age data that was gathered from 201 respondents, the majority of respondents were from the 30-39 years old age group, which is (31.34%), followed by the 40-49 years old age group (30.35%), and the 20–29 years old age group accounted for (27.86%). The age categories of 50–59 and 60–69 years old represent a minority of respondents, with 5.47% and 4.98%) of respondents, respectively. The data also showed that 56.72% of the respondents were male and 43.28% female. The majority of the respondents were Malay (87.06%), followed by Chinese (8.46%) and Indian (4.48%). The majority of the respondents had a tertiary education level (90.05%), followed by secondary education (8.46%) and primary education (1.49%). The result also showed that most of the respondents were employed in the private sector (50.23%), and 43.78%) were in the government sector, and 3.98% and 1.99% of the respondents were retired and unemployed, respectively. In terms of household size, the result showed that most respondents were categorised with 1-4 household members (59.20%), and 40.80% were within the group of 5-9 household members. Regarding income, most respondents had income between RM3001 and RM7000 (52.24%), 25.87% had income greater than RM7000 per month, and 21.80% had income less than RM3000.

Table 3. Socio-demographic profiles of the respondents.

Variables	Frequency (n)	Percentage (%)
Age		
20 – 29	56	27.86
30 – 39	63	31.34
40 – 49	61	30.35
50 – 59	11	5.47
60 – 69	10	4.96
Gender		
Male	114	56.72
Female	87	43.28
Ethnic		
Malay	175	87.06
Chinese	17	8.46
Indian	9	4.48
Education Level		
Primary	3	1.49
Secondary	17	8.46
Tertiary	181	90.05
Current Employment Status		
Government Sector	88	43.78
Private Sector	101	50.23
Retired	8	3.98
Unemployment	4	1.99
Current Household Members		
1 – 4	119	59.20
5 – 9	82	40.80

Variables	Frequency (n)	Percentage (%)
Monthly Income		
≤ RM3,000	44	21.89
RM3001 – RM7000	105	52.24
≥ RM7,001	52	25.87

Conditional logit was used to estimate the households' preferences and WTP for compost attributes from food waste. Table 4 below presents the results from the conditional logit model. The results showed that the alternative specific constant (ASC) was -1.0501, with the corresponding negative sign indicating that respondents favor the improvement of compost attribute from food waste rather than the status quo. The alternative specific constant (ASC) reflects the effect on utility of a respondent continually selecting the status quo (option C) compared to the value received from selecting A and B. This measure determines whether there is a status quo bias among respondents. All coefficients were statistically significant at the 5% level except for the form_pelletised attribute. The positive signs for the attribute ingredient label and certificate indicated that households in Klang Valley prefer compost with an ingredient label and certificate. This result was supported by Gwara, S. et al. (2023) findings, which showed a correlation between specific attributes and increased demand for compost certification and fortification. Herbes et al. (2020) also found that consumers most strongly prefer potting soil derived from biogas digestate when it has a label which increases consumer trust in environmentally responsible practices. Moreover, this finding indicated that compost with ingredient labels improves households' utility. Khachatryan, H. et al. (2016) discovered that the marginal WTP for the labelled fertilizer was higher than that of the unlabeled (base) option, which validated this finding. The result showed that the compost form was not significant, suggesting that customers were not convinced that the pelletized compost form is a desirable attribute. The price is statistically significant at the 5% level, and its negative coefficient indicates that the level of household utility decreases as the price of compost derived from food waste increases. This finding aligned with research conducted by Amirnejad & Tonakbar (2015) in Tehran, which determined that the price variable harmed consumers' willingness to pay for organic products. Similarly, Hu et al. (2024) argue that consumers often seek to minimize risks associated with higher prices, which can reduce their willingness to pay for products perceived as costly, further emphasizing the adverse impact of elevated prices on willingness to pay.

Table 4. Conditional Logit Result for Basic Model

Variable	Estimates
Alternative Specific Constant	-1.0501** (0.1833)
Ingredient label_Labelled Bag	0.6063** (0.6063)
Certification With Certificate	1.7744** (0.0719)

Variable	Estimates
Form_Pelletised	0.0273 (0.0598)
Price	-0.2172** (0.0182)
Log Likelihood	-2082
Number of observations	2412

Notes: Standard errors are in parentheses. **Significant at the 5% level.

Table 5 presents the marginal willingness to pay for compost attributes derived from food waste. The result showed that the households would pay RM2.79 more for the compost with the ingredient label relative to unlabelled compost. This finding is aligned with Danso (2006), who suggests that labelling ingredients is an essential attribute as it helps the farmers to choose the right one, as different nutrients are needed for other crops. The result also showed that households would pay RM8.17 more for certified compost than non-certified compost. This finding is in line with studies by Gwara (2023), in which they discovered that certification was the second most desired feature by the consumers in South Africa.

Table 5: Willingness to Pay (RM) for Basic Model

Variable	Marginal Willingness to Pay
Ingredient label_Labelled Bag	RM2.79
Certification_With Certificate	RM8.17

Conditional logit for interaction model was utilized to determine socio-demographic factors influencing the households' willingness to pay. The results for the interaction model (Model 2) are presented in Table 6. Gender and Income above RM3001 with certificate attribute appear to impact WTPs for compost attributes from food waste significantly. The coefficient's positive value indicates that the consumers preferred the attributes.

Table 6. Conditional Logit Result for Interaction Models

Variable	Estimates
Alternative Specific Constant	-1.1540** (0.1784)
Ingredient label_Labelled bag	-0.9359 (0.5015)
Certification_With Certificate	0.9984** (0.4125)
Price	-0.2322** (0.0184)
Ingredient label_Labelled bag x Gender_Female	0.4463** (0.1077)
Certification_With Certificate x Gender_Female	0.5671** (0.1003)
Ingredient label, Labelled bag x Secondary Education	1.8057** (0.5259)

Variable	Estimates
Certification_With Certificate x Secondary Education	0.0395 (0.4390)
Ingredient label_Labelled bag x Tertiary Education	1.4263 (0.5113)
Certification with Certificate x Tertiary Education	-0.0691 (0.4208)
Ingredient label_Labelled bag x Income_3001-7000	0.0867 (0.1278)
Certification_With Certificate x Income_3001-7000	0.7239** (0.1254)
Ingredient label_Labelled bag x Income_7001	-0.3893 (0.1598)
Certification_With Certificate x Income_7001	1.2037** (0.1482)
Log Likelihood	-1996
Number of Observations	2650

Notes: Standard errors are in parentheses. **Significant at the 5% level

An interaction model was used to determine how much households are willing to pay for compost qualities made from food waste (Model 2). To further customize the marketing and pricing strategies, WTP can assist in identifying certain target categories based on their WTP. Table 7 shows the total WTP findings for the interaction variables about compost made from food waste. The results showed that a household's WTP for composting food waste was influenced by gender and income level.

The findings indicated that females were willing to pay an additional RM6.74 for certified compost compared to males, consistent with the study by Adebo (2012) in Ekiti State, which found that women were more likely to pay a premium for compost. This aligns with Van Doorn and Verhoef's (2011) observation that women tend to perceive organic products as higher in quality than men, further supporting the notion that gender differences influence willingness to pay for environmentally certified products. The finding also showed that the higher income households were willing to pay RM7.42 and RM9.48 more for certified compost than the lower income households. It is aligned with a study by Zhou (2018), which indicated that net income had a substantial beneficial relationship with compost's WTP. Several studies have explored the impact of income levels on consumers' willingness to pay (WTP) for fertilisers. Nasrin et al. (2021) demonstrated that farmers with higher annual incomes in Bangladesh showed a greater willingness to invest in quality fertilisers. Similarly, Zondo and Baiyegunhi (2021) observed that smallholder potato farmers with higher off-farm incomes in South Africa were more likely to pay a premium for organic fertilisers. These findings indicate that higher income improves financial capacity, positively influencing WTP for fertilizers.

Table 7: Willingness to Pay (RM) for Interaction Models (Model 2)

Attribute Level x Demographic Categories	WTP based on the Interaction Model
Certification_With Certificate x Gender_Female	RM6.74
Certification_With Certificate x Income_3001-7000	RM7.42
Certification_With Certificate x Income_7001	RM9.48

5. Conclusion

This study addresses the potential of utilizing food waste by converting it into compost. This study aimed to identify households' WTP for compost made from food waste and identify socio-demographic factors influencing their WTP for compost attributes. The findings suggest that households are generally willing to purchase compost if it includes ingredient labels and certification attributes, with certifications significantly building trust. Socio-demographic factors, including income level and gender, significantly affect WTP, with higher-income households more inclined to pay for premium compost features.

Since the households are willing to pay more for the certified and labelled compost, it is suggested that there is a potential market for the compost derived from food waste. If marketers respond to this demand, this can translate into business opportunities. The WTP also varies according to gender and income. The marketer can design appropriate market strategies for this target group since they are willing to pay more for certified and labelled compost from food waste. In conclusion, converting compost from food waste cannot only help promote environmental sustainability but also generate new business opportunities if the producer can respond to the demand of the households.

6. Patents

Author Contributions: Conceptualization, Hanna Zulaikha A Hadi Kamil, Nurul Nadia Ramli and Muhammad Mu'az Mahmud; methodology, Hanna Zulaikha A Hadi Kamil, Nurul Nadia Ramli; software, Hanna Zulaikha A Hadi Kamil. validation, Nurul Nadia Ramli and Muhammad Mu'az Mahmud; formal analysis, Hanna Zulaikha A Hadi Kamil, Nurul Nadia Ramli; investigation, Hanna Zulaikha A Hadi Kamil, Nurul Nadia Ramli, Muhammad Mu'az Mahmud.; resources, Hanna Zulaikha A Hadi Kamil, Nurul Nadia Ramli; data curation, Hanna Zulaikha A Hadi Kamil; writing—original draft preparation, Hanna Zulaikha A Hadi Kamil, Nurul Nadia Ramli; writing—review and editing, Hanna Zulaikha A Hadi Kamil, Nurul Nadia Ramli and Muhammad Mu'az Mahmud.

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