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Household food waste behaviour in Sarawak, Malaysia: a hierarchical regression analysis

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ABSTRACT

INTRODUCTION: Food and Agriculture Organization defines food waste as the reduction in the nutritional value or mass of any edible part of food intended for human consumption. Malaysia produces approximately 17 thousand tons of food waste daily, which can threaten the environment. Present study aims to apply the Theory of Planned Behaviour to identify the factors associated with food waste behaviour in Sarawak.

METHODS: A study was conducted between October 2020 and August 2022 using cross-sectional study design. Households across Sarawak state were chosen using multistage random sampling technique. 2,059 respondents' data were collected via face-to-face interviews. Data analysis was performed using SPSS version 27.0 with a p-value of < 0.05 being considered statistically significant.

RESULTS: Hierarchical linear regression analysis revealed that personal attitude ($p < 0.001$), subjective norms ($p < 0.01$), age ($p < 0.05$), gender ($p < 0.05$) and wealth ($p < 0.01$) positively and age inversely related with intentions not to waste food, while personal attitude ($p < 0.001$), subjective norms ($p < 0.001$), inversely related and perceived behavioural control ($p < 0.001$), and intentions ($p < 0.05$), age ($p < 0.01$) and gender ($p < 0.01$) positively related with food waste behaviour.

CONCLUSION: Results from the present study can strengthen the understanding of food waste behaviour among the Sarawak population. Long-term programs focusing on reducing food waste behaviour would be more effective in tackling this issue, as changing attitudes and norms in the community usually require a long time.

Keywords: Food waste, Theory of Planned Behaviour, Sarawak

INTRODUCTION

The food and Agriculture Organization (FAO) defined food waste as the reduction in the nutritional value or mass of any edible part of food intended for human consumption [1]. It is result from the actions and decisions of consumers and food service providers. Although such foods are usually in good condition and safe for consumption, they are not consumed and instead discarded either due to spoilage or expiration [2]. Food waste is often associated with retailers' or

consumers' behaviour [3]. There are many ways edible food is being wasted at these stages. At the retailer level, food is often discarded when it almost reaches its expiry date. For food service providers and household consumers, food that is left unused is being dumped from their kitchens [4]. This situation occurs given that food service providers and household consumers usually purchase large quantities of food to save money but cannot use them in time.

Every year, it has been approximated that more than one billion tons of food are wasted globally. This amount is equal to one-third of the overall food produced globally [5]. Further exploration revealed that one-fourth of global food waste happens during the handling and storage stage, whereas one-third happens at the consumption stage [6]. These two stages accounted for more than half of global food waste. Statistically, developing and developed countries accounted for 44% and 56% of global food waste, respectively. Food waste production was higher among affluent living standards [7].

Meanwhile, a positive relationship was reported between better access to quality food regulated by better food product standards and higher living standards in developed nations. This improvement in food access led to higher demand and purchase of food, subsequently leading to food waste creation. The affordable price of foods also makes consumers buy more and keep it in household storage. This stored food may expire as the consumer may not be able to consume it in time. Instead of being donated to people in need through a charity organization, the expired food will then be disposed.

In Malaysia, Malaysians produce an average of 17 thousand tons of food waste daily [8]. One-fifth of this food waste was avoidable, such as untouched leftovers. This food waste could have fed 5.3 million people three meals daily [9]. It was also reported that Malaysia's household food waste is more than 8,000 tons every day, representing more than 50% of total food waste [10]. This amount is almost on par with the level of food waste found in developed countries. In contrast, other developing countries only generate less food waste at the same duration.

The majority of local studies on food waste behaviour in Malaysia focused mainly on West Malaysia [11-16]. Despite being part of Malaysia, Sarawak State is culturally different from West Malaysia. As such, the findings from the research in West Malaysia may not readily apply to Sarawak. Hence, the present study aims to apply the Theory of Planned Behaviour (TPB) to identify the factors associated with food waste behaviour in Sarawak. Specifically, the objectives of this study are (1) to explore the association between the intention not to waste food and psychosocial factors and (2) to assess the effect of the intention not to waste food and psychosocial factors on food waste behaviour.

Using TPB as the framework, food waste behaviour could be affected and directed by the intention. Subsequently, three psychological factors: subjective norms, personal attitudes, and perceived behavioural control, may predict the intention not to waste food. Personal attitudes usually involve a person's position, feelings, or views towards food waste behaviour. Meanwhile, an individual's perception of their immediate family members or friends' opinions toward practicing food waste reduction is described as subjective norms. An individual's availability of resources and opportunity not to waste food refers to perceived behavioural control. Intention focuses on a person's readiness to not waste food. As food waste is commonly linked to environmental health and public health, the outcome of this study may synthesise vital information for developing targeted strategies to combat food waste in Sarawak. Novel findings from this study may provide a new research direction on food culture, values, norms, and food planning at the household level.

METHODS

Study design and setting
Two models were assessed in this study; the first model applied the TPB to evaluate the association between psychosocial factors (i.e., subjective norms, personal attitudes, and perceived behavioural control) and the intention not to waste food. The second model examines how food waste behaviour is influenced by psychosocial factors, intention, and sociodemographic factors.

This study was conducted between October 2020 and August 2022 to gather information regarding food waste behaviour and its influencing factors among households and respondents in Sarawak

using a cross-sectional study design. Potential respondents were recruited based on specific inclusion criteria; adults aged 18 years and above living in the selected households in Sarawak, being mentally sound and responsible for catering for food in their various families. Both male and female Malaysians were eligible to participate in this study. In contrast, non-Malaysians and those with mental disorders or living outside the selected households were not included. Only one respondent was interviewed from each selected household.

Data collection instruments and procedure

The current sample size was calculated using a single proportion formula [17]. A minimum sample size of 2,160 was obtained based on an expected prevalence of 30% [10], a 95% confidence interval, a precision level of 3%, a design effect of 2, and a 20% non-response rate. The sampling procedure was based on a multistage sampling approach. Six divisions were randomly chosen, followed by selecting two districts randomly for each chosen division to be included in this study. Next, nine villages were chosen randomly from each district. In total, 108 villages were chosen. The selection of villages from the lists started with a random number, followed by every fifth interval. Overall, 108 villages were included in this study. Lastly, 20 households were systematically selected from each village, starting from the head of the village's household, followed by every fifth interval. The list of villages was obtained from each District Office. Face-to-face interviews were used to collect data.

Measurements

Respondents' socio-demographic profiles were documented. For gender, female was coded "0", and male was coded "1".

The wealth index was obtained by collecting information on 27 common household assets. The respondents answered 'Yes' or 'No' based on their household assets. The approximation of relative wealth was calculated using the first principal component of Principal Component Analysis [18]. This index is a standardized score with zero as mean and one for standard deviation and was used for further statistical analysis.

Food waste behaviour was assessed using 10 Likert-scale questions. These items were adopted from Rahman et al. [19]. It consists of ten questions assessing respondents' food waste behaviour. The scale consists of five rating scores ranging from one

(1) "always" to five (5) "never." An overall mean score for food waste behaviour was calculated and used for further statistical analysis.

Factors associated with food waste behaviour were assessed using 17 Likert-scale questions. These factors comprised respondents' "perceived behavioural control", "personal attitudes", "intention" and "subjective norm". For the latter three constructs, the statements/questions were adapted from the instrument by Aktas et al. [20]. Meanwhile, the instrument developed by van der Werf et al. [21] was used in perceived behavioural control statements. For these four factors, respondents were asked to answer using a seven-point Likert scale. The scale ranges from 1 = strongly disagree to 7 = strongly agree. An overall mean score for each factor was calculated and used for further statistical analysis.

Pilot test

The content of the questionnaire was validated by Wong and Rahman [22]. The relevance, simplicity, clarity and ambiguity of each item were assessed by five content experts. Subsequently, items reflecting low item and scale level content validity index were re-evaluated and adjusted for improvement. Next, a pilot test had been performed to check the questionnaire's reliability. 168 respondents participated for the test. The Cronbach's Alpha for each component was good, with a minimum reliability coefficient of 0.7 [23]. For corrected item-total correlation, items with low values were removed. The remaining items reflected a good correlation value of more than 0.3 [24]. Upon refining ambiguous and unclear items, the instrument disclosed good reliability and validity in investigating food waste behaviour.

Statistical analysis

All the gathered data were manually assessed and verified before transferring to a Microsoft Excel sheet [24]. The data were later imported to IBM SPSS, version 27, for analysis [25]. Prior to data analysis, data were screened, coded, and verified for any missing or duplicated entries. Factors influencing food waste behaviour were determined using hierarchical multiple linear regression. The independent variables comprised gender, age, wealth index, household family members, perceived behavioural control, subjective norms, personal attitudes, and intention. Meanwhile, the dependent variable or outcome of interest was

food waste behaviour – a continuous variable. The gender was a dummy coded '1' as male and '0' as female. Firstly, univariate and multivariate outliers were identified using Mahalanobis distance [26], Cook's distance [27], and studentized residuals [28]. A total of 101 data were removed, with the remaining 2,059 data proceeding for further analysis. Next, assumptions for multiple linear regression such as multicollinearity, normality, linearity and homoscedasticity were checked. The data did not violate the assumptions for multiple linear regression. Regarding the Intention and Food Waste Behaviour, respondents' demographic profiles and psychological factors were introduced into their respective first and second models, respectively. In addition, the intention was introduced into the third model for food waste behaviour. Statistical difference was considered present when a p-value is less than 0.05.

Participation in this study was voluntary and respondents' personal information and identities were kept confidential. The Medical Ethics Committee approved this study (Ref: FME/21/65).

RESULTS

Characteristics of the respondents

2,059 respondents had interviewed in this study. Table 1 demonstrates respondents' socio-demographic characteristic. The mean (SD) age was 44.78 (12.82) years, ranging from 18 to 83 years old. In Malaysian Ringgit (RM), the mean (SD) household income was RM 2,309.20, with a minimum of RM 100 and a maximum of RM 25,000. Almost two-thirds of the respondents were females (64.7%), and the remaining one-third were males (35.3%). Most of the respondents were Christians, and of Iban ethnicity, with secondary school education and worked as homemakers.

Intention not to waste food

The regression model for the predictors of the intention not to waste food is depicted in Table 2. Age, gender, wealth index, subjective norms, and personal attitudes potentially impacted the intention not to food waste (Adj. R^2 = 0.19). The Analysis of Variance (ANOVA) for the model reflected a statistically significant [F(df)=82.23 (6, 2058); p < 0.001].

Table 1: Percentage distribution of the respondents by socio-demographic characteristics (N=2,059)

Variable	n	%	Statistics
Age in years			44.78 (12.82)
Mean (SD)			
Gender			
Male	726	35.3	
Female	1,333	64.7	
Ethnicity			
Malay	458	22.2	
Iban	766	37.2	
Chinese	172	8.4	
Bidayuh	571	27.7	
Melanau	66	3.2	
Others*	26	1.3	
Religion			
Islam	532	25.8	
Christianity	1,422	69.1	
Buddhism	84	3.9	
Atheism	24	1.2	
Education level			
No formal education	175	8.5	
Only religious school	14	0.7	
Primary school	352	17.1	
Secondary school	1,261	61.2	
Matriculation/ Pre-University	34	1.7	
Diploma	127	6.2	
University	96	4.7	
Occupation			
Not working	291	14.1	
Self-employed	473	23.0	
Private sector	487	23.7	
Government	163	7.9	
Homemakers	624	30.3	
Others^	21	1.0	
Household income			RM2,309.20
Mean (SD)			

RM: Malaysian Ringgit; SD: Standard deviation; *Others include respondents of Kadazan, Kayan, Kenyah, Penan, Punan, and Selakau ethnicity; ^Others include student or already retired

Table 2: Multiple linear regression analysis for intention not to waste food (N=2,059)

Model	Unstd. B	SE	Std. Beta	95.0% CI for B		Correlations	Adj. R²
				LL	UL	Part	
(Constant)	5.31	0.08		5.16	5.46		
Age	-0.01	0.00	-0.07**	-0.01	0.0	-0.07	0.01
Gender	-0.04	0.04	-0.02	-0.13	0.05	-0.02	
Wealth index	0.02	0.02	0.02	-0.02	0.06	0.02	(p =0 .006)
(Constant)	2.19	0.17		1.86	2.52		
Age	0.00	0.00	-0.04*	-0.01	0.0	-0.04	
Gender	0.08	0.04	0.04*	0.01	0.16	0.04	
Wealth index	0.06	0.02	0.06**	0.02	0.1	0.06	0.19
Personal Attitudes	0.44	0.03	0.39***	0.38	0.49	0.32	
Subjective Norms	0.07	0.02	0.08**	0.03	0.11	0.06	(p <0 .001)
Perceived Behavioural Control	0.02	0.02	0.03	-0.01	0.05	0.02	

*$p < 0.05$, **$p <0.01$, ***$p <0 .001$; LL = Lower limit of 95% confidence interval; UL = Upper limit of 95% confidence interval*

Personal attitudes accounted for 31.5% variation in the model, which makes it the most important predictor of intention. This was accompanied by subjective norms, contributing 6.1% to the variation in intention. However, household family members and perceived behavioural control did not impact the model significantly.

Food waste behaviour

Table 3 presents the hierarchical multiple linear regression for food waste behaviour. For the final model, the dependent variable was significantly influenced by gender, age, subjective norms, personal attitudes, intention, and perceived behavioural control (Adj R2 = 0.17). The ANOVA results for the model were statistically significant [F(df)= 62.29 (7, 2058); p < 0.001]. Resultantly, Personal Attitudes (21.3% contribution) were the most crucial predictor of food waste behaviour, albeit with a negative effect. This is followed by perceived behavioural control (13.5% contribution) and Subjective Norms (8.8% contribution). Intention not to waste food only had a 4.9% contribution on the final model.

DISCUSSION

The present study aims to apply the TPB to identify the factors associated with food waste behaviour in Sarawak. Results from this study revealed the effectiveness of TPB in describing food waste behaviour in Sarawak. The upcoming section discusses the psychosocial factors of food waste behaviour and the intention not to waste food.

The present study found a positive association between respondent's personal attitudes and intentions, which is in accordant with reports from research conducted in European [21,29,30] and Asian countries [14,16,20]. McDermott et al. [31] argued that a person would have a firm intention for a behaviour if that individual has a positive attitude towards that behaviour. Likewise, a positive relationship was observed between the intention and subjective norms. This finding aligns with three other studies [14,20,32]. Having the support and acknowledgement of friends and family can assist in creating a strong intention towards a particular behaviour [33]. Conversely, the current study did not find any relationship between intention and perceived behavioural control. Perceived behavioural control was used in the TPB to predict intention and behaviour that was not voluntary [34]. This study revealed that perceived behavioural control did not have strong volitional control for intention. Two other studies also found similar results [29, 35].

Demographic profiles such as age, gender, and household wealth were found to be predictors

Table 3: Multiple linear regression analysis for food waste behaviour (N=2,059)

Model	Unstd. B	SE	Std. Beta	95% CI for B		Part	Adj. R²
				LL	UL		
(Constant)	2.57	0.03		2.52	2.63		
Age	0.00	0.00	0.07**	0.00	0.00	0.07	0.024
Gender	0.09	0.02	0.12***	0.06	0.12	0.12	(p<0.001)
Wealth index	0.02	0.01	0.07**	0.01	0.04	0.07	
(Constant)	3.35	0.06		3.23	3.48		
Age	0.00	0.00	0.06**	0.00	0.00	0.06	
Gender	0.05	0.02	0.06**	0.02	0.08	0.06	0.170
Wealth index	0.01	0.01	0.04	0.00	0.03	0.04	(p<0.001)
Personal Attitudes	-0.13	0.01	-0.30***	-0.15	-0.10	-0.24	
Subjective Norms	-0.04	0.01	-0.12***	-0.06	-0.02	0-.09	
Perceived Behavioural Control	0.04	0.01	0.14***	0.03	0.05	0.13	
(Constant)	3.40	0.07		3.27	3.52		
Age	0.00	0.00	0.06**	0.00	0.00	0.06	
Gender	0.05	0.02	0.07**	0.02	0.08	0.07	
Wealth index	0.01	0.01	0.04	0.00	0.03	0.04	0.173
Personal Attitudes	-0.12	0.01	-0.28***	-0.14	-0.09	-0.21	(p<0.05)
Subjective Norms	-0.04	0.01	-0.11***	-0.05	-0.02	-0.09	
Perceived Behavioural Control	0.04	0.01	0.14***	0.03	0.05	0.14	
Intention	-0.02	0.01	-0.06*	-0.04	0.00	-0.05	

*p < 0.05, **p <0.01, ***p <0 .001; LL = Lower limit of 95% confidence interval; UL = Upper limit of 95% confidence interval*

for intentions not to waste food. The younger age group displayed more intention not to waste food than the elderly, which is not in agreement with the findings reported by van der Werf et al. [21]. The disparity is in consequence of the period of data collection. This study was performed during the COVID-19 pandemic period in which most households' incomes were affected by the Movement Control Order (MCO) implemented by the government [36]. As a result, the intention might have increased among the younger age groups, including their propensity to save money. On the other hand, females demonstrated a higher intention not to waste food than males, corroborating a prior study by Graham-Rowe et al. [37]. They were reported to be more conscious about food wastage, thereby leading to higher behavioural intention to avoid wasting food [38]. Finally, respondents with higher household wealth were associated with higher odds of having a higher intention not to waste food. This finding

may be due to wealthier household having more exposure to food waste through education [39]. Nevertheless, other study found no significant connection between household wealth and intention [21].

The second analysis examined the relationship between food waste behaviour with psychosocial factors, intention not to waste food, and socio-demographic factors. Food waste behaviour was significantly influenced by all three psychosocial factors analyzed in this study. Two previous studies partially supported these findings [21,30], as food waste behaviour was predicted by only perceived behavioural control and personal attitudes. In the present study, food waste behaviour was significantly and negatively influenced by intention. The risk of food-wasting behaviour is generally lower among individuals with strong intention. Similar findings were published in previous research [14,20,21,29,30,32]. Nevertheless, only 5% of food

waste behaviour was explained by intention. The contributions of other psychosocial factors to the final model were relatively higher, with personal attitudes accounting for a 21% variation in food waste behaviour. For this reason, policymakers can design interventional programmes that target psychosocial factors to reduce food-wasting behaviour in public.

Further analyses depicted that age and gender were significant predictors of food waste behaviour, which contradict the reports from previous studies [29,40,41]. Quested and Luzecka [42] posited that factors such as cooking, preparing and serving too much food contributed to food wastage among the younger age groups relative to the older population. Nevertheless, this study found that younger people wasted less food than older people. The first analysis explains that the COVID-19 pandemic has affected household income. Thus, most households may have started to decrease household food waste to conserve money. The younger age group may be motivated to decrease more food waste given that they may lack sufficient savings to weather the storm. Our analysis found that males wasted more food as compared to females, in line with findings from other countries [38,40,43]. This could be attributed to females having a higher intention, thus motivating them to waste less food than males.

Lastly, the wealth index did not predict food waste behaviour among households in Sarawak. In most instances, higher household income was found to waste more food than the lower household income [13]. Poverty and limited income resulted in this group of consumers buying smaller amounts of food each time that would suffice for current consumption [44]. Nonetheless, the pandemic may contribute to the insignificant finding between wealth index and food waste behaviour in the present study. Most households may have been impacted financially by the MCO, thus the need to decrease their household food waste and ensure the availability of sufficient food for the family, regardless of whether they are wealthy or poor. The research findings are promising and could have a significant impact in terms of policy adjustment and changes. Informed decisions on policies concerning the management of food waste could be developed from the present results.

Government and non-governmental organizations can use the TPB model to determine the factors affecting food waste behaviour in the community. In turn, effective policies and programs that target the community's major contributing factors can be developed to decrease food waste. Longitudinal study could be performed in the future to cover respondents' intentions and perceptions over a longer duration. More accurate and detailed results on the research topic could be gleaned by comparing results between various periods.

Several limitations were identified in the present study. First, this study was conducted using cross-sectional study design. As such, the cause-and-effect relationship between variables could not be determined as both the independent (psychosocial factors) and dependent variables (food waste behaviour) were measured in the same timeframe. Second, this study did not perform observational measures to assess food waste behaviour, which was considered to be the better method [14]. Nevertheless, it was not feasible to conduct this study using observational measures due to the nature of the study. Lastly, respondents were required to answer all the questions; they may have responded to each question without going into depth [45].

CONCLUSION

Food waste behaviour in the context of Sarawak can be addressed by influencing the intentions and psychosocial factors among the community. Subsequently, intentions not to waste food can be effectively managed by tackling subjective norms and personal attitudes. The present findings have enhanced the current body of knowledge regarding food waste behaviour among Sarawak households. Hence, imprinting food waste reduction practices is crucial, especially during childhood. Long-term programs focusing on reducing food waste behaviour would be more effective in tackling this issue, as changing attitudes and norms in the community usually require a long time.

REFERENCES

1. Food and Agriculture Organization. Global Food Losses and Food Waste- Extent, Causes, and Prevention. Rome 2011. Available: www.fao.org/3/i2697e/i2697e.pdf

2. US Department of Agriculture. USDA and EPA Launch U.S. Food Waste Challenge : Calls on both Public Sector and Private Industry to reduce food waste. Washington, USA: US department of agriculture,; 2013; Available from: https://www.usda.gov/media/press-releases/2013/06/04/usda-and-epa-launch-us-food-waste-challenge.

3. Parfitt, J.; Barthel, M.; Macnaughton, S.; Food waste within food supply chains: quantification and potential for change to 2050. Philosophical Transactions of the Royal Society B: Biological Sciences. 2010, 365, 3065-81, doi: 10.1098/rstb.2010.0126.

4. Food and Agriculture Organization. Food Loss and Food Waste. 2020; Available from: http://www.fao.org/food-loss-and-food-waste/en/.

5. High-Level Panel of Experts. Food losses and waste in the context of sustainable food systems Sweden: Stockholm Environment Institute, 2015. Available: https://www.siani.se/wp-content/uploads/2017/10/siani_policy_brief_flw_hlpe_june_23_web.pdf

6. Lipinski, B.; Hanson, C.; Waite, R.; Searchinger, T.; Lomax, J.; Kitinoja, L.; Reducing Food Loss and Waste. Washington, DC: Working Paper, Installment 2 of Creating a Sustainable Food Future; 2013.

7. Thi, N.B.D.; Lin, C.Y.; Kumar, G.; Waste-to-wealth for valorization of food waste to hydrogen and methane towards creating a sustainable ideal source of bioenergy. Journal of Cleaner Production 2016, 122, 29-41, doi: 10.1016/j.jclepro.2016.02.034.

8. Hani, A.; Malaysia throws away 17,000 tonnes of food daily. The Malaysian Reserve. 2022 15 February

9. Abdullah, N.I.; Impact of food wastage. The Star. 2016 26 May.

10. Jereme, I.; Siwar, C.; Rawshan, A.B.; Basri, A.; Food wastes and food security: The case of Malaysia. International Journal of Advanced and Applied Sciences 2017, 4, 6-13, doi: 10.21833/ijaas.2017.08.002.

11. Fatoumata, J.; Norshamliza, C.; Consumers' Awareness and Knowledge about Food Waste in Selangor, Malaysia. International Journal of Business and Economic Affairs 2017, 2. Available: http://www.ijbea.com/ojs/index.php/ijbea/article/view/56.

12. Kasavan, S.; Mohamed, A.F.; Abdul Halim, S.; Drivers of food waste generation: Case study of island-based hotels in Langkawi, Malaysia. Waste Management 2019, 91, 72-9, doi: 10.1016/j.wasman.2019.04.055.

13. Zainal, D.; Hassan, K.A.; Factors Influencing Household Food Waste Behaviour in Malaysia. International Journal of Research in Business, Economics and Management 2019, 3, 56-71, Available: https://www.ijrbem.com/volume-3-issue-3-may-june-2019/.

14. Fegalo, K.; Ismail, T.H.; Household Purchase and Generation of Food Waste in Malaysia (Sri Serdang and Taman Connaught Cheras Kuala Lumpur). Advances in Recycling & Waste Management 2017, 2, 1-8, doi: 10.4172/2475-7675.1000139.

15. Amirudin, N.; Gim, T-H.T.; Impact of perceived food accessibility on household food waste behaviors: A case of the Klang Valley, Malaysia. Resources, Conservation and Recycling 2019, 151,104335. doi: 10.1016/j.resconrec.2019.05.011.

16. Loh, C.T.; Moorthy, K.; Gunasaygaran, N.; Chong, S.L.; Omapathi, D.; Ho, J.Y.; et al. Intention to reduce food waste: A study among Malaysians. Journal of the Air & Waste Management Association 2021, 71, 890-905, doi: 10.1080/10962247.2021.1900001.

17. Cochran, W.; Sampling Techniques: John Wiley & Sons, Inc.; 1977.

18. Córdova, A.; Methodological Note: Measuring Relative Wealth using Household Asset Indicators. Americas Barometer Insights. 2009, 1-9, Available: https://www.vanderbilt.edu/lapop/insights/I0806en_v2.pdf.

19. Rahman, M.M.; Viknesraj, S.; Jantan, Z.; Knowledge, Attitude and Practice of Household Food Wastages among Villagers in Sekuau, Sibu, Sarawak. CMPH Bulletin 2018, 5, 30-9.

20. Aktas, E.; Sahin, H.; Topaloglu, Z.; Oledinma, A.; Huda, A.K.S.; Irani, Z.; et al. A consumer behavioural approach to food waste. Journal of Enterprise Information Management 2018, 31, 658-73, doi: 10.1108/JEIM-03-2018-0051.

21. van der, Werf, P.; Seabrook, J.; Gilliland. J.; Food for naught: Using the theory of planned behaviour to better understand household food wasting behaviour. The Canadian Geographer / Le Géographe canadien 2019, 63, 478-93, doi: 10.1111/cag.12519.

22. Wong, L.T.; Rahman, M.M.; Psychometric Evaluation of a Questionnaire for Measuring Food Waste Behaviour and Food Security at the Household Level. The Indonesian Journal of Public Health 2022, 17, 184-95, doi: 10.20473/ijph.v17i2.2022.184-195.

23. Hair, J.; Babin, B.; Black, W.; Anderson, R.;

Multivariate Data Analysis. 8th edition ed: Pearson Education Inc.; 2018.

24. Cooper, J.; Introduction to Data Management: Statistical Associates Publishers; 2015.

25. IBM SPSS. IBM SPSS Statistics for Windows. 27 ed 2020.

26. Mahalanobis, P.C.; On the Generalized Distance in Statistics. Proceedings of the National Institute of Science of India 1936, 2, 49-55.

27. Cook, D.; Detection of Influential Observation in Linear Regression. Technometrics 1977, 19, 15-8. doi: 10.1080/00401706.1977.10489493.

28. Aguinis, H.; Gottfredson, R.; Joo, H.; Best-Practice Recommendations for Defining, Identifying, and Handling Outliers. Organizational Research Methods 2013, 16, 270-301, doi: 10.1177/1094428112470848.

29. Stancu, V.; Haugaard, P.; Lähteenmäki, L.; Determinants of consumer food waste behaviour: Two routes to food waste. Appetite 2016, 96, 7-17, doi: 10.1016/j.appet.2015.08.025.

30. Visschers, V.; Wickli, N.; Siegrist, M.; Sorting out food waste behaviour: A survey on the motivators and barriers of self-reported amounts of food waste in households. Journal of Environmental Psychology 2016, 45, 66-78, doi: 10.1016/j.jenvp.2015.11.007.

31. McDermott, M.; Oliver, M.; Svenson, A.; Simnadis, T.; Beck, E.; Coltman, T.; The theory of planned behaviour and discrete food choices: a systematic review and meta-analysis. International Journal of Behavioral Nutrition and Physical Activity 2015, 12, 162, doi: 10.1186/s12966-015-0324-z.

32. Russell, S.; Young, W.; Unsworth, K., Robinson, C.; Bringing habits and emotions into food waste behaviour. Resources, Conservation and Recycling 2017, 125, 107-14, doi: 10.1016/j.resconrec.2017.06.007.

33. Ham, M.; Jeger, M.; Ivković, A.F.; The role of subjective norms in forming the intention to purchase green food. Economic Research-Ekonomska Istraživanja 2015, 28, 738-48, doi: 10.1080/1331677X.2015.1083875.

34. Armitage, C.; Conner, M.; Efficacy of the Theory of Planned Behaviour: A meta-analytic review. British Journal of Social Psychology 2001, 40, 471-99, doi: 10.1348/014466601164939.

35. Stefan, V.; van Herpen, E.; Tudoran, A.A.; Lähteenmäki, L.; Avoiding food waste by Romanian consumers: The importance of planning and shopping routines. Food Quality and Preference 2013, 28, 375-81, doi: 10.1016/j.foodqual.2012.11.001

36. Ismail, M.K.; Vija, Kumaran, V.; Munawwarah, S.N.; Muhamad, M.Z.; Sarifuddin, S.; COVID-19 Outbreak: An Analysis of Malaysian Household Income Class During Movement Control Orders (MCO). Asia Proceed.ings of Social Sciences 2021; 39, doi: 10.31580/apss.v7i1.1738.

37. Graham-Rowe, E.; Jessop, D.; Sparks, P.; Predicting household food waste reduction using an extended theory of planned behaviour. Resources, Conservation and Recycling 2015, 101, 194-202, doi: 10.1016/j.resconrec.2015.05.020.

38. Secondi, L.; Principato, L.; Laureti, T.; Household food waste behaviour in EU-27 countries: A multilevel analysis. Food Poicy 2015, 56, 25-40, doi: 10.1016/j.foodpol.2015.07.007.

39. Wolla, S.A.; Sullivan, J.; Education, Income, and Wealth: PAGE ONE Economics. Federal Reserve Bank of St. Louis; 2017.

40. Neff, R.; Spiker, M.; Truant, P.; Wasted Food: U.S. Consumers' Reported Awareness, Attitudes, and Behaviors. PLOS ONE 2015, 10, e0127881, doi: 10.1371/journal.pone.0127881

41. Grasso, A.; Olthof, M.; Boevé, A.; van Dooren, C.; Lähteenmäki, L.; Brouwer, I.; Socio-Demographic Predictors of Food Waste Behavior in Denmark and Spain. Sustainability 2019, 11, 3244, doi: 10.3390/su11123244.

42. Quested, T.; Luzecka, P.; Household food and drink waste: A people focus: Waste & Resources Action Programme 2014. Available: https://refreshcoe.org/wp-content/uploads/2017/08/People-focused-report-v6_5-full.pdf

43. Aschemann-Witzel, J.; De Hooge. I.; Amani, P.; Bech-Larsen, T.; Oostindjer, M.; Consumer-Related Food Waste: Causes and Potential for Action. Sustainability 2015, 7, 6457-77, doi: 10.3390/su7066457.

44. Food and Agriculture Organization. World fertilizer trends and outlook to 2018. 2015.

45. Nederhof, A.; Methods of coping with social desirability bias: A review. European Journal of Social Psychology 1985, 15, 263-80, doi: 10.1002/ejsp.2420150303.