

Household Food Consumption and Disposal Behaviour in Malaysia

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Abstract: The problem of food waste among households in Malaysia is becoming a great concern to the local authorities as enormous amount is spent in disposing food waste. With increased in households income, as a result of good economy in the last two decades and changes in consumption pattern, food waste has grown to alarming figures. Therefore, this study examines food consumption and disposal behaviour among households in Klang Valley, Malaysia. Households were randomly selected from Kajang, Bangi and Serdang with the objective to investigate household food consumption and disposal behaviour so as to achieve sustainable food consumption and food waste management in these areas. Also, what factors influences their consumption and disposal behaviour. Factor Analysis (FA) was used for the empirical analysis. Findings from the result have revealed that over all respondent's attitudes shows that they do not like to waste their food while some of them prefer to eat freshly cook food both at home and restaurants rather than leftover food. However on the other hand, food waste composting and disposal behaviour is influenced by neighborhood attitude towards disposal.

Key words: Household food consumption, sustainable consumption and disposal behaviour, food, food waste management, Malaysia

INTRODUCTION

Food waste is a general phenomenon in many affluent societies or countries. But, the irony of it all is that while many have much to waste, there are millions out there who cannot afford such to put on their tables. Global food waste is on the increase as thousands tones of wasted food are dumped daily in unsanitary landfills. Of most concern to many stakeholders is the impact food waste has on the generation of greenhouse gas emissions such as methane and carbon dioxide. However, there are also growing concerns about the economic and environmental viability of existing food waste disposal systems, as well as interest in food waste as a resource input to agriculture. This constitute nuisance to the environment and as well endanger the wellbeing of those living where the landfill is located which often times are not properly managed.

According to a recent study by Gustavsson *et al.* (2011) for FAO on global food waste, the results found that roughly one-third of food produced for human consumption is lost or wasted globally which amounts to

about 1.3 billion ton year⁻¹. This inevitably also means that huge amounts of the resources used in food production are used in vain and that the greenhouse gas emissions caused by production of food that gets lost or wasted are also emissions in vain.

Generally, food waste mostly occurs throughout the supply chain from initial agricultural production down to final household consumptions. In the medium and high-income countries, food is to a significant extent wasted at the consumption stage, meaning that it is discarded even if it is still suitable for human consumption. Also, a lot of significant losses do occur early in the food supply chains in the industrialized regions. But in low-income countries, food is lost mostly during the early and middle stages of the food supply chain much less food is wasted at the consumer level. In a nutshell on a per-capita basis, more food is wasted in the industrialized world than in developing countries. The same study by Gustavsson *et al.* (2011) for FAO suggests that the per capita food waste by consumers in Europe and North-America is 95-115 kg year⁻¹ worth some \$38.3 billion while for sub-Saharan Africa and

South/Southeast Asia this figure is only 6-11 kg year⁻¹. The Australians waste \$6 billion of food each year this would be enough to feed the entire nation for 3 weeks. The Japanese on the hand throw away one-fourth of available food (CAP, 2010). Food wastage has become a problem as societies become more affluent. This trend will continue if nothing sustainable is done to reduce the impact on the society at large.

Here in Malaysia, the economic boom in the last 2 decades has drastically improved the living standards of the people. As a result of this many have become affluent, as such food waste is now an issue to the local authorities. Households and business outlets like hotels, restaurants and resorts are left with large quantities of food after daily business activities, such as during wedding parties, conferences, banquets and such like. Malaysians are throwing away up to 930 ton of unconsumed food daily. This is equivalent to throwing away 93,000 kg bags of rice each day (Aruna, 2011). However, wastage of unconsumed food alone in Malaysia has doubled over the past 3 years, this does not even include leftover food. The unconsumed food mostly consists of expired bread, eggs and old or rotten fruit. For example, food waste is becoming a growing trend that almost 50% of the 31,000 ton of waste produced daily by Malaysians comprised organic kitchen waste such as leftover food. Malaysia was close to a developed country status in the amount of waste generated as compared to developing nations like India and Bangladesh which had almost zero unconsumed food. Table 1 shows a recent data on food waste disposed from various outlets in Malaysia.

Table 1 shows households have the highest generations of food waste which is also the main area of focus in this study. In Malaysia according to findings, food wastage was higher in urban areas due to the difference in income levels with rural areas. This has become a burden to local councils as they are spending

a large amount of their annual allocation to dispose waste. Throwing food waste away is an unsustainable practice because it wastes not only the food but also all of the resources that went into growing, transporting, storing and preparing the food. Recently, the existing landfills are getting to the end of their life span as building new landfills always attract outcry as nobody want where he lives to be a deposition ground of what others rejected, the problem of Not-In-My-Back-Yard (NIMBY) is always there in this issue (Wai, 2007).

According to Dr Tee Ee Siong, Nutrition Society of Malaysia president many Malaysians over eats or usually taking more than they could consume at a time. It was a common sight to see Malaysians pile too much food on their plates, especially during meals at restaurants and buffets he bemoaned (Aruna, 2011). When people have too much food on their plates, they tend to over eat and this is the course of obesity in Malaysia. According to statistics, 30% of Malaysians are obsessed which is more than a quarter of the today's population. While, there are numerous studies and reports that may be drawn upon to make the case for tackling the problem, actual data on food waste generation avoidance and management are sparse and difficult to verify. Malaysia is already in food crisis according to Marditech consultant Ahmad Zamzam Mohamed. Malaysians would have to change their eating habits to lessen its impact, quoting him.

The government has been shielding Malaysians from the real impact of the crisis with various subsidies. He said adding that they would soon face the reality as these were being slowly removed.

Malaysians eat too much and many have no qualms about throwing away food even with a crisis looming. There is a saying that in some countries, they eat to live but here in Malaysia, Malaysians live to eat. This is a true statement as the economic boom for about 2 decades has drastically changed the food consumption pattern of Malaysians. The 24 h restaurants have sprang up every corner. Shopping malls are full to capacity with households on daily basics and most at times during weekends buying different kinds of food stuffs for family consumptions.

As a result of these large quantities of edible food are wasted at households. Per definition, food wastes are the masses of wasted food in the part of food chains leading to edible products going to human consumption. Therefore, food that was originally meant for human consumption but which fortuity gets out the human food chain is considered as food waste even if it is then directed to a non-food use (feed, bioenergy). This

Table 1: Food waste generated in Malaysia

Estimated food waste generated in Malaysia	Generation rate	
	ton/day	ton/year
Sources of food		
Households	8,745	3,192,404
Wet and night markets	5,592	2,040,929
Food courts/restaurants	5,319	1,941,608
Hotels	1,568	572,284
Food and beverages industries	854	311,564
Shopping malls	298	108,678
Hypermarkets	291	106,288
Institutions	55	26,962
Schools	45	21,808
Fast food/chain shops	2521	808
Total	22,793	8,331,589

MHLG (2011)

approach distinguishes planned non-food uses to unplanned non-food uses which are hereby accounted under losses (Parfitt *et al.*, 2010).

On the other hand, food losses refer to the decrease in edible food mass throughout the part of the supply chain that specifically leads to edible food for human consumption. In a nutshell, food losses take place at production, post harvest and processing stages in the food supply chain. Food losses occurring at the end of the food chain (retail and final consumption) are rather called food waste which relates to retailers and consumers' behavior (Parfitt *et al.*, 2010). However for the purpose of this study, post consumed food and disposal will be the main areas of focus. Post consumed food here means edible food that has been bought and collected to be consumed but not used due to excess in quantities and consumed leftovers food.

The objective of the study is to understand the factors that influence household food consumption and disposal behaviour in these areas, so as to achieve a sustainable food waste management system.

Literature review: Global food waste has become a daily issue as societies became affluent. This growing trend has brought about different methodologies in finding ways to reduce food waste. Yet, food waste is still a problem to develop and developing countries at households both in developing and most especially on developed countries. In the US, Economic Research Service in 1997 conducted a survey on food waste on the US market and concluded that approximately 27% of the amount of food available for human consumption in the US is lost during the stages of retail, food service and household. Again it reviewed that about one fourth of US American edible food supply is lost in 1995 due to over preparation, expanded menu choices, unexpected flotation and leftovers (Kantor *et al.*, 1997). The proportion of total food used in commercial food service industries, convenience stores (e.g., at petrol stations) account for 26.3% of food loss and fast food restaurants for 9.6% in the USA (Jones, 2004).

In Australia, a study by DSEWPC (2005) asked 1,644 members of households across Australia what they believed was spent on food that was not eaten during that year (2004). Based on these responses, the study estimated that approximately \$5.2 billion was spent nationally in 2004 on food that was not consumed. A sense of the lost opportunities, this figure represents is perhaps best understood by applying it to alternative uses. For example at current prices, \$5.2 billion would pay for the installation of 315 L solar hot water systems on 960000 homes the study reviewed.

According to the report, DSEWPAC (2009) asked similar questions to 12,000 households in New South

Wales as part of the NSW government's "Love Food Hate Waste" program. This study showed that NSW households spent approximately \$2.5 billion on food that was not consumed. This cost only accounts for lost opportunities for more productive spending by households. It does not include spending by businesses, energy costs, costs of lost labour and materials or the costs associated with other liabilities and risks that were involved.

A Swedish study analysed four different restaurants and school kitchen to measure the various kinds of food losses, improper storage and preparation losses, serving losses left on serving dishes, in bowls and discarded leftovers not served as well as plate waste. From the results, it revealed that around 16% of the purchased food was cooked and ready to eat but ends up as loss whereas plate waste was the largest proportion with 10% (Engstrom and Carlsson-Kanyama, 2004). Another survey conducted in Hong Kong showed that only 13% of the interviewed people stated to eat up the portion received at restaurants. To support food waste prevention, parts of the gastronomy of Hong Kong fine customers who do not eat up their food on the plate (Blume, 2007). Similar considerations are reported from Brazil where the penalty should make the public attention aware of the environmental impact of beef production. In South Korea, the food waste recycling rate increased to 81.3% in 2004 from 45.1% in 2002 after the implementation of strict regulations on food waste recycling and expansion of waste to energy facilities (Low and Aw, 2010).

On the local scene, Agamuthu found out that Malaysians throw away up to 930 ton of unconsumed food (expired bread, eggs old and rotten fruit daily). This is equivalent to throwing away 9,300 kg of rice daily (double over 3 years), i.e., almost 50% of 31,000 ton of waste generated (Aruna, 2011). Based on several studies regarding waste composition, food waste comprises about 50% of waste in landfills. Non-organic waste makes up about 10% of waste in landfills. A key factor in this ratio is the fact that while other recyclable materials are extracted before entering disposal sites, recovery rates for food waste are negligible. However, a little comfort came from a local study of 26 hawkers on composting project by MPSJ, four participating centers' were randomly selected for a pilot study in Subang. The questionnaire survey was conducted by the council after 6 months to access the effectiveness of the project. It revealed that 95% of the hawker's interviewed believed that food waste separation at source and composting are beneficial to the environment (MPSJ, 2009). They expressed that the segregation was not considered a burden to them because the method of food waste segregation was easy to follow.

This further shows that there is positive attitude towards food waste composting when friendly methods are applied.

The distribution of compost to the hawkers was also an inducement the studied revealed. The most important success of the pilot projects was the achieved participation for segregation of food waste by hawkers. It clearly demonstrated value and outcome of their efforts to them. The study revealed there is a relationship between participation and awareness to food reductions campaign. Further observations from the studies discovered that commingle waste with food waste increased cost as food waste must be sorted before been used for composting. The studied shows that for effective food waste recycling, non food waste must be segregated from food waste for composting. With campaign and enlightenments program to create awareness, the projected 500 kg day⁻¹ was achieved. The face-to-face visits to the hawkers and the visit by hawkers to the composting facility were found to be most positive (MPSJ, 2009).

MATERIALS AND METHODS

The study was conducted among the households in Kajang, Bangi and Serdang to understand their food waste management and disposable behavior based on Factor Analysis (FA).

The sample selection was among than 30 household which were randomly selected, out of these only 24 respondents completed and returned their questionnaire. The sample size was therefore, based on 24 households. Pallant (2010) is of the opinion that in factor analysis both large and small sample does not generalize. Stevens (1996) suggests that the sample size requirement advocated by researchers have been reducing over the years, as more research has been done on this topic. However, he went further to say that some researchers suggest that it is not the overall sample size that is the concern rather the ratio.

SPSS version 20 was used for the factor analysis to understand the variables that effluences household food consumption and disposal behaviour. In general, the factor analysis model according to Sharma (1996) is:

$$\begin{aligned}x_1 &= \lambda_{11}\xi_1 + \lambda_{12}\xi_2 + \dots + \lambda_{1m}\xi_m + \varepsilon_1 \\x_2 &= \lambda_{21}\xi_1 + \lambda_{22}\xi_2 + \dots + \lambda_{2m}\xi_m + \varepsilon_2 \\&\vdots \\&\vdots \\x_p &= \lambda_{p1}\xi_1 + \lambda_{p2}\xi_2 + \dots + \lambda_{pm}\xi_m + \varepsilon_p\end{aligned}$$

Where, the variables $x_1, x_2 \dots x_p$ are functions of the latent construct (s) or factor (s), $\varepsilon_1, \varepsilon_2 \dots \varepsilon_m$ and the unique

factors. In other words, they reflect the presence of the unobservable or the latent constructs, i.e., the factors and hence, the variables called reflective indicators. The respondents eating behavior variables factors were group as fresh food, served food and expired food while food composting and disposal behaviour variables factors were group as food separation and composting. To ascertain the relationship of the factors influencing their food consumption and food waste behavior, a correlation analysis was carried out to understand the relationship between the variables on food consumption and disposal behaviors.

Statistical analysis: In conducting factor analysis, Tabachnick and Fidell (2007) recommends that an inspection of the correlation matrix for evidence of coefficients should be >0.3 . If few correlations above this are found, factor analysis may not be appropriate. Bartlett (1954) recommends that sphericity should be significant at ($p < 0.05$). Kaiser-Meyer-Olkin (KMO) should be >0.60 and above while 0.90 is seem as marvelous for KMO to be applied. Kaiser (1970) is a popular diagnostic indicator measure. KMO provides a means to access the extent to which the indicator of a constructs belong together. This is a measure of homogeneity of the variables (Kaiser, 1974). Eigen value >1 should be applied for attracting the number of factors. However, as suggested by Cliff (1988) he advised that caution should be used on relying completely on eigenvalue >1 for the appropriate numbers. Results of simulations studies by Zwick and Velicer (1986) found that the best-performing rules were the Minimum Average Partial correlation (MAP). The MAP, however mostly performed well for large numbers of indicators per factor.

Demography of the respondents: The total number of the male respondents who participated in the survey was 17 (70.8%) and the female are 7 (29.2%). The respondents' age ranges from; 18-30 (33.8%) while those at 61-75 (4.2%) and others. Most of the respondents ages fall within 30-40 years and monthly income of majority of the participants are from RM 3,000.00-4,000.00. Respondents who were married are 17 (70%) and single 6 (25%). The number of respondents who had degree certificates has the highest participants at 11 (45.8%) while post graduates were 3 (12%). Secondary school leavers were the least educated of the entire respondents with 7 (29.2%), respectively. While, diplomas holders were 3 (11.3%). Overall, 89.6% of the total respondents in both the areas have a very good higher education. Respondents who are from Serdang were 13 (54.2%), 7 (29.2) from Bangi and 4 (16.7%) respondents are from Kajang.

RESULTS AND DISCUSSION

Analysis of eating behaviour of households: In this study for household food waste in Bangi, Kajang and Serdang, the sample was first assessed for its suitability for factor analysis. Bartlett's test of sphericity was highly significant ($p < 0.058$) and the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy value of 0.652 supported the factorability of the matrix (Tabachnick and Fidell, 2007). Table 2 is the output for the KMO and Bartlett's test standard for the factor analysis which was applied in this study.

The Exploratory Factor Analysis (EFA) used in this analysis revealed that there are three eigen values exceeding 1, explaining 27.69, 12.21 and 7.21% of the variance, respectively. These 3 factors are the first that exceeded the criterion value which shows in this Kaiser analysis (Watkins, 2000). In Table 3 of the rotated factor matrix, the 3 factor loading items of fresh food (factor 1), served food (factor 2) and expired (food factor 3) loaded strongly on factor 1 with 8 items, the highest being 0.725 and -0.682 and 0.675 indicating a good fit on their food consumption behaviour as generally most households will prefer eating fresh food whether it is left over or not hence is fresh and still nutritious.

Table 2: KMO and Bartlett's test

Analysis	Tests	Values
Kaiser-Meyer-Olkin measure of sampling adequacy		0.653
Bartlett's test of sphericity	Approx. Chi-square df Sig.	50.234 36.000 0.058

Table 3: Respondents eating and consumption behaviour

Respondents	Factors		
	Fresh food (F1)	Served food (F2)	Expired food (F3)
I normal eat fresh cook food (Eb25)	-	0.534	-
At home, I and my families consume leftover food (Eb26)	0.725	-	0.471
There is difference between freshly cooked meal and leftover food (Eb27)	0.482	0.549	-
I eat food that is expired for 2 or 3 days (Eb28)	-	-	-0.645
I think the whole issue of food is as a result of no discipline on food table manners, e.g., gluttony (Eb29)	-	0.484	-
I throw away food because the taste is not good (Eb30)	-0.684	-	-
My customers eat up what is cooked or served all times (Eb31)	0.404	0.614	-
I normally put leftovers food to the refrigerator after finishing on daily business (Eb32)	0.675	-	-
I often take my family out for dinner (Eb33)	-0.478	-	-

Extraction Method = Principal Axis Factoring; Rotation Method = Varimax with Kaiser Normalization; Rotation converged in 5 iterations

Descriptive analysis: In factor 1 eating of fresh food by respondents loaded strongly with 0.725 while putting food in the refrigerator as well has a loading of 0.675 which indicates that most respondents prefer fresh food than leftover food. However, the throwing of food because the taste is not good shows a -0.684 and taking families out for lunch which -0.478, indicating negative respondent's attitudes towards this issue.

Factor 2 (served food) respondent attitudes when served food shows a slightly high load at a correlation of 0.614 while respondents preferring to eat freshly cooked food to leftover loaded at 0.549. Food manners at table which is a result of overeating shows the lowest loading in factor 2 but loaded positively with 0.484 indicating that not everybody generally lack tables manners in that sense.

Factor 3 (expired food) shows only two loadings with 0.471 being the positive and -0.646 negative. The fact that these variables loaded highly only in these two variables is an indication that respondents are not generally consuming expired food for fear of health implications. Other variables loaded quite small which was why it was ignored.

Analysis of the correlation for eating and consumption behaviour of households:

The results of the correlation of the analysis for the eating and consumption behaviours of the respondents in Table 4 suggest that there seems to be no strong correlation between the different eating behavior variables that is a considerable degree of independence among these variables. However, the results suggest some patterns of weak correlation among certain variables. For example, putting leftover food in the refrigerator (Eb26) is correlated with Eb27 and Eb32 at 0.506 and 0.632, respectively. The results indicate, however that though respondents eat leftovers food, preference for freshly cooked food for is highly significant. Throwing food away because the taste is not good shows no correlation at all with eating freshly cooked food.

Food disposal and composting behaviour

Analysis of the correlation of food disposal and consumption behaviour:

The correlation of food disposal and composting behaviour of respondent shows almost similar pattern like that of eating behaviour as there is a degree of independents among various variables. There is no strong relationship among most variables. I do not separate food waste because it is not useful for any purpose again (Fdcb36) shows weak relationship with (Fdcb35) food waste could be used to feed animals correlates at 0.508 and 0.140. However, I am influence by

Table 4: Correlations of eating and consumption behaviour

Correlation	Eb25	Eb26	Eb27	Eb28	Eb29	Eb30	Eb31	Eb32	Eb33
Eb25	1.000	-	-	-	-	-	-	-	-
Eb26	0.025	1.000	-	-	-	-	-	-	-
Eb27	0.331	0.506	1.000	-	-	-	-	-	-
Eb28	-292	-358	-0.197	1.000	-	-	-	-	-
Eb29	0.240	-94	0.266	-0.061	1.000	-	-	-	-
Eb30	0.000	-501	-311	0.139	0.280	1.000	-	-	-
Eb31	0.310	0.193	0.435	0.038	0.154	-0.110	1.000	-	-
Eb32	0.116	0.632	0.450	-0.171	-0.128	-0.361	0.448	1.000	-
Eb33	0.083	-200	-0.179	-0.073	0.055	0.442	-0.221	-0.221	1.000

Table 5: Correlation of food disposal and composting behaviour

Correlations	Fdcb34	Fdcb35	Fdcb36	Fdcb37	Fdcb38
Fdcb34	1.000	-	-	-	-
Fdcb35	-0.002	1.000	-	-	-
Fdcb36	0.508	0.140	10.000	-	-
Fdcb37	-0.321	0.039	-0.337	1.000	-
Fdcb38	0.449	0.099	0.685	-0.038	1.000

Table 6: Food disposal and composting behaviour

Respondants	Factors	
	Food composting (F1)	Separate food waste (F2)
I separate food wastes from other waste (Fdcb34)	0.409	0.463
Food waste could be used to feed animals (Fdcb35)	-	-
I compost vegetable waste such as vegetables peelings and fruits peels (Fdcb36)	0.688	0.507
I do not separate food waste because it is not useful for any purpose again (Fdcb37)	-	-0.773
I am influence by my neighbors to practice food composting (Fdcb38)	0.885	-

Extraction Method = Principal Axis Factoring; Rotation Method = Varimax with Kaiser Normalization; Rotation converged in 3 iterations

my neighbors to practice food composting (Fdcb38) correlates positively with food waste could be used to feed animals at (Fdcb36) 0.449 and 0.685 and indication households following the part of neighbours in practicing good food waste management behaviour. Table 5 is the output of the result.

Exploratory factor analysis of food composting and disposal behaviour: Factor 1 (food composting), in Table 6 all the variables loaded positively in factor 1. Variable (Fdcb 38), i.e., I am influence by neighbors to practice food composting has a strong loading more than other variables with 0.885 while composting of vegetable and fruits peels (Fdcb36) is 0.688. Separation of food waste from others loaded with 0.405. The results indicate a strong positive attitude towards food waste composting and separation by respondents in both areas of study.

Factor 2 (separate food waste) composting of vegetable and fruits peel again loaded positively at 0.507 while separation of food waste and others loaded 0.463 in

this factor. Over all the results shows respondent apparent knowledge on food waste composting. Variable (Fdcb37), i.e., I do not separate food waste because is not useful loaded negatively at -0.773 on factor 2.

CONCLUSION

The consumption and disposal behaviour of households in these three areas are almost influence by the same factors. Consuming freshly cooked food seems to be the general food consumption pattern by households. However, eating freshly cooked food is what always compels respondents to keep their leftover food in the refrigerator to have it retain its freshness even after some days for consumption.

Eating of expired food tend to be avoided by respondents because of its health implication. However, it should generally be made known how long expired food could have health implications after its expiration date is due if consumed after then this could help reduce some edible food not to be wasted as respondents are also confused with the term “best before” and “expired date”.

Factors that brought about household food disposal are the respondent's general knowledge of food composting. It is very clear from the results that household understands vegetables peels and fruits peels are good for composting and could help increase fertility of soil. Attitudes and behaviour of neighbours towards pattern of disposal of food waste, also plays very significant role in sharpening respondent's attitudes towards positive good environmental behaviour. Neighbors who practice good environmental behaviour like having composting gardens at home are more likely to influence those neighbors who do not practice that and this could be seen in the results of the output as this show strong positive output.

As most respondents here understands the need for composting and practice good consumption behaviour, there is still need for the local authorities to spur this good attitude more future by providing different waste bins for each households for food waste and non food

waste as it practiced in developed countries like Sweden and even some nearby Asian country like South Korea. Edible food waste could be channel to food banks for those in the food insecurity brackets for distribution as it is done in the US and Australia. With this provisions, hence from the findings of this study that environment attitude of neighbors have significant influence within the neighborhood, there is no how those who do not have good disposal attitude will not be influence to change and become pro environment.

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