

# Household food wastage by income level: A case study of five areas in the city of Tshwane Metropolitan Municipality, Gauteng Province, South Africa

F.R. Ramukhwatho. Department of Environmental Sciences, UNISA, South Africa. [4humulani@gmail.com](mailto:4humulani@gmail.com)

R. du Plessis. Department of Environmental Sciences, UNISA, South Africa. [dplesr@unisa.ac.za](mailto:dplesr@unisa.ac.za)

S. Oelofse. Natural Resources and Environment, CSIR, South Africa. [SOelofse@csir.co.za](mailto:SOelofse@csir.co.za)

## ABSTRACT

Food waste is generated throughout the supply chain including at household level. Household waste contains a fairly large percentage of food in developing countries. This study assesses household food wastage in five selected areas in the City of Tshwane Metropolitan Municipality (CTMM). The main goal of the study was to assess food waste by income level and the reasons for wasting food. Household food wastage was assessed using questionnaires during face-to-face interviews. A total of 210 households participated in the study that used a purposive sampling method. Results showed that high-income households wasted the most food. The main reason why food is wasted, as reported by the respondents, is that they prepare too much porridge and rice.

## 1. INTRODUCTION

Globally, 30 - 50% of food produced for human consumption is wasted (Gustavsson et al., 2011). The growing population increase the demand for food and resource scarcity for the production of food as underscored by the recent drought in South Africa, will affect food availability. The issue of food waste is crucial because a large amount of resources such as energy, water, transportation and land required during food production and distribution stages is wasted if the food is wasted (Baker et al., 2009). The amount of food wasted equates to 250 km<sup>3</sup> of water and 1.4 billion hectares of land use (FAO, 2013). When food is wasted, it leads not only to wasted resources but also causes environmental impacts as a result of disposal. Methane generated during decomposition of food waste at landfill contributes to climate change and pollution (air and water (FAO, 2013). There is no single definition for food waste, while Gustavsson et al., (2011) and Griffin et al., (2009) define it as any waste that is raw, cooked, edible and associated inedible material (e.g. bones, egg shells, and fruit and vegetables peelings) generated during the preparation or consumption of meals or all food produced or purchased that is unused by humans.

Over several decades, global studies have been conducted assessing food waste in the supply chain and Lundqvist et al. (2008) estimated that 50% of food grown is lost before and after it reaches the consumers. According to Gustavsson et al (2011), developing countries waste less food than developed countries in the supply chain. On average sub-Saharan Africa and South and Southern Asia are estimated to waste 120 – 170 kg of food per capita per year, compared to 280 – 300 kg of food per capita per year in Europe and North America. Developed countries experience more food loss at the last stages of the supply chain e.g. in households and eating establishments (Gustavsson et al., 2011). However developing countries suffers more food loss at first stages of the supply chain due to impoverishment such as lack of advanced harvesting technologies, lack of transport and lack of storage coupled with harsh weather conditions (Parfitt et al., 2010). There is however a lack of empirical evidence on actual food wastage at household level in developing countries

Oelofse and Nahman (2013) estimated that in South Africa only about 4.14% of food waste occurs at post-consumer stages while the majority of food waste, 8.67 million tonnes per annum, is generated during agricultural production (26%), post-harvest handling and storage (26%), processing and packaging (27%) and distribution (17%). Although household food waste is likely to be only a small component of the overall food waste problem in South Africa, the total costs to society of household food waste are estimated at approximately R21.7 billion per annum, or 0,82% of the annual South African 2011 gross domestic product (GDP) (Nahman et al., 2012). Hosken, (2013) estimated that up to 12 million (24.5%) of the South African population go to bed hungry each day. Globally, food waste is a problem that is growing, costing a lot of money and consuming many resources (Payne, 2014). If the country avoids wasting food, there will be benefits to combat hunger and improve food security all around the world (Tukker et al., 2006).

Currently one-third of food produced globally is wasted or lost from farm to fork (FAO, 2011). The way food is prepared or cooked influences the amount of food discarded. Households cook, prepare and serve more than can be consumed (Quested & Johnson, 2009). Inappropriate storage of food in homes contributes to food waste at household level (Waste and Resources Action Programme (WRAP), 2007). Reducing the amount of food wasted is very important to attain sustainable food coordination, especially because it has been estimated that by 2050 the global population would have increased to 9 billion people (Gustavsson *et al.*, 2011). This means that if the amount of food wasted is not reduced, there will be a need to increase food production globally.

This paper focused on assessing food waste generated at household level. To achieve a better understanding of the complexity of food wastage, the income level and drivers of household food wastage were assessed.

### 1.1 Influence of income level in wasting food

Income level plays a pivotal role in food wastage (Skourides *et al.*, 2008). High-earning people are prone to buy more food than people earning less due to the degree of affordability (Skourides *et al.*, 2008). An economic factor such as income influences households to waste food (Skourides *et al.*, 2008), although Koivupuro *et al.* (2012) found no correlation between households' income levels and the amount of food wasted. A study conducted by Ramukhwatho *et al.* (2014) found that household income level has an impact on the amount of food wasted. In their study, the respondent households with a monthly income of less than R5 000 wasted more food than those with a higher monthly income (Ramukhwatho *et al.*, 2014). This may be due to the living conditions of the poor that may impact on their ability to preserve food.

However, a few studies report a correlation between income level and food wastage (Jones, 2003; Hamilton *et al.*, 2005 and Skourides *et al.* 2008).

### 1.2 Food waste disposal in South Africa

In South Africa, municipalities mainly collect household waste, which contains a fairly large portion of food waste, once a week for disposal at landfill. Waste from food establishments is typically collected on a daily basis and also taken to the landfill for disposal. South African landfills are reaching full capacity and there is limited disposal space available due to the large quantity of waste that is being disposed of (Oelofse, 2012). This has motivated the South African government to set a target in the National Waste Management Strategy to minimise waste to landfill by 25% by 2016 (National Waste Management Strategy, 2016). Madubula and Makinta (2012) explained that composting is another alternative way to extend landfill life span by diverting organic waste away from landfill and creating a useful product.

Composting as an alternative disposal method diverts waste from landfills and reduces potential environmental impacts by beneficiating waste materials from households thus reducing the impacts of greenhouse gas emission (USEPA, 2011). To minimise organic waste disposal, the Department of Environmental Affairs (DEA) (2013) encourages home composting as a way to divert food and garden waste from landfills, while producing products that will benefit individuals and the community at large.

## 2. METHODOLOGY

This study assesses household food wastage in selected areas in the CTMM with the main goal of assessing the reasons for food wastage with a focus on income levels.

### 2.1 Population and sample

In this study, the target population was people from the selected areas in the CTMM households aged from 18 to 70+ years. The study was designed by using a purposive sampling method, which belongs to a class of non-probability and is known as a convenience sampling technique. According to Babbie *et al.* (2001), a questionnaire is the appropriate method for collecting survey data in studies in which the objective is to obtain information from the respondents about their demographic data, behaviour, opinions and attitude. Although there are established questionnaires used for similar studies in developed countries, the questionnaire used for this study was customised to local conditions and approved by UNISA. The questionnaire was chosen because: (i) it was easy to minimise non-responses and maximise the quality of data collected; (ii) the presence of the interviewer made it easier for the respondent to either clarify answers or ask clarification of the questions on the questionnaire without researcher bias (Cohen *et al.*, 2000).

### 2.2 Data collection

Persons responsible for preparation of food in their houses were recruited to partake in the study. Appointments were made with the selected individuals and interviews were conducted accordingly. A research sample of 210 households voluntarily participants completed survey in 24 non-consecutive days using the face-to-face interviews.

### 2.3 Data analysis

The chi-square test is a test that is often applied to categorical data, i.e. data that is grouped into categories, which may or may not be ordered, and for which the number of occurrences within each category is counted or expressed as a proportion of the total. (For categorical data, the data is recorded as a category, as opposed to numerical data that is

recorded as measurements, which could, for example, be averaged for different groups in the data). The chi-square test determines whether differences in proportions between groups may be attributable to random differences between the groups or whether they represent a consistent, non-random pattern of differences. The chi-square test uses the chi-square probability distribution ( $\chi^2$ ) to calculate the probability value (or p-value). Such probability values could be calculated using pivot tables and the chi-square. The test function in Excel or a statistical software package can be used for this. In this study, the statistical software SAS was used to apply the chi-square test and determine the relevant p-values. Households were asked in the questionnaire when and why they threw away food; there was no list of reasons provided why households waste food. The researcher categorised all the reasons given by the households.

#### 2.4 Ethics and study limitations

The study was conducted according to UNISA's Policy on Research Ethics, in particular part 2 "Guidelines for research involving human participants" (UNISA, 2007) and ethical approval was also obtained from UNISA. All households' responses were treated confidentially and the use of the cell phone camera was explained. The questionnaire was written and conducted in English. There were, however, some limitations concerning the data collection; due to limited time and financial constraints, the sample of the survey was restricted to five areas in the CTMM. Since this study was limited to one municipality, it is not possible to generalise the findings to the whole of South Africa.

### 3. RESULTS AND DISCUSSION

#### 3.1 Respondents demographic profile

Table 1. Summary of respondents' demographic profile

Variable	Selection provided	% of respondents (n=210)
Gender	Male	42
	Female	58
Age range	18-20	0
	21-30	43
	31-40	31
	41-50	14
	51-60	8
	61-70	2
	>70	1
Level of Education	Unschooling	1
	Matric	31
	Diploma	30
	Degree	26
	Post graduate	11
Household size	1	11
	2	28
	3	26
	4	20
	5	9
	6	1
	7	3
	8	2
Monthly household income	R500-R5000	25
	R6000-R9000	20
	>R10 000	55

There were more females respondents (58%) than males (42%); the summary of respondents' demographic profile is shown in Table 1. More than 90% of respondents had some form of education (e.g. certificate, diploma and degree), while only 1% were unschooled (no form of education, no certificates). Most of the respondents who participated in this study were from 2-member households (28%), however the majority of the respondents (55%) had a monthly income of over R10 000. Age and gender are two relevant personal characteristics whose effects on food waste have been highly debated in the literature reviewed.

### 3.2 Household food wastage

Chi-square results for the different income categories and questions related to food wastage are shown in Table 2. Any p-value of < 0.05 is considered statistically significant, i.e. an indication of an underlying consistent, non-random pattern. Any p-value of > 0.05 is considered not statistically significant.

Table 2. Respondents indicating either to waste or not waste food

Income category		Do you waste food?		
		No	Yes	Total
R10000+	number	40	75	115
	%	35	65	
R500-R5000	number	35	17	52
	%	67	33	
R6000-R9000	number	12	31	43
	%	28	72	
Total		87	123	210
Test result:				
p-value	<.0001	statistically significant (p < 0.05) difference between income categories shown		

Table 2 shows that the majority of the respondents had a monthly income of over R10 000, followed by respondents receiving a monthly income ranging from R500 - R5 000 and respondents with a monthly income of R6 000 - R9 000. The chi-square results show that there were statistically significant differences at (p < 0.05) in the values of questions regarding whether respondents wasted food. The results indicate that 75 out of 115 (65%) high-income respondents admitted to wasting food, compared to 17 out of 52 (32%) low-income households and 31 out of 43 (72%) middle-income households. It can therefore be concluded that middle and high-income households are more aware of their food wastage than low-income households in this study.

### 3.3 Reasons for food wastage

Table 3. Reasons for household to waste food

		Reason for wasting food						
		Buying too much	Cooking too much	Food residue	Fruit and vegetables going off	Poor storage	Special offer	Total
R10000+	number	33	49	8	9	3	13	115
	%	29	43	7	8	3	11	
R500-R5000	number	11	15	4	3	5	14	52
	%	21	29	8	6	10	27	
R6000-R9000	number	12	11	3	5	2	10	43
	%	28	26	7	12	5	23	
Total		56	75	15	17	10	37	210
Test result:								
p-value	0,1348	not statistically significant (p > 0.05) no difference between income categories shown						

As presented in Table 3, 29% of respondents with a monthly income of R10 000+ wasted food because they bought too much. There was not much difference between income categories: 28% of respondents in the R6 000 - R9 000 and 21% in the R500 – R5 000 categories wasted food for this reason. Twenty seven percent of respondents with a monthly income of R500 - R5 000 wasted food because of special offers, and only 11% with a monthly income of R10 000+ wasted food for this reason. Respondents (43%) with a monthly income of R10 000+ wasted food due to cooking too much. 26% and 29% of respondents with a monthly income of R6 000 - R9 000 and R500 - R5 000 respectively, wasted food for this reason. 10% of respondents with a monthly income of R500 - R5 000 wasted food because of poor storage.

The study found that respondents with a monthly income of R500 - R5 000 had the highest percentage (8%) of respondents who wasted food because of food residue. The range between the categories, however, was very small and ranged between 7 and 8%. Respondents with a monthly income of R6 000 - R9 000 and R10 000+ had the lowest percentage (7%) of respondents who wasted food because of food residue. The highest percentage, 12% of respondents with a monthly income of R6 000 - R9 000 wasted food because of fruit and vegetables going off. There was no statistically significant difference in the results of the questions on the reasons for wasting food.

It is however notable that overall (75 out of 210) 35.7% wasted food due to cooking too much, (56 out of 210) 26.7% buy too much food and (37 out of 210) 17.6% respond to special offers which result in food wastage.

### 3.4 Household food waste disposal

Table 4. Food waste disposal methods

Income category	Food waste disposal method				
		Fed to pets	Home compost	Household garbage bin	Total
R10000+	number	5	1	109	115
	%	4	1	95	
R500- R5000	number	10	3	39	52
	%	19	6	75	
R6000- R9000	number	15	1	27	43
	%	35	2	63	
Total		30	5	175	210
Test result:					
p-value	<.0001	statistically significant (p < 0.05) difference between income categories shown			

As presented in Table 4, households with a monthly income of R500 - R5 000 had the highest number of respondents who composted their food waste (6%). 2% of respondents with a monthly income of R6 000 - R9 000 composted their food waste and only 1% of those with a monthly income of R10 000+ did so. It can therefore be concluded that there is a correlation between income level and food waste disposal methods and the difference between income levels was statistically significant. Households with a monthly income of R6 000 - R9 000 had the highest number (35%) of respondents who fed their food waste to pets. Households with a monthly income of R10 000+ had the lowest number (4%) feeding food waste to pets. 95% of respondents with a monthly income of R10 000+ relied on the household garbage bin for their food waste disposal, followed by 75% with a monthly income of R500 - R5 000 and 63% with a monthly income of R6 000 - R9 000. Overall, 175 out of 210 (83%) of households dispose of their food waste to the household garbage bin.

## 4. CONCLUSION

The results presented in this study show that 58% of the respondents were females and 42% were males. This is an indication that women are more responsible for the household groceries and food preparations. The most dominant age group that participated in this study was 21 - 30 years (43%). The study found that most (55%) of the respondents had a monthly income of R10 000+. The higher number of households with formal education may have contributed to their better lifestyle; this shows that there are benefits of acquiring education. One clear benefit is increased income potential as a result of better jobs.

Though more households with a higher income admit to wasting food, there is not much difference between low and medium income. Households with a monthly income of R500 - R5 000 admits to waste more food than households that have an income of more than R5 000. The statistical chi-square test was applied and a probability value (p-value) of < 0.0001 was obtained, indicating that the difference between income categories was more than just a random pattern. (Note that any p-value of < 0.05 is considered statistically significant, i.e. an indication of an underlying consistent, non-random pattern.)

Six reasons that drive households to throw away food were reported without being prompted. These are: cooking too much, buying too much, special offers, fruit and vegetables going off, food residue and poor storage. The study found that the main driver of wasting food is cooking too much. Households prepare more than what their family members can consume. This may be symptom of South African culture, where provision is made for the unexpected visitor. Changing practices relating to culture may prove to be challenging, but given the large majority of responses, it may be worthwhile to raise awareness of this situation with the public at large.

The study presented three methods that respondents could employ to dispose of their food waste. The majority of the respondents (83%) in this study relied on the household garbage bin, i.e. municipal waste collection services. 14% of respondents fed their food waste to pets and 3% of respondents composted food waste for their garden. There is thus huge potential to increase household composting as a means of diverting food waste away from landfill.

## RECOMMENDATIONS

The findings of this study reveal that for households to reduce the amount of food waste, several recommendations can be made which will lead to better management of households' food waste in the CTMM and possibly in all other municipalities in South Africa. The outcomes of this study have led to the following recommendations:

1. It is recommended that households prepare only the amount of food that they can consume and finish. It may require education on portion sizes and general meal planning at households.
2. The household garbage bin as the main food waste disposal method provides an opportunity for CTMM to raise awareness on composting as an alternative to landfills. The CTMM may consider using food waste as a biofuel input material for bio digesters to generate gas such as electricity. The CTMM must prohibit food waste from being disposed of with general waste in the municipality bins because it ends up at the landfills that contributes to environmental pollution; household food waste should be stored and collected separately for recycling. It is recommended that food waste separation at source be started in household kitchens.
3. This is an opportunity for the CTMM to raise awareness of reducing household food waste and to educate people on the impacts of food waste. Additionally, the CTMM needs to raise awareness to encourage households to recycle food waste and the benefits of doing so.

## 5. ACKNOWLEDGEMENTS

5.1 The University of South Africa Masters and Doctoral Support Program funded this research.

## 5.2 REFERENCES

- Babbie, E., Mouton, J., Vorster, P. & Prozesky, B. (2001). *The Practice of Social Research*, South African Edition, London: Oxford University Press, pp 230.
- Baker, D., Fear, J. & Denniss, R. (2009). What a Waste - An Analysis of Household Expenditure on Food. The Australian Institute, Available: <http://www.tai.org.au/node/1580> food ISSN: 1836-9014 [accessed 08 March 2014].
- Barr, S. (2002). Household waste in social perspective: Values, attitudes, situation and behaviour. Aldershot: Ashgate.
- Buzby, J.C. & Hyman, J. (2012). Total and Per Capita Food Loss in the United States. *Food Policy*, 37: 561–570. Available: <http://dx.doi.org/10.1016/j.foodpol.2012.06.002> [accessed 11 May 2014].
- Cohen, L., Manion, L. & Morrison, K. (2000). *Research methods in education*. 5<sup>th</sup> edition. London: Routledge Falmer, pp 44-171.
- DEA. (2013). *The waste information report*. Department of Environmental affairs Pretoria: pp12.
- FAO. (2013) Urgent collaboration required on food wastage. Food and Agriculture Organization for the United Nations, Rome. [Online] [WWW document]. URL <http://www.fao.org/news/story/en/item/202914/icode/> (accessed on 1 July 2014).
- Food and Agricultural Organization (FAO). (2011). Global Food Losses and Food Waste: Extent, Causes and Prevention. Available: <http://www.fao.org/docrep/014/mb060e/mb060e.pdf> [accessed 13 June 2014].
- Griffin, M., Sobal, J. & Lyson, T.A. (2009). An analysis of a community food waste stream: *Agriculture and Human Values* 26: 67–81. Available: <http://dx.doi.org/10.1007/s10460-008-9178-1> [accessed 11 November 2013].
- Gustavsson, J., Cederberg, C., Sonesson, U., Otterdijk, R. & Meybeck, A. (2011). Global Food Losses and Food Waste: Extent, Causes and Prevention. Food and Agriculture Organization of the United Nations. Available: <http://www.fao.org/docrep/014/mb060e/mb060e00.pdf> [accessed 12 June 2012].
- Hamilton, C., Denniss, R. & Baker, D. (2005). Wasteful Consumption in Australia. Discussion paper number 77, March, Manuka, Australia: The Australia Institute. Available: [http://www.tai.org.au/documents/dp\\_fulltext/DP77.pdf](http://www.tai.org.au/documents/dp_fulltext/DP77.pdf) [accessed 11 October 2012].
- Hosken, G. (2013). Twelve Million going to Bed Hungry in SA. Available: <http://www.timeslive.co.za/thetimes/2013/01/30/twelve-million-going-to-bed-hungry-in-sa> [accessed 06 February 2013].
- Jones, T. (2003). Using Contemporary Archaeology and Anthropology to Understand Food Loss in the American Food System. Unpublished paper. Tucson: Bureau of Applied Research in Anthropology, University of Arizona, pp42

- Koivupuro, H.K., Hartikainen, H., Silvennoinen, K., Katajajuuri, J.M., Heikintalo, N., Reinikainen, A. & Jalkanen, L. (2012). Influence of socio-demographical, behavioural and attitudinal factors on the amount of avoidable food waste generated in Finnish households. *International Journal of Consumer Studies*, 36 (2): 183–191. Available: <http://dx.doi.org/10.1111/j.1470-6431.2011.01080.x> [accessed 12 January 2015].
- Lundqvist, J., De Fraiture, C. & Molden, D. (2008). Saving Water: From Field to Fork – Curbing Losses and Wastage in the Food Chain. SIWI Policy Brief. Stockholm: Stockholm International Water Institute.
- Madubula, N. & Makinta, V. (2012). Submission for the 2013/14 division of revenue technical report. Financial and Fiscal Commission, chapter 6, pp 199-236.
- Nahman, A., De Lange, W., Oelofse, S. & Godfrey, L. (2012). The costs of household food waste in South Africa. *Waste Management*, 32: 2147–2153.
- Oelofse, S. & Nahman, A. (2013). Estimating the magnitude of food waste generated in South Africa. *Waste Management & Research*, 31 (1): 80-86.
- Oelofse, S. (2012). South African Households in Large Centres to Separate Household Waste by 2016. Available: [http://www.csir.co.za/enews/2012\\_nov/01.html](http://www.csir.co.za/enews/2012_nov/01.html) [accessed 07 January 2014].
- Parfitt, J., Barthel, M. & McNaughton, S. (2010). Food waste within food supply chains: Quantification and potential for change to 2050. *Philosophical Transactions Royal Society B: Biological Sciences*, 365: 3065-3081. Available: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2935112/> [accessed 15 March 2014].
- Payne, K.K. (2014). The consequences of food waste. *Student Pulse* 6 Available: <http://www.studentpulse.com/a?id=890> [accessed 02 January 2015].
- Quested, T. & Johnson, H. (2009). Household food and drink waste in the UK: A report containing quantification of the amount and types of household food and drink waste in the UK. Banbury: Waste and Resources Action Programme, pp 4.
- Ramukhwatho, F.R., Du Plessis, R. & Oelofse, S. (2014). Household food wastage in a developing country: A case study of Mamelodi Township in South Africa. WasteCon 2014, 22nd Waste Management Conference and Exhibition: Wired for Waste - Value, Grow, Sustain, Somerset West, 6-10 October, pp 468 – 475.
- Skourides, I., Smith, S.R. & Loizides, M. (2008). Sources and factors controlling the disposal of biodegradable municipal solid waste in urban and rural areas of Cyprus. *Waste Management & Research*, 26: 188-195.
- Tukker, A., Eder, P. & Suh, S. (2006). Environmental impacts of products: Policy relevant information and data challenges. *Journal of Industrial Ecology*, 10 (3): 183–198.
- UNISA. (2007). Policy on Research Ethics. Available: [http://www.unisa.ac.za/contents/research/docs/ResearchEthicsPolicy\\_apprvCounc\\_21Sept07.pdf](http://www.unisa.ac.za/contents/research/docs/ResearchEthicsPolicy_apprvCounc_21Sept07.pdf) [accessed 27 April 2011].
- US Environmental Protection Agency (USEPA). (2011). Reducing Greenhouse Gas Emissions through Recycling and Composting. Available: [http://www.epa.gov/region10/pdf/climate/wccmmf/Reducing\\_GHG\\_s\\_through\\_Recycling\\_and\\_Composting.pdf](http://www.epa.gov/region10/pdf/climate/wccmmf/Reducing_GHG_s_through_Recycling_and_Composting.pdf) [accessed 13 October 2014].
- Waste and Resources Action Programme (WRAP). (2007). Understanding Food Waste: Research Summary. Available: [http://www.wrap.org.uk/sites/files/wrap/FoodWasteResearchSummaryFINALADP29\\_3\\_\\_07.pdf](http://www.wrap.org.uk/sites/files/wrap/FoodWasteResearchSummaryFINALADP29_3__07.pdf) [accessed 13 June 2014].