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Reflections on the Influence of Family Demographics on Food Waste Generation among the City of Tshwane Households, Republic of South Africa

Machate Machate

Abstract

This chapter presents the influence of households' demographics on food waste generation. A mixed method research approach consisting of meta-analysis, survey (structured interviews), and experimental were used to collect opinions and weigh the amount of waste generated in each household. Although not all demographic variables were investigated, the influence of: (1) family size, (2) household monthly income, (3) employment status, (4) educational level, and (5) age of respondents on food waste generation were analyzed. The results of the study confirmed that age and family size are positive factors that influence the amount of food waste generated in households of the City of Tshwane, as opposed to the level of education, employment status, and monthly income levels. It should be noted, however, that this study does not conclusively exclude the other factors as not having an influence in food waste generations. However, their influence in the current food waste generation quantities was not conclusive. Further studies with larger sample size are thus recommended.

Keywords: food waste, waste management, food losses, causes of food wastage, household demographics waste socioeconomic profile, household

1. Introduction

The complexities of food waste generation in its entirety are a subject of social and economic profile of the generator. Evidence from Gustavsson et al. [1], one of the leading global authors in food waste management, shows that food waste generation increases proportionally with the levels of development. As a result, developed countries generate more food waste than their developing counterparts. In this study, the influence of these development profiles at households' level is investigated because households are identified as the biggest food waste generators than other institutions [1]. The European Commission [2] estimates that households are responsible for 42% of the total amount of food waste generation, while the retail (including wholesale) contributes 5%, and food service and manufacturing sectors contribute 14 and 39%, respectively.

Thyberg et al. [3] points out that the amount of food waste generation increases over the years. On average, the sub-Saharan Africa and South Asia generate 145 kg of food waste per capita per year as compared to 290 kg in Europe and North America [1]. Dhia et al. [4] found a difference of 50-170 kg of food waste generated per person per year between developed and developing countries. In the sub-Saharan African countries, FAO [5] estimated that on average a person produced 145 kg of food waste generation per year in 2011. Using statistics on available food waste generation rates per person per year from 14 developed and developing countries, **Figure 1** presents the profile.

Food waste generation ranges from 0.12 to 0.4 kg per person per day, with a range of 0.28 kg as compared to 0.06–0.18 kg, with a range of 0.12 kg in developing countries. These statistics confirm the previous findings by Gustavsson et al. [1] about high food waste generation per person per day in developed than developing countries.

Available literature also shows that development levels of countries differentiate the stages at which more food wastes are generated, as evident from Abeliotis et al. [20] and Graham-Rowe et al. [21]. The former studies confirmed Gustavsson et al. [1] to the fact that developing countries generate more food waste during the early stages of the food supply chain, as compared to developed countries. The generation of food waste at early stages of food supply chain in developing countries proves to be a contributing factor of the high prevalence of hunger in these countries, as opposed to the high generation of food waste at later stages from developed countries. The former is attributed to oversupply of food and high quantity of leftover food from these socioeconomically well-off households.

Parfitt et al. [22] attributes food wastage in developing countries to the lack of advanced harvesting technologies, transport, storage, and harsh weather conditions. It can be deduced from Parfitt et al. [22] that farmers in developing countries loose more food at different agricultural stages ranging from harsh weather conditions at the farm, during harvesting, and until during storage due to partly lack of means of protecting their agricultural harvest, including preservation and processing technologies. The socioeconomic strength of these farmers and the affordability of the households who are the targeted market for these food products remain central to the challenge. This vicious poverty circle entraps both the farmer and the target end user of the food products.

Factors that differentiate households in developing countries from their developed counterparts, which are viewed as drivers of food waste generation, are the socioeconomic factors. For example, the affordability, levels of technological sophistication, levels of education, etc. Hence, Gustavsson et al. [1] concluded that

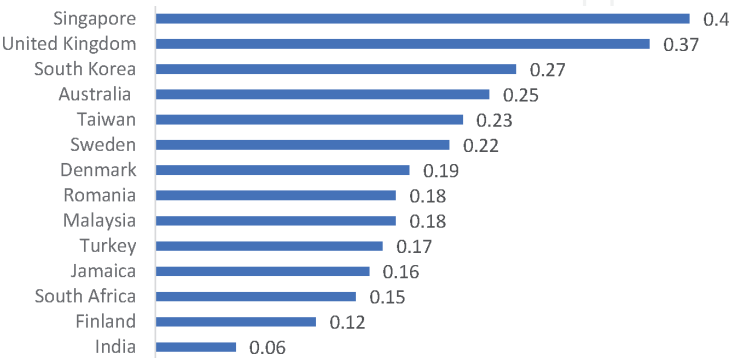


Figure 1. Food waste generation rate per person per year from 14 countries. Source: Compiled from Liu [6], Franke [7, 8], Katajajuuri et al. [9], WRAP [10], Lisa [11], Taiwan EPA [12] and Danish Agriculture and Food Council [13], Ioannis et al. [14], Zeeda and Keng [15], Yan [16], Oelofse and Nahman [17], Meghan [18], and Manipadma [19].

households in developed and developing countries produce more food wastes at different stages of the food supply chain.

In addition to the influence of household socioeconomic factor in food waste production, Munesue et al. [23] emphasizes the fact that food production involves the use of variable input resources such as land, water, energy, etc. At a household level, the accessibility of these resources also depends on the socioeconomic capacity of each household. Similarly, food wastage is also attributable to multiple social, economic, and environmental challenges facing communities, that is, hunger, poverty, land degradation, water carbon footprint, climate change, and others. Thus food waste generation has a significant influence on major global sustainability and climate change-inducing pollutants such as carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), and sulfur hexafluoride (SF₆) per fluorinated compounds (PFCs) and hydro fluorocarbons (HFCs) [24]. Hence, it became critically important for this study to investigate and report on factors that influence household generation of food waste.

The influence of five selected demographic variables (age, family size, household income, employment status, and educational levels) on food waste generation is presented in this study. The rationale beyond the selection of these variables is because a precedent on their influence on waste management in general, has been established. However, the influence of these household demographic factors on food waste has not been established. Hence the focus of this study on this specific category of waste.

1.1 Influence of age

Jörissen et al. [25]; Secondi et al. [26] and Melbye et al. [27] independently concurred that age influences the amount of food waste generation. According to these authors, older people waste less food than the younger ones. Melbye et al. [27] define old age as people at the age of 65 years or older. The reasons associated with less food waste generation are that older people are more aware of saving and recycling, because of their past and experience times of scarcity [27]. Evidence from the above studies show that households with older people as compared to young ones produce more food waste than those with older family members.

1.2 Influence of family size

According to Canali [28], the number of people in a household is associated with the amount of food wasted per person. In previous studies by Jörissen et al. [25] and Parizeau et al. [29], it was concurrently and independently concluded that bigger size households wasted less food than their smaller counterparts on a per capita basis. Based on the latter study, households with one person wasted more food per capita than the ones with bigger sizes [25]. Although affordability of bigger families and other factors could also be responsible for the food waste generation levels, they remained untested and are outside the focal point of this study.

1.3 Influence of levels of education, employment status, and household income

Inconsistencies in the findings of different studies about the influence of household income on food waste generation were observed. A study by Porpino et al. [30, 31] concluded that low-income households generate more food waste. In contrast, Hamilton et al. [32], Skourides et al. [33] and Gustavsson et al. [1] concluded that higher-income households waste more food than lower-income ones. The argument in support of high household income being proportional to high food waste generation is supported by Gustavsson et al. [1] and Pearson et al. [34], who argue that in developed countries, consumers buy more food than they need, whereas consumers in developing

countries buy smaller amounts of food each time they shop. This practice is known to influence the way food is prepared or cooked and, subsequently, the amount of food discarded as waste. Quested and Johnson [35] argue that households prepare and serve more food portions than what they are able to consume, which results in more left-overs being generated. Rathje and Murphy [36], Pekcan et al. [37] and Evans [38, 39] concluded that household income does not only influence food waste generation but the generation of waste in its broad sense.

Inappropriate or lack of storage facilities for raw and cooked food in low-income households contribute to food waste at household level [40]. The household income levels are also interlinked with the levels of education and employment status of household members. Hence, these factors are compounded in their exploration in this study.

2. Materials and methods

A total of 122 females and 88 males participated in this study, representing a total of 210 households across five suburbs in the City of Tshwane (Atteridgeville, Lyttleton, Montana, Olivenhoutbosch and Silverlakes). Suburbs were purposefully selected based on their differences in income levels or status. Individual households within each suburb were selected based on convenience (accessibility of elders, wiliness of participants to be interviewed, and the availability of a competent respondent within a household). Structured interviews were used for all primary data collection, except for the physical weighing of food waste generated by each participated household, which followed experimental research design.

Meta-analysis (in-depth exploratory and explanatory analysis of authoritative secondary data sources) was used to collect and analyses secondary data. Meta-analysis studies primarily helped with the conceptualization and formulation of research variables which were investigated in this study. These secondary data sources were randomly selected through online search, using content analysis method. Subsequently, selected a range of keywords, based on their frequency appearance from the in-depth literature analysis were used to determine relevance of a secondary source for inclusion in this chapter. Following Creswell [41] and Leedy and Ormrod [42], qualitative and quantitative data (secondary and primary) data from literature sources and structured interviews were used to determine the common household demographics that influence food waste generation in general. Data analyses were descriptive and presented through qualitative figures and table in accordance with Keller [43]. Semiquantitative analysis of the factors that influence food waste generation was conducted as per Semenya and Machete [41, 44].

3. Results and discussion

These results are based on mixed methods of meta-analysis, structured interviews, and experimental research. The influence of five major household demographic factors (age, family size, household income, employment status, and educational levels) on food waste generation is presented in this study.

3.1 Influence of age on food waste generation

Figure 2 presents the relationship between age of respondents and food waste generation. (a) Age profile of respondents, (b) Correlation of age and food waste generated.

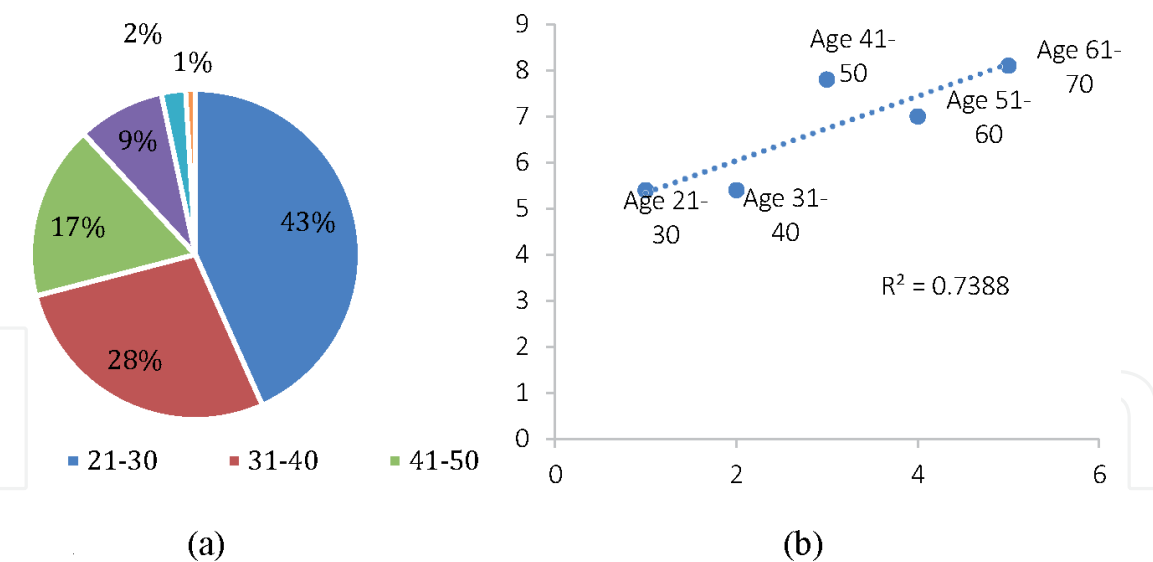


Figure 2.
Influence of age on food waste generation per kilogram per day.

The respondents' age ranged between 21 and 71 years. Majority of the respondents (43%) were between the ages of 21 and 30 years, followed by 31–40 at 28% (**Figure 2(a)**). It is evident from these results that most households were represented by the youth (age 35 and below). In line with earlier discussions of the relationship between age and food waste generation rates, these results suggest that more food waste is generated in the households with the study area. These assumptions were confirmed in **Figure 2(b)** which shows the correlational results between age and the amount of food waste generated by households. The results confirm appositive and strong correlation between age and amount of food waste generation at regression coefficient of 0.7.

3.2 Influence of family size on food waste generation

There is a correlation between family size and food waste generation rates (**Figure 3**).

According to the results in **Figure 3(a)**, households who participated in this study had between 1 and 8 2 family members at different ratios. In **Figure 3(b)**, the results show that there is a positive but weak correlation between family size and the amount of food waste generation per household. The results confirm the previous findings by Canali [28], Jörisen et al. [25], and Parizeau et al. [29].

3.3 Influence of household income on food waste generation

Figure 4 presents the influence of household income on food waste generation in the five City of Tshwane suburbs.

Three broad household income groups were categories from total household income responses of the 210 households' sampled (**Figure 4(a)**). According to the results, 55% of the households earned more than ZAR9001 per month, while the remaining 21 and 24% earned between ZAR1-5000 and ZAR5001-9000, respectively. Adopted from Semanya and Machete [45], the affordability of households was estimated by calculating:

“the 2018 minimum monthly threshold is determined using the World Bank's [46] updated global poverty line of \$1.90. The following formula is used:

$$Y = X \times \$1.90 \tag{1}$$

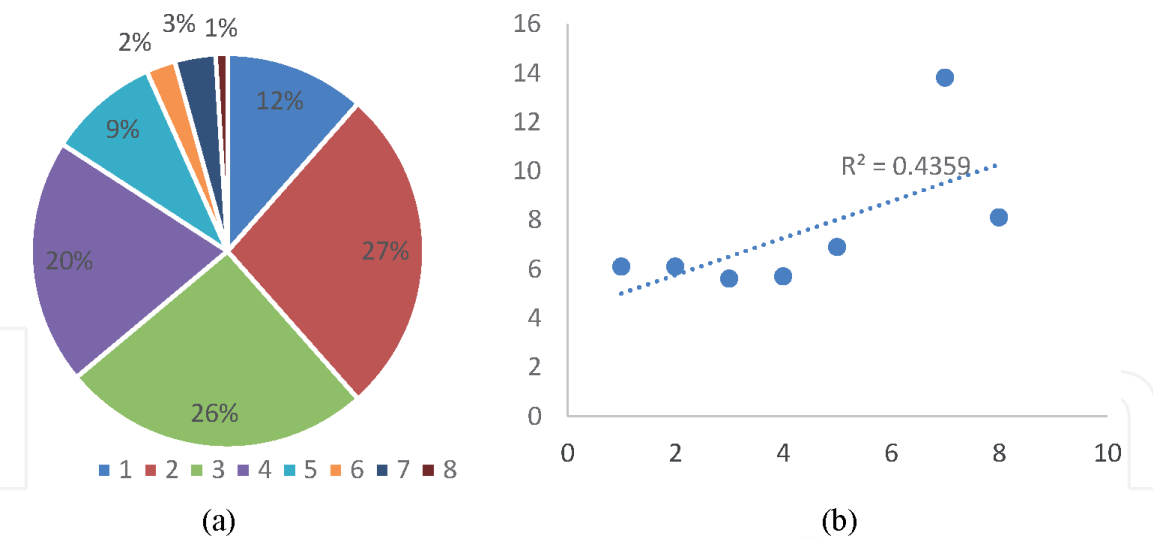


Figure 3. Influence of family size on food waste generation. (a) Family sizes of households, (b) correlation of family size and food waste generation rate.

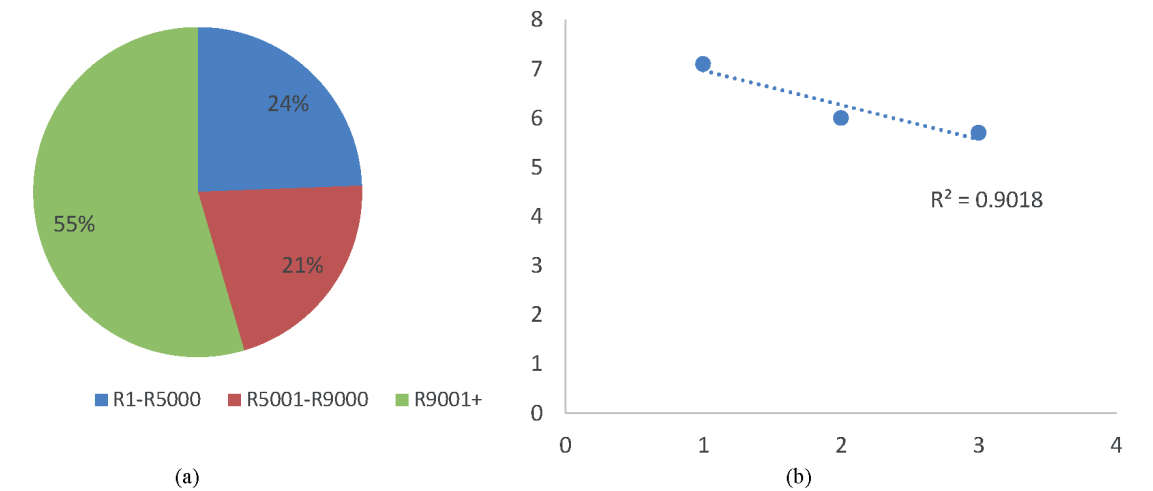


Figure 4. Influence of household income on food waste generation. (a) Monthly households income levels, (b) correlation of household income and food waste generation.

where Y is the 2018 threshold, X is the 2001 threshold used by Schwabe [47] and \$1.90 is the international poverty line set by the World Bank [46] based on purchasing power parity. According to the World Bank [46], the global poverty line is the acceptable minimum amount a person can live on per day in any country considering exchange rates.”

Consequently, Semenya and Machete [45] record that the affordability of these households is as per **Table 1**.

Ultimately, in **Figure 4 (b)**, this study presents a strong, but negative correlation between household income and the amount of food waste generated by the households in the five selected suburbs in the City of Tshwane. These results imply that the higher the household’s monthly income, the lesser the amount of food wastes generated. Significant number of possibilities can be attributed to these findings, that is, the educational levels, employment status, ages, and other demographic factors of individual household members. The findings of this study are contrary to most previous studies. However, these results are consistent with the findings of Koivupuro et al., (2012) who found no correlation between households’ income levels and the amount of food wasted. Similarly, looking at the family sizes and income levels, this study can reveal that more than 50% of the sampled households lived below poverty line.

Family size	R (2001)	R (2013)	R (2018/9)
1	R 587 (587)	R 1174 (1174)	R 1115 (1115)
2	R 773 (387)	R 1546 (773)	R 1469 (735)
3	R 1028 (343)	R 2056 (685)	R 1953 (651)
4	R 1290 (323)	R 2589 (645)	R 2451 (613)
5	R 1541 (308)	R 3082 (616)	R 2928 (586)
6	R 1806 (301)	R 3612 (602)	R 3431 (572)
7	R 2054 (293)	R 4108 (587)	R 3903 (557)
8+	R 2503 (313)	R 5006 (626)	R 4756 (595)

Source: Adopted from Semenya and Machete [45].

Table 1.
South African minimum monthly affordability standards in 2018/9.

3.4 Influence of household employment profile on food waste generation

Figure 5 presents the relationships between employment status of households and food waste generation.

The study found that 72% of respondents were employed, 13% self-employed, and others 15%represents housewives (house executives), retired, students and other. Consequently, **Figure 5(b)** shows a weak and negative correlation between households’ employment status of household members and food waste generation. Interestingly, the results suggest that employed people generate less food waste followed by self-employed. From these results, it can be noticed that house executives (housewives), students, and other categories were the ones generating higher quantities of food waste than those who were employed and self-employed. A number of scenarios may be responsible for the above, namely: (1) the main food waste generators may be the people who prepare food in the households, (2) the main waste generators may be those who spend most of their time within the household than those who leave home in the morning and only come back late after work, and (3) the main waste generators may be those who are not responsible for making food available in the households.

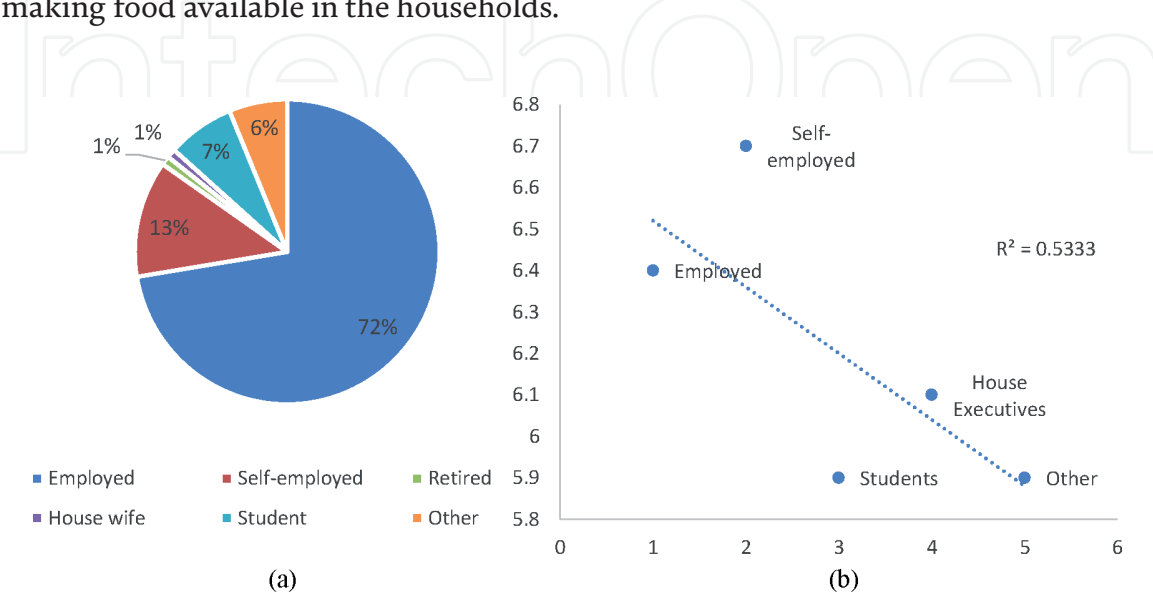


Figure 5.
Influence of employment status on food waste generation. (a) Households’ employment profiles, (b) correlation of household employment status and food waste generation rate.

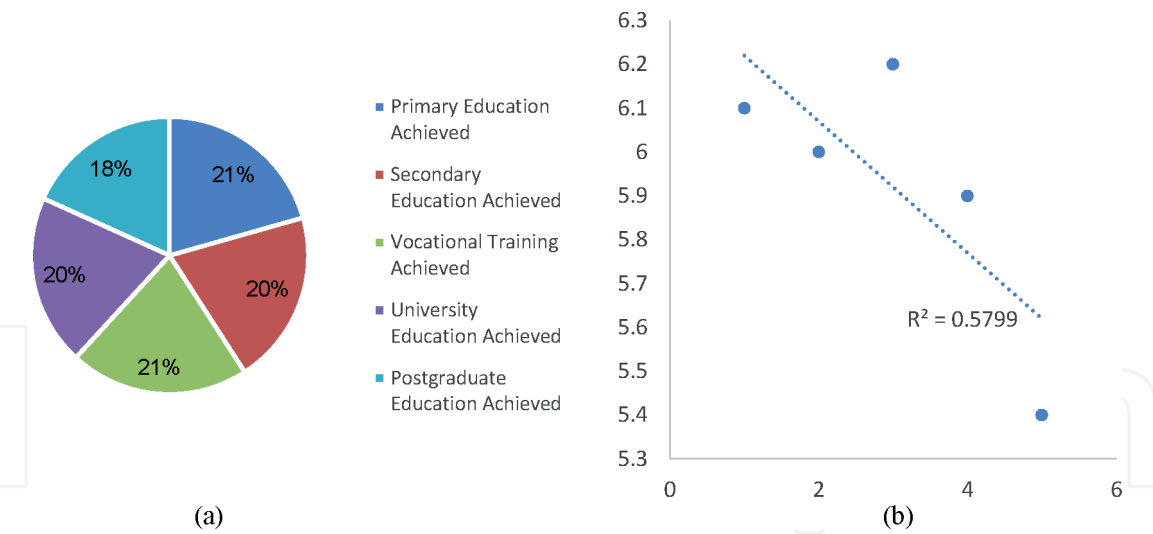


Figure 6. Influence of household educational levels on food waste generation. (a) Educational levels of respondents, (b) correlation of households' educational levels on food waste generation.

3.5 Influence of household educational level on food waste generation

The last demographic variable investigated in this study was the influence of educational level of respondents (households) on food waste generation (**Figure 6**).

These results show only 21 and 20% of the population achieved primary (grades 1–7) and secondary (grades 9–12) as their highest level of education. The remaining 59% of the population achieved vocational training and university undergraduate and postgraduate levels. No correlation was proven between educational levels of respondents and the amount of food waste generated. More than 90% of the respondents had some form of education (e.g., matric, diploma, and degree), while only 1% was unschooled (no form of education and no certificates).

4. Conclusion

This chapter presented the influence of households' demographics on the amount of food waste generated by five suburbs in the City of Tshwane. In-depth analysis (meta-analysis) of secondary data sources, structured interviews, and experiments were the mixed methods used for data collection and analysis. Through meta-analysis, five major household variables (potential factors) were identified and investigated, namely, (1) family size, (2) monthly household income, (3) employment status, (4) educational level, and (5) age. The results confirmed that age and family size are positive factors that influence the amount of food waste generated in households in contrast to households' levels of education, employment status, and monthly income levels. However, this study does not conclusively exclude levels of education, employment status, and monthly income levels as non-potential factors that may influence food waste generation. Instead, these factors may not be primary drivers of food waste generation. They may be secondary factors, meaning they are triggers of other factors that influence food waste generation. For example, educational levels may influence household income and household head's decision about family size. Similarly, the employment status of individual household members influences the household monthly income, which ultimately has proven to directly influence food waste generation. Given the sample size of the current study and mixed results thereof, it is recommended that further studies with bigger sample size and multi-variable households be investigated to validate the outcomes of the current study.

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