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Socio-economic factors affecting household solid waste generation in selected wards in Ife central Local Government area, Nigeria

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Solid waste is generated by man through domestic, commercial, industrial and agricultural activities. With the increase in technology, industrial activities and population, solid waste generation has consequently been increasing over the years. In this paper, the socio-economic factors that affect household solid waste generation in some selected wards in Ife Central Local Government Area were presented. The quantities of household solid waste generation were monitored continuously (weekly) for two months. The solid wastes collected were weighed using a weighing scale. A total of one hundred and fifty four (154) questionnaires were administered to selected households to elicit information on the socio-economic characteristics of the respondents. The data collected were analyzed statistically. The study revealed that gender, educational background and family size are important socio-economic factors affecting household solid waste generation. The highest overall mean weight of solid waste generated by households was 5.5kg (1-10kg) per week. Educational background (X^2 =9.950, $p < 0.05$) and family size (X^2 = 20.539, $p < 0.05$) were found to significantly affect household solid waste generation. The study concluded that there are variations in the level of household solid waste generation across different socio-economic status.

Keywords: household, socio-economic factors, seasonal variations, solid waste generation

INTRODUCTION

Solid wastes have been defined by several authors as unused, unwanted, useless and discarded materials with insufficient liquid content to be free flowing generated through human activities (United States Environmental Protection Agency, 1971; Rushbrook and Pugh, 1999; Ogwueleka, 2009; Oke et al., 2010). Solid waste is often called Municipal Solid Waste (MSW) that consists of all the solid and semisolid materials discarded by a community (Peirce et al., 1990). These generally originate from households, commerce and trade, small businesses, office buildings and institutions such as schools, hospitals, government buildings and sometimes it includes wastes from parks and gardens (European Commission, 2003). Hornby (2006) defines household as

a domestic unit consisting of the people who live together in one house. The above definition of household implies that members of a household may include male and female, young or old. Household solid waste therefore entails all forms of solid waste generated by the members of a household living together. In essence, household solid waste consists of by-products of activities and consumption.

According to Rushbrok and Pugh (1999), household (residential) solid waste was defined as products from household activities which include food preparations, sweeping, clearing, garden waste, old clothing, abandoned equipments and news print, paper, plastic, metals, glass and packaging materials among others. Studies on the quantity of municipal solid waste generation in urban cities of the world indicate that households account for the largest percentage of solid waste generation (Koushki and Al-khaleefi, (1998);

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Encyclopedia of public health, 2006; Afon, 2007; Ogwueleka, 2009; United State Environmental Protection Agency, 2012). Also, Babayemi and Dauda (2009) observed that out of the total solid waste generated in Ibadan, 66.1% are from domestic sources while 20.3% and 11.4% are from commercial and industrial. In view of this, this work is therefore designed to identify the socio-economic factors responsible for the generation of household solid waste.

Literature has shown that there are many factors which affect solid waste generation globally. These factors are socio-economic, socio-cultural, and political factors. A number of socioeconomic variables which affect the quantity of solid waste generation significantly as identified by different authours (Collins and Downes, 1977; Filani, 1983; Adedibu, 1984; Koushki and Al-Khaleefi, 1998; Afon, 2007; Nwachukwu, 2010) are land use, family size, employment and occupation type, income, education status, and age of the head of the household as well as seasonal variations in agricultural production. A study carried out by Afon (2007) on the patterns of household solid waste generation in three distinct ecological zones (the traditional core, the transitional and the suburban) in Ogbomoso, Nigeria reveals that the quantities, types and nature of solid waste generation vary across different housing types. Afon (2007) observed that education, income and social status affect household solid waste generation. He stated that as these socio-economic factors increase, per capita waste generation declines, especially with regard to heavier organic waste products which accounted for more than three-quarters of the total waste generated in the study area.

Adedibu (1983) and Afon (2007) show that the level of education significantly affects the quantity and composition of waste generated in Nigeria. Also, changes (increase or decrease) in the earning capacity of individuals influence the propensity of buying more goods which affects the quantities of solid waste generation. Hale (1972), Alakinde (1987) and Nwachukwu (2010) noted that increase in national income could increase income accruing to individual which contribute immensely to the high level of refuse generation in urban centres. Boadi and Kuitunen (2005) reported that as income of the residents' increase, waste generation also increases in Ghana however; Afon (2007) observed that as households' income increase, per capita waste generation decline from the core zone to the transitional and suburban zones in Nigeria. Age and numbers of people living in a household can also affect the quantity of solid waste generated. Theoretically, the higher the size of household and their age the higher the household solid waste generated. In addition, studies from literature (Babayemi and Dauda, 2009; Nwachukwu, 2010) have shown that the quantities of solid waste generation have being increasing as a result of economic growth, household consumption patterns, population growth,

technology advancement, urbanization and industrialization. Population reports (2006) reveal that urban areas gain one million people every week which will be reflected in the level of solid waste generation. Therefore, it can be concluded that population growth is one of the major factors affecting solid waste generation. Occupation has also been identified as one of the socio-economic factors that affect solid waste generation. Afon (2007) noted that many of the indigenous population in the core area of Ogbomoso are mainly farmers which resulted to the high volume of waste generated in form of food items such as vegetables, leaves and corns. In essence, the type of job people engage in reflects and affects the type of solid waste they generate.

Studies on solid waste generation in Nigeria show that there is need for further studies on the socio-economic factors affecting household solid waste for effective management. Emphasis of many prior studies focused municipal solid waste generated by a whole community, location or an area with little attention on the socio-economic factors affecting solid waste generation at household level (Adedibu, 1984; Alakinde, 1997; Ayotamuno and Gobo, 2004; Afon, 2007; Babayemi and Dauda, 2009; Nwachukwu, 2010; Ukpong and Udofia, 2011). Solid waste generation has been increasing particularly in cities of Nigeria as a result of population growth, rapid urbanization, advancement in technology, industrialization and environmental development (Afon, 2009; Oke et al., 2011; Ukpong, 2011). Due to continuous solid waste generation coupled with improper solid waste disposal practices and poor management particularly in many cities of developing countries like Nigeria several environmental problems are now being experienced. These environment challenges include blockage of drainages, pollution of water and land, poor environmental sanitation and loss of aesthetic value (Babayemi and Dauda, 2009; Oke, et al., 2011; Akor, et al., 2013). Similar environmental challenges are also being experience in Ile-Ife. The continuous expansion and population growth in Ile-Ife due to urbanization and development have led to continuous generation of solid waste (Ajala and Olayiwola, 2013). Effective management of solid waste is one of the environmental challenges experienced in Ife Central local Government. Household solid waste is disposed indiscriminately in open spaces within the study area. This paper contributes to the existing literature by focusing on the socio-economic factors affecting household solid waste generation in some selected wards in Ife Central Local Government Area for effective solid waste management.

The study area

Ife Central Local Government Area is within Ile-Ife town in Osun State, Nigeria, which lies approximately between latitude 7^0 31'N and $7^0$34'N of the equator and between
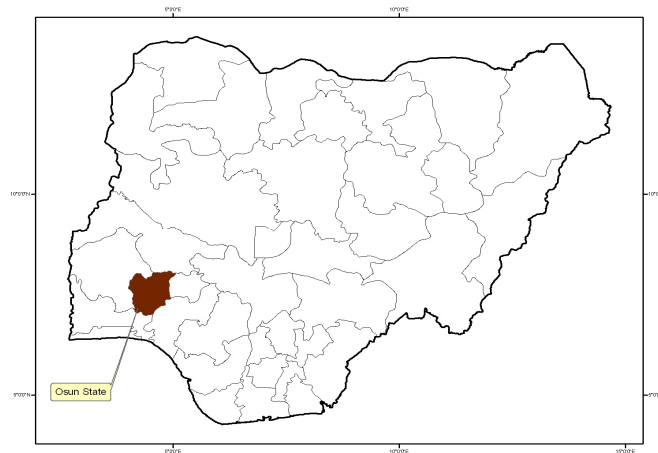
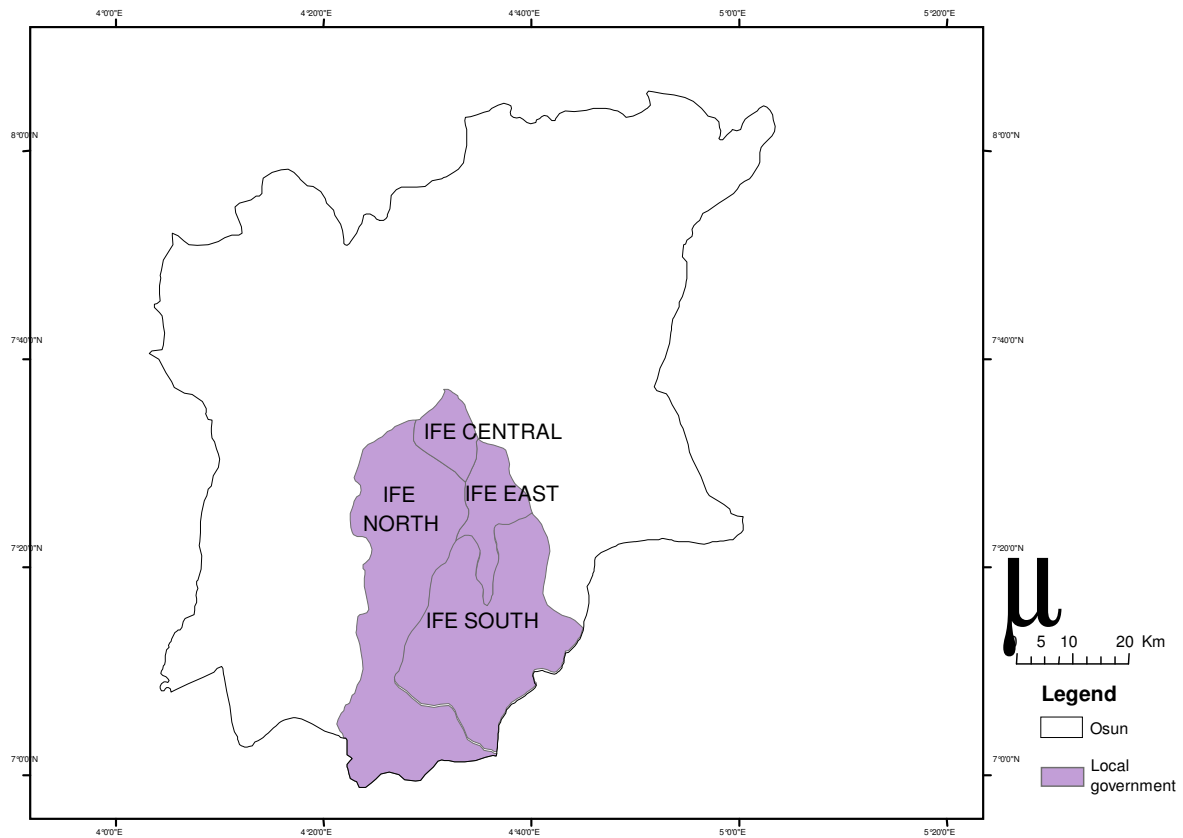**Figure1:** Map of Nigeria showing Osun State. Source: Adapted from GIS based software (Arcview 3.3).

Figure 2. Map of Osun state showing Ife Central Local Government
Source: Adapted by the author from GIS based software (ArcMap 10.2)

longitude $4^{0}30'E$ and $4^{0}34'E$ of the map of Nigeria. (Figure 1 and 2). The study area has the Koppens Af humid tropical rainforest climate. Mean annual rainfall is about 1,400mm with the rainy season extending from April to October. The land use pattern of the study area is mainly residential, commercial, agricultural and institutional (Ifabiyi, 2008). Ife central local government area has a population of

Table 1: The selected wards and the number of households sampled

Wards	Number of households sampled
Ilare II	39
Ilare III	26
Iremo I	22
Iremo III	33
Iremo V	34
Total	154

Source: Field survey, 2010

about 167,254 (National Population Commission, 2006).

MATERIALS AND METHOD

The research methodology for this study was designed to obtain data on socio-economic factors that influence household solid waste generation in Ife central local government area. The variables that were considered are housing type, gender, age, occupation, family income, education and family size.

Research Design

The study generated primary data through an extensive fieldwork in the study area. Questionnaires were administered on the residents of Ife central to obtain the socio-economic status of the residents, with a view to investigating how these have affected their consumption patterns and solid waste generation in their environment. The secondary data was obtained from the inventory of Ife central local government secretariat, textbooks, newspapers, magazines, maps, journals and unpublished papers.

Sample Frame and Sample size

A local government area (Ife Central local government Area) was selected in Osun State, Nigeria. The sample for this study was randomly selected from the five political wards out of the eleven political wards in Ife Central Local Government. The wards are Ilare ward I, Ilare ward III, Iremo ward I, Iremo ward III, Iremo ward V. This method gives each member of the entire population an equal chance of being selected within the study area. There is no report available on the numbers of households and buildings in Ife central local government area. The absence of proper quality of listings of households or addresses makes it difficult to determine the total number of household

units present in each ward. Therefore, the sample size for this study was systematically drawn from the five selected political wards in Ife Central Local Government. Samples were taken from every 40th house in each of the five selected ward. Incomplete and abandoned buildings, religious and recreational centre as well as shops were not counted. The numbers of households sampled in each wards were 39 in Ilare ward I, 26 in Ilare ward III, 22 in Iremo ward I, 33 in Iremo ward III and 34 in Iremo ward V. A total of 154 households were sampled in the study area. The number of houses selected for the study represents around 5 percent of the houses from each ward (Table 1). Since, the research deals with the study of household solid waste generation, the target population were adult residents who are waste handlers within the five selected political wards regardless of their socio-economic status.

Sampling Techniques

Preliminary survey was carried out on the study area. A detailed structured questionnaire was administered on one adult in each of the selected household within the study area to elicit information on socio-economic characteristics of the respondents. The quantities of household solid waste generation were monitored continuously (weekly) for two months. One garbage polythene bag was provided to the selected household unit once a week. The selected household units were asked to dispose their household solid waste in the provided polythene bags. Polythene bags were used because they are cheap, very light and convenient to replace. This was done in order to obtain the quantities of household solid waste generation in the study area. The solid wastes collected were weighed using a weighing scale. The total weekly household solid waste generation ranged from 1- 37kg. The average quantities of household solid waste were grouped into four classes as follows: 1-10kg, 11-20kg, 21-30kg and above 30kg.

Data Analysis

The data collected was collated and analyzed using inferential statistical techniques. These include cross-tabulation, chi-square, correlation and multiple regression analysis to achieve the objectives of the study.

i) The cross tabulation is a joint frequency distribution of cases according to two or more classificatory variables. The tables generated were used to study the comparative and percentile relationship between socio-economic factors and average household solid waste generation.

ii) The chi-square test measures the significant effect between the selected socio-economic variables and the quantity of household solid waste generated in the study area. The level of significance used is 0.05.

iii) Pearson's Product Moment Correlation Co-efficient analysis (PPMCC) was employed to examine the relationship between the independent (socio-economic) variables and the dependent variable (quantity of household solid waste generation). This may be positive or negative. Also, the PPMCC explains the strength of the relationship between the independent and dependent variables which may be strong or not strong.

iv) The multiple linear regression analysis was used to examine the effects of the changes in the independent (socio-economic) variables over the dependent variable (quantity of household solid waste generation). The R^2 was also reported. This was used to measure the goodness of fit of the model and show the variation in the dependent variable as explained by the independent variables.

RESULT AND DISCUSSION

All tables in this section are from the field survey carried out by the authors in 2010. Results from this study are presented under the following headings. Household solid waste generated across different socio-economic characteristics of respondents and statistical analysis of socio-economic characteristics of respondents and the quantities of household solid waste generation.

Household solid waste generation across different socio-economic characteristics of respondents

Table 2 presents the socio-economic characteristics of respondents in Ile-Ife Central Local government Area and the quantities of household solid waste generation. The cross-tabulation method was used to show the proportion of household solid waste generation across different socio-economic characteristics of the respondents in the study area. The socio-economic characteristics considered in the study are housing type, gender, age, occupation, educational background, family size and family income.

The housing type was categorized into three groups. These include traditional compound houses, shared accommodation (also known as 'face- to- face') and single family unit accommodation. Based on the result of this research, the highest quantity of household solid waste generated weekly is between 1- 10 kg. Out of the 154 respondents, 24.8% live in traditional compound houses, 64.7% live in shared accommodation while 10.5% live in single family unit accommodation. Of the total 154 respondents, 61.4% are female while 38.6% are males.

The ages of respondents in the study area were grouped into six categories. From table 2, 39.1% whose ages are less than 26 were the highest respondents among solid waste handlers in the study area. This is followed by 17.9% respondents who are within the ages of 26 and 35. This group represents the young adults. 11.9% respondents are between the ages of 36 and 45, 11.3% are between the ages of 46 and 55. 7.9% respondents are between the ages of 56 and 65. Lastly, 11.9% respondents are between the ages of 66 and above.

Occupation is one of the socio-economic characteristics that reflects the types and sources of solid waste generation. In this study the respondents' occupation were grouped into civil servants/ professionals, Artisan, Commercial business and unemployed. The results show that 16.6% are civil servants/professions, 5.9% are Artisans, 51.7% engage in commercial businesses while 25.8% are unemployed. From these results, it is evident that majority of the respondents in the study area engage in commercial businesses. The educational background of the respondents indicates that 13.1% have no formal education, 22.4% have primary education, and 43.4% have secondary education while 21.1% have territory education. This implies that majority (86.9%) of the respondents have formal education with an average generation rate of 1- 10kg weekly.

Also, out of the 154 respondents, 10.9% have less than 2 family size, 38.1% family size is between 2 and 4, 34.7% family size are between 5 and7, 9.5% family size is between 8 and 10 while 6.8% family size is from 11 and above. These results reveal that the family size in the study area is not large with 38.1% being the highest family size of 2 to 4. This will influence the quantities of solid waste generation in the area.

Table 2 also shows the income class of the respondents. The monthly family income of the respondents shows that 59. 8% earn less than ₦7,500, 8.4% earn between ₦7,501 – ₦30,000, 29.2% earn between ₦30,000 – ₦52,000 while 2.6% earns ₦52,501 and above. Following the classification by Afon (2010), income was classified into low (≤ ₦15, 000), middle (₦15, 000 – ₦35, 000) and high (≥₦35, 000). The implication of these results is that majority (59.8%) of the respondents is low income earners and they generate about 60% of

Table 2. Proportion (%) of household solid waste generation across different socio-economic characteristics of respondents

Socio-economic Characteristics	Weekly waste (kg)				Total
	1-10	11-20	21-30	Above 30	
Housing Type					
Traditional Compound Houses	13.7	9.2	1.9	0	24.8
Shared Accommodation	37.9	23.5	2.6	0.7	64.7
Single Family Unit	6.5	4.0	0	0	10.5
Total	58.1	36.7	4.5	0.7	100
Gender					
Male	21.6	16.3	0.6	0	38.6
Female	36.6	20.3	3.9	0.6	61.4
Total	58.2	36.6	4.5	0.6	100
Age					
Less than 26	23.8	13.3	1.3	0.7	39.1
26-35	8.6	8.6	0.7	0	17.9
36-45	5.9	5.3	0.7	0	11.9
46-55	5.9	3.5	1.9	0	11.3
56-65	5.9	2.0	0	0	7.9
66 and Above	7.9	4	0	0	11.9
Total	58	36.7	4.6	0.7	100
Occupation					
Civil Servants/ Professionals	7.3	8.6	0.7	0	16.6
Artisan	3.3	1.9	2.0	0	5.9
Commercial Business	31.8	17.2	0.7	0.7	51.7
Unemployed	15.9	9.2	0.7	0	25.8
Total	58.3	36.9	4.1	.7	100
Educational Background					
No Formal Education	6.6	3.9	1.9	0.7	13.1
Primary	15.8	5.9	0.7	0	22.4
Secondary	27.6	14.5	1.3	0	43.4
Tertiary	8.6	11.8	0.7	0	21.1
Total	58.6	36.1	4.6	0.7	100
Family Size					
Less than 2	5.4	5.5	0	0	10.9
2-4	23.8	11.6	2.7	0	38.1
5-7	21.7	11.6	1.4	0	34.7
8-10	5.4	4.1	0	0	9.5
11 and Above	2.0	3.4	0.7	0.7	6.8
Total	58.3	36.2	4.8	0.7	100
Family Income (Monthly) (₦)					
Less than 7,500	33.1	22.7	3.3	0.7	59.8
7,501- 30,000	5.2	2.5	0.7	0	8.4
30,001-52,500	16.3	12.9	0	0	29.2
52,501 and Above	0.7	1.9	0	0	2.6
Total	55.3	40	4	0.7	100

Source: Author's field survey

Table 3. Chi-square analysis of differences between socio-economic variables and the amount of household solid waste generation

Socio-economic Variables	Degree of freedom	X^2 calculated value	Significant level
Housing Type	6	2.370	0.883
Gender	3	3.326	0.344
Age	15	13.225	0.585
Occupation	24	14.692	0.929
Educational Background	9	19.950	0.018**
Family size	12	20.539	0.050**
Family income	15	4.173	0.997

•**Significant level at 0.05

Table 4. Pearson's Product Moment Correlation Co-efficient analysis of socio-economic variables and household solid waste generation

Socio-economic variables	Pearson correlation	Significant level
Housing Type	-0.064	0.429
Gender	0.025	0.759
Age	-0.061	0.453
Occupation	-0.099	0.224
Educational Background	-0.013	0.878
Family size	0.115	0.167
Family Income	0.062	0.520

• ** Correlation is significant at the 0.05 level.

household solid waste in the study area.

The study shows that there are variations in the level of household solid waste generation across different socio-economic status. The highest overall mean weight of solid waste generated by households was 5.5kg (1-10kg) per week across different socio-economic status in the study area. This finding is similar to the results obtained by Afon (2007) who reported that household solid waste generation rate ranges from 4.76kg-7.14kg in Ogbomoso.

Statistical analysis of socio-economic characteristics of respondents and the quantities of household solid waste generation

Tables 3 to 5 present the statistical analysis of socio-economic characteristics of respondents and the quantities of household solid waste generation. The statistical analyses used in this study are chi-square, Pearson's Product Moment correlation Co-efficient and multiple linear regression. From table 3, educational background and family size were found to be the significant at 5 % among the other socio-economic variables such as (housing type, gender, age, occupation and level of income). These results are similar to the

results obtained by Adedibu (1983) and Afon (2007). Both studies identified education status as one of the socioeconomic factors affecting solid waste generation in Ilorin and Ogbomoso in Nigeria respectively.

Furthermore, based on the results obtained from table 4, there is no strong correlation between housing type and household solid waste generation in the study area. A coefficient of 0.064 is low and not significant at (P< 0.05). The coefficient indicates a negative relationship between housing type and household solid waste generation. The study shows that as housing type improves from traditional compound houses to single family unit accommodation, household solid waste reduces. This implies that household solid waste generation is higher in the traditional compound houses than the quantities generated in either shared accommodation or single family unit accommodation. This further shows that there is awareness on solid waste minimization and also the residents in the shared accommodation and single family unit accommodation reuse and recycle some of their household products. Hence, this is interpreted to mean that improvement in housing type reduces solid waste generation. Also, there is no strong correlation between gender and household solid waste generation in the study area. A coefficient of 0.025 is not high and not significant at (P< 0.05). The

Table 5. Multiple linear regression analysis of socio-economic variables and household solid waste generation

Socio-economic Variables	Coefficient	Std. Error	T- Statistic	Significant Level
Housing Type	-0.008322	0.115188	-0.072246	0.9426
Gender	0.359518	0.127658	2.816262	0.0059*
Age	-0.025154	0.039962	-0.629445	0.5305
Occupation	0.039801	0.033049	1.204292	0.2313
Educational Background	0.111256	0.065731	1.692606	0.0936
Family size	0.127563	0.059344	2.149554	0.0340**
Family Income	0.087702	0.078115	1.122720	0.2642

- R^2 = 0.092259
- *Significant level at 0.01
- ** Significant level at 0.05

coefficient indicates a positive relationship between gender and household solid waste generation. This implies that as gender of waste handler changes from male to female, the amount of household solid waste generation will also increase.

There is no strong correlation between age and household solid waste generation in the study area. The coefficient indicates a negative relationship between age and household solid waste generation. Furthermore, the correlation value of 0.061 is low and not significant at ($P < 0.05$). This is interpreted to mean that household solid waste generation decreases with age. Likewise, the correlation between occupation and household solid waste generation in the study area is also low. The coefficient shows a negative relationship between occupation and household solid waste generation. The correlation value of 0.099 is not significant at ($P < 0.05$). This implies that as people acquire more skills and knowledge, the less the quantity of household solid waste generation. Table 4 also shows that there is no strong correlation between educational background and household solid waste generation in the study area. A coefficient of 0.013 is not high and significant at ($P < 0.05$). The coefficient indicates a negative relationship between educational background and household solid waste generation. This shows that as the level of education increases, household solid waste reduces. This implies that as people acquire more education, their level of awareness on proper waste management increases and the amount of household solid waste generation will be reduced.

Also, there is a positive correlation between family size and household solid waste generation. The coefficient value of 0.115 reflects a low correlation between family size and house solid waste generation. The correlation is also not significant. This is interpreted to mean that as family size increases; household solid waste generated also increases. The correlation between family income and household solid waste generation is

low. The coefficient value of 0.062 shows a positive relationship between level of income and household solid waste generation. A coefficient of 0.062 is not high and significant at ($P < 0.05$). This therefore implies that as level of income increases, household solid waste generation also increases.

From the multiple linear regression analysis in table 5, the socio-economic variables such as gender and family size have been found to be significant. Whereas, housing type, age, occupation, educational background and family income are insignificant. The coefficient value of housing type is 0.0083, it is insignificant and negative. The coefficient value of gender is positive and significant at 1 %. This implies that household solid waste increases with changes in the gender of household solid waste handler. This is interpreted to mean that females generate household solid waste more than males. This may be due to the fact that females are more involved in household chores than males in Nigeria (Balogun, 2013). Age variable has a negative coefficient value of 0.0252. This means that younger people generate more household solid waste. The occupation coefficient value is however positive with 0.0398 and not significant. This however means that the more skillful you are, the more the household solid waste generation. Also, the educational background has a positive coefficient value of 0.1112 and also insignificant. The family size socio-economic variable too is also positive but significant at 5%. This is interpreted to mean that as family size increases household solid waste generation also increases. Finally, family income is also positive though not significant. It means that household solid waste generation increases with the level of income.

The R^2 measures the goodness of fit of the model and shows the variation in the dependent variable (solid waste generation) as explained by the independent (socio-economic) variables. The R^2 is 0.092259. This implies that only 9 % of the dependent variable (solid waste generation) is explained by the independent

variables (housing type, gender, age, occupation, education background, family size and family income). The R^2 value is low, which indicates that there are some other factors that could affect household solid waste generation apart from the socio-economic variables considered in this study like lifestyle as identified by Takatsuki (2013).

In conclusion, it is clear from the analysis that gender and family size are the significant factors among the socio-economic variables with positive quantitative contributions to household solid waste generation.

CONCLUSION AND RECOMMENDATION

The following conclusions can be drawn from the results of the study on household solid waste generation in Ife Central Local Government Area:

(i)   The highest overall mean weight of solid waste generated by households was 5.5kg (1-10kg) per week.

(ii)   Gender, educational background and family size were found to be important factors affecting household solid waste generation in the study area.

(iii)   As gender of waste handler changes from male to female, the amount of household solid waste generation also increases in the study area.

(iv)   The positive coefficient values of family size and family income indicate that household solid waste increases with increase in family size and family income.

(v)   As housing type improves from traditional compound houses to single family unit accommodation, household solid waste reduces.

(vi)   Since solid waste is generated through various activities, there should be public enlightenment on solid waste reduction through reuse and recycling.

(vii)   Since there is reduction in household solid waste generation with improvement in housing type, there is need for public environmental education on waste reduction for people living in traditional compound houses or areas with poor housing conditions.

(vii)   Household solid waste generation have been found to reduce with increase in the level of occupation and education, which implies that the target group of people that needs more   enlightenment on ways of reducing of reducing solid waste generation are those that are unskilled as well as those that have no formal education.

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