ASSESSMENT OF SOLID WASTE MANAGEMENT METHODS IN SOME SELECTED PARTS OF OWERRI WEST, IMO STATE, NIGERIA

ABSTRACT

In many developing countries, improper solid waste management (SWM) poses serious environmental and public health risks. Solid wastes are typically dumped into drains and open areas since they are not collected. The effects of this incident affect both human life and the environment. In addition to identifying sources, types, and defining features of solid waste in the study region, this study aimed to evaluate the current solid waste management methods in three host communities (Eziobodo, Obinze, and Ihiagwa) of the Federal University of Technology Owerri, Imo state, Nigeria. A systematic questionnaire was used to collect data for the cross-sectional descriptive study. Four hundred and four (404) copies of the questionnaire were distributed, and a multi-stage sampling procedure was adopted for the selection of respondents and subsequent data collection. The data generated were presented in tables in percentages and were analyzed using the Statistical Package for Social Science (SPSS) version 22.0. Results obtained from this study show that 52.7% of the respondents were female while 47.3% are male. The age range was between 26 and 35 years. Considering the pattern of waste management practice, the majority of the respondents practice incineration (42.8%), this was followed by recycling (35.9%), and fermentation (11.6%) while composting (9.7%) was the least practiced waste management pattern. Garbage 42.8%, plastics 35.9%, cans 11.6%, and paper 9.7% were the types of solid wastes obtained from this study. The majority of the respondents (42.3%) disposes of waste by themselves while Government/paid collectors constitute only 2.0% of waste disposal method. About 55.4% of the waste is dumped in the gutter/drains, while 34.7%, 5.7%, and 4.2% of the waste are disposed of at nearby bushes, roadsides, and approved dumpsites respectively. The major factor associated with the improper waste disposal method as reported by the majority of respondents 71% (286) was lack of information. According to the study, there is a significant relationship between access to waste dumpsites and environmental sustainability ($p= 0.022$). There is a need for government to equip rural areas with facilities to dispose of refuse and also place them at a close interval apart from the households so that they can be easily accessed as well as train local residents about how solid waste affects human and environmental health.

Keywords: Solid waste, Environment, Waste management, Waste disposal.

INTRODUCTION

Waste is an unavoidable by-product of most human activity. The rising economic development in Nigeria has led to increases in the quantity and complexity of generated waste. Solid waste management has become one of the major environmental issues in recent times. The desire to protect the environment and natural resources is increasingly becoming a great concern to many

countries through environmentally sustainable waste management programs (Kumar *et al.*, 2017; Ugwu *et al.*, 2018).

Solid waste disposal has been a serious challenge in Nigeria, especially in rural areas like Eziobodo, Obinze, and Ihiagwa in Owerri West Local Government Area, Imo state, the eastern part of Nigeria. The growing environmental and ecological concerns have made landfill site selection regulations more rigid. The very preliminary step in Landfill engineering is the selection of the appropriate location for dumping hazardous and non-hazardous waste materials. The factors associated with the task of landfill location are essential to spatial nature. It is accepted that the management of solid waste is a global problem. The problem is more pronounced in developing countries such as Nigeria where the solid waste management is a major concern. Ogwueleka (2009) reported that solid waste management is by far the greatest challenge facing environmental bodies in the country, as a result of management challenges. It has been recorded that Nigeria generates over 3.2 million tons of solid waste annually and only a fraction is collected.

The increase in population and the use of non-biodegradable waste such as plastic bottles, sachet water, etc in Owerri has posed a serious challenge in the management of domestic waste from the point of collection to the point of disposal. Poor waste management and disposal could lead to various diseases, infections, and infestation and these include fly-transmitted diseases like myiasis, diarrhoea, typhoid, and cholera; rodent-transmitted diseases like Lassa fever plague, leptospirosis, murine typhus; mosquito-borne diseases such as malaria, yellow fever, filariasis (Adogu *et al.*, 2015).

2.0 Materials and Method

2.1 study area

Eziobodo, Obinze and Ihiagwa are communities situated in Owerri West Local Government Area located in Owerri West Local Government Area, Owerri Imo state, Nigeria (Fig. 1).

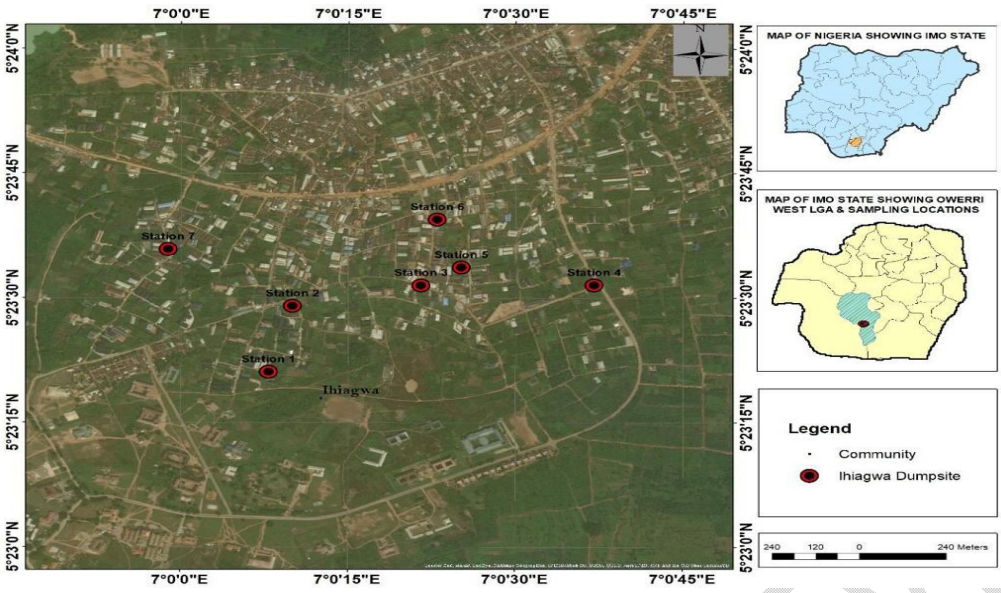

Figure 1 Eziobodo, Owerri West Local Government Area, Imo state, Nigeria.

2.2 Population of Study

The population of study on the assessment of solid waste management methods in Eziobodo, Obinze, and Ihiagwa, Imo state, Nigeria would be among residents in Eziobodo, Obinze, and Ihiagwa and the total population of residents at these three communities (15,862) (NPC, 2016).

2.3 Inclusion Criteria

The study would include the following;

i. Residents present at the time of the study.

ii. Residents who would give in their consent for the study

2.4 Exclusion Criteria

The study would exclude the following;

i. Residents admitted at the Health Center during the study.

ii. Residents who are lunatic or psychologically affected.

iii. Residents who refuse to give in their consent for the study.

2.5 Sample Size Determination

The sample size was determined using the formula of Yamen (1967) for sample size determination.

$n = N \div 1+Ne^2$

Where:
n is the desired sample size

N is the population size (15,862) (NPC, 2016).

e is the margin of error (0.05)

Therefore:

$$n = \frac{15862}{1+15862(0.05)^2}$$

n = 374.857142
Furthermore, to account for the Non-Response Rate of 10% (i.e Expected response= 90% = 0.9)

$$\frac{374}{0.9}$$

n = **415.55**

Therefore n= 416

2.6 Sampling Method

The multi-stage simple random sampling procedure was employed to obtain the desired sample for the study.

First stage: *Selection of villages/settlements*

Two (2) villages each were selected out of the villages in Eziobodo, Ihiagwa , and Obinze communities respectively via simple random sampling using balloting. The names of the 6 villages were written out on the ballot papers and 4 randomly chosen.

Second stage: *Selection of households*

A systematic sampling method was used to select a sampling interval of 1. This simply means that after each selected household where the adults were sampled, there was an interval of one household meaning the next household was not sampled till got to the next eligible household where there are adults. In situations where any of the selected adults refused consent for

participation, the adults in the next household were selected till the 416 respondents were obtained from the communities.

2.7 Validity of the Instrument

The questionnaire as the instrument of data collection was developed by the researcher and was submitted to the project supervisor for face validity and proper scrutiny to ensure that the questionnaire is valid to obtain the objectives of the study. The questionnaire was also presented to two (2) experts in Environmental Health for consensus validity before the distribution of the questionnaires for reliability testing.

2.8 Reliability of Instrument

The reliability of the instrument was determined using the test-to-retest method. 30 copies of the questionnaire were given to some respondents at Umuchima. This area shared similar characteristics with Eziobodo, Ihiagwa, and Obinze that were used for this study. Chrombach alpha test was used to test the reliability of the questionnaire. The Chrombach coefficient was 0.87.

2.9 Data Collection Method

Data was obtained using an interviewer-administered semi-structured questionnaire. This was done with the aid of two (2) field assistants who are trained to aid the researcher in the data collection process. This information from the respondents was obtained face to face with them for easy explanation and apprehension.

2.8 Data Analysis

Statistical Package for the Social Sciences (SPSS) version 22.0 was used for the analysis of the data. Results were expressed in percentages, frequencies, tables, and charts (Descriptive Statistics).

2.9 Ethical consideration

A letter of introduction and ethical clearance was obtained from the Department of Environmental Health Science Ethical clearance committee before the research was conducted. The purpose of the research was explained to each respondent and verbal informed consent was obtained from them before inclusion into the study. Also, the anonymity of the

respondents was assured and ensured. The confidentiality of the information they gave was also maintained.

3.0 RESULTS

3.1 Socio-Demographic Characteristics of Respondents

From Table 1, the demographic characteristics of respondents show that the majority of the respondents were female making 52.7% (213) while males were 47.3% (191). The age of the respondents from the table also shows that the majority of the respondents fall between the age of 26 and 35 years making 46.3% (187) followed by 18-25 years making 41.6% (168) while 46 years and above made the lowest age range (2%). Married status shows that 56.9% were single while 36.1%, 5.3%, and 17% represent married, divorced, and widows respectively. Traders comprised 58.7% (237) while, 17.8%, 15.6%, and 7.9% of the respondents, were students, civil servants, and farmers respectively.

Table 1: Socio-Demographic Characteristics of Respondents

Characteristics	Frequency	Percentage (%)
Sex		
Male	191	47.3
Female	**213**	**52.7**
Total	404	100
Age:		
18-25	168	41.6
26-35	**187**	**46.3**
36-45	41	10.1
46 and above	8	2
Total	**404**	**100**
Level of Education		
No formal	21	5.1
Primary	76	18.8
Secondary	190	47.0
Tertiary	117	28.9
Total	**404**	**100**
Marital status:		
Single	**230**	**56.9**
Married	146	36.1
Divorced	21	5.3
Widowed	7	1.7
Total	**404**	**100**

Occupation:		
Trading	**237**	**58.7**
Civil servant	63	15.6
Farming	32	7.9
Student	72	17.8

3.2 Patterns of Waste Management Practice

The pattern of waste management practice shows that 42.8% of the respondents practice incineration while 35.9%, 11.6%, and 9.7% practice recycling, fermentation, and Compositing respectively**.**

Table 2: Patterns of Waste Management Practice

Variables	**Frequency**	**Percentage (%)**
Patterns of Waste Management Practice		
Incineration	**173**	**42.8**
Fermentation	47	11.6
Compositing	39	9.7
Recycling	145	35.9
Total	**404**	**100**

3.3 Types of Solid Waste Generated

Figure 1 shows the Variety of solid waste reported to be generated from the households included in the study is as follows, garbage 42.8%, plastics 35.9%, cans 11.6%, and paper 9.7%

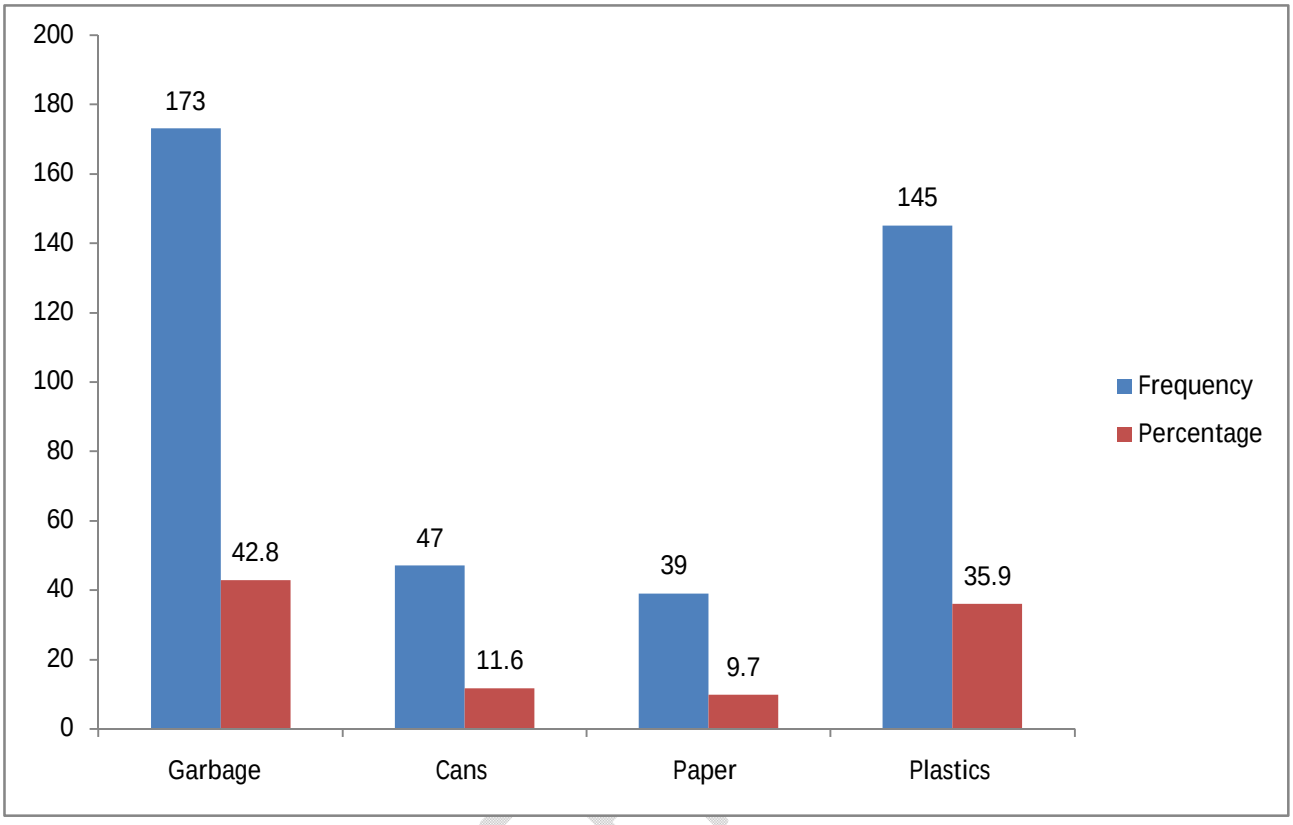

Fig 2: Frequency distribution of types of solid waste generated and disposed of by households.

3.4 Waste Disposal Personel

Table 3 shows that the majority of the respondents (42.53%) dispose wastes by themselves, while 37.1%, 18.6%, and 2.0% dispose of waste by friends, children, and Government/paid collectors respectively.

Table 3: Waste Management Practice

Variables	Frequency	Percentage (%)
Domestic waste generated is always disposed of by:		
Self	**171**	**42.3**
Children	75	18.6
Friends	150	37.1
Paid collectors	8	2.0
Total	404	100

3.5 Location of Solid Waste Dumpsite

Table 4 shows the locations where the various wastes are dumped. The majority of the waste representing 55.4% is dumped in gutters/drains, while 34.7%,5.7%, and 4.2% are dumped in nearby bushes, at roadsides, and approved dumpsites respectively.

Table 4: Dumpsite locations

	Frequency	**Percentage (%)**
Anywhere	-	-
Approved dumpsite	17	4.2
At roadside	23	5.7
Drains/gutters	**224**	**55.4**
Nearby bushes	140	34.7
Total	404	100

3.6 Frequency of Waste Dump

Table 5 shows how often solid wastes are dumped. The result shows that most of the wastes are dumped once a week (65.1%), while 25.7%, 6.2%, and 3% are dumped once in two weeks, once in two days, and once in a day respectively.

Table 5: Frequency of Waste Dump

	Frequency	**Percentage**
Once a day	12	3
Once two days	25	6.2
Once a week	**263**	**65.1**
Once two weeks	104	25.7
Total	404	100

3.7 Storage of Solid Waste

The storage of solid waste generated by the households as shown in Table 6 shows that the majority of the waste is stored in polythene bags at 41.6%, this was followed by waste buckets at 23.8%, while old buckets and cartons are used at 22% and 12.6% respectively.

Table 6: Storage of Solid Wastes

	freq	%
Carton	51	12.6
Old bucket	89	22
Wastebaskets	96	23.8
Polythene bags	**168**	**41.6**
Total	**404**	**100**

3.8 Perception of dumpsite location and operational activities

According to table 4, the majority of respondents (71%, or 289 people) agreed that there should be a garbage dump near every bus stop, whereas 28.5%, or 115 people, disagreed. Furthermore, while 23.8% (96) of respondents disagreed, 75.7% (308) said adequate waste management is necessary to control health concerns. When asked if they participate in sanitation activities to keep their living spaces clean, the majority of respondents—92% (351)—said they do, while only 8% (53) said they don't. When asked if they would make financial sacrifices for environmental conservation, the majority of respondents, 94.5% (356) said no, while 5.4% (48) said yes. Last but not least, the majority of respondents—80.4% (325)—agreed that effective waste management is important for every household to practice, while 10.5% (79) disagreed.

Table 7: Perception of dumpsite location and operational activities

Variables	Frequency	Percentage (%)
Refuse Dump should be made close to every bus stop		
Agree	115	28.5
Disagree	**289**	**71.5**
Total	404	100
Proper waste management is essential to manage health conditions		
Agree	**308**	**75.7**
Disagree	96	23.8
Total	404	100
People are more prone to dispose their waste when the system is closer		
Agree	**351**	**75.7**
Disagree	96	23
Total	404	100
Making financial sacrifices for environmental protection		
Disagree	**356**	**94.5**
Agree	53	2.9
Total	404	100
Proper waste management is essential for every household to practice		
Agree	**325**	**80.4**
Disagree	79	10.5

Total	404	100

3.9 Factors that Contribute to the Increased Improper Dumping of Wastes.

Shown in Table 8 below are the factors that contribute to the increase in improper dumping of waste. Lack of information contributed to 25.6% of the factors while 23.6%, 21.7%, 15.9%, 12.7%, and 0.5% are lack of time, religious belief, crowded environment, and laziness respectively.

Table 8: Factors that contribute to increased dumpsite impact on the environment

Variable	Frequency	Percentage
What are the factors that contribute to increased dumpsite impact on the environment		
Lack of Information	108	25.6
Crowded Environment	67	15.9
Laziness	2	0.5
Religious belief	92	21.7
Inadequate water supply	54	12.7
Lack of time	100	23.6
Total	**404**	**100**

DISCUSSION:

Waste is a necessary byproduct of life and a part of us. Race, age, or classes are no restrictions on its generation. Yet, it is influenced by socioeconomic factors like marital status, age, household size, occupation, degree of education, and income. Thus, according to Abel (2009), an increase in household size, income level, and marital status all contribute to waste generation.

Table 1 details the respondents' demographic information. Age, sex (gender), marital status, occupation, and level of education are among the characteristics that were found and examined. The age range of 46 years and above had the fewest occurrences (2%), followed by 18–26 years

(41.6%) and 26–35 years (46.3%) of the respondents had the highest occurrence. This demonstrates that the majority of responses are from active young adults. Adogu *et al*. reported similar outcomes (2015). 52.7% of respondents are females, and more than 56% of the respondents are single.5.1% of respondents reported being illiterate, which is defined as having no formal education and being unable to read or write, while 47% reported being literate (officially educated). 58.7% of people are traders, the student population made up about 17.8%, and 15.6% were employed by the government. This finding is in contrast to the report of Zawde *et al*. (2022) who reported a higher number of males (63.1%), higher illiteracy levels (42.%), and more Government workers (50.6) in their assessment of solid waste management practice in Kebridehar city Somali regional state, Ethiopia.

Different types of waste were generated. The majority were garbage and the main storage facility used was polythene bags. This study is in line with the study of Fakere *et al*. (2012) that there are different types of waste depending on their sources, the waste according to the authors includes; domestic waste mostly garbage as well as others such as rubbish, ashes, dead animals, etc. The study also relates to the study of Oreyomi (2005) that garbage denotes waste resulting from the growing, handling, preparation, and consumption of foods, it attracts and breeds flies and other insects, and odour. This result is in contrast with the report of Odonkor et al. (2020), who found that the major types of waste generated by households in the Ghanaian district were plastic and rubbers.

It was observed that most of the wastes (42.3%) are disposed of by the individuals themselves while Government/ paid collectors contributed the least (2.0) in waste disposal. This finding is in contrast with the report of Shamaki and Shehu et al. (2017) who reported that children and maids contributed to the majority of waste disposed of in the Sokoto metropolis. In developing countries, improper solid waste disposal is common and about 55.4 % of the respondents in our study dispose of their solid waste improperly (dumping in the gutters/drains). From the result, it was observed that indiscriminate dumping of waste either at the nearby dumping site or drainages are very common practice with few individuals patronizing the services of private waste managers. According to research conducted in Keko Machungwa, Tanzania, 62% of households dispose of their solid wastes improperly. This high rate of inappropriate solid waste disposal was caused by the area's inaccessibility due to informal settlements and small roadways

(Kasala, 2014). in the same way as this, Debrebrihan, Ethiopia reported a high percentage (75%) of improper solid waste disposal practices (Tyagi, et al., 2014). The frequency of disposal of wastes was assessed. The majority of the respondents (65.1%) dispose of their waste once a week. This is in contrast with the finding of Shamaki and Shehu (2017) who reported daily waste disposal as the highest proportion (40.8%).

The result showed that the respondents in the study area do not have a good perception of waste disposal considering the waste management practices by the residents were poor. The findings of this study are in line with the observations by Afangideh *et al.,* (2012) who conducted a similar study on Ihiagwa residents and noted that the residents of Ihiagwa community showed a negative attitude towards waste management and disposal evident in the low waste management practice revealed in that study.

Concerning the perception of dumpsite location and operational activities, the respondents expressed the need to locate dumpsites close to every bus stop to ease disposal (71%). A study by Nwosu & Chukwueloka, (2020) expressed the need for the strategic location of dumpsites. They reported that proper designation of dumpsites in strategic locations promoted good solid waste management by 20% in studied locations in Umuahia and Enugu. Findings from the results also indicated that 92% of the respondents noted that they participated in sanitation practices to keep the household environment clean, stating that proper waste management is essential to manage health conditions (75.7%). Concurrent to a similar study conducted by Nwaka, (2012) in Ebonyi, where it was reported that most of the residents participated in environmental sanitation practices every fortnight. This points to the availability of adequate sensitization programs on environmental sanitation in the region. Although 94.5% of the respondents did not agree to make a financial sacrifice for environmental protection, which could be a result of the low economic status of the residents in the region, 80.4% of the respondents reiterated that proper waste management is essential for every household to practice. The importance of proper waste management has been reported in recent studies (Ukala et al., 2020; Ugwu et al., 2018).

Lack of information was the most common factor that contributed to the increase in dumpsite in the environment, followed by lack of time (23.6%). Inaccessibility to information on waste management and time to practice good solid waste management have been reported to be

problems associated with increased refuse dumpsites in other studies (Nwaka, 2012; Kumar et al., 2017; Izugbara & Umoh, 2013). 'Laziness' was reported in a study by Ezeah, (2010) which also corroborates this study's findings (0.5%). According to another study by Amasuomo & Baird (2016), the most common factor observed among respondents was lack of water (23.5%). Inadequate water supply (12.7%) was also reported by the respondents in this study and thus agrees.

The results from the hypothesis tests revealed a significant relationship between access to the waste dumpsite and environmental sustainability ($p = 0.022$). This translates that proper access to dumpsite locations promoted good solid waste management practices and ergo environmental sustainability. This is in agreement with the finidings of Ukala et al., (2020) ($p = 0.0012$), and Nwosu & Chukwueloka, (2020) ($p = 0.004$).

Conclusion

From this study, solid waste management plays an integral role in human activities, the overall view of solid waste management is to collate, treat, and dispose domestic waste in the rural area in an environmentally and socially satisfactory manner. From this study, factors responsible for domestic waste disposal were lack of information, crowded environment, inadequate water supply which influences waste management methods. The study also shows that the public has good perception about the need for a good waste management facility, as it could improve health and environmental sustainability. Residents tend to dispose their waste on the street or burn them due to the long distance of legal dumpsites to the communities.

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