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Assessment of Municipal Solid Waste Management Practices in Akure, Ondo State, Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. Author OMO designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Author BWA supervised the preparation of the first draft of the manuscript, while author GJO managed the analyses of the study. Authors AOK and TJA managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Rapid urbanization and uncontrolled population growth in the city of Akure create a huge generation of municipal solid waste (MSW) and waste management authority has not been able to manage it properly. This has led to inefficient waste collection methods, insufficient coverage of the collection system and improper disposal of solid waste. This paper investigated municipal solid waste management practices in Akure, Ondo State, Nigeria. Simple random sampling was used in selecting 392 respondents within the eight districts in the study area. Information was collected on socio-economic characteristics of the respondents; nature and compositions of municipal solid waste and solid waste management practices in the study area. The study showed that female

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respondents (58.2%) were more than male (41.8%) in the study area. Also, a larger proportion of the respondents earned above N40,000 per month. More than one-third of the respondents (37.8%) created squander from vegetable and food remains, next to this were plastic (19.1%), paper (8.2%) and metal waste (6.6%). Further findings showed that the majority of the respondents (66%) do not segregate waste before disposal while the wastebasket was commonly preferred to collect waste due to its affordability. The study concluded that despite the establishment of waste management authority, most of the wastes collected was not sorted before disposal while the majority of the respondents preferred to burn their waste. The study recommended that government and non-governmental organizations should pay much attention to the issue of waste management in the area as waste was not properly managed.

Keywords: Municipal; solid waste management; practices; Akure; Nigeria.

1. INTRODUCTION

Issues of waste management are on the increase. This has attracted the attention of scholars in developed and developing countries in recent times [1,2,3,4]. However, while waste generation in the developed world is properly managed with effective implementation of consistent waste policies, waste generation in developing countries of global south especially Nigeria is not properly managed due to lack of effective implementation of consistent waste policies [1,5]. This has made solid waste management to be the most pressing environmental challenge faced in Nigeria cities.

Nigeria, among other developing countries, is witnessing an unprecedented growth in urban centers [6]. The rate of this growth is one of the highest on the planet, exceeding 6.5% per annum [7]. This growth rate has a series of implications on every aspect of people's socioeconomic and cultural lifestyles. Among these implications are pressure on urban amenities, poor housing conditions, unemployment, crime and violence, traffic congestion, and environmental problems.

One of the most relentless ecological issues in most urban centers, especially in Nigerian urban centers is municipal solid waste management [8]. The evidence of this is the piles of uncollected waste indiscriminately disposed on vacant plots, open spaces, and in channels [9]. These open waste collection points create significant environmental problems, for example, contamination of water resources, production of methane due to decomposition of organic waste which contributes to global warming and generation of solid leachates because of organic procedure which pollutes groundwater resources [10]. Notwithstanding, this could be attributed to the low capacity of Local Governments and Municipal Authorities to deal with the expansion in solid waste generation resulting from population growth, urbanization, and industrialization. These processes have placed so much demand and have created major environmental and public health problems in urban areas [11].

The by and large acknowledged view is that most urban communities in Nigeria have insufficient solid waste management strategies. Be that as it may, the circumstance fluctuates with urban areas and governments at different levels [12]. In Akure, the Ondo State capital, for example, a lot of efforts have been made towards effective municipal solid waste management. This includes the establishment of the Ondo State Waste Management Authority in 1999, to control and manage municipal solid waste in all areas in the state, one of which is Akure, the state capital. The activities of the Ondo State Waste Management Authority in Akure include the provision of waste disposal bins, street cleaning, waste collection, transportation, and partnership with private waste collectors [13]. Despite the creation of the Ondo State Waste Management Authority in 1999, studies have shown that inadequate collection methods, insufficient coverage of the collection system, and improper disposal of solid waste are the characteristics of solid waste management in the state [14]. The amount of waste produced continues to grow at a high rate as a result of income, population, and economic growth that have influenced the composition of waste generation. In addition, the amount of waste produced varied according to the season, social behavior, culture, industrial production, size of the market for waste material, and level of urbanization [15,16]. Akure, the state capital, has experienced uncontrolled population growth and this has directly increased the generation of wastes which resulted in

degradation of the city landscape and unhealthy living conditions on the residents.

Based on the foregoing, this study aims at examining municipal solid waste management practices in Akure, Ondo State, Nigeria. The specific objectives of the study were to examine the socio-economic characteristics of the respondents, analyze the nature and compositions of municipal solid waste, and assess the municipal solid waste management practices in the study area.

2. CONCEPTUAL ISSUES

Two concepts were considered in this article, namely – Municipal solid waste, solid waste management. Municipal solid waste (MSW) could be referred to waste generated from household, working environments, hotels, shops, schools, open area, and other similar institutions which are hazardous. It includes all domestic refuse and non-hazardous wastes such as commercial and institutional wastes, street sweepings, and construction debris. The rate at which municipal solid wastes are generated varies from one urban center to the other and also from season to another [17]. Municipal solid waste management according to [18] involves the collection, transportation, processing, recycling or disposal, and monitoring of waste materials. Its operation could be seen as part of the planning process which coordinates operational goals of a larger organization. Rogdgers [19] further explained waste management as the systematic control of generation, storage, collection, transportation, separation, processing, recovery, and disposal of solid waste. Waste management practices vary from urban to rural areas and also from the residential area to other areas such as industrial, commercial, institutional, recreational areas. Most solid wastes are generated from households; these include wastes generated from offices, shopping complexes/shops, hotels, institutions, schools, as well as from municipal services such as street cleaning. Example of solid waste that is generated in the residential and commercial area includes food wastes, paper, cardboard, plastics, textiles, glass, ashes, and metals while paper, plastics, wood, food waste, glass, metals, special wastes, hazardous waste, and cardboard are the types of waste that are generated from institutions. Municipal services types of waste include street sweeping, tree trimming, general waste from parks, and other open spaces. According to United Nation Environment Programme [20] the common types of municipal solid waste are food waste, rags, metal, paper, plastic, and glass, with some hazardous household wastes such as electric bulbs, automotive parts among others.

Major services of municipal solid waste management agencies include waste collection, transportation, treatment, and disposal. Methods of solid waste collection vary from either door to door, street to street to cart pushers, or by using containers or communal bins. Every agency has an administrative structure for providing collection services, with the use of a non-compaction truck for daily collection. The most common means of disposing waste include recycling/ recovery, composting, incineration, and landfilling/ open dumping.

2.1 The Study Area

Akure is situated between Latitude 7°15^{l} North of the equator and between Longitude 5° and 15' East of the Greenwich Meridian and spreads an absolute region of about 41.2 km^2 [21]. Akure is limited on the West by Ibule town in Ifedore Local Government Area, in the South, by Idanre town in Idanre Local Government Area, in both the East and North; Akure shares a typical limit with Ogbese and Itaogbolu towns both in Akure North Local Government Area. The examination zone is, roughly, 700 kms southwest of Abuja, Nigeria the Federal Capital Territory (FCT), and around 350 kilometers to Lagos, Nigeria's business focus (Fig. 1). As experienced incomparable medium measured urban focuses in Nigeria, the relative increment in the political impact of Akure as the State capital since 1976 has extraordinarily advanced its fast populace and areal degree development. It lies within Nigeria's tropical rain forest zone. The climatic condition of Akure follows the pattern of south-western Nigeria, where the climate is mainly affected by the rain-bearing southwestern monsoon winds from the ocean and the dry north-westerly winds from the Sahara Desert. Two distinct seasons occur in Akure, the rainy and dry seasons. The population census of Akure in 1991 was 324,000. Ever since then the population of Akure has been increasing. The population increased from 324,000 through 360,268 in 2006 to 486,300 in 2017 using 3.18% yearly improvement rate [22]. According to [23,14] increase in the population of any society in developing countries has a direct influence on the proportion of the waste generated per household.

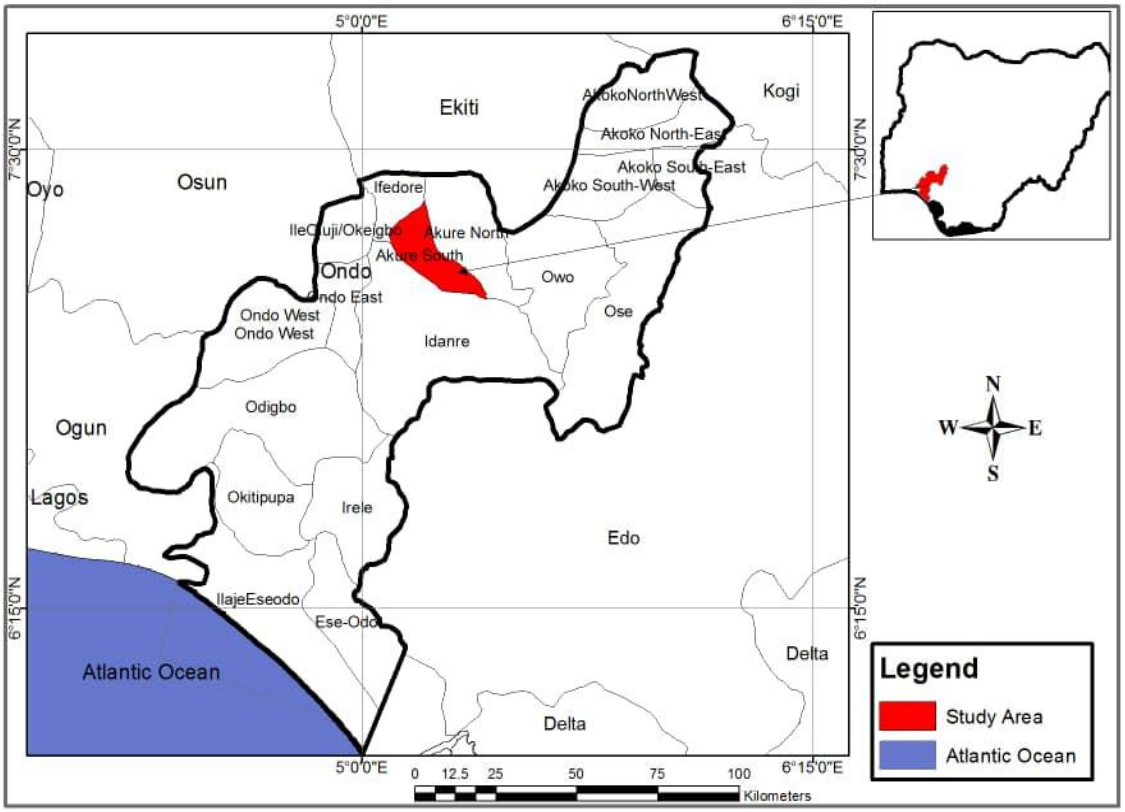

Fig. 1. Ondo state map highlighting Akure
Source: Cooperative Information Network (COPINE 2019)

3. MATERIALS AND METHODS

Data were obtained from the primary source to achieve the objectives of this study across eight districts (Alagbaka, Arakale, Ayedun, Ijoka, Ijapo, Ojo – Oba, Oke-Aro, and Isolo). Primary data were collected using the questionnaire. The questionnaires were administered on residents within the eight districts of the study area. A set of 392 questionnaires was administered randomly to households in the private areas of the study area. Information was collected on the socio-economic characteristics of the respondents; nature and compositions of municipal solid waste and solid waste management practices in the study area. Information gathered was entered and prepared by utilizing SPSS (Version 20).

4. RESULTS AND DISCUSSION

Solid waste management practice is influenced by income, gender, education, marital status, age among others [24]. Information on age distribution in Table 1 revealed that the majority of the respondents (51.1%) were within the age group of 19 – 40 years, while 34.8% and 14.2% of the respondents were between 41-60 years and above 61 years. It could be noted that most of the respondents were in the working population. The proportion of females (58.2%) was more than their male counterparts (41.8%). This implied that the study area included more females than males. The results showed that most of the respondents (52%) were married, 22.4% were single and 17.3% were widow/widower. It was recorded that 50%, 26.5% and 14.3% of the respondents respectively had tertiary, secondary, and primary education. The proportion of respondents that were businessmen, civil servants, farmers was respectively 42.9%, 26.5% and 15.3%. The Table revealed that most of the respondents (32.7%) earned above 40,000 per month. The proportion of respondents earning above 40,000 per month might influence the size, nature, and composition of waste generated per household in Akure, the study area.

Table 1. Socio-economic attributes of residents in the study area

Socio-economic attributes	Frequency	Percentage (%)
Gender		
Male	164	41.8
Female	228	58.2
Age		
19-30	92	23.5
31-40	108	27.6
41-50	88	22.6
51-60	48	12.2
Above 60	56	14.2
Marital Status		
Single	88	22.4
Married	204	52.0
Divorced	32	8.3
Widow/Widower	68	17.3
Education		
No Formal Education	36	9.2
Primary	56	14.3
Secondary	104	26.5
Tertiary	196	50.0
Occupation		
Farming	60	15.3
Business	168	42.9
Civil Servant	104	26.5
Others	60	15.3
Monthly Income		
Below 10,000	76	19.4
10,000-20,000	116	29.5
20,000-40,000	72	18.4
Above 40,000	128	32.7

Source: Author's fieldwork (2019)

4.1 Nature and Composition of Municipal Solid Waste

Information on the nature and composition of urban solid waste in the study area showed that a greater part of the respondents 37.8% created squander from vegetable and food remains. This was trailed by 28.3% of the respondents that produced polythene bags. Other waste generated includes plastic (19.1%), paper (8.2%) and metal waste (6.6%). It could be deduced that vegetable and nourishment remains were the most widely recognized waste produced by the respondents in the study area. The reason for this result could probably be because of the way of life of the respondents in the study area.

4.2 Municipal Solid Waste Management Practices in Akure

Analysis of the structure of waste segregation before disposal in Fig. 3 showed that most of the respondents 66% do not segregate waste before disposal, while 34% segregate waste before disposal in the area under study. It could be inferred that most of the wastes collected were not sorted before disposal (see Plate 1). This could compound solid waste management problems in the study area. This finding corroborates UN-HABITAT's [25] assertion that there is no mechanism for sorting waste in developing countries.

The heterogeneous nature of waste generated has made the majority of the respondents to find it difficult to segregate their waste before disposal. This could have a strong implication on waste reuse and recycling system.

Information on the types of waste collection containers in Table 2 showed that 37.8% of the respondents used the wastebasket to collect waste, 23.5% used polythene waste bag, 22.4% used government-issued containers while 16.3% used metal drum in collecting waste in the area

under observation. The reason why most of the residents used wastebasket could probably be because wastebasket is more convenient and affordable.

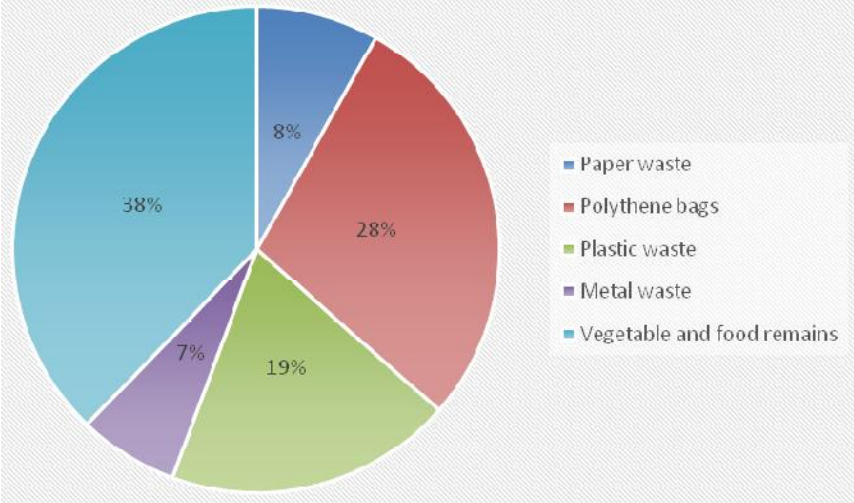

Fig. 2. Composition of waste generated
Source: Author's fieldwork (2019)

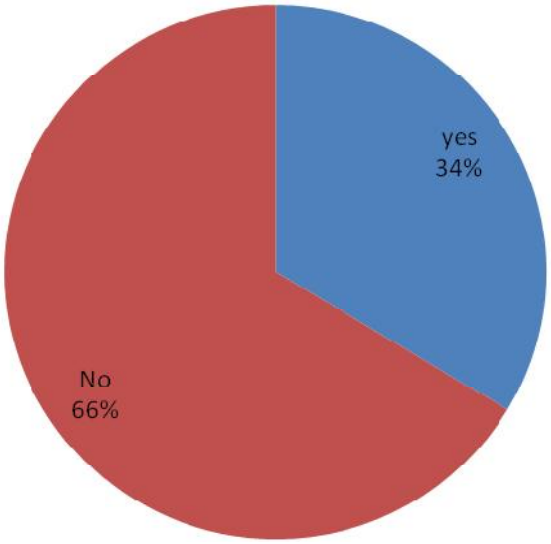

Fig. 3. Waste segregation before disposal
Source: Author's fieldwork (2019)

Table 2. Responses on types of containers used in waste collection

Types of the waste container	Frequency	Percent
Waste Basket	148	37.8
Metal drum	64	16.3
Polythene waste bag	92	23.5
Government-issued containers	88	22.4
Total	392	100

Source: Author's fieldwork (2019)

Plate 1. Heterogeneous nature of waste at avenue 6 in Orita Obele Estate, Akure
Source: Author's fieldwork (2019)

Plate 2 showed the standard waste container provided by the Ondo State Waste Management Authority (OSWMA) for waste collection.

This is the size of the waste bin made available by the Ondo State Government (dimension 0.24 cubic meter (240 liters) in the volume, length, width, and height are 660 mm, 585 mm, 1060 mm respectively) and its maximum load weight is 96 kg. It is the standard waste container for waste collection because it is durable, it has a cover that prevents the odor of waste from escaping to the atmosphere. It also prevents wastes from littering the environment that causes disease outbreaks and turns into a breeding ground for mosquitoes, rats, and flies. However, waste bins were not evenly distributed because of its cost.

Analysis of the frequency of municipal solid waste disposal in Fig. 4 revealed that 45.9% of the respondents disposed of their waste ones a week while 27.6% and 17.3% of the respondents disposed of their waste twice a week and daily respectively. About 9.2% of the respondents do not specify. It could be observed that a higher percentage of the residents disposed of their waste weekly. Weekly disposal of waste could have a negative effect on the environment as it creates unsightly environment, environmental nuisance, stinky environment, storm or runoff may scatter the waste, littering the entire landscape before the collection time, forms conducive habitats for rodents, reptiles (lizards) and insects (flies, cockroaches, mosquitoes) as well as breeding of micro-organisms which may be dangerous to human health.

Information on waste disposal methods in Table 3 showed that 49% the respondents preferred to burn their combustible waste while 35.7% used open dumping. About 8.2% of the respondents buried their waste while 7.1% of the respondents indicated other methods. It could be observed that most of the respondents were burning their waste. This method has observed by [26] has a negative effect on the environment. One of the effects includes environmental pollution which may impair human health, lungs, and skin. Indeed, some of the irritants have been implicated for cancer, formation of thin layer on leaves, leading to reduction in transpiration and destruction of soil micro-organism.

Plate 2. Waste bin provided by the Ondo State Government in the study area
Source: Author's fieldwork (2019)

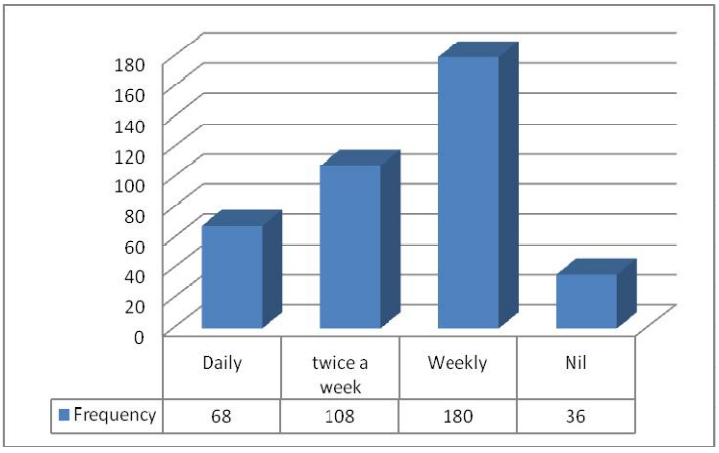

Fig. 4. Frequency of waste disposal
Source: Author's fieldwork (2019)

Table 3. Different methods of waste disposal

Methods	Frequency	Percent
Burning	192	49.0
Burying	32	8.2
Open dumping	140	35.7
Others	28	7.1
Total	392	100

Source: Author's field survey (2019)

5. CONCLUSION

This paper has examined municipal solid waste management practices in Akure, Ondo State, Nigeria. The study specifically assessed the socio-economic characteristics of the respondents, nature, and composition of municipal solid waste and municipal solid waste management practices in the study area. The study discovered that a higher proportion of the respondents were within the working population. The proportion of females was more than male in the study area while a larger proportion of the respondents earned above N40,000 per month.

The proportional representation of respondents that earned above N40,000 per month influenced the volume, nature, and composition of waste generated per household in the study area. Information on the nature and composition of municipal solid waste showed that vegetable and food remains have the highest proportion of the waste generated. These were followed by polythene bags, plastic, paper, and metal waste. Moreover, the study showed that most of the wastes collected were not sorted before disposal as most of the wastes were collected with wastebasket. Waste sorting is an important step in waste management and recycling. It helps in converting waste to energy but as the majority of the waste generated in the study area was not sorted before disposal, this does not promote safe and effective waste management, and the cost of recycling and reducing will be high. The study observed that the majority of the respondents preferred to burn their waste while others used open dumping and burying methods.

Based on the above findings, the study concluded that despite the establishment of waste management authority, most of the wastes collected was not sorted before disposal while the majority of the respondents preferred to burn their waste. The study recommended that incentives should be given to the individual by the municipal authority to promote the sorting of waste in the study area. The study also recommended that government and non-governmental organizations should pay much attention to the issue of waste management in the area as waste was not properly managed. There is need for government to sensitize the residents on the adverse effect of poor waste management on the environment resulting from the indiscriminate disposal of waste in the area.

CONSENT

As per international standard or university standard guideline participant consent has been collected and preserved by the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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