

Analysis of Domestic Solid Waste Management Strategies in Tunga, Chanchaga Local Government Area, Niger State, Nigeria

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Abstract

The management of solid wastes in Nigeria and other African Countries has become a very big challenge, the problem of waste generation, handling and disposal has reached a disturbing level in Nigerian urban centers. The study analyzed domestic solid waste management strategies in Tunga, Niger State, Nigeria which was achieved through characterizing the types of domestic solid wastes generated, examining the domestic solid waste management strategies employed, identifying the key players in domestic solid waste management and ascertaining the effectiveness of the domestic solid waste management strategies employed in the study area. The primary data used in this study was obtained by direct field observations, questionnaire administration and oral interviews while the secondary data was obtained from books, journals, published and unpublished texts, documents, conference articles, government ministries and agencies. 327 out of 2040 households were sampled. The results showed that the nature of domestic solid wastes generated in the study area were mainly organic, paper, plastic, old and rusted metals and textile wastes while the domestic solid waste management strategies in place were burning, open dumping and burying, with open dumping being the most common domestic solid waste management strategy practiced in the study area. It was also observed that the key players involved in the management of solid wastes were the government and individual households and the rate of waste generation was found to exceed the rate of waste disposal in the study area. Also the daily generation of waste (about 74%) exceeded the daily disposal of wastes (about 49%) in the study area. 63% of the respondents reported that burning of domestic solid waste is effective, 84% reported that burying domestic solid wastes is effective while 14% reported that open dumping of domestic solid wastes is effective. The Chi Square analysis showed a significant difference between the frequency of wastes generated and waste disposed in the study area with an alpha value of 0.01, while the Kruskal Wallis H test showed no significant difference in the effectiveness of the domestic solid waste management strategies in the study area ($\alpha = 0.646$).

Keywords: domestic solid waste, solid waste management strategies, open burning, key players

INTRODUCTION

Waste management is a global environmental challenging issue that is severe especially in developing countries where increased urbanization, poor planning and lack of adequate resources contribute to the poor state of Municipal Solid waste management (Mwanthi, Nyanbola and Tenambergen, 1997). The Federal Ministry of Environment (2012), defined waste as any damaged or useless material produced during or left over from human activities. Rushton (2010), reported that one person's waste could be another person's valuable material, due to changing technologies, availability and cost of input materials, the demand and need to use recovered waste is changing and thus defined waste as something that nobody wants at a particular point in time and needs to be disposed of. Aliyu (2010) classified wastes into three basic types; solid, liquid and gaseous which could be biodegradable, semi biodegradable and non-biodegradable. Based on land use and practices in the human environment, Ayo, Ibrahim and Mohammed, (2010), reported that there are seven major sources of waste namely; domestic/ residential, commercial, agricultural, construction and demolition, mining, industrial and institutional wastes.

Onu, Price, Surendran and Ebie (2001) referred to solid waste management as the application of techniques that ensures the orderly execution of the functions of collecting, transfer, processing, treatment and disposal of solid wastes. Major global techniques of waste management were listed by Rushton (2010) to include: recycling, composting, sewage treatment, incineration and landfill. The ever increasing global concern on environmental health demands that wastes be properly managed and disposed off in the most friendly and acceptable way, this is to minimize and where possible eliminate its potential harm on plants, humans, animals and natural resources (Onu, Price, Surendran and Ebie, 2001). The World Health Organization (WHO 2004) and United Nations International Children Education Fund (UNICEF 2004) joint report in August 2004 as cited by Uwaegbulam (2004), revealed that: "about 2.4 billion people will likely face the risk of needless disease and death by the target of 2015 because of bad sanitation". The hardest hit by bad sanitation is rural poor and residents of slum areas in fast-growing cities, mostly in Africa and Asia.

A research carried out by Sridhar and Adeoye (2003) puts the daily solid waste generation rate per person as 0.58kg which is remarkably high when multiplied with 170 million inhabitants in Nigeria today. An environment with a high standard of sanitation that is both clean and beautiful has a great influence on our psychological, emotional and social wellbeing. It enhances public health and quality of living. Therefore, to ensure a healthy environment, solid wastes need to be properly managed to control or limit pollution (Agbede and Ajagbe, 2004). Manaf, Samah and Zukki (2009), reported that the population growth in Tunga is higher than the average of the whole country in Nigeria because of its proximity to Abuja. The population drift in Tunga is also associated with job opportunities in the Federal Capital Territory where it is proximally located. However, more people means more waste, and more waste means more resources needed for waste management (Ayo, Ibrahim and Mohammed, 2010). Solid waste management in Niger State has traditionally been undertaken by the Niger State Environmental Protection Agency (Federal Ministry of Environment, 2012).

STATEMENT OF THE RESEARCH PROBLEM

The problems associated with solid waste generation and its management has been the focus of considerable environmental attention during the last quarter of the twentieth century as communities all over the world over have begun to recognize the hazards that its management entails (Onu, Price, Surendran and Ebie, 2001). In developing countries, millions of people live without a waste management system, wide spread dumping of waste in water bodies and

uncontrolled dumpsites aggravates the problem of generally low sanitation, which pose serious threat to the surrounding environment and are a health risk to the population, causing contamination of the drinking water and soil (Anthony, 2011).

Agbede and Ajagbe (2004) in their research on solid waste management in Ibadan North using critical observation, questionnaires and literature review. Their findings revealed that no effort was made at treating different types of wastes differently for disposal purposes. The methods of waste disposal were sanitary landfill, composting and incineration. They also reported that the Solid waste management authority, the only institution responsible for the management of solid waste in the study area has not been successful in getting rid of solid waste. They attributed this to political interference, technical and labour limitations, inadequate finance and bad roads.

Similarly, Efe (2010) examined the problem of solid waste generation and management in Ughelli using direct field measurement and questionnaire administration. He reported that there were no authorized dumpsites in the area and the major method of waste disposal are open dumping, land filling and dig and bury. He further noted that wastes are disposed indiscriminately in the various neighborhoods thus causing environmental despoliation, health hazards, economic and social menace in the area. In addition, He reported that there is no solid waste management agency established by government in Ughelli.

Aliyu (2010) analyzed solid waste management in Kano metropolis, Nigeria using data gotten from government agencies, interviews and field surveys in three residential zones that are representative samples of the city, reported that about 3085 tonnes of solid waste were generated each day and the largest amount of waste generated comes from households in the study area. Also, the waste is not properly managed and thus has grave implications on the environment in the study area. From the foregoing, all the literatures reviewed were carried out outside Tunga. Furthermore, none of the studies reviewed have been able to appraise the strategies of domestic solid waste management on the method of waste collection, transportation and disposal which imposes great burden on the environment. Thus, this study seeks to assess the sustainable compliance of handling Domestic Solid waste in the study area.

The aim of this study was to analyze domestic solid waste management strategies in Tunga, Niger State. This was achieved by characterizing the types of domestic solid wastes generated in the study area, examining the domestic solid waste management strategies employed in the study area, identifying the key players in domestic solid waste management in the study area and ascertain the effectiveness of the domestic solid waste management strategies employed in the study area.

HYPOTHESES

1. Ho. There is no significant difference between the frequency of waste generated and the frequency waste disposed in the study area.
2. Ho. There is no significant difference in the effectiveness of the domestic solid waste management Strategies in the study area

THE STUDY AREA

Tunga is located in Chanchaga Local Government Area of Niger State, in the Northern Guinea Savanna and North- Central Nigeria. It lies within latitude $9^{\circ} 37' - 9^{\circ} 61'$ North of the equator and longitude $6^{\circ} 33' - 6^{\circ} 56'$ East of the Greenwich Meridian (Maxlock, 1979). Tunga is located

at the south eastern part of Minna, the capital of Niger State (see figure 1.4). The study area falls within the Aw climate type according to Koppen’s classification scheme

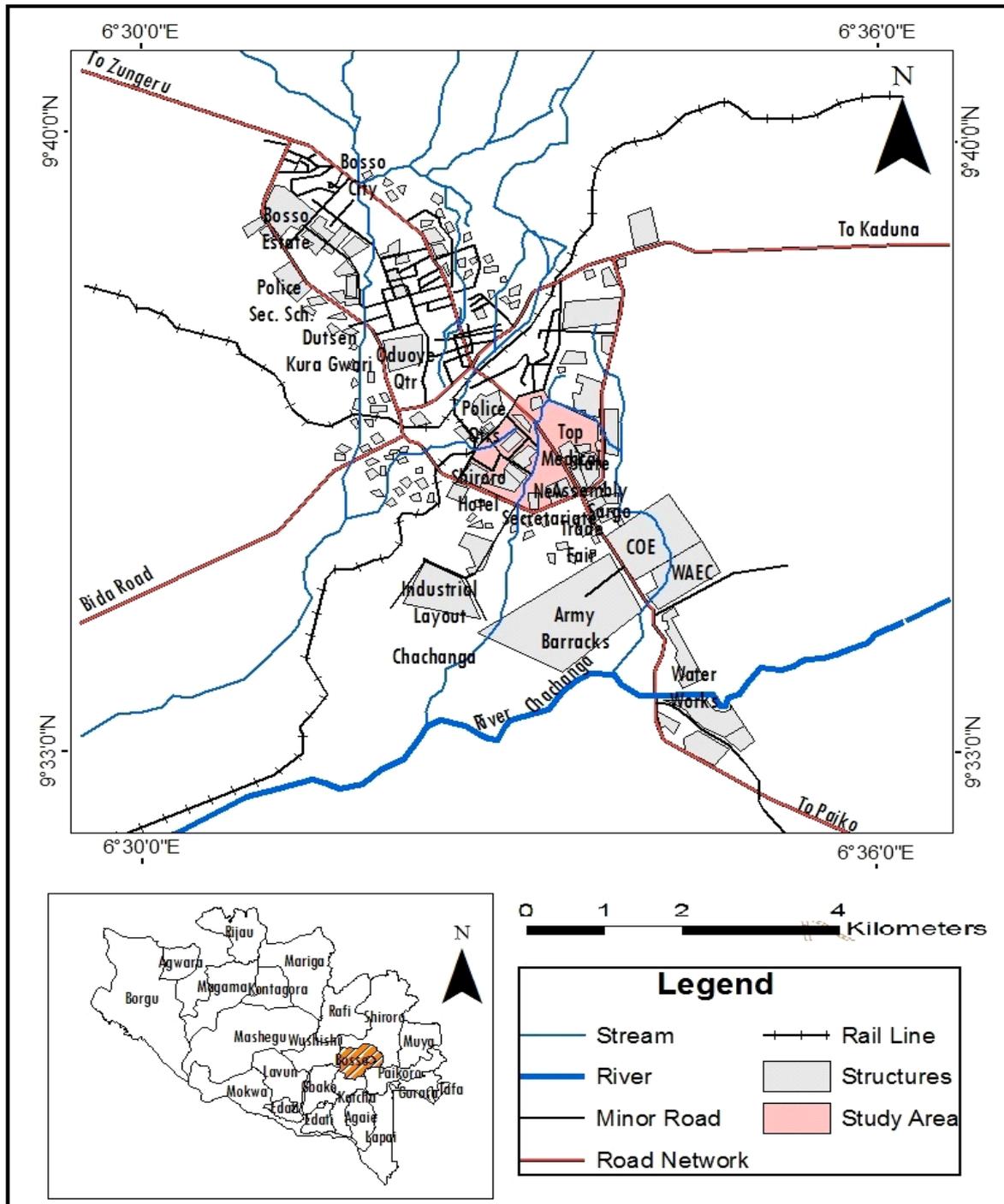


Figure 1.4: The Study Area
Source: Ministry of Lands and Survey Minna (2012).

The study area experiences two distinct seasons, dry and wet. The average temperature remains high throughout the year, hovering between 32- 35°C, particularly in March and June.

However, the lowest minimum temperatures between 26-28°C occur in December and January. The town experiences an annual average rainfall of 1334 mm and daily average humidity at 44.4% (UNDP/NISEPA, 2009). The landscape of Tunga is generally low lying between 60-80

metres above sea level and about 200- 250 meters above sea level towards the western part with intermittent hills (Maxlock, 1980). A few streams flow through the study area, they include Bosso, Shango, Chanchaga, Ekpa, Suka and Gora (UNDP/NISEPA, 2009). Soils in the study area belong to the ferruginous tropical soil class based on the CCTA classification system (Niger state regional plan, 1980). The study area lies in a natural vegetation characterized with scattered trees, shrubs and tall grasses. However due to the population pressure in this area, human activities have fondly modified the local vegetation. The predominant economic activities in the study area include commerce, service sector (civil service) and agriculture. The 2006 National Population Census, Chanchaga Local Government Area recorded a population of 201,429 (Niger State Planning Commission, 2011).

MATERIALS AND METHOD

Two types of data were used in this study; primary and secondary data respectively. The primary data was gotten through the use of structured questionnaires. The questionnaires were prepared and administered to obtain information on the types of domestic solid wastes generated, domestic solid waste management strategies employed, the key players in the domestic solid waste management and the effective levels of the domestic solid waste management strategies in the study area. The secondary data was obtained from books, journals, published and unpublished texts, documents, conference articles, government ministries and agencies such as the N.P.C. for population and household Census of 2006 and related websites. Niger State Environmental Protection Agency (2013), reported that there are a total of 2040 houses in the study area. Krejcie and Morgan's (1970) method of determining sample size was used to determine the sample size for this research, they reported that: for an area with a population between 2000-2200, the sample size to be used is 327. Thus, a total number of three hundred and twenty seven (327) Households were sampled systematically in the study area. The data was analyzed using tables of frequencies and percentages, pie chart and Chi Square.

RESULTS AND DISCUSSION

1.6.1 Statistics in table 1.6.1 below shows the distribution of the kinds of solid waste generated in the study area. From the table, it was observed that about two-third of all the domestic solid waste generated in the study area are mainly organic wastes in nature, while one third of the domestic solid waste generated are from paper, plastic, metal and textile wastes respectively.

Table 1.6.1: Types of Domestic Solid Wastes Generated in the Study Area

Type of waste	Frequency	Percentages (%)
Paper	76	23.24
Organic	234	71.56
Plastic	9	2.75
Metal	4	1.22
Textile	3	0.92
Others	1	0.31
Total	327	100

Source: Field Survey, 2015.

This means that a very large percentage of the domestic solid wastes generated in the study area are biodegradable (about 96%) compared to the non-biodegradable wastes generated in the study area (about 4%), this also implies that the biodegradable wastes can be decomposed and used for other purposes. Afangideh, Kinuagbeye and Atu (2012), in the same vein reported that majority of the wastes generated in Calabar are biodegradable waste compared to non-biodegradable waste which when decomposed can be harmful to human health.

Domestic Solid Waste Management Strategies Employed In the Study Area

Table 1.5.2 below shows that the major domestic solid waste management strategies employed in the study area is open dumping, burning and burying. About 62% of the respondents dump their wastes openly; about 22% bury their wastes while about 16% burn their wastes. Efe (2010) in the same vein reported that there were no authorized dumpsites in Ughelli and the major method of waste disposal are open dumping, land filling and dig and bury. This is an indication that most residents dump their domestic solid wastes on the streets, gutters or any available open space.

Table 1.6.2: Types of Domestic Solid Waste Management Strategies in the Study Area

Strategies	Frequencies	Percentage %
Burning	52	15.90
Burying	71	21.71
Open dumping	202	61.77
Other	2	0.61
Total	327	100

Source: Field Survey, 2015.

Open dumping could be a source of health problems for the residents and can make roads inaccessible by obstructing the free flow of traffic. It can also lead to flooding due to blockage of gutters and other water channels during the rainy season. Burying is also carried out in the area, all the residents have to do is to dig a hole and throw their wastes there and cover it when it is filled up. Some of the residents reported that burning their wastes is convenient for them but it causes air pollution.

This shows that modern means of managing domestic solid waste such as recycling, composting and incineration are not carried out in the study area and the exploration and use local initiatives and strategies which could go a long way to improve solid waste management is not carried out in the study area. According to Ayo, Ibrahim and Mohammed, (2010), the domestic solid wastes management strategies in place would result in significant threats to human health and the environment in the study area.

Key Players in Domestic Solid Waste Management in the Study Area

The key players domestic solid waste management in the study area is shown in the Figure 1.6.3 below. The chart shows that 59% of the respondents reported that the government plays the key role in managing domestic solid waste in the study area through the Niger State Environmental protection Agency (NISEPA) while 41% of the respondents reported that

individual households play the key role in managing domestic solid waste in the study area through different avenues like the use of trucks and wheel barrows. This shows that the private sector participation in managing domestic solid wastes is absent in the study area.

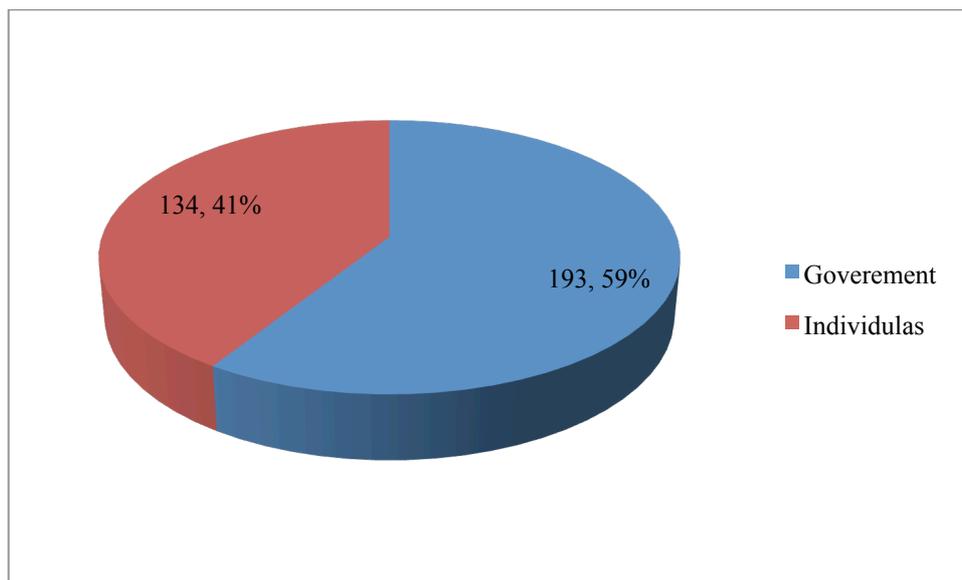


Figure 1.6.3: Pie Chart Showing Key Players in the Domestic Solid Waste Management in the Study Area
 Source: Field Survey, 2015.

Frequency Of Waste Generated And Disposed In The Study Area

The results on the the frequency of waste generation and disposal in the study area is presented in table 1.6.4 below.

Table 1.6.4: Frequency of Waste Generation and Disposal in the Study Area

Frequency	Waste Generation	Percentage (%)	Waste Disposal	Percentage (%)
Daily	243	74.31	159	48.62
Twice a Week	78	23.85	104	31.80
Weekly	5	1.53	59	18.04
Others	5	1.53	1	0.31

Source: Field Survey, 2015.

The table shows that about 74% of the respondents generate their wastes daily, while about 49% of the respondents dispose their wastes daily; about 24% of the respondents generate their wastes twice a week, while about 32% of the respondents dispose their wastes twice a week; about about 2% of the respondents generate their wastes once a week and 18% dispose their wastes once a week. This implies that the rate of waste generation is greater than the rate of waste disposal. It also shows that the residents in the study area are exposed to domestic solid wastes for longer periods of time than necessary. According to Agbede and Ajagbe (2004), these wastes could provide breeding grounds for pathogenic organisms, attract insects and rodents and cause health problems to these residents.

1.6.5 The Effective Levels of the Domestic Solid Waste Management Strategies and NISEPA in the Study Area

Statistics in table 1.6.5 below shows the effective levels of the Domestic Solid Waste Management Strategies and Niger State Environmental Protection Agency (NISEPA) in the study area. The assessment shows that about 42% of the respondents reported that burning of domestic solid waste is not effective while about 38% and 25% reported that burning of domestic solid waste is effective and very effective in the study area. The result shows that the respondents are not aware of the health implication of burning domestic solid wastes in the study area. Burning causes air pollution; it increases the concentration of carbon (IV) oxide and contributes to global warming. About 15% of the respondents are of the view that burying of domestic solid waste is not effective, about 56% think that burying of domestic solid waste is effective while 28% think that burying of domestic solid waste is very effective. This shows that a large percentage of the respondents see burying as an effective method of managing domestic solid waste.

Table 1.6.5: Effective Levels of Domestic Solid Waste Management Strategies and NISEPA in the Study Area

Strategy	Not Effective	Percentage (%)	Effective	Percentage (%)	Very Effective	Percentage (%)
Burning	138	42.20	123	37.61	66	20.18
Burying	50	15.29	184	56.27	93	28.44
Open Dumping	282	86.24	34	10.40	11	3.36
NISEPA	176	53.82	140	42.81	11	3.36

Source: Field Survey, 2015.

The table on the respondent's view on open dumping shows that about 86% reported that open dumping is not an effective method of managing domestic solid waste, while about 10% and 4% feel that open dumping is effective and very effective in managing domestic solid waste in the study area. This is because open dumping pollutes the environment; it can make roads inaccessible by obstructing the free flow of traffic. It can also lead to flooding due to blockage of gutters and other water channels during the rainy season.

About 54% of the respondents feel that Niger State Environmental Protection Agency (NISEPA) is not effective in managing domestic solid waste, while about 43% and 4% feel that NISEPA is effective and very effective in the management of domestic solid wastes in the study area. This assessment shows that more than half of the respondents do not think that the management of domestic solid waste by NISEPA is effective in the study area. The assessment of NISEPA in the study area shows that more has to be done on waste collection and disposal. The problems of solid waste such as inadequate service coverage, inadequate finance, irregular waste collection, waste spill over from bins and storage containers, and nonchalant attitude of people towards indiscriminate disposal on unauthorized places and waste littering are common. Onibokun and Kumuyi (1999) noted that problems in cities have become burdensome despite efforts being made by city authorities and governments. Sustainable development according to World

Commission on Environment and Development, (1987) refers to development that meets the needs of the present generation without compromising the ability of future generations to meet their needs. For sustainable development to take place, it means that wastes need to be managed effectively. Thus, it entails a sustainable solid waste management system that is environmentally, financially, and socially appropriate and acceptable.

DATA ANALYSIS

Chi-square Analysis of the Frequency of Wastes Generated and Waste Disposed in the Study Area

The first hypothesis (there is no significant difference between the frequency of waste generated and the frequency of waste disposed in the study area) was tested using Chi Square at 0.05 level of significance. The result obtained is presented in table 1.6.6.1 below.

Table 1.6.6.1: Chi-square Analysis of the Frequency of Wastes Generated and Waste Disposed in the Study Area

Chi Square Analysis	Value	Degrees of Freedom	Significance
Pearsons Chi Square	126.186	24	0.01
Likelihood Ratio	108.875	24	0.01
Linear –by Linear association	57.317	1	0.01

Source: Author's Analysis, 2015

From the table above, the result obtained showed that the Alpha value of 0.01 is lower than 0.05, the implication of this is that the null hypothesis which states that there is no significant difference between the frequency of waste generated and the frequency of waste disposed in the study area was rejected and the test concluded that there is a significant difference between the frequency of waste generated and the frequency of waste disposed in the study area. This is an indication that the rate of waste generation does not determine the rate of waste disposal in the study area

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Linear –by Linear association	57.317	1	0.01

Source: Author's Analysis, 2015

Kruskal Wallis Analysis of the Effectiveness of the Domestic Solid Waste Management Strategies

The second hypothesis (there is no significant difference in the effectiveness among the domestic solid waste management strategies in the study area) was tested using Kruskal Wallis at 0.05 level of significance. The result obtained is presented in table 1.6.6.2 below. From the table the assumed significance for the domestic solid waste management Strategies in the study area is 0.646. The result obtained showed that the Alpha value ($\alpha = 0.646$) is greater than $p > 0.05$. Therefore, the null hypothesis was accepted. This shows that there is no statistically significant difference in the effectiveness among the domestic solid waste management

strategies in the study area. It also indicates that the domestic solid waste management strategies are not effective in managing domestic solid wastes in the study area.

Table 1.6.6.2. Kruskal Wallis H Analysis of the Effectiveness of the Domestic Solid Waste Management Strategies

Kruskal Wallis	H	Df	α	Remark
Value	6.014	8	0.646	Significant

Source: Author's Analysis, 2015

CONCLUSION BASED ON THE FINDINGS

The findings of this study showed that the method of waste management adopted in the study area does not conform to sustainable waste management strategy. This implies that much attention has not been given to domestic solid waste management in the study area. The methods of managing domestic solid wastes in the study area were found to be inefficient and unsustainable. Thus, the study revealed that the government as well as the stakeholders needs to pay more attention to the management of domestic solid wastes in the study area. To ensure a healthy environment, domestic solid wastes need to be properly managed; this therefore calls for urgent precautionary measures to protect the population against the adverse impacts of pollutants as well as degradation of the environment.

The study recommended the adoption of composting as a method of waste management since majority of the domestic solid waste generated is organic in nature, the encouragement of Private Sector participation in domestic solid waste management, public enlightenment on the importance of creating a healthy environment and on the mechanism of reducing waste generation at the source, Recycling of waste materials and increased budgetary allocation of NISEPA to enhance effective Domestic Solid Waste Management in the study area.

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