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Research Article

Solid Waste Disposal Practices on the Environment

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Abstract: The purpose of the study was to examine solid waste disposal situation and its resultant effects in Winneba The research adopted quantitative approach for the study. The design for this research was a descriptive survey. The population for the study were residents of Winneba Township the capital of the Effutu municipality. The area is a fast growing urban community. Stratified sample sampling technique was used to select the respondents for the study. One hundred and fifty-six (156) residents were selected using strata sampling to answer questionnaires. The data entry and analysis was done by using the SPSS software package. The data was edited, coded and analysed into frequencies, percentages with interpretations. The study revealed that there was irregular or lack of routine collection of waste by WMD of EMA and ZoomLion Ghana Ltd. The study also indicated that, the landfill did not meet the requirement of a sanitary landfill as in the case of EMA and therefore could be described as an open dump. It is recommended that, adequate dustbins and skips should be provided by ZoomLion Ghana Ltd. in collaboration with the WMD and Municipal Assembly for residents in the Municipality for waste storage. It is recommended that the landfill site should be properly managed to avoid heaping of waste and burning.

Keywords: Effect, Solid Waste, Disposal, Practices

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1. Introduction

1.1. Solid Waste Disposal

Waste management should be approached from the perspective of the entire cycle of material use, which includes production, distribution and consumption as well as waste collection and disposal. Whilst immediate priority must be given to effective collection and disposal, waste reduction and recycling should be pursued as equally important, longer-term objectives [1]. The interest in private sector participation in the management of solid waste is very high. There is a positive attitude among community towards privatization of solid waste management in Ghana [2]. A research on "Attitude of People towards Private Sector Participation in Solid Waste Management in the Komenda-Edina-Eguafo-Abrem (KEEA) Municipality in Ghana". Published in American Journal of Environmental Engineering and Science revealed that, waste disposal data are the most difficult to collect. Many countries do not collect waste disposal data at the national level, making comparisons across income levels and regions difficult. Management approach to solid waste management in the district is top-down approach. ZoomLion workers were dissatisfied with the top-down waste management approach. This implies that almost all management decisions concerning solid waste are taken by only management members. This is because the views of technocrats and others in lower positions are not sought in management decisions which makes it very difficult to deal with solid waste disposal in Ghana [2]. Furthermore, in cases where data is available, the methodology of how disposal is calculated and the definitions used for each of the categories is often either not

known or not consistent [3]. In developing countries, the prevalent methods of solid waste disposal is through uncontrolled dumping or burning on open ground or city streets [4, 5]. This often results in more pollution and loss of salvageable economic value [4, 6]. A research revealed that, the most commonly recognized methods for the final disposal of solid wastes were:

- dumping on land, canyons and mining pits
- dumping in water
- ploughing into the soil
- feeding to hogs
- reduction and incineration [7].

Some of these unwholesome practices of solid waste identified during the early disposal practices still exist in cities, towns and villages today. Indiscriminate dumping on opened land and dumping in gutters particularly are clearly evident in towns and cities, while dumping in water especially people living in coastal towns is common place. The high moisture content and organic composition of wastes in the developing world may lead to problems of increased decomposition rates in areas with high average daily temperatures; high seasonal or year-round rainfall would only compound these problems, presenting additional challenges with insect populations and conditions conducive to disease. A higher solid waste density also has many implications for the 'traditional' methods of collection and disposal; collection and transfer trucks which are able to achieve compression rates of up to 4:1 in industrialized nations may achieve only 1.5:1 in developing countries, and landfill compression technology which averages volume reduction of up to 6:1 in industrial nations may only achieve 2:1 compaction with these increased waste densities [8]. It is estimated that about 83% of the population dump their refuse in either authorised or unauthorised sites in their neighbourhood, and due to weak capacity to handle solid waste, unsanitary conditions are created. Burning of dumps is also common in peri-urban and rural communities in Ghana and in many other less developed countries. A study conducted in Nairobi, Kenya revealed that, the end disposal of Nairobi's waste is open dumping at a site located at Dandora, in the Eastland's section of the city although there is a minimal amount of disposal by open burning and incineration, the ash also ends up in Dandora open dumpsite. This has gone to confirm that the practices of solid waste disposal in the 1950s still exist today and study area is not an exception [9]. In the contemporary era, the methods of managing solid waste include source reduction, sanitary landfills, composting, recycling, and incineration [10].

Source reduction, also known as waste prevention, means reducing waste at the source. It can take many different forms, including reusing or donating items, buying in bulk, reducing packaging, redesigning products, and reducing toxicity. Source reduction focuses on reducing the volume and /or toxicity of waste generated [11]. A researchers elaborated that, waste or source reduction initiatives (including prevention, minimization, and reuse) seek to reduce the quantity of waste at generation points by redesigning products or changing patterns of production and consumption. It is agreed that, source separation and resource recovery is an important method in waste management. This is because there is nothing like waste on this earth. Examples of possible reduction at the consumption level include reuse of containers (including bags), better buying habits and cutting down on the use of disposable products and packaging. Recycling is the first of the three "recovery" processes in the waste hierarchy. Recycling recovers materials, by preventing them from being disposed of, and makes them into new goods. This can involve turning the old materials into a new version of the same thing, or materials can be recycled into something completely different. For example, used glass bottle can be recycled into new bottles, or they can recycle into something different, such as materials used in road construction [12]. Recycling has been viewed as a veritable tool in

minimizing the amount of household solid wastes that enter the dump sites. It also provides the needed raw materials for industries [13].

Composting process uses microorganisms to degrade the organic content of the waste. Aerobic composting proceeds at a higher rate and converts the heterogeneous organic waste materials into homogeneous and stable humus [14]. Composting as a biological decomposition of biodegradable solid waste under controlled predominantly aerobic conditions to a state that is sufficiently stable for nuisance-free storage and handling and is satisfactorily matured for safe use in agriculture [15]. Experience from many jurisdictions shows that composting source separated organics significantly reduces contamination of the finished compost, rather than processing mixed MSW with front-end or back-end separation [3]. Studies alluded that in developing countries, the average city's municipal waste stream is over 50% organic material; studies in Bandung, Indonesia and Colombo, Sri Lanka have found residential waste composed of 78% and 81% compostable material, and market waste 89% and 90% compostable, respectively [3,5].

In the views of Hoornweg and Bhada-Tata, incineration of waste (with energy recovery) can reduce the volume of disposed waste by up to 90%. These high volume reductions are seen only in waste streams with very high amounts of packaging materials, paper, cardboard, plastics and horticultural waste. Recovering the energy value embedded in waste prior to final disposal is considered preferable to direct landfilling - assuming pollution control requirements and costs are adequately addressed. Typically, incineration without energy recovery (or non-autogenic combustion, the need to regularly add fuel) is not a preferred option due to costs and pollution [3]. Open-burning of waste is particularly discouraged due to severe air pollution associated with low temperature combustion. Incinerators have the capacity to reduce the volume of waste drastically, up to nine fold than any other method [11].

The placement of solid waste in landfills is the oldest and definitely the most prevalent form of ultimate waste disposal [16]. The waste or residue from other processes should be sent to a disposal site. Landfills are a common final disposal site for waste and should be engineered and operated to protect the environment and public health. Proper landfilling is often lacking, especially in developing countries [3]. An argument put forward by Zerbock suggests that, "landfills" are nothing more than open, sometimes controlled dumps. According to him the difference between landfills and dumps is the level of engineering, planning, and administration involved. Open dumps are characterized by the lack of engineering measures, no leachate management, no consideration of landfill gas management, and few, if any, operational measures such as registration of users, control of the number of "tipping fronts" or compaction of waste [16]. Disposing of waste in a landfill involves burying the waste, and this remains a common practice in most countries. Landfills were often established in abounded or unused quarries, mining voids or borrow pits. The open dump approach is the primitive stage of landfill development and remains the predominant waste disposal option in most of the countries [17].

1.2. Effects of Poor Solid Waste Disposal on the Environment and Health

Inappropriate disposal of solid waste can have a major adverse impact or consequences on humans in the society both in terms of the natural environment and health. The environment can include surface and groundwater, solid and air. The greater part of waste in Winneba is disposed of through landfills. The effects of landfills include odour, pest and ground and surface water contamination from leachate. There are some human health risks associated with solid waste handling and disposal in all countries to some degree, but certain problems are more acute and widespread in underdeveloped nations. A research classified landfills into four main categories: 1) presence of human fecal matter, 2) presence of potentially hazardous industrial waste, 3) the decomposition

of solids into constituent chemicals which contaminate air and water systems, and 4) the air pollution caused by consistently burning dumps and methane release [8].

Human faecal matter is present in every solid waste system; in developing nations the problem varies with the prevalence of adequate sanitary disposal systems such as municipal sewerage or on-site septic systems, outhouses, etc. In areas where such facilities are lacking (especially shantytowns and over-crowded municipal districts), the amount of human faecal matter present in the solid waste stream is likely to be higher. This presents a potential health problem not only to waste workers, but also to scavengers, other users of the same municipal drop-off point, and even small children who like to play in or around waste containers [16]. This is evident in the recent outbreak of cholera in some major cities in Ghana which has so far claimed about 200 lives out of about 10,000 reported cases [18]. Industrial waste can also pose significant health risks for those involved in the collection and ultimate disposal of solid waste.

The decomposition of waste into constituent chemicals is a common source of local environmental pollution. This problem is especially acute in developing nations; very few existing landfills in the world's poorest countries would meet environmental standards accepted in industrialized nations, and with limited budgets there are likely to be few sites rigorously evaluated prior to use in the future. The problem is again compounded by the issues associated with rapid urbanization. As land becomes scarce, human settlements encroach upon landfill space, and local governments in some cases encourage new development directly on top of operating or recently closed landfills. A major environmental concern is gas release by decomposing garbage. Methane is a by-product of the anaerobic respiration of bacteria, and these bacteria thrive in landfills with high amounts of moisture [16]. Current practices in the developing world range from absolutely no leachate management (unofficial dumps or those operating continuously for years without 'sanitary' specifications) to discharge into municipal sewer and sewage systems, direct discharge into surface water systems (rivers), multi-pond aeration and settlement systems, chemical treatment facilities, and recirculation systems [17].

According to a researcher, the health status of a community is affected by its state of environment. Poor sanitary militates against the protection and preservation of health. Improper solid waste disposal can be very harmful to the environment. These wastes when improperly dumped into the environment can lead to the destruction of the ozone layer and may cause diseases such as cancer. As a result, there is problem in global warming. Air pollution can often lead to the formation of acidic rain which is dangerous to crop life since its fastens the removal of soil fertility from the surface of the ground. It also affects drainage, when solid wastes are dumped in drainage channels and gutters; they block the flow of the sewerage. This may cause flooding which destroys human lives and properties. At the same time, solid wastes also affect soil drainage which hinders the growing of crops [19].

Rapid increase in volume and types of solid waste as a result of continuous economic growth, urbanization and industrialization, is becoming a burgeoning problem for national and local governments to ensure effective and sustainable management of waste [2]. However, production and consumption of products has resulted in an increase in the tons of waste generated on a daily basis in the Winneba municipality. The municipal authorities, however have not been able to keep pace with the rapid accumulation of waste and now the authorities are overwhelmed by the waste situation in Winneba. This has resulted in waste being found in gutters, drains and on pavements or streets in Winneba. The municipality's final garbage disposal site is also located near the sea and it is polluting it. These practices have created an unhealthy environment resulting in diseases such as malaria and cholera among the citizens. Winneba, a town that used to pride herself with long clean, white, breezy beaches that provide a serene and congenial atmosphere for tourism cannot today boast of these nice places because filth has taken over these beaches. The situation is an eye saw and a worrying situation. the Winneba

residents and city authorities are well aware of the waste problem however the question that needs to be answered is do the residents and these authorities really understand the problem? The purpose of the study was to examine solid waste disposal situation and its resultant effects in Winneba. The study sought to answer these research questions. (1) What is the solid waste disposal situation in Winneba? (2) What are the effects of poor solid waste disposal practices in Winneba?

2. Materials and Methods

The researchers quantitative approach for the study. The design for this research was a descriptive survey. The population for the study were residents of Winneba Township the capital of the Effutu municipality. The area is a fast growing urban community. stratified sample sampling technique was used to select the respondents for the study. One hundred and fifty-six (156) residents were selected using strata sampling to answer questionnaires. The data entry and analysis was done by using the SPSS software package. The data was edited, coded and analysed into frequencies, percentages with interpretations.

3. Results

3.1. Solid Waste Disposal Practices

This section seeks to give a description of the waste disposal practices among residents, how the respondents manage their waste, problems they face as to where they dispose of waste and how refuse is collected regularly in Winneba township. Since the nature of the problem indicates how concerned people will be in dealing with it, respondents were asked to indicate the nature of the solid waste situation in their various localities.

Table 1. How will you describe the General Waste Situation in your Neighbourhood?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very satisfactory	6	3.8	3.8	3.8
	Satisfactory	53	34.0	34.0	37.8
	Poor	69	44.2	44.2	82.1
	Very poor	28	17.9	17.9	100.0
	Total	**156**	**100.0**	**100.0**	

As indicated in Table 1, 69 respondents representing 44.2% of the residents held the view that the nature of the waste management problem in Winneba is poor, 53 people representing 34% were of the view that the general waste situation in Winneba is satisfactory, 28 individuals representing 17.9% held the view that the situation was very poor and only 6 individuals representing 3.8% thought that the situation was very satisfactory. The most common waste management institutions responsible for collecting waste for disposal in Winneba, are WMD, EMA and ZoomLion Ltd.

Table 2. Which Waste Management Institution collects waste in your area for disposal?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Waste Management Department (of the municipal assembly)	23	14.7	14.7	14.7
	ZoomLion	80	51.3	51.3	66.0
	None	34	21.8	21.8	87.8
	Don't know	19	12.2	12.2	100.0
	Total	**156**	**100.0**	**100.0**	

Table 2 shows that the use WMD of EMA facilities and services constitute only 14.7% representing 23 respondents and as 80 individuals representing 51.3% rely on ZoomLion Ghana Ltd. to collect their waste. This proves that the dependency rate of the residents' users on the facilities and service provided by ZoomLion Ghana Ltd. for disposal of refuse is very high which creates a lot of pressure on ZoomLion Ghana Ltd. facilities in Winneba.

Table 3. Where do you dump your waste?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Roadside	4	2.6	2.6	2.6
	Skip	8	5.1	5.1	7.7
	Dump site	79	50.6	50.6	58.3
	Open spaces	16	10.3	10.3	68.6
	Nearby gutter	10	6.4	6.4	75.0
	Backyard	26	16.7	16.7	91.7
	other, specify	13	8.3	8.3	100.0
	Total	**156**	**100.0**	**100.0**	

As shown in Table 3, 79 respondents representing 50.6% dispose their refuse at approved dump sites, 26 individuals representing 16.7% also dump their waste at their backyards. Another option available to residents was to dump waste in open spaces and as much as 16 individuals representing 10.3% resorted to this practice,10 other individuals representing 6.4% chose to use nearby gutters as the most convenient place to dispose their waste. This evident in Figure 1 where residents chose use gutter at Wonsom market as a convenient place to dispose waste. Some 8 respondents representing 5.1% used skips provided by either ZoomLion or WMD of EMA to dispose waste.

Figure 1. A Gutter at Wonsom market used as a Refuse Site

Table 4. How many times is the waste collected in a week?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	48	30.8	31.2	31.2
	Once	44	28.2	28.6	59.7
	Twice	37	23.7	24.0	83.8
	Thrice	6	3.8	3.9	87.7
	Four times	4	2.6	2.6	90.3
	Five times	4	2.6	2.6	92.9
	Throughout	11	7.1	7.1	100.0
	Total	**154**	**98.7**	**100.0**	
Missing	System	2	1.3		
	Total	**156**	**100.0**		

From Table 4, 30.8 percent of respondents representing 48 individuals indicated that waste was not collected at all within a week and in some instances once a week as indicated by 28.2 percent of the respondents representing 44 residents. Five times a week which should have been the required number of times waste was collected was rather the least particularly in the low class residential areas. This brought about heaping of waste in dumpsites and skips overflowing with waste particularly in the low class residential areas. Since these skips are not replaced immediately when they are taken people resort to dumping waste in open spaces. This is evident in Figure 2.

Figure 2. An Overflowing skip near the ZoomLion Office.

Table 5. What is the mode of collection of waste in your area?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Door-to-door	38	24.4	25.3	25.3
	Curb	11	7.1	7.3	32.7
	Communal	68	43.6	45.3	78.0
	Other, (specify)	33	21.2	22.0	100.0
	Total	**150**	**96.2**	**100.0**	
Missing	System	6	3.8		
	Total	**156**	**100.0**		

From the Table 5, 43.6 percent of the respondents representing as much as 68 individuals indicated that, waste was collected directly from their communal dumpsites while 24.4 and 7.1 percent of the respondents representing 38 and 11 residents indicated waste was collected from their door-to-door and curb respectively. Table 5 shows the main mode of waste collection in EMA.

Table 6. How will you describe the Quality of Waste Disposal Service you Receive?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very satisfactory	6	3.8	3.9	3.9
	Satisfactory	62	39.7	40.0	43.9
	Poor	68	43.6	43.9	87.7
	Very poor	19	12.2	12.3	100.0
	Total	**155**	**99.4**	**100.0**	
Missing	System	1	6		
	Total	**156**	**100.0**		

As indicated in Table 6, 68 respondents representing 43.6 percent of the residents held the view that the quality of waste disposal service they receive in Winneba was poor, 62 people representing 39.7 percent were of the view that the generally the quality of waste disposal service they receive in Winneba was satisfactory, 19 individuals representing 12.2 percent held the view that the quality of waste disposal service they receive was very poor and only 6 individuals representing 3.8percent thought that the quality of waste disposal service they receive in Winneba was very satisfactory.

3.2. Effects of Indiscriminate Waste Disposal

Under this section, respondents were asked to respond to some series of statements. These statements describe their knowledge on waste disposal practices, management in their locality and the effects of indiscriminate waste disposal practices.

3.3.1. Poor Waste Disposal Practice Leading to the spread of Diseases

From the presentation in Table 7, the data revealed that as many as 99 residents representing 63.5 percent Strongly Agreed to the statement, Poor waste disposal practices can lead to the spread of diseases and 43 other respondents constituting 27.6 percent Agreed to the statement. However, 5 respondents representing 3.2 percent disagreed to the statement, Poor waste disposal practices can lead to the spread of diseases

Table 7. Poor waste disposal practices can lead to the spread of diseases

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	SA	99	63.5	63.9	63.9
	A	43	27.6	27.7	91.6
	NS	8	5.1	5.2	96.8
	D	5	3.2	3.2	100.0
	Total	**155**	**99.4**	**100.0**	
Missing	System	1	6		
	Total	**156**	**100.0**		

3.3.2. Environmental Problems Associated with Indiscriminate Waste Disposal

Respondents were asked if they knew any environmental problems associated with their methods of waste disposal. The out of the question is presented in Table 8. From the presentation, 94 respondents representing 60.3 percent said No to the question, **Do you know of any environmental problems associated with your method of waste disposal?** And 61 others constituting 39.1 percent responded Yes to the question, **Do you know of any environmental problems associated with your method of waste disposal?**

Table 8. Do you know of any environmental problems associated with your method of waste disposal?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	61	39.1	39.4	39.4
	No	94	60.3	60.6	100.0
	Total	**155**	**99.4**	**100.0**	
Missing	System	1	6		
	Total	**156**	**100.0**		

The respondents were then asked to mention some of these environmental problems that they know. The data gathered is presented in Table 9.

Table 9. Environmental Problem associated with improper waste disposals

Problem	Number of Respondents	Percentage
Air pollution	19	12.1
Littering	25	16
Air pollution &littering	14	9
Flooding	12	8
Water pollution	21	13
Water pollution &flooding	26	16.6
Water pollution &air pollution	27	17.3
Water pollution & littering	12	8
Total	**156**	**100.0**

3.3.3. Common Diseases in the Town

An interview with the Technical Officer (Health Information) of TSH also showed some common diseases that are caused by insanitary conditions. These diseases were malaria, typhoid and cholera. The data was collected on the frequency of the diseases from January 2013 to December 2013 and from January 2014 to October 2014. The data gathered is presented in Table 10.

Table 10. Most Common Diseases associated with insanitary conditions

	Number of Times Recorded	
Disease	January - December 2013	January - October 2014
Malaria Cases	4292 cases	3753 cases
Typhoid Cases	1354 cases	743 cases
Cholera Cases	-	51 cases

Source: Trauma and Specialist Hospital, Winneba – November, 2014

4. Discussion and Analysis

4.1. Solid Waste Disposal Situation in the Winneba Township

As part of the objectives for the study in describing the waste disposal situation in the study area, this section looks at how the respondents manage their waste, problems they face as to where they dispose of waste and how refuse is collected regularly in the study area. Objective one of the work was to describe the solid waste disposal situation of Winneba Township.

Majority of the locals 70 and 64 agreed and strongly agreed respectively that waste disposal is a problem in the community, only 11 respondents disagreed that waste is a problem in the community (Figure 3). The unanimous responses that waste disposal is a problem in the Winneba Township was evident ($\chi 2$= 8.068, df=12, P= 0.780).

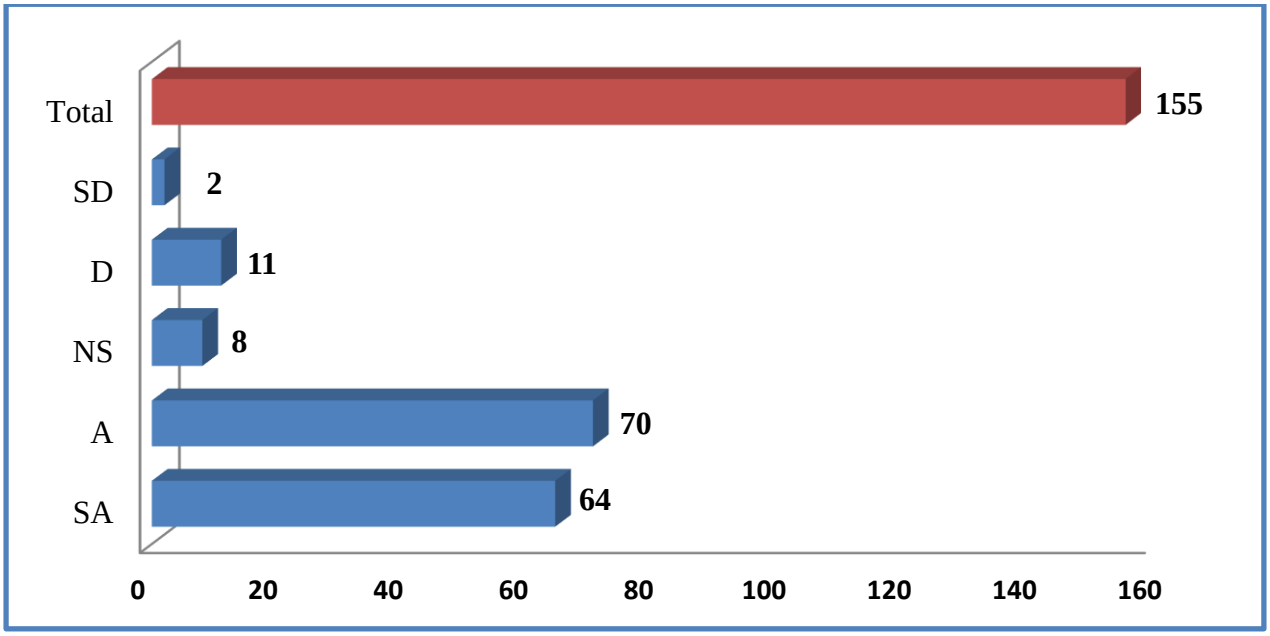

Figure 3. Waste disposal is a problem in the community

From Table 11, regardless of one's educational level they all perceived waste disposal situation in the community as a problem. 41.3% of the indigenes of all education level sampled, strongly agreed that waste disposal is a problem in the Town, and 45.2% agreed that waste disposal in the township is a problem. Meanwhile, 7.1% of respondents of all levels of education disagreed that waste disposal is problem in the community.

Table 11. Relative comparison of ones' educational level and perception of waste disposal situation in the communities.

		Waste disposal is a problem in my community					Total
		SA	A	NS	D	SD	
Highest educational level	Never	0.0	100.0	0.0	0.0	0.0	100.0
	Primary	50.0	50.0	0.0	0.0	0.0	100.0
	Middle school/JSS	42.1	57.9	0.0	0.0	0.0	100.0
	SHS/Technical	42.0	48.0	2.0	4.0	4.0	100.0
	Tertiary	40.8	38.2	9.2	11.8	0.0	100.0
	Total	**41.3**	**45.2**	**5.2**	**7.1**	**1.3**	**100.0**

Further, almost all the different age groups 40.8% and 46.1% agreed strongly agreed and agreed respectively that waste disposal is a problem in the Winneba Township. A chi-square test result ($\chi 2$= 25.179, df=12, P= 0.014, Critical Significant Level (α) =0.05 0r 5%). Majority of women and men in the locality sampled greed (45.2%) and strongly agreed (41.3%) that waste disposal is a problem in the town and 7.1% disagreed with this assertion.

Table 12. Age and gender and of how they perceived waste disposal as a problem in the Township

		Waste disposal is a problem in my community					Total
		SA	A	NS	D	SD	
Age	Under 20 years	44.4	51.9	3.7	0.0	0.0	100.0
	21-30 years	39.4	45.1	2.8	12.7	0.0	100.0
	31-40 years	40.0	48.6	8.6	2.9	0.0	100.0
	over 41 years	42.1	36.8	10.5	0.0	10.5	100.0
	Total	**40.8**	**46.1**	**5.3**	**6.6**	**1.3**	**100.0**
Gender	Male	42.7	42.7	5.3	8.0	1.3	100.0
	Female	40.0	47.5	5.0	6.2	1.2	100.0
	Total	**41.3**	**45.2**	**5.2**	**7.1**	**1.3**	**100.0**

Describing the general waste condition of the respective neighbourhoods, majority of the residents sampled (44%) described the situation as poor, 34% described it as satisfactory and 18% said it was very poor. Only 4% of the respondents described the waste situation as very satisfactory (Figure 4).

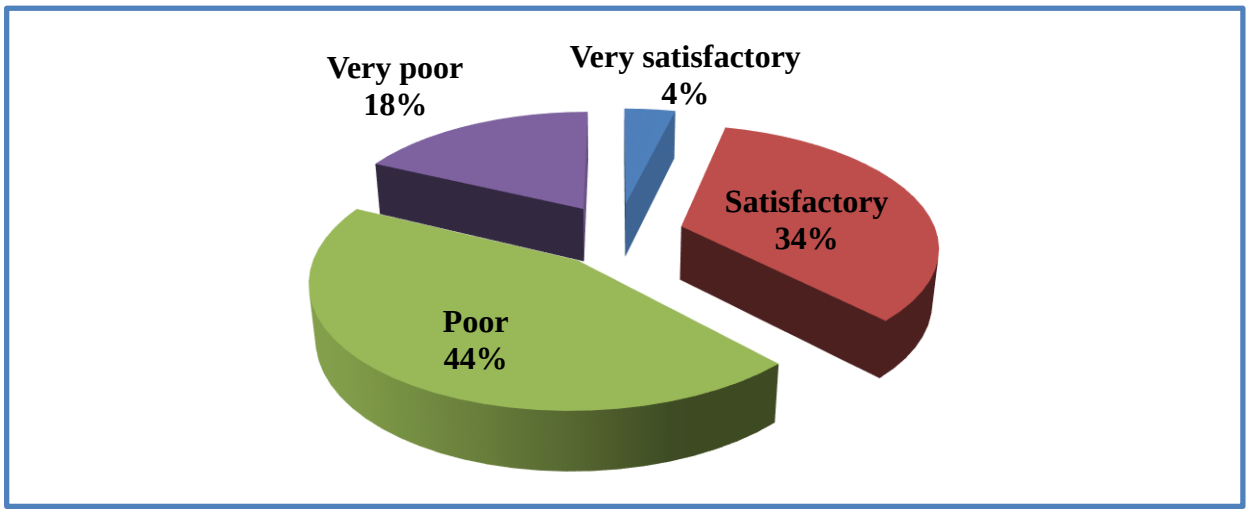

Figure 4. Residents' description of the general waste situation in your neighborhood

From Table 12, the commonest place for waste disposal was the dump site (50.6 per cent). This method was used in suburbs such as Zongo and other areas. This is followed by storing waste at the backyard (16.7 percent) mostly in the high class residential areas and some middle class residential areas in the Municipality. These areas were: Abasraba, Low Cost and Kojo Beedu. The rest of respondents who were located in seven different suburbs in Winneba, including Zongo, and others such as Wonsom, Yepimso, Sakagyaano, Penkye, Aboadze and Ponko-ekyir, all located near the fishing beach constituted (32.7percent) resorted to dumping waste in either the roadside, skips, open spaces, nearby gutter and others specified places. This resulted in littering and heaping of waste thereby making the environment filthy. Therefore, the possibility of outbreak of cholera and other environmental related diseases is high if such practice continues. At a statistical significant level of 0.05 or 5%, it was shown that there was no association between ones level of education and where they disposed of their waste in the Winneba Township ($\chi 2$= 30.835, df=24, P= 0.159). From (Table 13, 50.6% of respondents of all levels of education said they dumped their waste at a designated dump site and 16.7% said they dumped their waste at their backyard. Regardless of gender, respondents were unanimous ($\chi 2$= 4.130, df=6, P= 0. 659) on where they disposed of waste.

Table 13. Relative comparison of level of education and where waste is disposed off.

		Where do you dump your waste? (%)							Total
		Road-side	Skip	Dump site	Open spaces	Nearby gutter	Backyard	Other	
Level of education	Never	0.0	0.0	100.0	0.0	0.0	0.0	0.0	100.0
	Primary	0.0	0.0	12.5	12.5	0.0	50.0	25.0	100.0
	Middle school/JSS	0.0	10.5	52.6	26.3	0.0	10.5	0.0	100.0
	SHS/Technical	4.0	4.0	60.0	2.0	4.0	18.0	8.0	100.0
	Tertiary	2.6	5.2	46.8	11.7	10.4	14.3	9.1	100.0
	Total	**2.6**	**5.1**	**50.6**	**10.3**	**6.4**	**16.7**	**8.3**	**100.0**
	Chi-square results	χ^2= 30.835, df=24, P= 0.159, Critical Significant Level (α)=0.05 0r 5%							

4.1.1. Solid Waste Collection

Solid waste management includes the hauling and final disposal at landfills. Figure 5 displays the mode of collection of solid waste in the Municipality.

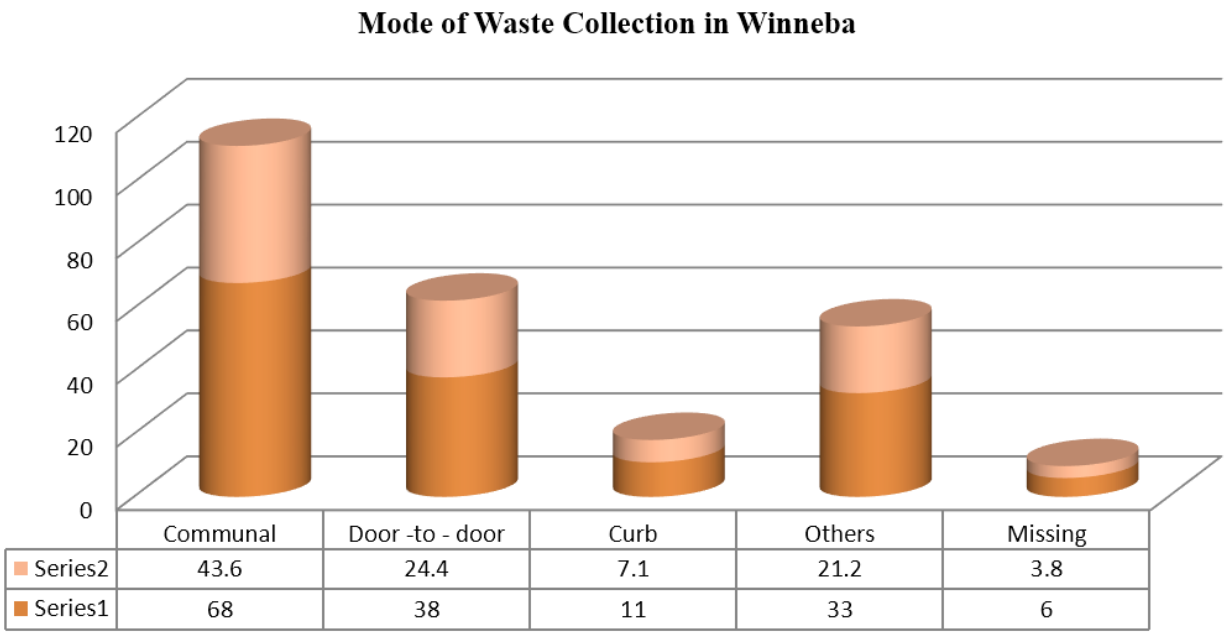

Figure 5. Mode of Solid waste Collection

As shown in Figure 5, there are three main modes of waste collection in EMA. These are: communal dumpsites (primary waste collection), door-to-door and curb (secondary waste collection). The waste collected was finally disposed of in a landfill located at Osubunpeyin, a suburb of Effutu Municipality. From the survey, 43.6 percent of the respondents indicated that, waste was collected directly from their communal dumpsites while 31.5 percent indicated waste was collected from their door-to-door and curb. These are displayed in Figure 5. The door-to-door and curb modes of waste collection were carried out mainly in the high class residential areas such as Low Cost, Kojo Beedu etc. These modes of waste collection were verified with key stakeholders (the Assemblymen, WMD and ZoomLion Ghana Ltd.).

Figure 6 shows that, the main mode of waste collection in EMA was communal. This was carried out mainly in the low class residential areas. Figure 6 shows a communal skip

used for waste collection. This shows that, waste from various households were dumped in the skips for onward collection by ZoomLion Ghana Ltd.

Figure 6. Communal Mode of Waste Collection at Winneba

4.1.2. Final Disposal of Waste

The final disposal site of solid waste in the Municipality was landfill site at Osubunpeyin, about 13 kilometres away from the city centre. A visit to the site showed that, it was in a bad shape. Ideally, a sanitary landfill should have the following functional elements:

- Weighbridge
- Internal access
- Treatment plant
- Leachate collection system
- Gas recovery and
- Location should be far away from human settlement and existing water body.

This was not the case with the landfill in Winneba. Though there was number of the facilities mentioned above they were not functional. Additionally, the landfill has no internal access and the site was closed to a community called Gengen-adzi. This community was about one kilometer (1km) away from the site. Almost all the cells at the site were filled to capacity. Waste dumped in the cells was not levelled and compacted as required of a sanitary landfill. This has left a mountain of waste at the site.

Figure 7. A Landfill site, Wonsom, EMA

4.2. Effects Of Poor Solid Waste Disposal Practices In Winneba

Majority of respondents of all the different age groups 63.8% and 27.6% respectively strongly agreed and agreed that poor waste disposal can lead to spread of diseases. At a Critical Significant Level (α) of 0.05 0r 5% chi-square test results ($\chi 2$= 8.771, df=9, P= 0. 459) shows no association between the different age groups and poor waste disposal practices leading to diseases. The views of men and women of the Township generally supported the claim that poor waste disposal can lead to the spread of diseases in the community 63.9% and (27.7%) strongly agreed and agreed respectively (Table 14). Thus this unanimity was supported by the chi-square test results ($\chi 2$= 16.004, df=3, P= 0.001, Critical Significant Level (α) =0.05 0r 5%.

Table 14. Relative Comparison of age and gender and waste disposal practices that can lead to diseases

		Poor waste disposal practices can lead to the spread of diseases (%)					Total
		SA	A	NS		D	
Age	Under 20 years	70.4	22.2	3.7		3.7	100.0
	21-30 years	63.4	29.6	5.6		1.4	100.0
	31-40 years	62.9	31.4	0.0		5.7	100.0
	over 41 years	57.9	21.1	15.8		5.3	100.0
	Total	**63.8**	**27.6**	**5.3**		**3.3**	**100.0**
Gender	Male	78.7	13.3	5.3		2.7	100.0
	Female	50.0	41.2	5.0		3.8	100.0
	Total	**63.9**	**27.7**	**5.2**	**3.2**	**100.0**	**Total**

An overwhelming majority (99) and 43 strongly agreed and agreed respectively that poor waste disposal practices could lead to the spread of diseases in the community (Figure 8).

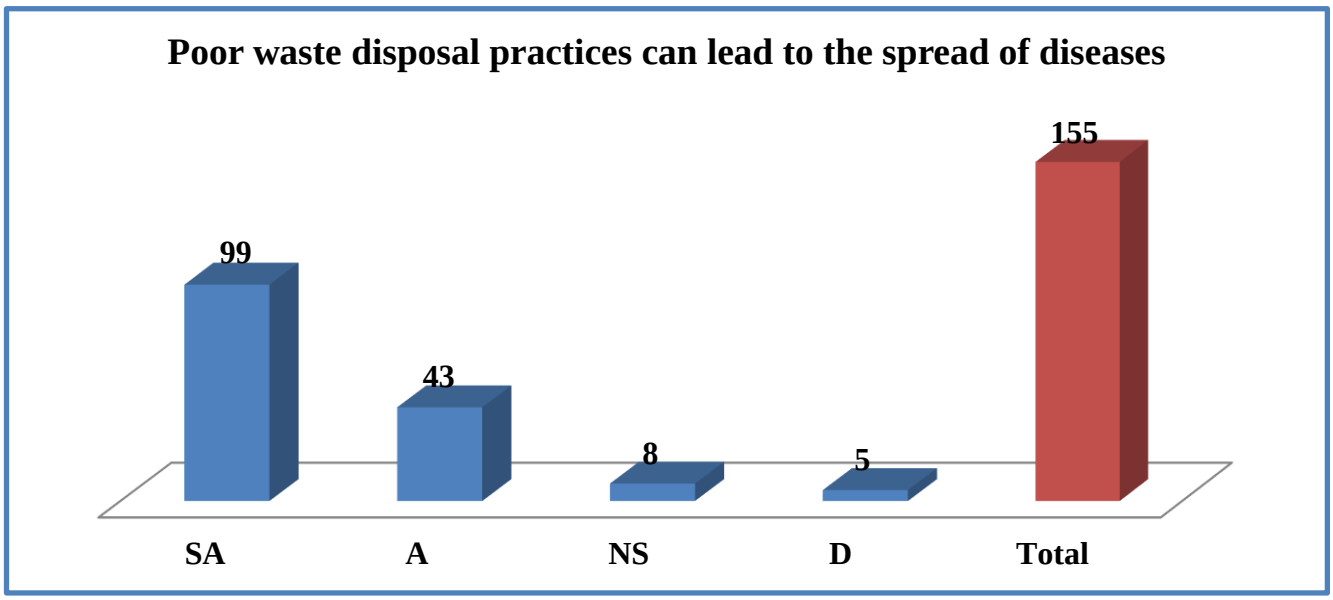

Figure 8. Effects of poor waste disposal in the communities

In a similar situation, majority of respondents of all education level (63.9%) strongly agreed that poor waste disposal practices can lead to the spread of diseases and 27.7% agreed with the assertion that poor waste disposal could lead to the spread of diseases. Only 3.0% of respondents of all level of education disagreed with this view (Table 15).

Table 15. Comparison of respondents' educational level and the effects of poor waste disposal practices.

		Poor waste disposal practices can lead to the spread of diseases (%)				Total
		SA	A	NS	D	
Education level	Never	0.0	0.0	50.0	50.0	100.0
	Primary	25.0	75.0	0.0	0.0	100.0
	Middle school/JSS	42.1	42.1	10.5	5.3	100.0
	SHS/Technical	64.0	30.0	4.0	2.0	100.0
	Tertiary	75.0	18.4	3.9	2.6	100.0
	Total	**63.9**	**27.7**	**5.2**	**3.0**	**100.0**

Littering causes an eyesore, which devalues the land around it. This ugly scenario have impacted negatively on tourism, businesses and residents alike. Winneba a town that used to pride herself of long clean sandy beaches can no longer boast of that since firth has taken over most beaches in the town. Figure 9 shows how waste has polluted the sea and also made the beaches become unattractive.

Figure 9. Effect of Indiscriminate Waste Disposal on the Environment at Wonsom

Waste materials like toxic if consumed by animals can be very dangerous to life and worse still if these wastes are dumped in water bodies. Solid wastes, when improperly disposed off can be an environmental hazard in that the surrounding environment as well as the fishes in the sea is affected since some waste materials are dangerous to aquatic life. This improper damping led to the spread of diseases to man such as malaria, typhoid and cholera. As evident in Table 14 these diseases have been reoccurring in the township. Residents were also asked to write down some environmental problems associated with improper waste disposal and from Table 13 the most common once were water pollution, air pollution, flooding, and littering.

Majority of locals sampled (94) said they were not aware of the environmental problems associated with waste disposal methods while 61 respondents said they were aware (Figure 10).

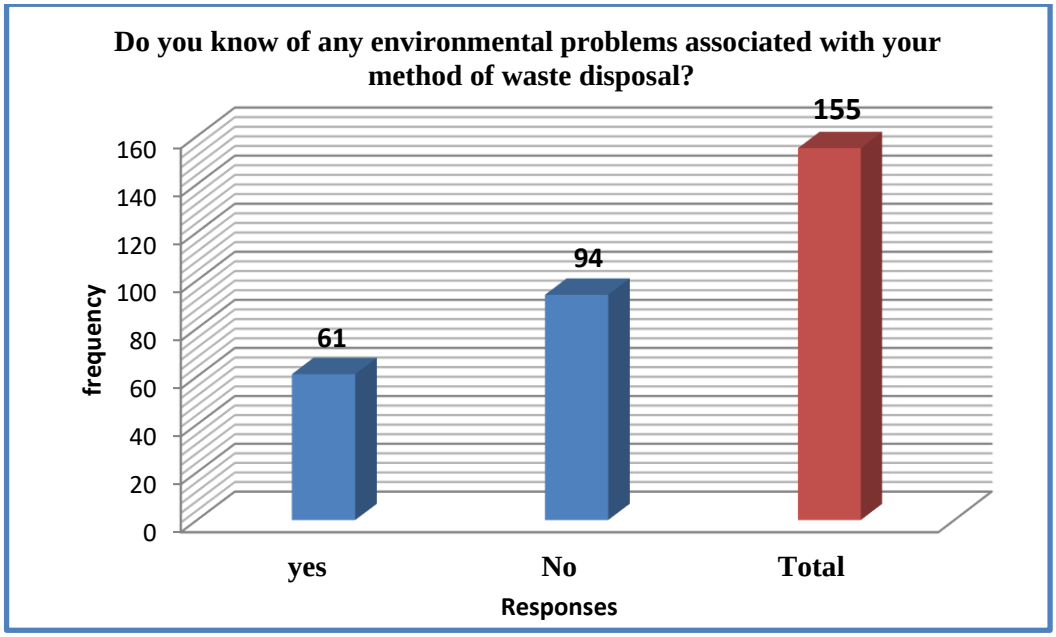

Figure 10. Respondents Awareness of Environmental Problems Associated with Waste Disposal Methods

5. Conclusions and Recommendations

The study revealed that there was irregular or lack of routine collection of waste by WMD of EMA and ZoomLion Ghana Ltd. especially in the low class residential areas in the Municipality. Waste collection was mostly carried out once a week in some low class residential areas. Residents therefore resorted to dumping waste in nearby gutters, by roadside, opened spaces and other unapproved ways of managing their domestic waste. Unlike the door-to-door collection which attracted a monthly charge in some residential areas, the communal collection was carried out at no cost to the residents in all the low class residential areas. The study also indicated that, the landfill did not meet the requirement of a sanitary landfill as in the case of EMA and therefore could be described as an open dump. The landfill had no internal access and sited near a settlement. Additionally, waste was not usually separated into their various components before final disposal. This led to burying of some valuable resources in the landfill which could have been otherwise re-used. The study also revealed that, flooding, water pollution, air pollution, littering was the cause of environmental problems which has resulted into spread of diseases like malaria, typhoid and cholera in the Winneba township.

It is recommended that, adequate dustbins and skips should be provided by ZoomLion Ghana Ltd. in collaboration with the WMD and Municipal Assembly for residents in the Municipality for waste storage. This should be provided particularly for the low class residential and middle class residential areas to avoid dumping of waste in open spaces, gutters, boilers and roadside. These should be placed at least within 30 metres radius and at most 50 metres radius in the low class residential areas. With this, residents in the low class residential areas will spend less time to dispose off their domestic waste at the skip site. Also, one thousand, four hundred (1400) dustbins should be supplied by ZoomLion Ghana Ltd. particularly for the high class residential areas and some middle class area. It is also recommended that there should be regularity in waste collection by ZoomLion Ghana Ltd. Particularly in highly populated areas like Zongo, Wonsom, Yepimso, Sakagyaano, Penkye, Aboadze and Ponko-ekyir to avoid heaping of waste and over flowing of skips with solid waste. At least, waste should be collected three times a week in these areas and twice in the Middle and high class residential areas. There should be regular monitoring of waste collection by the Municipal Assembly. This will keep the place

constantly clean and prevent any possible outbreak of communicable diseases such as cholera and typhoid.

It is recommended that the landfill site should be properly managed to avoid heaping of waste and burning. The following should be revived for the landfill to work effectively. These include the weighbridge, gas recovery system and leachate collection system. With the weighbridge the quantity of waste that goes into the landfill can be easily determined. With proper leachate system put in place the possibility of waste polluting groundwater in the area will be prevented. Also, waste dumped in the landfill should be spread, compacted and cover with soil. This will prevent heaping of waste in the landfill. Furthermore, the landfill management should ensure that waste that is carried to the landfill does not contain fire. Any container that contains fire should be isolated and fire quenched before dumping is done. Waste collection sources should be checked to ensure that waste does not contain any drop of fire. This will go a long way to prevent the burning of waste in the landfill. The landfill site should also be relocated because of its negative environmental impact on the lives of people in a nearby community. The relocation will prevent the community from being constantly engulfed by smoke from the landfill. This will also prevent possibility of the waste in landfill especially hazardous waste from polluting water sources of the community through percolation.

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