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ASSESSING HOUSEHOLD SOLID WASTE MANAGEMENT SYSTEMS IN BARATON CENTRE

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Abstract

Solid-waste management is a major challenge in urban areas throughout the world. Without an effective and efficient solid-waste management program, the waste generated from various human activities, both industrial and domestic, can result in health hazards and have a negative impact on the environment. The objectives of the study were; to determine different types of solid waste generated by the households, to assess handling methods at household level, to ascertain common challenges associated with waste management systems in Baraton Centre and to determine factors that affect household waste management methods. The study employed a Quantitative Descriptive Case study design and Convenience sampling technique. The study findings shows that majority of the respondents (78%), knew about solid waste management. In conclusion the research provided statistically accurate answer to a number of household solid waste related issues. The fact that the education level of a family head was negatively associated with the practices regarding household solid waste management indicates that improving general public awareness concerning the problem of solid waste management should be a high priority of the responsible authorities and the general public as well.

Key words: Solid Waste, Solid Waste Management, Management Systems.

Background Information

A waste refers to any material or product that has been considered useless by the owner and needs to be discarded or has been discarded. Solid waste is any organic or inorganic materials generated from various human activities which have been considered unwanted or useless therefore disposed treated or untreated (Birute, 2012). Solid waste management refers to the process of generation, storage, source separation, collection, transportation, processing, recycling and disposal of both organic and inorganic solid waste (Kreith, 2008).

Inadequate infrastructure, financing, lack of clear roles and responsibilities of these authorities and uncollected and uncontrolled disposal of waste in public areas have made the task more difficult, hence public health and sanitation is threatened in several growing cites (Martin et al, 2008). In Africa today, waste management systems are not well maintained at household level since thousands of tons of solid waste are generated daily which most of it ends up in open dumps and wetlands, contaminating surface and ground water and posing major health hazards to human beings and the environment (Chuen-Khee et al., 2011). Several cases are reported about outbreaks of diseases due to poor waste handling and disposal facilities. For example, in 1994, 61,960 cases of cholera resulting in 4,389 deaths were reported in the states of Angola, the Democratic Republic of the Congo, Malawi, Mozambique and Tanzania, Africa (UNDP, 1997).

Current situation in Kenya shows that the town authorities collect household solid waste and dump it at designated sites but no proper treatment is given to the waste so piles of the waste are seen in residential areas (Kuria *et al.*, 2011). Some of the factors that affect household waste management are demographic features such as age, education however household size had an insignificant impact over the choice of alternative waste management systems, whereas the supply of waste facilities significantly affected waste disposal choice (Tewodros et al., 2008).

Problem Statement

Without an effective and efficient solid-waste management program, the waste generated from various human activities, both industrial and domestic, can result in health hazards and have a negative impact on the environment. Understanding the waste generated, the availability of resources, and the envi-

ronmental conditions of a particular society are important to developing an appropriate waste-management system (Tay-joo et al., 2007). Factors influencing household solid waste management include; lack of awareness, proper waste management equipment and facilities, laws and policies and low income to help improve solid waste management systems among the households (Issam et al., 2010).

Justification

Safe and acceptable solid waste management practices are of serious concern from the public health point of view. The concern comes from both poor policies and solutions proposed by all associated authorities of the government for the management of solid waste and a perception that many solid waste management facilities use poor operating procedures. Lack of support from the authorities such as the Municipal Council has led to negative impacts on people's health as well as the environment (Kuria et al., 2011).

Household solid waste management is becoming a serious public health concern in Baraton Centre. This is mainly because Baraton Centre residents are not conscious of proper and well maintained waste management systems. As a result, there was need to carry out this study to determine types of solid waste generated, and to evaluate waste management methods use by the households and to ascertain common challenges associated with waste management in Baraton Centre.

Purpose of the Study

The purpose of this study was to assess household solid waste management systems in Baraton Centre so as to create knowledge on good solid waste management methods for a good public health and a sustainable environment.

General Objective

To assess household solid waste management systems in Baraton centre.

Specific Objectives

By the end of this study, the researcher has been able to:

1. Determine different types of solid waste generated by the households.
2. Assess solid waste handling methods at house hold level.
3. Ascertain common challenges associated with household waste management systems Baraton Centre.

Hypothesis

There is no significant relationship between level of education and practices regarding household solid waste management systems.

Literature Review

Types of Waste Generated by the Household

Household wastes consist of a variety of materials. The best overall household waste composition estimated currently showed that household waste consists of garden waste (20% of the total), paper and board (18%), wood and furniture (5%), kitchen waste (17%), general household sweepings (9%), metal packaging (3%) glass (7%), wood (5%), scrap metal (5%), soil (3%), textiles (3%), and 2% being disposable nappies (Julian, 2002). Excessive packaging of consumer products is one of greatest sources of unnecessary household waste where 50% of the total the waste is made up of paper, plastic, glass and metal packaging (Cunningham, 2009).

Handling Methods at Household Level

Household solid waste handling methods involves; control of waste at source, waste storage and separation at source, collection, transportation and disposal (Cunningham, 2009). Control of waste at source greatly reduces the volume of solid waste if people compost and utilize the daily organic waste in their kitchen or garden as manure (Marden, 2009). Waste should be separated at source for easy collection and transportation for final disposal and people should segregate the inorganic waste such as papers, plastics, fused bulbs, blades, glass wares and empty bottles at source (Marden, 2007). Waste collection can be done through door-to-door collection which involves the use of containers or dust bins within the households and communal collection that involves the use bins placed near markets, in residential areas and other appropriate locations (Spies et al., 2006). Household

waste is commonly placed in plastic bags or other containers and stored at the collection centers in community containers which are placed at the roadsides to be collected by vehicles or hand-operated carts (Tay-joo et al., 2007).

The lowest collection frequency is twice weekly. However, the collection area coverage in a city can be as low as 50% (Huang et al., 2007). The wealthy neighborhoods are provided with adequate collection systems, but poor neighborhoods do not enjoy the same treatment (Scheinberg et al., 2007). Once collected, household solid waste is transported to disposal sites by open trucks or compactor trucks (Hsiao-His et al., 2007). The disposal site provides another opportunity for segregation of waste by the rag-pickers (Gene et al, 2008). The final disposal of organic waste has three easy options; composting (decomposition of organic waste by anaerobic micro-organisms to form manure), sanitary land-fills (disposal of organic by burial in thin films or layers) and incineration which involves the combustion of organic substances contained in waste materials into ash, fuel gas and heat (Scheinberg et al., 2009). Incineration reduces the mass of the original waste by 80-85% and the volume by 95-96% (Bandela et al., 2008).

Challenges Associated with Waste Management Systems

Improperly managed solid waste poses a risk to human health and the environment (Lorina, 2007). Uncontrolled dumping and poor household solid waste management leads to contamination of water, attraction of insects and rodents and increases flooding due to blockage of drainage canals or gullies (Marden, 2009). Planning for and implementing a comprehensive program for waste collection, transport, and disposal along with activities to prevent or recycle waste can eliminate these problems (Cunningham, 2009).

Solid waste management is a major problem worldwide and in Kenya since it is faced with several challenges from clogged drainage and sewers, waterborne diseases like typhoid, cholera and diarrhea, increased upper respiratory diseases and malaria (Rotich et al., 2006). Solid waste management has been the responsibility of local authorities but the fact is now changing with the realization that local authorities are not capable of managing waste on their own (Rotich et al., 2009). This is unsustainable and Kenyan cities and towns end up with endless heaps of garbage (Andrew, 2009). From a study done in Malaysia, attitudes and behaviors were found to affect household solid waste management but tend to differ based on the size of the households and households that have positive attitudes toward waste management have satisfactory behaviors, supporting Ajzen's theory of planned behavior (Chamhuri, 2009). The important and significant factors that affect household attitudes toward waste management include household size, source reduction, reuse and recycling measures, frequency of waste collection, participation in training programs and waste disposal method (Pereira et al., 2008).

Study Design

Quantitative descriptive case study design was used in the study at Baraton Centre. It was a quantitative study because only measurable data was gathered using questionnaires and analyzed. It was also a descriptive case study since it involved an in-depth study of the Baraton Centre households only.

Study Population and Study Area

The study was on Baraton Centre households. Total number of the households was 450. Baraton Centre is in Kapsabet division within Nandi Central District, Nandi County. It lies on the western side of the Rift Valley Province. It occupies 1,482 square kilometers and rises from 1,300m to 2,500m above sea level in the highlands. The district is hilly and underlain by outcrop of basement rock system, distinct in the north. It is about 9km from Chepterit on the Kapsabet-Eldoret highway and about 10 meters away from the University of Eastern Africa Baraton.

Sample Size

The general population of the households was 450. The sample size used in this study was 248 based on the Fisher et al. sample size calculation and adding the attrition rate (this gave the approximate number of questionnaires that were either spoilt or not returned by the subjects but still gave the actual number of the expected sample size which was 207).

Sampling and Data Collection Techniques

Convenience sampling technique was used because not all household heads were present during collection of the data. Data collection was done by use of self-administered closed ended questionnaires. Statistical package for social sciences (SPSS) version 15.0 was used to analyze the data that was obtained.

Pilot Study

Pilot study was conducted in Cheptirit location to test for both reliability and validity of the questionnaires. Ten questionnaires were used. The validity was done to test for the clarity, relevance of the questions to the study and whether the questions stood for the intended purpose. Reliability was tested to determine the consistency of the questionnaires.

Findings

Types of Waste Generated by the Households

Figure 1 shows that most waste being generated by the households is kitchen waste (91%) followed by house general sweepings (74%), while the least being generated is scrap metal (7%).

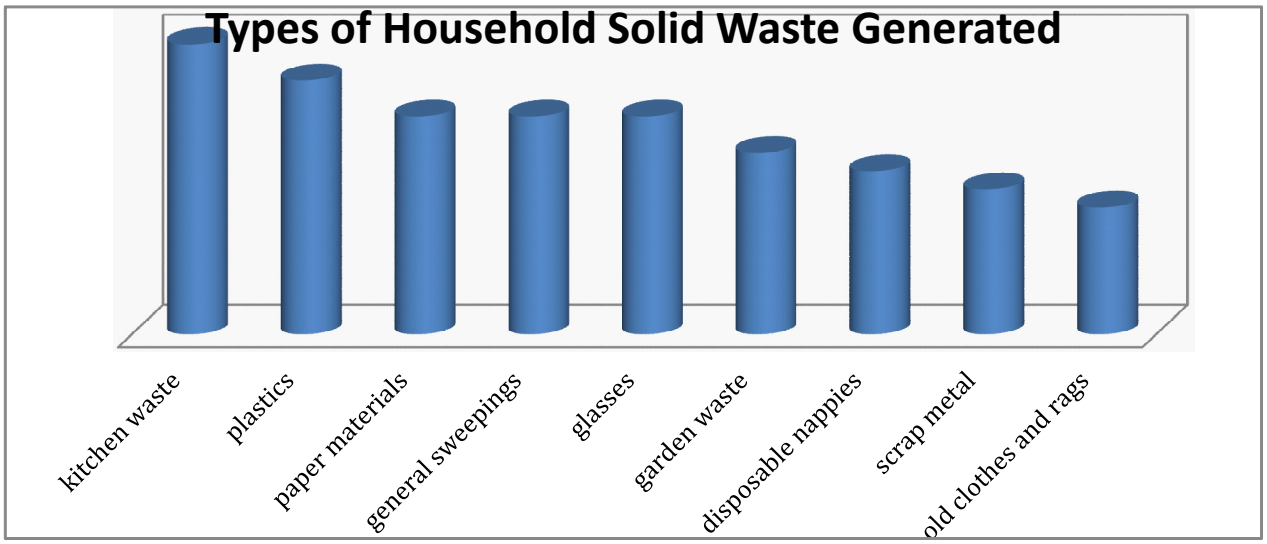


Figure 1: Types of waste generated by the households

Solid Waste Handling Methods at Household Level

Control of waste generation at source. Figure 2 shows that 85% of the respondents control the amount of waste they generate at source while 15% of the respondents do not control generation of waste at source.

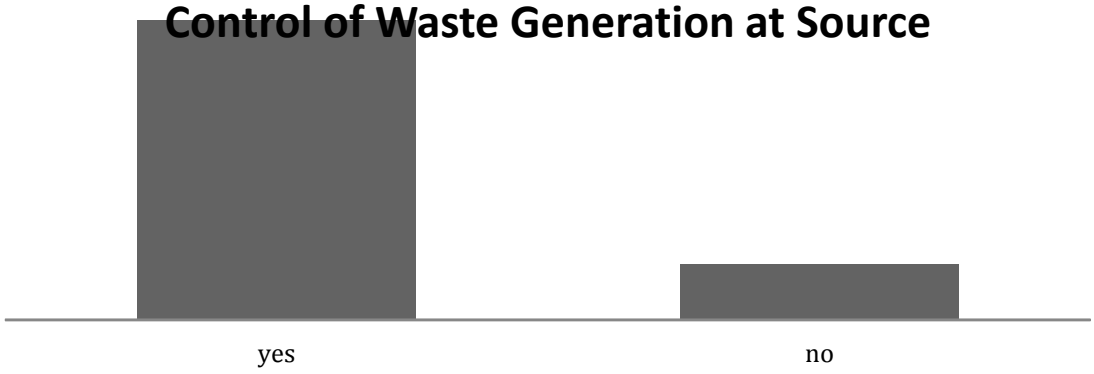


Figure 2. Control of waste generation at source.

Separation of waste at source. Figure 3 shows that majority of the respondents do not separate the household waste at source (38%) while 62% are those respondents who do not separate the different types of solid waste they generate in their houses.

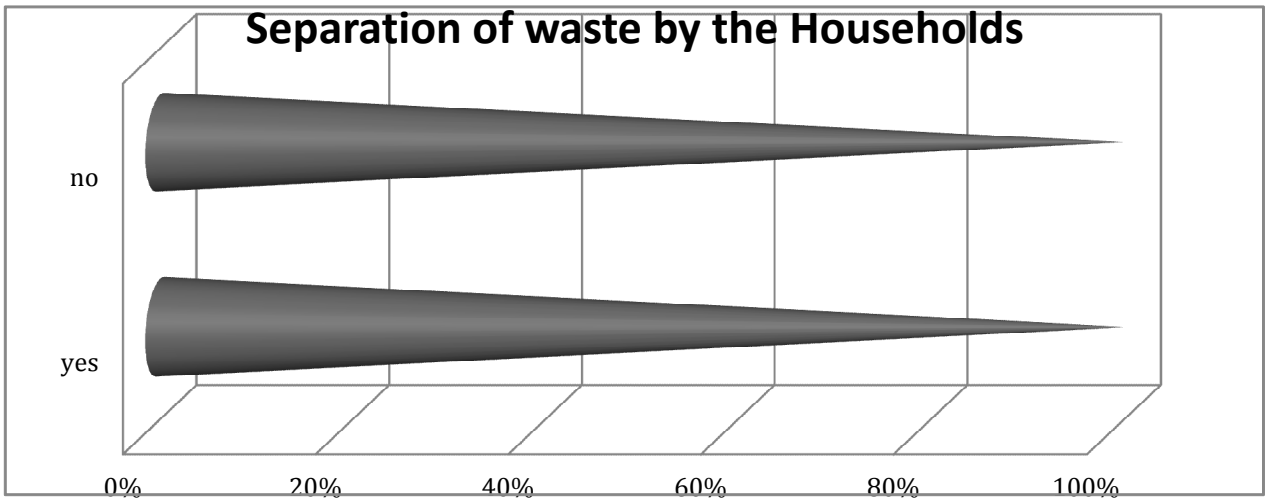


Figure 3: Separation of waste at source at household level.

Storage of waste at source. Figure 4 shows that most of the respondents use dustbins to store their household solid waste after generation at source (69.8%).

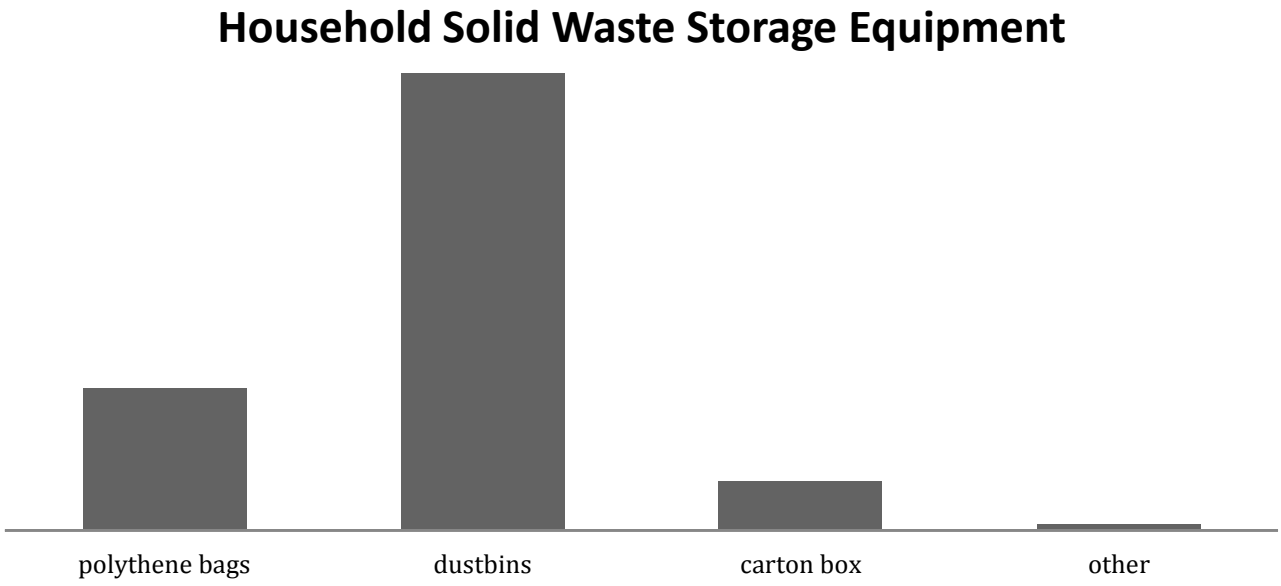


Figure 4: Household solid waste storage equipment

Waste collection method used. Figure 5 shows that most of the respondents use communal bin as a method of their household solid waste collection (69%).

Figure 5: Household solid waste collection method.

Waste transportation mode to the disposal site. Figure 6 shows that most of the respondents walk to the disposal site to dispose off their household solid waste (87%), 7.1% use tractor while 5.2% use wheel-barrow.

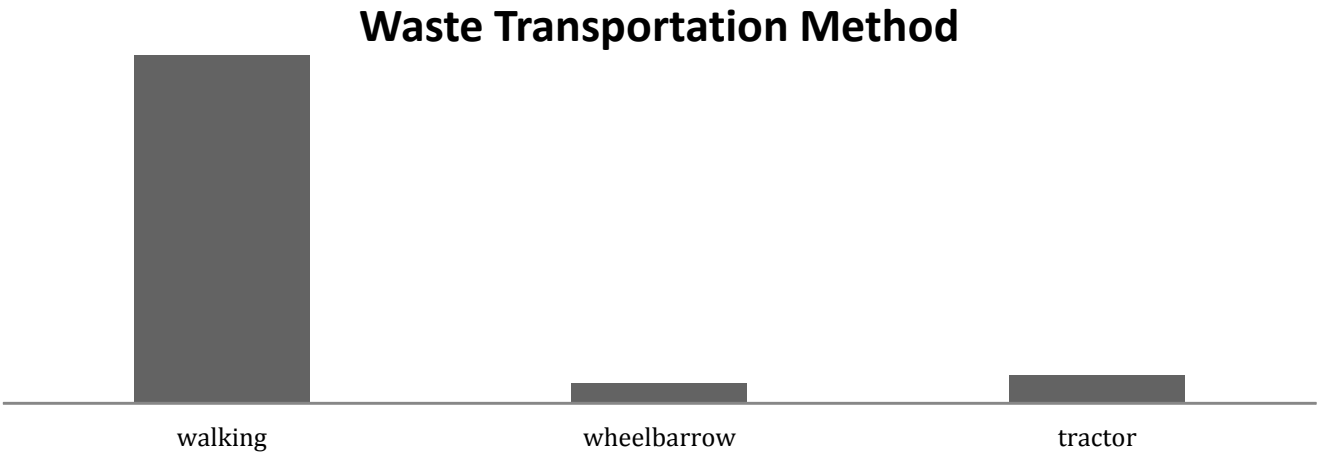


Figure 6: Waste transportation mode to the disposal site.

Waste disposal method used by the households. Table 1 shows that most of the households in Baraton centre use opening dumping in disposing off their household wastes (56.6%).

Table 1

Waste Disposal Method Used by the Households

Disposal method	**No. of households**	**Percentage (%)**
Open dumping	*120*	*56.6%*
Burying in the soil	*21*	*9.9%*
Burning	*54*	*25.5%*
composting	*38*	*17.9%*

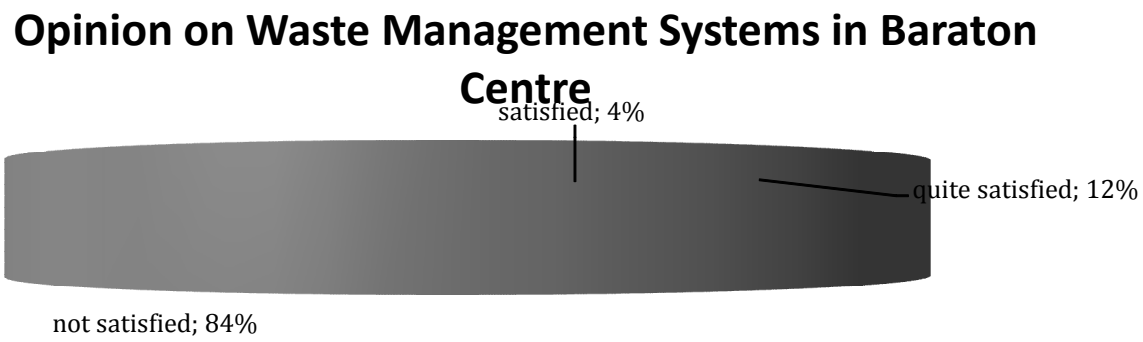
Challenges Associated with Household Solid Waste Management Systems in Baraton Centre

Table 4

Challenges Associated With Household Solid Waste Management

CHALLENGES	FREQUENCY		PERCENTAGE (%)	
	Yes	*No*	*Yes*	*No*
Household size	*150*	*62*	*70.8%*	*29.2%*
Improper disposal equipment	*178*	*34*	*84.0%*	*16%*
Poor disposal method	*185*	*27*	*87.3%*	*12.7%*
Low income level	*79*	*133*	*37.3%*	*62.7%*
Lack of laws and policies	*140*	*72*	*66.0%*	*34.0%*

Most of the respondents said that poor disposal methods in the main challenge they face when managing their household solid waste (87%) followed by lack of proper disposal equipment (84%) while only 37% said that low income level is also a challenge they face. Some of the respondents also said that ignorance, negligence of the residents and also invasion by domestic animals such as dogs and cats were also some of the challenges they face.



Best Household Solid Wastes Disposal Method

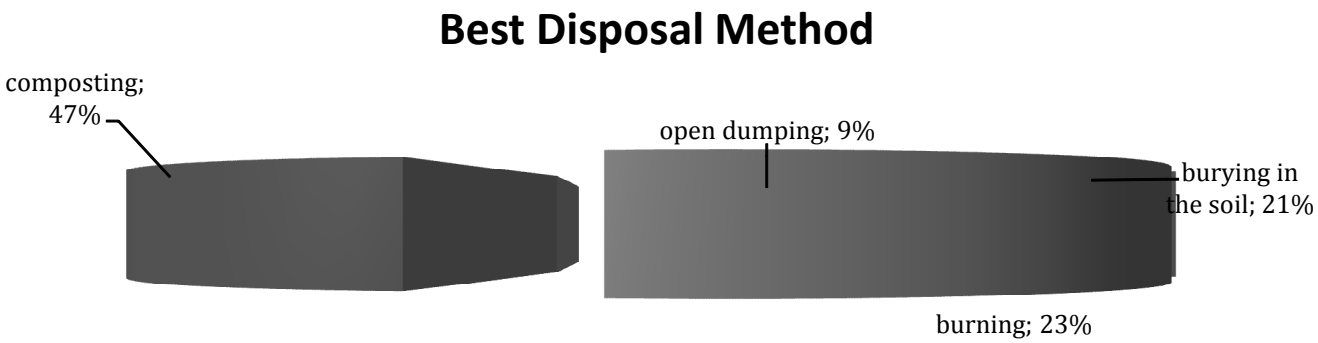


Figure 7: Best solid waste disposal method.

According to 47% of the respondents, composting is the best method of disposing household solid waste, burning is the best method to 23% of the respondents, 21% of the respondents said that landfill is the best method while only 9% said open dumping is the best method of disposing their household solid waste.

Hypothesis Testing

The following null hypothesis was tested: There is no significant relationship between **education level** and **practices** regarding household solid waste management in Baraton Centre. Multinomial linear logistic Regression analysis test was used to determine the relationship between level of education and practices regarding solid waste management in Baraton Centre. Chi-square test was done to examine the variables trends and statistical analysis. From table 5, the p-values of most of the practices are > 0.05 while control of waste at source and waste separation at the disposal site have p-values of <0.05 i.e. 0.039 and 0.041, respectively. This shows that there is a significant relationship between level of education and the practices on control of waste at source and waste separation at the disposal site.

Table 5

Relationship Between Level of Education and Practices Regarding Household Solid Waste Management

EFFECT	Likelihood Ratio Tests		
	Chi-square	Degree of freedom	Significant value
Intercept	*.000*	*0*	.
Control of waste at source	*4.278*	*1*	*.039*
Separation of waste at source	*.802*	*1*	*.370*
Method of waste separation	*2.685*	*1*	*.101*
Storage of waste at source	*.059*	*3*	*.996*
Waste collection method	*3.332*	*2*	*.189*
Waste transportation	*.862*	*2*	*.650*
Waste disposal method	*3.507*	*1*	*.061*
Waste separation at the disposal site	*4.164*	*1*	*.041*

Discussion

Types of Waste Generated by the Households

Based on this study, the distribution of types of waste generated by the households are as follows: kitchen waste (16%), plastics (14%), paper and board (12%), general sweepings (12%), glasses (12%), garden waste (10%), disposable nappies (9%), old clothes and rags (8%), scrap metal (7%). Kitchen waste, paper and board and plastics were the most generated. This is in agreement with a study carried out in one of Beijing urban centers which reported that kitchen waste (51,1%), paper materials(18.6%) and plastics(13.4%) are most generated household solid waste while metal cans was the least generated with 4.5%, (Al-Tamyan, 2005).

Solid Waste Handling Methods at Household Level

Control of waste generation at source. *This study shows that 85% of the respondents control the amount of waste they generate at source while 15% of the respondents do not control generation of waste at source. This is because control of waste generation at source helps reduce the volume of solid waste generated. This result is in agreement with a study that*

reported, control of waste at source greatly reduces the volume of solid waste hence ensuring proper disposal of the solid waste (Marden, 2009).

Separation of Waste at Source

Majority of the respondents do not separate the household waste at source (38%) while 62% are those respondents who do not separate the different types of solid waste they generate in their houses. This is may be attributed by the fact that they do not separate the solid waste at the disposal site therefore they find no need of separating the waste at source. This is contrary to a study reported by Thomson (2006), that many communities find it more convenient or economical to separate wastes after collection since it requires no extra effort beyond regular trash disposal procedures.

Storage of Solid Waste at Source

Most of the respondents use dustbins to store their household solid waste after generation at source (69.8%). This result concurs with a study which reported that solid waste is initially stored in dustbins at source because it has a sufficient capacity that is easy to empty and clean, long-lasting and hygienic to use compared to polythene papers, (Fassler et al., 2009).

Waste Collection Method Used

This study shows that most of the respondents use communal bin as a method of their household solid waste collection (69%). It is in accord with a research done on solid waste transportation, which reported that many households will want a communal bin outside their houses and the location of the communal bin or pit done in conjunction with the residents, (Mabel, 2008).

Waste Transportation Mode to the Disposal Site

This study found out that, most of the respondents walk to the disposal site to dispose off their household solid waste (87%). This is in agreement with a study that reported that members of low income communities are prepared to walk longer distance to larger storage point i.e. communal bin or pit to dispose their household solid waste, (Hsiao-His, 2007).

Waste Disposal Method Used by the Households

Most of the households in Baraton centre use opening dumping in disposing off their household wastes (56.6%) from this study. This is in agreement with the study which reported that the use of communal storage containers for waste disposal is widespread and common in low income communities which encourages open-dumping simply because the communal bins are usually not covered leading to spilling of waste at the entrance of the communal pit or the bin, (Nyang'echi, 2009).

Challenges Associated with Waste Management Systems

Most of the respondents said that poor disposal methods in the main challenge they face when managing their household solid waste (87%) followed by lack of proper disposal equipment (84%) while only 37% said that income level is also a challenge they face. Some of the respondents also said that ignorance, negligence of the residents and also invasion by domestic animals such as dogs and cats were also some of the challenges they face. This is contrary to a study that reported that increase in household size, increase in income level and low education level of household head, were the main challenges experienced in managing household solid waste, (Koushki et al., 2008).

Respondents' Opinion on the Solid Waste Management Systems State

Most of the respondents are not satisfied by the waste management systems in Baraton Centre (84%), while only 4% of the respondents are satisfied. This is simply because of the open-dumping disposal method they use which leads to nuisance such litter all-over the environment, awful smells, invasion by rodents. This study is in accord with a study that reported communal pits or containers are usually open therefore leads to contamination of water, attraction of insects and rodents and increases flooding due to blockage of drainage canals or gullies; which is undesirable for both hygienic and aesthetic reasons due people throwing their waste just inside the entrance forming small heaps which overflow on the environment (Marden, 2009).

Solid Waste Disposal Method

Choice of best disposal method mainly depends on the climatic and the economic status of a region or town, cost, health of the public and health workers, the quantity and characteristics of the solid waste to be disposed, (Nicolas, 2009). According to 47% of the respondents who took part in this study, composting is the best method of disposing household solid waste. This is supported by a study that reported that composting is the best method to use especially in low income communities because it helps eliminate nuisance such as bad smell, flies and rodents, reduces the volume of waste generate and also used where organic waste generated from homes is relatively little (Marden, 2009).

Conclusion

As expected, a number of household related factors affected the household solid waste management; family size, disposal method used, source reduction, reuse and recycling measures, frequency of waste collection, participation in training programs and the education level of the household head. The fact that the education level of a family head was negatively associated with the practices regarding household solid waste management indicates that improving general public awareness concerning the problem of solid waste management should be a high priority of the responsible authorities and the general public as well.

Recommendations

1. Create awareness and sensitization of the Waste management regulations, 2006 (Legal notice No. 121), which will have positive impact in solving solid waste problem of this country such as resource conservation and recovery, recycling, segregation at source, re-use, reduction and composting of solid waste.
2. Encourage, cooperate and give financial assistance to the right government agencies, private organizations, institutions and individuals in the conduct and promotion of researches, experiments and other studies on solid waste management.
3. Should finance the local government i.e. the Municipal Council, to carry out residential solid waste management programs effectively.

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