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Waste management system on the environment in Lalmonirhat town

Md. Moniruzzaman[1]*, N. Tabassum[1], Abu Rayhan[2], Md. Nazmul Hossen[3], M. Nazrul Islam[4]

[1]Department of Environmental Science, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh
[2]Department of Fisheries Technology, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh
[3]Department of Aquaculture, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh
[4]Graduate Training Institute, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh

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***Corresponding Author**

M Moniruzzaman
monirenvsc@gmail.com

ABSTRACT

Data were collected from 80 respondents in different areas in Lalmonirhat town. For study purpose 536 households were selected. Among them 80 (15%) households were chosen as sample for this study. The quantity of livestock /poultry waste was calculated by multiplication of the production head^{-1}day^{-1} and expressed the results in kg. The highest 26.2% respondents were sign only and lowest 6.3% were primary level. Maximum 45% of the respondents had high waste, 36.3% of the respondents had low waste and 18.7% of the respondents had medium waste condition. The highest portion 62.5% dustbins were absent and lowest 15% were fair. The respondents stored there wastes in various sites from which 23.8% on the dustbin, 20.0% on the road and drain side, 32.4% on the open place and 23.8% in pit. The municipality collects the wastes at different times. The highest 33.8% respondents made the environment filthy and lowest 12.5% had known nothing about pollution. Maximum 67.5% of the respondents were transported waste by others facilities like (poly bag, basket, net bag etc.) and the lowest 8.8% were transported by trolley. The highest waste collection 52.5% was irregular and the lowest waste collection was two/three day/month. The majority 38.8% respondents were disposed their waste at no fixed time of the day and the lowest 3.8% respondents were disposed their waste at noon. The maximum 27.5% respondents had facing lack of dustbin and only 2.5% realized no CBM (Community based management) .Total 50% of the respondents used waste as a fertilizer and the rest 50% of the respondents didn't do it. All of the wastes produced in municipal areas had been dumped at different open places of the municipality for landfill purposes. Highest 45% respondents indicated that the dumpsite made the place dirty and rest of the 13.8% respondents had no concern about effect of dumpsite. The respondents 25% had suffered from respiratory disease, 10% suffered by malaria, 32.5% suffered by diarrhea, 3.8% suffered by cholera, 6.3% suffered by eye irritating, 7.5% suffered by nausea, 5% suffered by vomiting and rest 10% were no disease condition. Highest 37.5% respondents were said to improve the dumping facility and lowest 3.8% said about need CBM facility.

INTRODUCTION

Waste is a wide ranging term encompassing most unwanted materials, defined by the Environmental Protection Act 1990. Waste includes any scrap material, effluent or unwanted surplus substance or article that requires disposal because it is broken, worn out, contaminated or otherwise spoiled. Wastes are those substances or objects which fall out of the commercial cycle or chain of utility for example glass bottles that are returned or reused in their original form are not waste, whilst glass bottles banked by the public and dispatched for remolding are waste until they have been recovered. Normally a waste is considered as a matter if it is in the wrong place. The damaged, defective or surplus materials produced by a manufacturing process, discarded materials from agriculture and forestry, non edible materials from kitchen, refuse available from the place of human and animal habitation, which are allowed to escape without utilized or underutilized on the site (Varshney, 1987). Solid waste defined as useless, unwanted or discarded materials and is not free flowing (WHO, 2000). Typically one to two third of the generated solid waste are not collected (World Resources Institute, 1996). As a result, the uncollected waste makes environmental pollution and endangering the human lives. It is also reported that uncollected waste mixed with human and animal excreta dumped indiscriminately on the road side, in the streets and in drains,

contributing to flooding, breeding of insects and rodent, vectors and spread diseases (UNEP-IETC, 1996). Any anthropogenic activity generates some waste. For example, many industrial activities generate toxic waste and effluents while consumption activities generate waste of various types. A large part of hospital waste usually consists of clinical and non-clinical waste. Such pollutants can, therefore, be broadly classified into a) solid wastes, and b) liquid waste (wastewater). Both are important source of physical and natural environmental degradation and constitute a health hazard. The soil associated or under the disposed wastes is one of the main reservoirs of microbial life, and contaminated water contains pathogenic microorganisms, which are causative agents of different types of disease. Amount and nature of waste differ from industry to industry. Inadequate waste disposal creates serious environmental problems that affects health of humans and animals and causes serious economic and other welfare losses. About 50% of the urban population in developing countries has no service for solid waste disposal. Globally, the amount of municipal community based solid waste produced is expected to be double by the end of century and double again before the year 2025 (Haque, 1995).

Environmental degradation due to unplanned waste disposal and improper waste management in urban areas was not the prime concern even a few decades ago in the developing countries like Bangladesh. But with the increasing urban population made the environmentalists thinks about the scientific waste management with topmost priority in urban planning in the developing countries. It has only been in the very recent times, when certain NGOs started working and highlighting the pathetic state of municipal waste services provision in the country. Then the decision-makers began to realize the importance of this particular aspect of environmental management (Rahman et al., 2000). Solid waste is one of the most visible, immediate and serious environmental problems confronting municipal authorities in developing countries like Bangladesh (Rahman et al., 2000). Most of the municipal waste materials in Bangladesh collected is dumped on open wasteland or low-lying areas even near creeks, forests, rivers, ponds and other ecological sensitive regions in a more or less uncontrolled manner, such inadequate waste disposal creates serious environmental problems that affect health of humans and animals and cause serious economic and other welfare losses. This does not meet the norms of disposal specified in the municipal solid waste rules (Sahu, 2007). Treatment of all kinds of wastewater prior to discharge into the environment is desirable so as to avoid pollution. Large quantities of untreated solid and liquid wastes are discharge indiscriminately into streams and rivers, particularly those flowing through towns, cities and villages.

Several disposal methods are being used in various parts of the world and the most prominent of these are: open dumping, sanitary land filling, incineration and compositing. Sanitary land filling is the main method used in industrialized countries and open dumping is very common in developing countries like Bangladesh and India, because it is cheap and requires no planning. Generally, the low-lying areas and outskirts of the towns and cities are used for this purpose. Sanitary land filling is a controlled engineered operation, designed and operated according to acceptable standards. If substances or objects are consigned to the process of waste collection then they are waste but they may not be where they are fit for use in their present form by another identified person. Thus organizations may dispose of items of considerable residual value, from production scrap materials to redundant plant and equipment, which may fall within the legal definitions of waste and their control regimes. The Environment Agency is the legal body in England that controls certain types of waste – known as 'Controlled wastes'. These include household, industrial and commercial waste. Other wastes called 'no controlled' (agriculture, mines and quarries) are not currently regulated in the same way. One estimate shows that some 5.2 million people (including 4 million children) die each year from waste-related diseases. Globally, the amount of municipal waste generated will double by the year 2000 and quadruple by year 2025 (Akter et. al. 1999).

By proper management waste will become wealth if it is reused with recovery and recycling process. Though waste management is quite impossible in developing countries like Bangladesh. A great

number of people lies below the poverty line so that they are not conscious about proper waste management. Civil society and government may organize mass consciousness about waste management. Lalmonirhat is a small district placed northern side of the country.

Population is increasing day by day and for this reason household, industrial, agricultural wastes are increasing which are dumped here and there and river side. There has no waste management system .Till now no investigation is conducted about the pollution which indicates respondents are not concern of environment. With these in mind the present study has been undertaken in urban community of Lalmonirhat town with the following objectives:

- To determine the selected personnel and socio-economic characteristics of the respondents.
- To explore the relationship between the amount of waste generation and the selected characteristics of the household respondents.
- To analyze the impact of waste management on surrounding environment of Lalmonirhat town.

MATERIALS AND METHODS

Study area and sampling

Lalmonirhat (Town) consists of 9 wards and 63 mahallas. Lalmonirhat municipality was established in 1973. Total numbers of household in Thanapara and Missionmore wards of Lalmonirhat town are 1200 and 800 respectively. The mahallas were namely Railstation colony, Babu para, Kali bari and Hari vanga. The total number of households in these four mahallas was 536 which constituted the sampling population. A list of all these households prepared to make it a sample frame. In the second step 15% of the total households of these four villages were selected as sample by using a table of random numbers. Eighty (80) household respondents were selected in this way for this study.

Measurement of variables

Measurement of independent variables like age, educational qualification, household size, farm size, annual income, household assets and household expenditure (monthly) were defined and described in results section (relevant data tables). Measurement of dependent variables like waste from household and kitchen, wastes from livestock/poultry in a homestead and ashes were estimated as up to 5 kg is equivalence to low waste, 5.1 to 10 kg is equivalence to medium waste and >10 kg is equivalence to high waste.

Data collection

For collecting data, personal interview from the individual respondent was carried out at their home. An introductory visit was made to the study area to become familiar with the respondent and their environment. During visit the objectives of the study were explained clearly to most of the respondents. Questions were asked systematically and explanations were made whenever it was felt necessary. The information supplied by the respondents was recorded directly on the interview schedule. The information was checked carefully before leaving the study area in order to minimize errors. Data were collected in local unit. These were subsequently converted into appropriate standard units. The respondents were interviewed at their own house in leisure time so that they could give accurate information in a sound mind. The data were collected from 80 respondents from September 7 to October 27, 2014. The schedule was carefully designed keeping the objectives of the study in view. The schedule was prepaid in Bangla. Before finalizing the schedule it was pre tested for judging the suitability of schedule and necessary correction, modification and alternations were done accordingly. Information on disposal of household wastes, condition of dustbin, disposal time of household waste, household resident's knowledge on pollution, frequency of collection of wastes by municipality, respondent's perception about health of community for dumpsite location, respondent's perception about pollution by wastes & waste management, problem facing of respondents for disposal of waste, transport system of waste, respondent's perception about uses of waste as fertilizer, respondent's perception about environment of surrounding community, consequences of dumpsite effect on nearby community, problems faced by respondents and diseases which have affected the people were collected .

Data Analysis

Basic statistics such as frequency (number of the respondents), percentage distribution, range, mean and standard deviation were used in describing the variables of the study. Pearson's Product Moment Correlation co-efficient (r) was used to compute the linear relationship among the variables with percent level of probability (0.10 to 0.05). The relationship between the selected characteristics of the respondents and amount of waste disposal on environment was computed in order to Pearson's Product Moment Coefficient of Correlation.

RESULTS AND DISCUSSION

Socio- economic conditions of the respondents

Age

The age of the respondents ranged from 27 to 67 years with an average of 47.39 year and standard deviation of 9.95 years. On the basis of their age, the respondents were classified into three categories as young (up to 35), middle age (36-50) and old aged (>51) (Table 1). The data reveal that 52.5% of the respondents were middle aged, 36.2 % of the participants belonged to the old age category having age above 51 years and 11.3% of them belonged to young age category.

Table 1
Age distribution of respondents.

Category	Frequency	Percent	Mean±SD
Young Age (Up to 35)	9	11.3	47.39±9.95
Middle Age (36-50)	42	52.5	
Old Age (>51)	29	36.2	
Total	80	100.0	

Level of education

Level of education of the respondents ranged from 0.5 to 12 years of schooling having an average of 5.53 and standard deviation of 5.08. On the basis of their level of education, the respondents were classified into four categories as can sign only (0.5), Can read and write only (1), primary (5), secondary (6-10) and higher secondary (12).

Table 2
Respondent`s level of education.

Category	Frequency	Percent	Mean ±SD
Can sign only	21	26.2	5.53±5.08
Can read and write only	19	23.7	
Primary	5	6.3	
Secondary	16	20.0	
Higher secondary	19	23.8	
Total	80	100.0	

It is observed that 26.3% of the respondents can sign only, 23.8% of the respondents can read and write only, 23.7% of the respondents had higher secondary level of education, 20% of the respondents had secondary level of education and 6.3% of them having higher primary level of education (Table 2). An educated individual is likely to be more receptive to the modern ideas. Hence, education gives favorable disposition to the respondents to adopt new ideas skills related to their waste generating and management activities to improve their environmental status in the changing conditions.

Household size

The household size of the respondents ranged from 3 to 11 members, with an average of 5.39 and standard deviation of 1.61. On the basis of their household size, the respondents were classified into three categories as small (up to 4), medium (5 to 7) and larger (>7) size family (Table 3). Data on the Table 4.3 reveal that 61.3% of the respondents possessed medium size family, 31.2% of the respondents possessed small size family and 7.5% of the respondents had larger family.

Table 3
Household size of the respondents.

Category	Frequency	Percent	Mean±SD
Small (up to 4)	25	31.2	5.39±1.61
Medium(5-7)	49	61.3	
Larger(>7)	6	7.5	
Total	80	100.0	

It is assumed that the respondents having small family likely to more involve in different waste management activities to improve their status.

Farm size

Among the respondents, the smallest farm size was found to be 0.04 hectare and the largest was 4.93 hectare. Average farm size was 0.67 hectare with a standard deviation of 0.77.

Table 4
Farm size of the respondents.

Category	Frequency	Percent	Mean ±SD
Landless (>0.02 ha.)	3	3.8	0.67 ±0.77
Marginal (0.021-0.2 ha.)	15	18.8	
Small (0.21-1 ha.)	48	60.0	
Medium (1-3ha.)	12	15.0	
Large (>3 ha)	2	2.4	
Total	80	100.0	

Data in the table 4 indicated that the majority of the respondents (60%) belonged to the small farm size category, 18.8% of the respondents belonged to the marginal farm size category, 15% of the respondents belonged to the medium farm size category, 3.8% of the respondents belonged to the landless category and 2.4% of the respondents belonged to the large farm size category. It indicates that most of the respondents were in the small farm size category.

Annual income

Annual income of the respondents ranged from BDT. 29000- BDT. 765000 with an average of BDT. 209736.88 and standard deviation of 143892.99.

Table 5
Annual income of the respondents.

Category	Frequency	Percent	Mean±SD
Low income	11	13.8	209736.88 ±143892.99
Medium income	17	21.3	
High income	37	46.3	
Very high income	15	18.6	
Total	80	100.0	

On the basis of annual income, the respondents were divided into five categories as low income (up to 100000), medium income (100000-150000), high income (150000-250000) and very high income (>250000). Findings indicate that majority 46.3% of the respondents had high income, 21.3% of the respondents had medium income, 18.6% of the respondents had very high income and 13.8% of the respondents had low income (Table 5).

Household assets

The household assets score ranged from 10-51 with a mean of 26.09 and standard deviation of 9.41. Based on the "household assets score" the respondents were classified into three categories: low assets holder (up to 25), medium assets holder (26-39) and high assets holder (>40) (Table 6)

Table 6
Household assets of the respondents.

Category	Frequency	Percent	Mean±SD
Low assets holder (up to 25)	35	43.8	26.09 ±9.41
Medium assets holder (26-39)	38	47.5	
High assets holder (>40)	7	8.7	
Total	80	100.0	

It is found that 47.5% of the respondents were medium assets holder, 43.8% of the respondents were low assets holder, while 8.7% of the respondents were high assets holder. The data indicated that majority 47.5% of the respondents had low to medium household assets meaning majority of the respondents have to change in the waste management status for their environment.

Household expenditure (monthly)

It refers to the expenditure incurred during a month by the respondent. The individual expenditure in each item were added together to get a total monthly expenditure incurred by a respondent. The respondents were divided into four categories as low expenditure (up to BDT 10000), medium (BDT 10001-20000) high (BDT 20001-30000), and very high (BDT >30001).

Table 7
Monthly expenditure of the respondents.

Expenditure	Frequency	Percent	Mean±SD
Low	30	37.5	
Medium	37	46.2	14011.38±
High	9	11.3	12206.99
Very High	4	5.0	
Total	80	100.0	

The data indicated 46.2% of the respondents had medium household expenditure categories, 37.5% of the respondents were under low expenditure categories, 11.3% of the respondents were high expenditure categories and 5.0% of the respondents under very high expenditure categories in the research area (Table 7).

Impact of waste management system on the environment

Waste amount

In the present study maximum 45% of the respondents had high waste, 36.3% of the respondents had low waste and 18.7% of the respondents had medium waste condition (Table 8).

Table 8
Classification of the respondent according to waste amount.

Category	Frequency	Percent	Mean±SD
Low waste (up to 5 kg)	29	36.3	
Medium waste (5.1-10 kg)	15	18.7	11.84 ±10.27
High waste (>10 kg)	36	45.0	
Total	80	100.0	

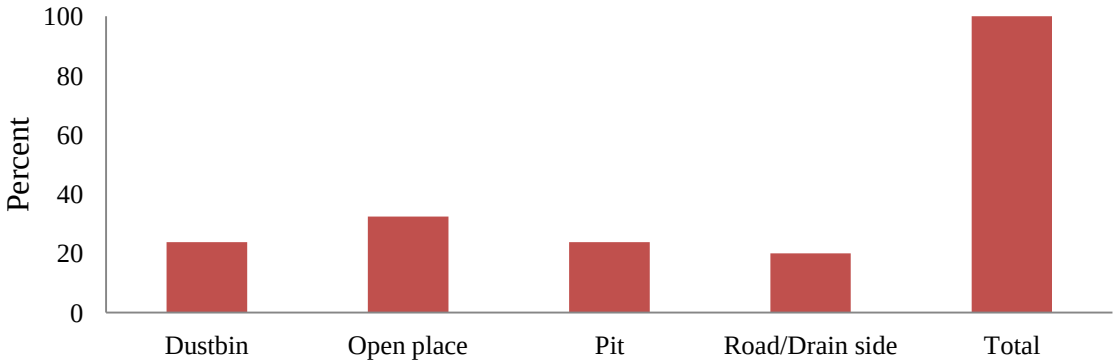

Figure 1
Disposal of household waste by the respondents.

Disposal of household wastes

At the time of survey it was found that the respondents followed several ways to dispose their household waste and the researcher made 4 categories viz, dustbin, open place, pit, road/drain side according to their disposal ways. Figure 1showed that highest 32.4% of the respondent's disposed their waste in open place, 23.8% of the respondents disposed in dustbin, 23.8% disposed in pit and the lowest 20.0% of the respondents disposed in road/drain side (Figure 1)

Condition of dustbin

The condition of dustbin was classified into 5 broad categories viz., good, bad, fair, broken dustbin, dustbin absent. The overall condition of dustbin is quite good. Most of the dustbins of Thana Para were in bad condition. It is observed that within highest respondent 62.5% dustbin were absent, 15% dustbin fair, 11.2% had bad condition, 3.8% was broken and rest 7.5% were in good condition (Figure 2).

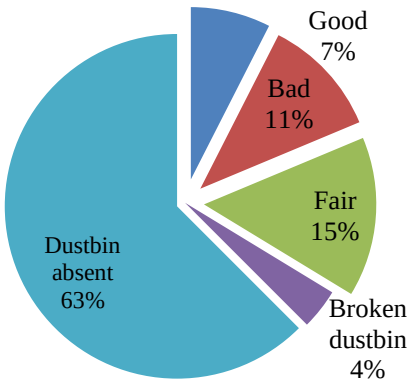

Figure 2
Percentage of respondents according to their dustbin condition.

Disposal time of household waste

It was observed that peoples had been disposing their household wastes of various times. It was observed 30% respondents were disposed their house hold waste at morning, lowest 3.38% at noon, 27.5% in the evening while the rest of majority 38.8% respondents followed no fixed disposal time (Figure 4).

Household resident's knowledge on pollution

From the study in different place of Lalmonirhat it was clear that in (Figure 4) the highest 33.8% respondents had made the environment filthy, 32.5% respondents were adds waste load to the environment, 21.3% respondents were causes sickness and rest lowest 12.5% respondents had know nothing about environmental pollution which is occurred by unwanted waste load.

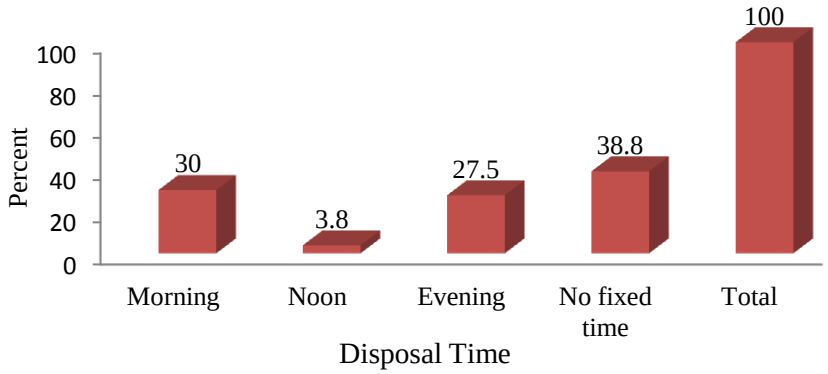

Figure 3
Bar graph showing the disposal time of household waste in the study area.

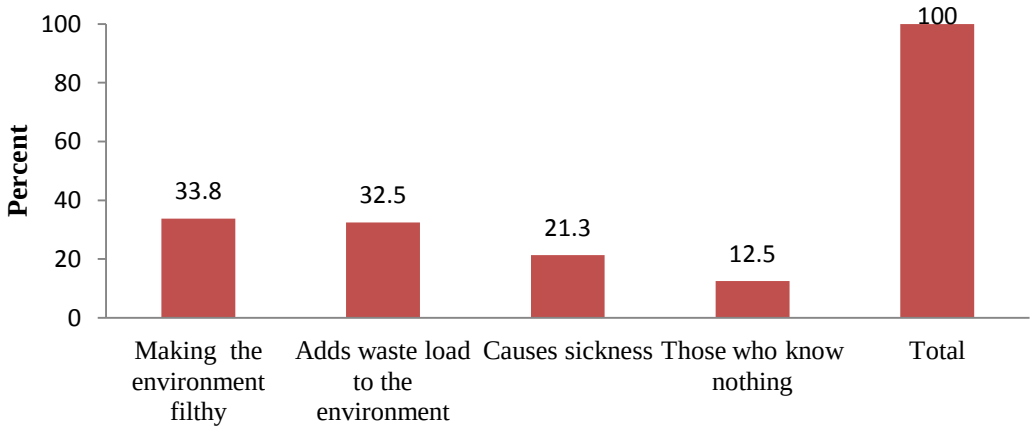

Figure 4
Household resident`s knowledge on pollution.

Frequency of collection of wastes by Municipality

The data indicated that, majority 52.5% waste collected by Municipal Authority was irregular,

15% waste collected by municipal authority was two day/month, 15% waste collected by municipal authority was three day/month and 17.5% waste collected by municipal authority was one day/month.

Spreading of waste on the surroundings

All the existing disposal structures of the study area were open sides, which can't protect the waste searching poor class peoples ("Tokai"), animals and birds. Poor children, women and men regularly search almost all the waste disposal places for polythene beg, metals, woods or branches of tree. Among animals dog was the most severe one to spare the waste materials its surrounds. Similarly, foxes, cat, even cows often spread waste materials to the surrounding of the structures. It becomes possible due to open side of dustbin. Cow and some other birds also spread waste materials. Botkin and Keller (1998) stated that various gases such as NH_3, CH_4 and N_2O from raw cow dung and others organic wastes generated due to faulty processing, preservation, management and polluting farm environment. That caused bad smell and environmental problem.

Disposal of waste

In these areas, waste use as many purpose such as manure, fuel, landfill etc. A significant amount of waste generate from domestic animal, especially cow dung has been used as fuel purpose. Besides these, ash, kitchen waste, feed wastage etc. are used as manure and land fill purpose. From the study result it was found that 50% of the respondents used waste as a fertilizer and the rest 50% of the respondents didn't do it. Besides 71.3% of the respondents were facing problem for disposal waste surrounding their community and 28.8% of the respondents had no problem.

Respondent's perception about health and pollution by waste

It was found that majority of the respondents (63.8%) had health effect for dumpsite in open place nearby community. The dumpsite were for the garment wastes disposal at the small industries area, drain condition at the railway station area, the open dumping of municipal waste in Putimarir dola, open dumping of cattle waste near home side in Balatari area, household waste dumping near home side pond and hotel waste dumping near kitchen in Missonmore area in Lalmonirhat town. From the study it was found that 67.5% had yes/positive perception about environmental pollution which was occurred by different kind of waste. On the other hand 32.5% had no perception about environmental pollution.

Transport system of waste

From the study it was found that the respondents had 4 types of waste transport system viz. by truck, by trolley, by Van and others (Basket, polythene bag, net bag etc.) Maximum 67.5% of the respondents transported their wastes by others facilities (Basket, polythene bag, net bag etc.), 23.8% of the respondents transport by Van and the lowest 8.8% transported by trolley but no one transported by truck except Municipality.

Problems faced by respondents

From the study result it was found that the respondents generally faced 5 types of common problem viz. bad odors, broken dustbin, lack of dustbin, lack of municipal facility, long distance of dustbin, no CBM (community based management system), and some were facing no problem. Data contained in mentioned that maximum 27.5% had facing lack of dustbin, 18.8% facing bad odors, 16.3% facing long distance of dustbin,10% facing lack of municipal facility, 6.3% facing broken dustbin, 2.5% facing no CBM and rest 18.8% respondents had facing no problems (Figure 6).

Diseases from waste

From the study data result indicates that 25% of the respondents had suffered from respiratory disease, 10% of respondents have suffered from malaria, 32.5% of respondents have suffered from diarrhea, 3.8% of respondents suffered from cholera, 6.3% were suffered by eye irritating, 7.5% were suffered by nausea, 5% were suffered by vomiting and rest 10% were no disease condition (Figure 7).

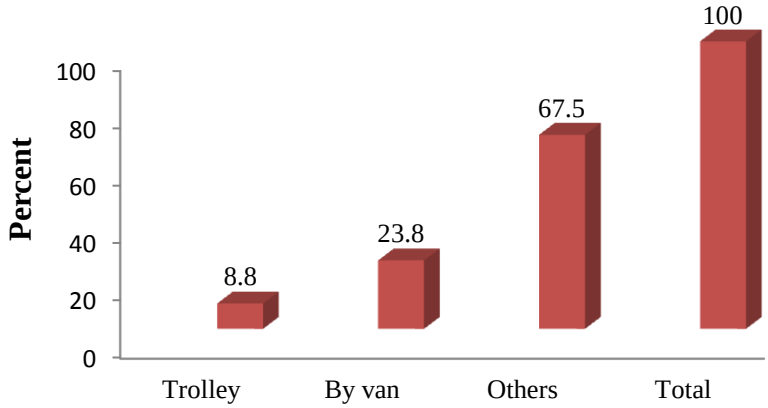

Figure 5
Transport system of waste.

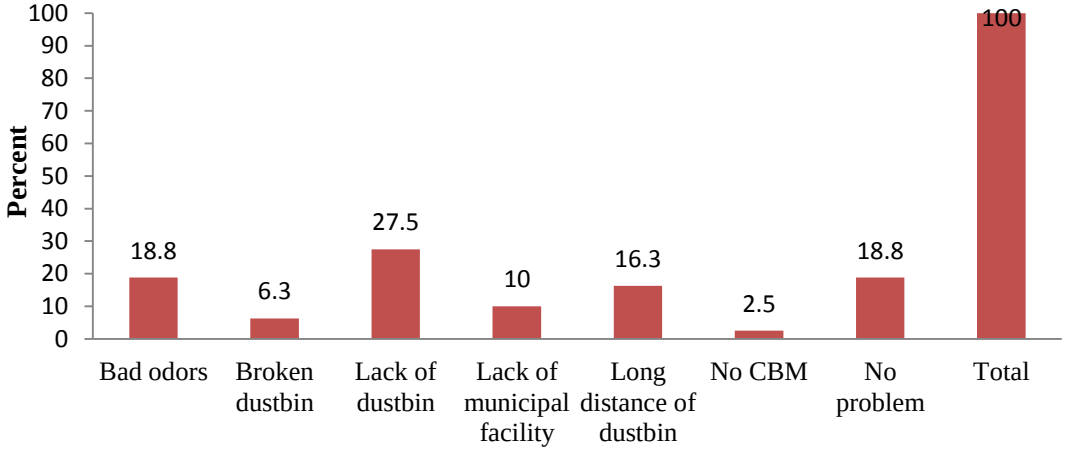

Figure 6
Clustered column showing types of problems facing by the respondents**.**

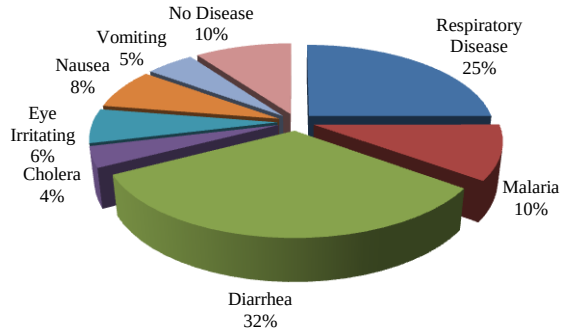

Figure 7
Diseases which have affected the people.

Respondent's suggestion for better waste management

At the period of study respondents was given valuable suggestion for better waste management. Data imputed in (Figure 8) showed that 37.5% had been suggested that improve the dumping facility, 27.5% were suggested to improve municipal facility,8.8% was suggested to increase municipal manpower, 3.8% said about need CBM facility and 22.5% had mentioned no idea about better suggestion.

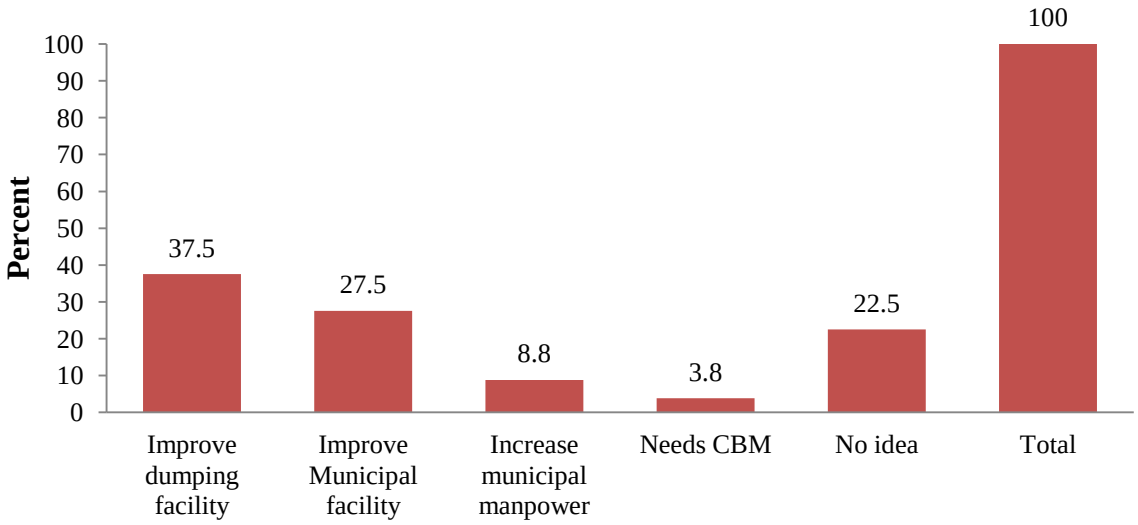

Figure 8
Respondent`s suggestion for better waste management.

Relationship between the selected characteristics of the respondents and impact of waste disposal on environment

There was no relationship of household size with the impact of waste disposal on the environment. There was negatively significant relationship between the level of education of respondents and impact of waste load to the environment indicating that more educated respondents can less amount of waste load to the environment. On the other hand there was a significant positive relationship of farm size, annual income, household asset, and household expenditure with the impact of waste load to the environment. The relationship indicated that the families which have more farm size they are more negatively dispose their waste materials and the waste load increases day by day in the environment. The persons who were involved in different professions and earning money are likely to concerned about waste management and they are not generally participate to damage environment by dispose a high amount of wastage. The family which has more assets they were more positive to change in the changing conditions and able to cope with the situations. But the family which has more household expenditure they were produced more waste to the environment.

Table 9
Relationship between the dependent and independent variables.

Dependent variable	Independent variables	'r' value with 78 df
Impact of waste on the environment (X_8)	Age(X_1)	0.140
	Level of Education (X_2)	-0.317**
	Household size (X_3)	0.216
	Farm size(X_4)	0.354**
	Annual income(X_5)	0.522**
	Household assets (X_6)	0.492**
	Household expenditure(X_7)	0.355**

** Significant at 0.01 level of probability
* Significant at 0.05 level of probability

CONCLUSIONS

It is noted from the study that both the nearby and far away residents were affected by the location of the dumpsite closer to their settlements. It was also observed that residents located less than 200 meters from the dumpsite are most affected by the dumpsite. As this waste is ultimately thrown into municipal waste collection centers from where it is collected by the area municipalities to be further thrown into the landfills and dumps. However, either due to resource crunch or inefficient infrastructure, not all of this waste gets collected and transported to the final dumpsites. If at this stage the management and disposal is improperly done, it can cause serious impacts on health problems to the surrounding environment Waste that is not properly managed, especially excreta and other liquid and solid waste from households and the community are a serious health hazard and lead to the spread of infectious diseases.

RECOMMENDATIONS

Dumpsites should be properly located and managed to minimize its effects on the environment. The government and municipalities should revise laws regarding the locations of dumpsites. These laws should include properly managed sites, which are well fenced in and away from human settlements. The government should annex laws which see to it that dumpsite are located properly and if it is not then action should be taken according to the law. There should be a follow up in the functioning of the dumpsites to avoid pollution on the environment and health hazards. Municipalities should open dumpsites on remote areas with no residents closer to them to avoid the effect of the dumpsite on the nearby residents and monitor the dumpsite properly. They also have to control the litter and monitor their volume. People need to be educated by health motivators about the effects of dumpsites on their health. This will limit the effect of the dumpsite on the residents. There should also be a follow-up to make sure that what they teach the residents is applied.

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