Applied Journal of Hygiene 3 (2): 24-30, 2014
ISSN 2309-8910

DOI: 10.5829/idosi.ajh.2014.3.2.8555

Waste Management Problems at Selected Abattoirs and Hospitals in Amhara Region and Dashen Brewery Factory: A Public Health Impacts Perspective

[1]Tadesse Guadu, [2]Mersha Chanie, [2]Basazinew Bogale and [3]Tewodros Fentahun

[1]University of Gondar, Faculty of Veterinary Medicine, Department of Veterinary Epidemiology and Public Health, P.O.Box 196, Gondar, Ethiopia
[2]University of Gondar, Faculty of Veterinary Medicine, Unit of Veterinary Paraclinical Studies, P.O.Box 196, Gondar, Ethiopia
[3]University of Gondar, Faculty of Veterinary Medicine, Department of Pharmacy and Biomedical Sciences, P.O. Box 196, Gondar, Ethiopia

ABSTRACT: Rising urban population growth, limited municipal resources and the complexity of municipal waste management in both industrialized and developing countries have complicated the relationship between environmental management and the health of urban inhabitants. The main objectives of this research was to identify the public health impacts of the existing waste management problems, to encourage investment on waste recycling and management systems in Amhara region. Institutional based cross-sectional study design was used for assessing the Public Health Impacts of Waste Management Problems at Selected Abattoirs and Hospitals in Amhara Region, namely Bahir Dar and Gondar Towns and Dashen brewery factory in Gondar towns from July, 2012 to June, 2013. The sample size of the study was calculated using the formula for the estimation of single proportion, which gives a total of 421 study subjects, including 10% non response rate and then systematic random sampling technique was employed for selection. The source populations were all neighboring residents, employees and clients of the institutions. The respective towns neighboring resident households were recorded and have house number in their administrative area. The data collecting questionnaires was pre-tested out of the study population and the questionnaire was translated to Amharic (native language) ahead of time. After complete check-up of the collected data, it was coded and entered to SPSS version 20.0 statistical package for windows and analysis was made. The study result indicated that the waste management system of the study areas are very poor, associated with diverse public health impacts; the majority of the respondents judged their work environment as dirty, 306 respondents (72.7%) and only very few, 34(8.1%) of the respondents judged as clean, indicating that their respective institution does not have an appropriate waste management system. It can also be concluded that there is a big gap on the knowledge, attitude and practice of the community on these institutions on waste collection system and recycling of the institutions is weak, where 370 of them (87.9%) replied that they still did not re-use their wastes; instead they dump wastes to rivers 404(96%). Unlike hospitals and abattoirs of the study areas, Dashen Brewery Factory has a good overall management of the waste water, water usage and use of treated water for other purposes like agriculture and its effectiveness. It is highly recognized that the existing waste collection and disposal services are inadequate both in terms of coverage and sanitary treatment of the wastes in hospitals, abattoirs and their surroundings. To improve this, the hospitals and abattoirs have to capacitate themselves to safely mange their wastes with relevant manpower and equipment both qualitatively and quantitatively, increase waste storage sites, re-usage of waste water and recycling of treated water, taking the good experience of Dashen brewery factory and distribute at reasonable distances for efficient use.

Key words: Waste · Wastewater · Waste Management Problems · Health Impacts · Recycling

Corresponding Author: Tadesse Guadu, University of Gondar, Faculty of Veterinary Medicine, Department it of Veterinary Epidemiology and Public Health, P.O. Box 196, Gondar, Ethiopia.

INTRODUCTION

Rising urban population growth, limited municipal resources and the complexity of municipal waste management in both industrialized and developing countries have complicated the relationship between environmental management and the health of urban inhabitants [1-7]. The combined effects of casual disposal of wastes, insufficient waste collection service and inadequate waste disposal facilities always had serious adverse implications for public health. Among these are the direct transmission of diseases and the spread of epidemics, degradation of the quality of the urban and natural environments and, most importantly, the social reinforcement of poor hygienic habits and practices, all of which compose a vicious cycle [8- 11].

The inclusion of hazardous waste, health care waste and excreta (although in small quantities) in the urban waste stream complicates the search for practical responses to the problem of maintaining the health of the public. For example, the potential spread of AIDS, SARS and other infectious diseases through the discharge of health care wastes into the general urban waste stream is a continuous and growing threat. The implications of inadequate municipal waste management upon the health of the public are serious and they cannot be ignored [12-15].

Urban environmental pollutions are caused by human activities through generation and disposal of wastes. It has been established that the non-degradable compounds such as dichlorodiphenyltrichloroethane (DDT), dioxins, polychlorinated biphenyls (PCBs) and radioactive materials can reach dangerous levels of accumulation as they are passed up the food chain into the bodies of animals and humans. For example, molecules of toxic compounds may collect on the surface of aquatic plants without doing much damage to the plants. A small fish that grazes on these plants accumulates a high concentration of the toxin. Larger fish or other carnivores that eat the small fish will accumulate even greater and possibly life-threatening, concentrations of the compound. This process is known as bioaccumulation. Because humans are at the top of the food chain, they are particularly vulnerable to the effects of non degradable pollutants. This was clearly illustrated in the 1950s and 1960s when residents living near Minamata Bay, Japan, developed nervous disorders, tremors and paralysis in a mysterious epidemic. More than 400 people died before authorities discovered that a local industry had released mercury into Minamata Bay [16-17].

Hence, the significance of developing this type of project is obvious. It would encourage participatory environmental management program with the view to inculcate the attitude of hygiene. The Regional indigenes will also become aware of the environmental protection laws and the need to involve the community in the effort, as the government is saddled with other equally urgent responsibilities. This study has the additional advantage of influencing other researchers to replicate the process in their other communities.

Abattoirs have been identified as large consumers of water, the annual water consumption of the red meat industry, as recorded in 1989, is approximately 5.8 million cubic meters. Approximately 84 % of this water is discharged as wastewater containing high organic loads including suspended matter. Abattoirs are classified as intensive energy users. The consumption of energy contributes to greenhouse gas emission and water consumption. Whereas abattoirs require high quality water due to the processing of a material destined for human consumption, discharges from these facilities significantly contributes to the organic load of raw sewage treated at sewage treatment plants and in addition there are the problems with regards to disposal of solid wastes [16- 19].

The study will focus on the public health implications of generating, collecting, processing and disposing wastes in selected abattoirs, hospitals and factory and on methods of managing the risks to the health and safety of the general public and of the personnel involved in collection and disposal of wastes. The approach adopted for this research work is to follow the various key stages, from generation through final disposal and in the process to find out common public health impacts on both the public and the workers who directly handle the wastes.

It is hoped that the research shall encourage the industry to continue to develop and implement technology and management practices that will enable it to meet requirements in terms of the environmental legislation through creating environmental awareness, minimizing the use of raw materials and utilizing cost-effective methods for handling, treatment and disposal of wastewaters and solid wastes generated. This will result in a reduction in the practices of illegal dumping of solid wastes and discharges of wastewater into the natural environment and thus minimize the degree of environmental degradation generated from abattoir and hospital wastes. In view of this, proper assessment of the public health impacts of waste management problems at selected organizations

(abattoirs, hospitals and factory) is needed. Hence, the main objectives of this work were to identify the possible public health impacts of the existing waste management problems, to encourage investment on waste recycling and consultation on waste disposal and management systems on the selected organizations of the Amhara region.

MATERIALS AND METHODS

Study Area: The study was conducted at selected institutions in Amhara region, namely Elfora abattoir, Gondar University Teaching Hospital and Dashen brewery factory in Gondar town and Felege-Hiwot Hospital and abattoir of Bahir Dar town. The study area mainly, Gondar town, is located in North Gondar Administrative Zone of the Amhara region and about 700 kms far from Addis Ababa (capital city). Gondar town is one of the ancient and largely populated towns of the country, having a population of about 303,815 [20].

Study Design: Institutional based cross-sectional study design was used for assessing the Public Health Impacts of Waste Management Problems at Selected Abattoirs and Hospitals in Amhara Region and Dashen Brewery Factory from July, 2012 to June, 2013.

Study Population: The source population was all neighboring residents, employees and clients of the institutions. The respective towns neighboring resident households were recorded and have house number in their administrative area. Then, study subjects households were randomly selected in which the survey was conducted after the selection of the houses and each household was surveyed only once.

Inclusion and Exclusion Criteria

Inclusion Criteria: It includes all neighboring residents, employees and clients of the respective institutions during the study period.

Exclusion Criteria: It includes all neighboring residents, employees and clients of the respective institutions, which are very sick and unable to respond during the study period.

Sample Size and Sampling Techniques: The sample size of the study is calculated using the formula for the estimation of single proportion as shown below;

$$N=\frac{(Z\alpha/2)^2 \text{ x } P\ (1\text{-}P)}{D^2}$$

Where; N = Sample size

- P = Proportion assumed (50%, no research conducted on this area)
- D = The margin of error between the sample and the population or Desired precision (5%)
- $Z\alpha/2$ = Critical value at 95% confidence level of certainty.
- Therefore, the required sample size will be: 384 subjects,
- 10 % non response rate, Total sample size = 421 subjects

The sampling technique was systematic random sampling by selecting one of the neighboring household to start with and selecting the first study subject from registration books of the Kebele administration of each selected Kebele and based on the proportional allocation of the sample.

Variables of the Study

Dependent Variables: Public health impacts

Independent Variables: Socio-demographic variables; like standard leaving index and Educational status and other variables, time of waste collection, area of waste collection, energy consumption, attending hygiene, education and others.

Data Collection Procedures: Data collection instruments: The questionnaire was pre-tested out of the study population and the questionnaire was translated to Amharic (native language). The Amharic version was pre-tested and standardized to ensure uniform understandings among the data collectors team. Ten data collectors were trained a three days training about the data management system and about the questionnaire and ways of collecting data by the respective researchers.

Data quality checking was made every day by the researcher via checking its completeness and errors in the questionnaire and instruments.

Data Processing and Analysis: After complete check-up the collected data, it was coded and entered to SPSS version 20.0 statistical package for windows and analysis was made. Data entry was done by two data clerks and the data after being checked, analyzed using different

statistical operations. Analysis was made for the seek of identifying public health impacts of the selected institutions of the Amhara region, so that appropriate interventions can be made. The data was presented using the descriptive statistics. The association between the dependent variable/ Public health impacts waste management problems and the independent variable/ Socio-demographic variables; like standard leaving index and Educational status and other variables, time of waste collection, area of waste collection, energy consumption, attending hygiene, education and others.

Ethical Considerations: Ethical clearance was obtained from the Research and Community Service Core Process Office (RCSCPO) of University of Gondar. Permission was obtained from the respective administrative office of the selected institutions. The questions from the questionnaire were proved not to affect the morale and personality of study subjects.

Informed consent was obtained from each study subject after explanation of what they will take part in the research and any involvement will be done after his/her complete consent. Agreement was taken, if there would be risks and benefits he/she could be part of it.

Confidentiality was ensured from all data collectors and principal investigator's side via using code numbers than names and keeping questionnaires locked. Data collectors were interviewed separately from other people to keep the privacy of the clients. Data collectors gave health education and advice to the household members during data collection about waste management system.

RESULTS AND DISCUSSION

Among the total of 421 completely filled questionnaires collected 76% of them were from the abattoirs and hospitals of Gondar and Bahir Dar towns (19% in each), while the remaining (101) 24% was collected from Dashen Brewery Factory. The majority of the respondents were males 276 (65.6%), while respondents lying between 18 and less than or equal to 35 years age groups were higher than the others 179 (42.5%). On the other hand the majority of these voluntary respondents were those individuals who have greater than or equal to 4 family sizes 258 (61.3%) and those who have an education level ranging from primary education to first degree 355 (84.3%). Nearly half 210 (49.9%) of the respondents were those having a monthly income of 500 to 1000 Ethiopian Birr. The details are shown in the Table 1 below.

The majority of the respondents judged their work environment as dirty, 306 respondents (72.7%) and only very few, 34 (8.1%) of the respondents judged as clean, indicating that their respective institution does not have an appropriate waste management system.

Table 1: Result of the questionnaire survey based on socio-demographic variables (location, age, sex, family size, monthly income and education level).

		Statistical Description			
Variables	Classification	Frequency	Percent	Valid Percent	Cumulative Percent
Location	Data collection site				
	Dashen BF	101	24.0	24.0	24.0
	Abattoir/Gondar	80	19.0	19.0	43.0
	Abattoir/Bahir Dar	80	19.0	19.0	62.0
	Hospital/Gondar	80	19.0	19.0	81.0
	Hospital/Bahir Dar	80	19.0	19.0	100.0
Age	less than or equal to 18	114	27.1	27.1	27.1
	between 18 and less than or equal to 35	179	42.5	42.5	69.6
	greater than 35	128	30.4	30.4	100.0
Sex	Male	276	65.6	65.6	65.6
	Female	145	34.4	34.4	100.0
Family Size	Less than or equal to 3	163	38.7	38.7	38.7
	Greater than or equal to 4	258	61.3	61.3	100.0
Income	Less than 500	144	34.2	34.2	34.2
	Between 500 and 1000	210	49.9	49.9	84.1
	Greater than 1000	67	15.9	15.9	100.0
Education	Illiterate	33	7.8	7.8	7.8
	Primary to first degree	355	84.3	84.3	92.2
	Second degree and above	33	7.8	7.8	100.0
	Total	421	100.0	100.00	

Table 2: Cleanliness, energy availability, waste storage/container availability, waste container type and nature of waste container type of institutions under study.

		Statistical Descriptions			
Variables	Classification	Frequency	Percent	Valid Percent	Cumulative Percent
Cleanliness	Dirty	306	72.7	72.7	72.7
	Fairly clean	81	19.2	19.2	91.9
	Clean	34	8.1	8.1	100.0
Energy availability	Firewood, cow dung, charcoal	323	76.7	76.7	76.7
	Firewood, charcoal, kerosene, electricity	98	23.3	23.3	100.0
Storage/container	Yes	308	73.2	73.2	73.2
	No	97	23.0	23.0	96.2
Container type	Plastic dust bin/plastic bag	321	76.2	76.2	76.2
	Paper dust bin	50	11.9	11.9	88.1
	Wooden container	34	8.1	8.1	96.2
	Other	16	3.8	3.8	100.0
Container cover	Proper cover	33	7.8	7.8	7.8
	Not properly covered	388	92.2	92.2	100.0
	Total	421	100.0	100.0	

Table 3: Status of institutional waste re-cycling (state of institutional waste re-usage, type of re-used waste, state of dumping wastes to river, state and type of selling wastes, where and how much the institutional wastes cost).

		Statistical Descriptions			
Variables	Classification	Frequency	Percent	Valid Percent	Cumulative Percent
Re-use of waste	Yes	51	12.1	12.1	12.1
	No	370	87.9	87.9	100.0
Type of reused waste	Water	99	23.5	23.5	23.5
	Other	322	76.5	76.5	100.0
Dump waste to river?	Yes	404	96.0	96.0	96.0
	No	17	4.0	4.0	100.0
Selling of wastes	Yes	67	15.9	15.9	15.9
	No	354	84.1	84.1	100.0
Type of wastes sold	No selling	273	64.8	64.8	64.8
	Plastics and metals	115	27.3	27.3	92.2
	Papers	16	3.8	3.8	96.0
	Others	17	4.0	4.0	100.0
Where to sell?	No selling	273	64.8	64.8	64.8
	Korales	114	27.1	27.1	91.9
	Others	34	8.1	8.1	100.0
How much do you pay?	No selling	113	26.8	26.8	26.8
	Up to 10 birr	258	61.3	61.3	88.1
	Between 10 and 50 birr	50	11.9	11.9	100.0
	Total	421	100.0	100.0	

Table 4: Institutions monitoring and evaluation system of wastes (presence/absence of monitoring body, satisfaction level on the waste management system, and suggestions to improve on the existing institutional management system).

		Statistical Descriptions			
Variables	Classifications	Frequency	Percent	Valid Percent	Cumulative Percent
Is there any Monitoring Body?	Yes	67	15.9	15.9	15.9
	No	354	84.1	84.1	100.0
Institution Waste Management Satisfactory?	Yes	67	15.9	15.9	15.9
	No	354	84.1	84.1	100.0
Suggestion to Improve	Awareness creation	196	46.6	46.6	46.6
	Punishment	225	53.4	53.4	100.0
	Total	421	100.0	100.0	

Among the respondents, more than two third, 323 (76.7%) of them use firewood, cow dung and charcoal as their main energy source. The limited ability of the respondents, to use electricity as an energy source, which could have contributed for poor cleanliness of the respective institutions.

On the other hand despite the presence of the containers/storage sites 308 (73.2%), the majority of them were not properly covered 388 (92.2%), while those having container are made up of plastic dust bin/plastic bags which exerts a public health impacts at rainy and windy occasions by spoiling off the contents and creating bad smell to the surroundings. The details are shown on the Table 2 below.

Many of the respondents, 370 of them (87.9%) replied that they still did not re-use their wastes; instead they dump wastes to rivers 404 (96%). Among those respondents who responded for re-using their wastes, only 99 (23.5%) of them sufficiently address that they were re-using waste water. On the other hand, the majority 354 (84.1%) of them still did not sell their wastes, of which 115 (27.3%) of them only sell plastics and metals and 273 (64.8%) of them did not know where to sell their wastes. Surprisingly, the majority 258 (61.3%) of them sold their wastes with a payment not more than 10 ETB (Ethiopian Birr). This shows that there is a big gap on the knowledge, attitude and practice of the community on re-using of wastes. The Dashen Brewery Factory is best in re-using of waste water and this role model activity should be taken in other governmental and non-governmental institution as well, since investment on re-using of wastes have a multiple advantages to our institutions and environment at large. The details are shown on the table 3 below.

Many of the respondents 354 of them (84.1%) did not know whether there is an appropriate monitoring body for the waste management system of the respective institutions and they were not satisfactory for the services regarding waste management. These respondents, 225 of them (53.4%) and 196 of them (46.6%), respectively suggest punishment and awareness creation as a mean of improving the waste management system of their respective institutions (see the details in Table 4 below).

CONCLUSIONS

The outcome of this study strongly suggests that the majority of the respondents judged their work environment as dirty, 306 respondents (72.7%) and only very few, 34(8.1%) of the respondents judged as clean, indicating that their respective institution does not have an appropriate waste management system. It can also be concluded that there is a big gap on the knowledge, attitude and practice of the community on waste collection system and recycling of the institutions.

Based on the above conclusion, the following recommendations are forwarded:-

- Waste reuse and recycling should be emphasized sufficiently. Some items can be reused again and again for the same purpose, or after worn out can be collected and processed again to produce new product (recycled), taking the good experience of Dashen Brewery Factory as a good model for hospitals and abattoirs, to safe guard their compound and the environment at large.
- Micro and Small Enterprises have to be encouraged to invest in the area of waste management, spreading good experiences of institutions (like Dashen Brewery Factory) and other perspectives.
- Institutions and Kebeles are expected to work in collaboration to bring change the public awareness, because some households are not willing to pay for their services.
- The study towns are growing very fast and becoming overpopulated, they have to prepare themselves for proper waste management system.
- Generally, based on the generation rate and composition of wastes of the towns integrated management system which combines a range of waste treatment options like source reduction, composting, recycling and waste to energy transformation are strongly recommended.
- The institutions have to capacitate “the Health and Environmental Sanitation Session” with relevant manpower and equipment both qualitatively and quantitatively. The institutions have to increase waste storage sites (containers) and distribute it with distances reasonable from households or firms and boarder Kebeles with serious attention.
- The institutions have to incite and motivate workers who have direct contact with waste management.

ACKNOWLEDGEMENTS

We would like to thank University of Gondar, Faculty of Veterinary Medicine for the grant provided to us to do this` research. We wish also to express our

profound gratitude to personnel of the study area abattoirs, hospitals, Dashen brewery factory and respective respondents for their unreserved guidance, valuable suggestions and voluntariness to do this research.

REFERNCES

1. Addis Ababa city Government Sanitation Beautification and Parking Development Agency (AACGSBPDA), 2005. Status of solid waste management of Administration of Addis Ababa.
2. Samuel, S., 2006. Commercial solid waste generation and composition Analysis: Arada Sub-City Addis Ababa. A thesis submitted to the School of Graduate studies, Addis Ababa University.
3. Minghua, Z., F. Xiumin, A. Rovetta, H. Qichang, F. Vicentini, L. Bingkai, A. Giusti and L. Yi, 2009. Municipal solid waste management in Pudong New Area, China. Journal of Waste Management, 29: 1227-1233.
4. Sujauddin, M., M.S. Huda and A.T.M., Rafiqul Hoque, 2008. Household solid waste characteristics and management in Chittagong, Bangladesh. Journal of Waste Management, 28: 1688-1695.
5. Burntley, S.J., 2007. A review of municipal solid waste composition in the United Kingdom. Journal of Waste Management, 27(10): 1274-1285.
6. Odeyemi, O., 2002. Department of Architecture, Ladoke Akintola University of Technology, Ogbomoso, Oyo State, Nigeria.
7. Taddese, K., 2004. Dry waste management in Addis Ababa City Submitted to ecological and Environmental economics program, Addis Ababa Ethiopia.
8. WHO (World Health Organisation), 2010. Health Care Waste Management. Washington, DC, USA. http://healthcarewaste.org.en.115_overview.html (accessed 01.10.10).
9. UNEP (United Nations Environmental Programme), 2010. Waste and Climate Change: Global Trends and Strategy Framework. Osaka; Shiga: United Nations Environmental Programme.
10. UNEP (United Nations Environmental Programme), 2010. Assessment of the Solid Waste Management System in Bahir Dar Town and the Gaps identified for the Development of an ISWM Plan. Forum for Environment, June 2010. <http://www.unep.or.jp/ietc/gpwm/data/t3/is_7_4_asses.pdf> (accessed on 25.03.2011).
11. UNEP (United Nations Environmental Programme), Cal Recovery, 2005. Solid Waste Management. United Nations Environment Programme, Division of Technology, Industry and Economics (DTIE)-International Environmental Technology Center (IETC).
12. WHO (World Health Organisation), 2010. Health topics. Life expectancy. Washington, DC, USA. <http://who.int.topics.life_expectancy.en> (accessed 01.10.10).
13. Filaba, M.A., 2004. A History of Karu with Specific Reference to the Consequences of the Rapid Urbanization Process of the Federal Capital City: 1976-2002, Ph D thesis (unpublished).
14. Turner, M., 2012. Decentralization, politics and service delivery: the introduction of one-stop shops in Mongolia. Public Management Review, 14(2): 197-215.
15. UNEP, 2010b. Solid Waste Characterization and Quantification of Bahir Dar City for the Development of an ISWM Plan. Forum for Environment, June 2010. <http://www.unep.or.jp/ietc/gpwm/data/t3/is_7_3_wastecq_bihardar.pdf> (accessed on 25.03.11).
16. World Bank, 2010. Data Catalogue. Washington, DC, USA. <http://data.worldbank.org.indicators> (accessed 06.03.11).
17. Workineh, K., 2007. Household Solid Waste generation rate and composition analyses in Injibara Town, Ethiopia. A thesis submitted to the School of Graduate studies, Addis Ababa University.
18. WHO (World Health Organisation), 2010. World health statistics. Indicator Compendium, Interim Report. <http://who.int.healthinfo.statistics.indneonatalmortality.en> (accessed 01.10.10).
19. WHO (World Health Organisation), 2010. Neonatal and Perinatal Mortality. Country, regional and country estimates. Washington, DC, USA. <http://whqlibdoc.who.int.publications.2006.9241563206_eng.pdf> (accessed 02.03.11).
20. Central Statistical Authority (CSA), 2007. Ethiopia Demographic and Health Survey (http://www.measuredhs.com/hivdata/start.cfm).