Assessment of municipal solid waste profile of Shendi City, River Nile State, Sudan

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Abstract

A cross sectional study was conducted to assess the solid wastes status of the household in Shendi City, Sudan. Questionnaire, interviews and observations were used. Results showed that 30% - 55% of the household produce about a kilogram a day per person, while 22% - 40% generate 5 or more kilograms daily. More than 50% of the household of different classes store their waste at home near the toilet, kitchen or other commodities in the house. Although most of the households were using suitable methods to store their solid waste (covered bins: 03%-09%; and closed plastic bags: 67%-74%), however, in some of the household the waste stored at the collection point (03%-06%) or other improper methods (05% - 18%). The most common types of solid waste from the household in the study area are accumulation of various municipal wastes (35%-47%), organic matters (32%-41%) and plastics (07% -23%). In conclusion, a daily solid waste generation per capita in Shendi City is relatively high. Uncontrolled collection and indiscriminately storage of the waste can create breeding sites suitable for insect or parasites that may pose risks to public health.

Keywords: Solid wastes, households, Shendi city.

Introduction

Solid waste is non-liquid waste generated in home, workshops, agriculture, industrials, mines and elsewhere. Many materials such as soil, food waste, packaging materials, paper, metals, plastics or glass the remains of unwanted clothes, furniture ,garden waste, dead animals, construction waste, industrial waste, from manufacturing and cutting processes, medical waste and hazardous and radioactive waste make up solid waste [1].

The weight, density and content of household waste differ not only from country to country but also from city to city. Daily household solid waste generated in the eastern Mediterranean region per person averages from 250 to 1200 grams with density range from 150 to 360 Kg/m^3. The output of daily waste generated depends upon the dietary habits, life styles, living standards and the degree of urbanization and industrialization .The per capita daily solid waste produced ranges between 0.25 to 2.5 kg in different countries [2]. However, in developing countries the problem is still hindered by social and economic predicaments and priorities.

In Sudan, the generation of solid wastes has become increasingly an important environmental issue over the last decade due to the escalating growth in population and

the changing life Style, leading to new trends of unsustainable consumption patterns concomitant with inflation in waste production. Sudan generates 5282000 tons of solid waste yearly, only 10% of this generated waste is collected and disposed, and the other 90% remain pollute the environment [3]. Methods of collection and disposal vary from one locality to another but any system adopted should insure efficiency and safety of means selected [4].

Refuse collection and disposal has been organized as a governmental work since the beginning of this century. When the British colonizers first adopted that system in big towns in the country by using animal carts [4]. Solid waste collection ,transportation and disposal constitute the most substantive means for cleaning which became the predominant in environmental sanitation [5].

Shendi City is of 9000 houses which are distributed in 29 Blocks (districts) , only 24 blocks are covered with solid waste services [6]. Shendi produces 45 tons of waste daily, only 18 tons (40%) of this amount is collected and transported to burning areas which represent the final disposal areas of the City, about 2 km far to the residential area [6]. Shendi pose challenging framework for waste management solutions due to the effects of the rapidly increasing economy and presence of large densely-populated residential areas and pressing demand for environmental protection [7].

Fate of solid waste starts from generation, collection, transportation and final disposal and shown obviously in direct disposal by open dumping left uncollected and at river side's or disposed in open areas [8]. The unsanitary disposal of solid waste generates health problems. Additionally, solid waste can cause fire, flooding and dangerous situation when there is lack of waste management [1]. The management dilemma of solid waste has been recognized and tackled seriously worldwide. The effect of living in an unhygienic and untidy environment may lead people to become demoralized and less motivated to improve conditions around them .Waste attracts more waste and leads to less hygienic behavior in general [9].

Although household refuse, does not usually contain such large amounts of germs as excreta, it can cause a risk to public health by attracting flies, mosquitoes, and rats and allowing them to breed. This may encourage the spread of diarrheal diseases as well as diseases like dengue fever, yellow fever, filariasis and bubonic plaque [10].

The objective of this study was to assess the status of solid wastes in Shendi City, Sudan.

Materials and methods

This observational community based cross sectional study was conducted in Shendi City, River Nile State, Sudan.

A multistage stratified system of

proportional allocation sampling was followed to select the sample units from household. The required sample size was determined using the formula:

$$n = \{2\sigma^2 (Z_\theta + Z p)^2\} / d^2$$

Where $\sigma = 7.14$

Z_θ = the value of standard normal variable corresponding to 95% confidence level = 1.96

$Z p$ = is the false negative probability = 1.282

d = the smallest difference to detect = 3

Sample size of 119 households was appointed accordingly. The amount of average per capita solid waste production estimated by collecting the waste generated in the selected sample units once a day at fixed time for 8 successive days to allow variation in waste generation over a week.

Solid waste segregation was conducted; separates the waste into different types and placed into different buckets. The weight of each type was recorded. For safety and ethical considerations we disposed and dump all the samples of the waste properly and clean the equipment used for its measurement and segregations. The following tools were used for data collection: An interview was done with locality public health officers; Questionnaire: standard questionnaire was designed for found heads of households of both class two and three; Observations: sanitation status; an intervention to collect waste generated from targeted households was done once a day at fixed time for 8 successive days to allow variations in types and composition of waste generation over a week.

Data analysis

Both Microsoft Excel and Statistic Package for Social Sciences program (SPSS) were used. Results were presented by percentage tables; cross tables and other statistical test of the significance between different factors were examined.

Results

About 30% to 55% of the household in Shendi city produce about one kilogram per person per day, while 22% to 40% generate 5 or more kilogram per day, Table 1. Some other household didn't know how much solid waste they produce per person a day. The amount of waste generation seem to be more from the third and second class levels but really it were the same at the different residential class levels, without significant differences.

Table 1. Daily solid waste generated per household among different residential class levels in Shendi City.

Amount of daily waste generation	Second class		Third class		Total	
	Frequency	%	Frequency	%	Frequency	%
One kilogram and less than five	11	30	45	55	56	47
Five kilograms and less than ten	15	40	18	22	33	28
Ten kilograms	00	00	02	02	02	02
More than ten kilograms	00	00	05	06	05	04
Those who don't know	11	30	12	15	23	19
Total	**37**	**100**	**82**	**100**	**119**	**100**

Less than 50% of the households storage their solid waste away from the house, while more than 50% of the household in different class level of Shendi store their waste at home near the toilet, Kitchen or the other commodities in the house, Table 2.

Table 2. Location of primary solid waste storage among different residential class levels in Shendi City.

Storage	Second class		Third class		Total	
	Frequency	%	Frequency	%	Frequency	%
Away from the home	17	46	35	43	52	44
At home near the toilet	11	30	12	15	23	19
At home near kitchen	00	00	05	06	05	04
Others	09	24	30	36	39	33
Total	**37**	**100**	**82**	**100**	**119**	**100**

Although most of the households in Shendi were using a suitable methods to store their solid waste (covered bins (03% - 09%) and closed plastic bags (67% - 74%)), but in some of the household the waste stored at the collection point (03% - 06%) or other improper methods (05% - 18%) found to be used for their storage, Table 3.

Table 3. Indoor solid waste storage methods among different residential class levels in Shendi City.

Storage method	Second class		Third class		Total	
	Frequency	%	Frequency	%	Frequency	%
In covered bins	01	03	07	09	08	07
In closed plastic bags	33	89	55	67	88	74
At collection point	01	03	05	06	06	05
Others	02	05	15	18	17	14
Total	**37**	**100**	**82**	**100**	**119**	**100**

Solid wastes from household of Shendi consist mainly of woods, charcoals, earth and dust, ceramic and textiles, beside clothes. The most common types of solid wastes were accumulation of various municipal waste (35% - 47%), organic matters (32% - 41%), and plastics (07% - 23%), Table 4.

Table 4. Composition of household solid waste in Shendi City during various season of the year 2012.

Types of solid waste	Winter		Autumn		Summer	
	Average day product	%	Average day product	%	Average day product	%
Organics Matters	27.29	41	21.29	31	40.36	32
Paper	1.82	03	4.57	07	9.29	08
Plastics	5.11	07	9.14	13	29.14	23
Metals	0.54	01	1.36	02	1.57	01
Glass	0.64	01	1.00	01	1.64	01
Others	31.46	47	31.86	46	43.86	35
Total	**66.86**	**100**	**692.14**	**100**	**125.86**	**100**

Only 09% of the solid waste was found to be collected within 24 hours after been generated, less than 20% of the produced waste collected after 3 days while the rest of the solid waste accumulated at the site of production around the household for a week or more, Table 5.

Table 5. Solid waste storage period in residential sites of Shendi City.

Period of storage	Frequency	%
One day	11	09
3 days	23	19
One week	37	31
Till arrival of the truck	33	28
Others	15	13
Total	**119**	**100**

Discussion

The results of this study indicate that about 30% to 55% of the household in Shendi city produce about one kilogram per person a day, while 22% to 40% generate 5 or more kilogram a day. Although there were no significant differences found considering the amount of waste generation, but the third class level produce more waste compared to the second residential class level. The output of daily waste generated reflect the dietary habits, life styles, living standards and the degree of urbanization and industrialization .The study implies that per capita daily solid waste generation is higher than what reviewed before that the per capita daily solid waste produced ranges between 0.25 to 2.5 kg in different countries [2]. This might be due to the escalating growth in populations and the changing life style in Shendi city, leading to new trends of unsustainable consumption patterns concomitant with inflation in waste production. Our findings were not far different from the daily household solid waste generated in the eastern Mediterranean region per person averages from 250 to 1200gm with density range from 150 to 360 Kg/m^3 [1, 2].

In this study, less than half of the households storage their solid waste away

from the house, while the large proportion of the residents store their waste at home near toilet or kitchen. A sanitary solid waste storage directive is not fully followed and not receiving the necessary attention and therefore might influences the solid waste management and hence the health quality and safety of residential people in these households and their environment. Although most of the households in Shendi City were using suitable methods to store their solid waste, but in some of the household the waste stored at the collection point or other improper methods, see table (3). These results to some extend go with what mentioned about the fate of solid waste which starts from generation, collection, transportation and final disposal and shown obviously in direct disposal by open dumping left uncollected and at river side's or disposed in open areas [8]. The uncontrolled collection and indiscriminately storage of the waste creating aesthetic nuisance and health problems, this status reflect the pressing demand for environmental protection [7].

The most common types of solid waste from the household in the study area are accumulation of various municipal waste, organic matters and plastics. This result is similar to previous reports on weight, density and content of household waste [1, 2]. Although household refuse does not usually contains such large amounts of germs as excreta as mentioned but it can pose a risk for public health [10].

For the solid waste storage period of Shendi City, only 09% was found to be collected within 24 hours after been generated and less than 20% of the produced waste collected after 3 days while the rest of the solid waste accumulated at the site of production around the household for week or more. Once household solid waste contains garbage, it needs quick removal and disposal because it ferments on storage, the longer the period the more fermentation and contamination to the environment. This condition create an unhygienic and untidy environment which may lead people to become demoralized and less motivated to improve conditions around; waste attracts more waste and leads to less hygienic behavior in general [9]. Solid waste if not correctly disposed it may provide breeding sites for insect-vectors-pests-snakes and vermin (rates) that increase the likelihood of disease transmission. It may also pollute water sources and the environment [9, 11].

In conclusion, it is recommended that for the government officials to conduct profile studies of solid waste overall the country to develop line database and plan for solid waste management. Shendi local authority is recommended to make the use the data of this study to develop and adopt an action plan for the solid waste management.

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