

Full Length Research Paper

A Study on the Causes of Water Pollution and its Effects on Public Health in Cases Kebena River, Addis Ababa, Ethiopia

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Abstract

The major purpose of the study was to examine the main causes of water pollution and its effect on societal health in the area of kebona river basin. In order to achieve this purpose the study employed descriptive survey and case study methods supported by qualitative data. A simple random sampling technique was used to select respondent to fill the questionnaire while availability and purposive sampling techniques were employed for the rest of the group. Focus group discussion and document analysis were conducted during the study in order to reliable the study. Data collected through questionnaire were tabulated and expressed in simple descriptive statistical tools like t-test, by using spss. It was found that the community in the sample area dispose their solid waste around their surround or at the interior and edge of the Kebena River. This may lead them, the committed individuals may hopeless to reduce it and lastly they may follow the uncommitted ones. So the government (the woreda administration office) and the community by themselves should care of about causes and try to reduce the above mention area of causes. Education (awareness creation), encourage recycling and minimize waste, water inlet pipes downstream of industries, keep the environment clean, and using environmentally friendly detergents, avoiding to pour oil down drainage areas, reducing pesticides misuse and abuse, are the mechanism that should be taken to reduce polluted water. The community also recommended that the automobiles should not be cleaned and maintained around river. The water that comes from these areas should not be linked with rivers rather it is better to forcedly bog down in the ground.

Key words: Community, Health, Kebena, Pollution, Water

Introduction

Addis Ababa is located within the Akaki River Basin, which covers an area of 11 454 km² (Ebba 2006). There are four artificial water reservoirs in the basin, namely Legedadi, Gefersa, Dire and Aba Samuel. The city is also dependent on groundwater, supplied through springs, and shallow and deep wells. Most of the springs are found at the foot of the northern Intoto mountain range (EPA, 2007).

However, the seasonal and perennial rivers and groundwater reserves of Addis Ababa are polluted by industrial and municipal solid and liquid wastes. The polluted river water is used by downstream residents to grow vegetables, which are sold and consumed by inhabitants of the city. The city's rivers are contaminated with different organic and inorganic pollutants. The shallow groundwater and springs are also contaminated (Tale, 2000, Alemayehu *et al.*, 2005, EPA 2005). Solid waste is often disposed of in open spaces, where it is washed by runoff during rains, and flows into rivers and seeps into shallow groundwater. Thus, water supply and sanitation issue is in question.

Accordingly, the river of kebona is polluted by different types of pollutants. Though, the community members live nearby use for consumption and ecosystem. As we all know, access to safe and quality water is one of the agenda of global issue to achieve that in the coming decades. Whereas, the uncontrollable source of pollutant that comes from domestic and industrial affected the Kebena River and that occurs the potential negative effect on the health of community. The high levels of pollution in the water sources of Addis Ababa have impacts on human and animal health, as well as on the urban ecosystem. According to EPA (2007), one of the environmental effects of the pollution of the water sources of Addis Ababa is eutrophication, caused by excessive use of phosphorous and nitrogen in agriculture, and effluents from sewerage and pit latrines and municipal wastes, causes growth of algae and weeds, which reduce the oxygen level of the water bodies, and in turn affect aquatic fauna and flora. Accordingly, kebona River is one of the polluted river among Addis Ababa rivers. Thus, the pollution of water creates problem on the community health and no attention is given to cause of river pollutant is another problem. In addition the community and government had not tried to take action or to provide mechanism to reduce water pollution of Kebena River. All these problems show that the community is still affected by polluted water and leads to health problem. Moreover, the current expansion of car washing services coupled with excessively increasing inorganic plastic wastes and petroleum residues are worsening the magnitudes pollution. Therefore, this study intended to

examine the perceived specific causes of Kebena River pollution and to sort out the health problems due to polluted water on the community health in the context of woreda 7, Arada sub-city, Addis Ababa.

Research Design and Methodology

Study Area

This study is conducted in the vicinity of Kebena River, which is one of the most contaminated water bodies of Addis Ababa. Tremendous industry effluents, hospital wastes and household sewerages' sink best characterizes this area. The investigators focused the perceptions of shanty households and peoples living around the two sides of the river near to the Kebena Bridge, Woreda 7 of Arada Sub-city of Addis Ababa.

Research and Sampling Design

The main purpose of the study is to find out the major effect of water pollution on societal health of people living around Kebena river of Addis Ababa. To this end, descriptive type of research design was employed. It also includes a case study that enables the researches to dig out the causes and effects of water pollution around the Kebena river area. So mixed research approach was employed to get holistic evidence and data about the issue, study area and the subject matter. The populations for this study were selected from the resident community whom near to Kebena river using the quota and convenience sampling methods as a sample respondent. The sampling on resident and renting community is taken based on the beneficiaries of Kebena River. The population of the study was drawn from the residents who dwell around the river and utilize the water for various purposes. Thus, the residents, or community members, nearer to the river were considered as the universe of the study. The sample population was arbitrarily selected to fill the semi-structured questionnaires. Accessibility, convenience and proximity are basis for selection.

Source of Data

The researchers used both primary and secondary data as a source of data. The primary data gathered through interview, questionnaire, focus group discussion and participant observation; and the secondary data (available written materials) are very important for the accurate data gathering method.

Method of Data Collection

Data was collected through qualitative and quantitative approach. Both primary and secondary sources of data were part of data collection instruments. The investigators used questionnaire (open and close ended), interview (structured and unstructured), observation and focus group discussion for the collection of primary data sources. The following is a brief explanation how the primary data were used. Interviews were conducted to gather information from government household individuals especially from house leaders. Focus Group Discussion was carried out to probe on the issues with those who are said to be main participants (those individuals who were lived a long period of time around the area). Questionnaires, on the other hand, were utilized to collect data from the sampled population of the area. Observation was made to physically evaluate what the situation is seems to be through staying there around the area. It also includes some dialogue with the community in order to confirm what the researchers see at the site. The research team also used secondary sources as to have some background information about the issues. Related documents were analyzed. Documents like magazines, books, journals, and research papers, published and unpublished materials were examined not only to help to establish the review of related literature, but also to come up with sufficient information about the issue.

Procedures of the Study

Questionnaire was set and distributed to be filled by the expected respondents stated above. Interview was made with female and male house hold owners living in the area. Observation had taken by the research team and of key informants, and focus group discussion was made to consolidate the information about how much series is the problem and realize the effort of the community in reducing the effect of water pollution on their health. The questionnaire prepared for the respondents to be piloted with individuals which were not selected as a sample to be studied. The pilot study carried out in order to avoid errors related to language, ideas etc and to enrich the framed items. The selection of the pilot respondents was arbitrary as the purpose of this stage is to confirm the application of instruments. Then the final copies were distributed for the expected respondents to make sure that they had convenient time to fill it.

Sampling Techniques

Probability and non-probability sampling technique were used to select samples of the research. Twenty key informants were selected from community dwellers of Kebena River using the purposive or judgmental method as sample respondents. This approach is used when a sample is taken based on certain judgments about the overall population. The entire population of the area residents whom near to the river and use the river are small in number, thus the purposive or judgmental sample design has chosen in order to accomplish this study. Purposive or judgmental sample design method has a great advantage to minimize cost and time during research investigation.

Selection of Key Informants

It is believed that some individuals and professionals have more information than others about the issues. There are also some other individuals who are not volunteer to respond. So in order to get relevant information what is expected of those respondents, the

investigation team tried to get those individuals who are rich in such information. The method to select those informants is snowball method.

Method of Data Analysis

The data collected from respondents through questionnaire, interview, focus group discussion and observation was collected, analysis and interpreted. The study includes a total of 121 respondents whose response was gathered through questionnaire, interview and focus group discussions. The questionnaire which was distributed to 90 household members was not totally returned. From a total of 90 questionnaires 80 (88.9%) were returned to the researchers. Three focus group discussions were made with 21 individuals (7 in each group) in different times. Only twenty short term interviews were made independently around respondents' place of living. The data gathered also analyzed through the mean scores tested by high level statistical analyses, using SPSS. It enables to test data on the 'statistical significance of a relationship', by examining the ratio of between-group variance/within-group variance. This tool was preferred because it enables to test for means, focuses on analyzing the variance within and across the sample at $\alpha=0.05$.

Result

Extent of Pollution

Collectively, about 39.17 % of the respondents from all parts of the study area assumed that the extent of water pollution is medium, were as 20.83 % thought that extent of water pollution is high. Based on the reply of 60.87 and 8.16 % of upstream and mid-stream, the extent of water pollution was low in the study area, respectively. The extent of water pollution, as it was illustrated on Table 1, is least in upper catchment in comparison to lower and middle catchment area. The highest level of water pollution was recorded in lower catchment. The pollution level, as agreed by more than half of the respondents (51.02 %) of mid-stream catchment, was found to be medium though significant proportion (40.82) of the same respondent category believed that the pollution level as high (Table 1).

Table 1. Extent of water pollution as perceived by the respondents, Kebena River, 2017/18

Respondents' Residence (within the district)	Extent of Water Pollution			Total (N)
	High	Medium	Low	
Upstream/ upper catchment	1(4.35%)	8(34.78%)	14(60.87%)	23
Middle stream	20(40.82%)	25(51.02%)	4(8.16%)	49
Low stream/lower catchment	4(8.33%)	14(29.14%)	30(62.5%)	48
Total	25(20.83%)	47(39.17%)	48(40%)	120

Major Causes and Effects of Water Pollution around Kebena River Basin

As shown on table 2 sewage from domestic households, underground storage and tube leakages, waste water and septic tanks are considered to be the major causes of water pollution around the Kebena River with a mean value of 4.31, 4.27, 4.23 and 4.03 respectively. Dumping solid wastes, disposed of industrial wastes, automobile maintenance products (oil and anti-freeze) are moderately cause water pollution and the area. The respondents argued that the effect of pest waste ($\bar{X}=2.63$) and home and garden pesticides ($\bar{X}=2.01$) are not significant to cause water pollution around the Kebena River basin of Addis Ababa. So around the study area sewerage from domestic households took the first place to pollute water. The sewerage comes from the community themselves. In here we can see that the community's activity lead the river water to be polluted. Disposal of waste water from households and septic tanks of toilet from the community is also another major factor that caused the river to be polluted. So the community is not responsible not to pollute the river by their waste materials.

Table 2:- The major Causes of Water Pollution around Kebena River

No	Item/Practice	Mean	Standard Deviation	Sig. (2-tailed)
1	Sewage from domestic households	4.31	0.56	0.787
2	Septic Tanks	4.03	1.23	0.033
3	Dumping solid wastes	3.74	1.54	0.027
4	Disposed of industrial wastes	3.12	1.29	0.006
5	Pest waste	2.63	0.87	0.671
6	Underground storage and tube leakages	4.23	1.04	0.190
7	Home and garden pesticides	2.01	0.52	0.438
8	Automobile maintenance products (oil and anti-freeze)	3.81	0.89	0.127
9	Waste water	4.27	1.77	0.878

*Significance level is 0.05,

When the relationships between these causes were observed, accelerated engagements of the others would be realized in water pollution. The response on item 2, 3 and 4 (Septic Tanks, Dumping solid wastes, Disposed of industrial wastes) shows us there is

statistically significance difference observed between the respondents. The 2-tailed value for item 2, 3 and 4 is 0.033, 0.027 and 0.006, respectively, which is much lower than the significant level of 0.05. The FGD and interview result consolidated the above argument that sewerage, septic tanks and disposal of solid waste are considered to be the major factors that cause water pollution in the area. They showed that most of the wastes had come from their households and they were not doubtfully committed to reduce the pollution. Most population of the area are aware of the causes but not jointly do activities in collaboration with others that leads them protect the river water from pollution. Nutrients, atmospheric contaminants, alien species and disruption of sediments (fine-grained powders) are a relatively moderate factor that polluted the Kebena River (table 2). They are certainly significant that cause water pollution as it was observed in FGD session. In addition, a moderate factor doesn't mean no negative impact for livelihood. So it need due attention not only on the major causes but also for the moderately rated factors. Littering by human, chemical waste and home and garden fertilizers are not considered to be the major causes of the pollution. The respondents rated them as a less factor that caused water pollution. There is statistically significance difference between the respondents on items 6 and 8. Heat and thermal pollution and alien species are responded by the respondents differently. But on the other items there is no observation of significance difference between the responses of participants.

Table 3:- The major Causes of Water Pollution around Kebena River

No	Item/Practice	Mean	Standard Deviation	Sig. (2-tailed)
1	Atmospheric contaminates	3.11	1.54	0.321
2	Nutrients	3.93	1.97	0.870
3	Home and garden fertilizers	2.43	0.54	0.218
4	Chemical Waste	2.12	1.90	0.078
5	Littering by human	2.03	0.45	0.631
6	Alien Species	3.23	1.42	0.029
7	Disruption of sediments (fine-grained powders)	3.01	2.12	0.390
8	Heat and thermal pollution	2.89	0.32	0.017

* Significance level is 0.05

The community in the sample area dispose their solid waste around their surrounding or at the interior and edge of the Kebena River. This may lead them, the committed individuals may hopeless to reduce it and lastly they may follow the uncommitted ones. From the interview session, authors got responses that strengthen the argument. If individuals became hopeless, they may neglect to protect their surrounding from pollution and it was continue without any concern for the issue. So the government (the Woreda administration office) and the community by themselves should care of about causes and try to reduce the above mention area of causes.

Mechanisms taken by the Community to reduce Water Pollution

As shown in table 4, all mechanisms except one (Tougher law enforcement) factor stated in the table are considered to be the best solution to reduce water (river) pollution. Education (awareness creation), encourage recycling and minimize waste, water inlet pipes downstream of industries, keep the environment clean, and using environmentally friendly detergents, not pouring oil down drains, reducing pesticides, are rated as the mechanisms to be used in order to reduce river pollution with a mean value of 4.76, 4.09, 4.12, 4.01 and 4.13 respectively. the analysis shows that there is also a statistically significance difference observed on two items namely; Tougher law enforcement and Keep the environment clean with a 2 tailed value of 0.045 and 0.017 respectively. But respondents have no differences in responding other items stated as a mechanism to be taken in reducing water pollution.

Table 4:- Mechanisms of Water Pollution reduction by the Community

No	Item/Practice	Mean	Standard Deviation	Sig. (2-tailed)
1	Education (awareness creation)	4.76	1.41	0.343
2	Encourage recycling and minimize waste	4.09	1.85	1.116
3	Tougher law enforcement	3.07	0.42	0.045
4	Water inlet pipes downstream of industries	4.12	1.33	1.063
5	Keep the environment clean	4.13	1.08	0.017
6	Using environmentally friendly detergents, not pouring oil down drains, reducing pesticides, etc	4.01	0.65	0.219

* Significance level is 0.05,

The community also recommended that the automobiles should not be cleaned and maintained around the river. The water that comes from these areas should not be linked with rivers rather it is better to be forcedly bog down in the ground. When their practice sought, in most cases they are waiting other organ, especially NGOs to support them to reduce pollution. But they do forgot their role is not be replaced by others. Simply what we observed from the discussion and the interview session is, they are aware of what causes the river to be polluted but are not surmount their responsibility.

Major Consequences of Water Pollution on the General Public

Common cold, Stomach sickness in humans, suffocation, and typhoid fever are the major effect of polluted water that causes human health with a mean value of 4.21, 4.04, 4.16 and 4.63, respectively. Cancer and reproductive problems are not resulted due to polluted water as rated by the respondents with a mean value of 2.74 and 2.37 respectively. Based on the response of the respondents, cancer and reproductive problems are the least to be caused by polluted water. The participants put poisonous drinking water is another effect of water pollution. They moderately rated it as one effect of water pollution on human health with a mean value of 3.81. We have observed a significance difference between the respondents in responding cancer as an effect of water pollution. Their way of responding is significantly different with a 2 tailed value of 0.031 in which it is much less than the significant level of 0.05.

Table 5:- Major consequences of Water Pollution on the Public

No	Challenges	Mean	Standard Deviation	Sig. (2-tailed)
1	Poisonous drinking water and poisonous food animals	3.81	0.91	0.214
2	Cancer	2.37	1.43	0.031
3	Reproductive problems	2.74	0.39	1.028
4	Typhoid fever	4.21	1.82	0.054
5	Stomach sickness in humans	4.04	1.59	0.203
6	Suffocation	4.16	0.52	1.006
7	Common cold	4.63	1.06	0.092

*significance level is 0.05,

As indicated in table 5, most of the population realized that most of the water borne diseases was resulted due to polluted water. They saw so many diseases that are occurred around the area in different time and are aware of what the water bone diseases are, the way the disease transmitted from person to person. But in practice the people are not highly motivated to reduce the exposure to these diseases. On the other hand they are aware of the mechanism but are not cooperatively done what is expected from them and it costs them from time to time.

The Effect of Water Pollution on Public Health

Apart from the above mentioned general public problems, water pollution was reported to have health related challenges too. Some of these diseases include Influenza, Paratyphoid fever, Bacillary dysentery, Infectious Hepatitis (jaundice) and Amoebic dysentery are another effect of water pollution on human health with a mean value of 4.64, 4.43, 4.11, 4.17 and 4.04 respectively.

Table 6:- The Effect of Water Pollution on Public Health

No	Item/Practice	Mean	Standard Deviation	Sig. (2-tailed)
1	Influenza	4.64	0.16	1.832
2	Paratyphoid fever	4.43	1.76	1.031
3	Cholera	2.65	0.49	0.004
4	Bacillary dysentery	4.11	0.31	0.087
5	Infectious Hepatitis (jaundice)	4.17	0.32	1.011
6	Poliomyelitis	1.32	1.97	1.876
7	Amoebic dysentery	4.04	1.60	0.016

* Significance level is 0.05

Most respondents, as shown in table 6, believed that Poliomyelitis and Cholera are not a disease cause by water pollution. Their response for Poliomyelitis and Cholera have a mean value of 1.32 and 2.65 respectively that shows these are not resulted due to polluted water around the Kebena river. Cholera and amoebic dysentery are differently rated by respondents and is said to be there is a significance difference between respondents to responses these two items. The community believed that most of water borne

diseases can easily controlled by several mechanisms taken by the community and the government. They also argued that the active involvement of NGOs in the area is also significance to control the diseases or to reduce water pollution.

Conclusion

From the result of the analysis made, sewage from domestic households, underground storage and tube leakages, waste water and Septic Tanks are considered to be the major causes of water pollution around the Kebena River. Dumping solid wastes, Disposed of industrial wastes, Automobile maintenance products (oil and anti-freeze) are moderately cause water pollution and the area and needs attention to it. The sewerage comes from the community themselves. In here we can see that the community's activity lead the water to be polluted. Disposal of waste water from households and septic tanks of toilet from the community is also another major factor that caused the river to be polluted. Partly, the community is not responsible not pollute the river from their waste. Nutrients, Atmospheric contaminates, Alien Species and Disruption of sediments (fine-grained powders) a moderate factor that pollute the river water of Kebena River. In addition a moderate factor doesn't mean no negative impact for livelihood. Further, it need due attention not only on the major causes but also for the moderately rated factors. The community in the sample area dispose their solid waste around their surrounding or at the interior and edge of the Kebena River. Others would follow and do the same thing if there are no social or legal repercussions. Awareness creation, encouraging recycling and minimize waste, water inlet pipes downstream of industries, Keep the environment clean, and Using environmentally friendly detergents, not pouring oil down drains, reducing pesticides, are the mechanism that should be taken to reduce polluted water. The community also recommended that the automobiles should not be cleaned and maintained around river. The water that comes from these areas should not be linked with rivers rather it is better to forcedly bog down in the ground. In practice, they are waiting for other organ; especially NGOs to support them reduce the pollution problem. But they hardly forgot their role was not be replaced by others. Common cold, Stomach sickness in humans, Suffocation, and Typhoid fever were the main diseases caused by ware pollution. The Population realized that most of the water borne diseases was resulted due to polluted water. But in Practice the people are not highly vulnerable to reduce the exposure to these diseases. On the other hand, they are of the mechanism but are not cooperatively done what is expected from them and it costs them from time to time. Influenza, Paratyphoid fever, Bacillary dysentery, Infectious Hepatitis (jaundice) and Amoebic dysentery are another effect of water pollution on human health. They believed that Poliomyelitis and Cholera are not a disease cause by water pollution.

Recommendation

To curb the existing water pollution problems and its effect on human health around the Kebena River basin, the government and NGOs that are working around sanitation were recommended to raise the awareness campaign to the society. The community should have a very linkage with the respected government body and work closely with them to reduce polluted water and its effect on human health. If there are NGOs working around the area, the sewerage system should be modernized and free from any kind of contamination. Solid and liquid sewerage system should be done in significance with the world standard. Recycle of waste materials come from the community is expected to be introduced as a newest technology. By the same token, the government (the Woreda administration office) and the community by themselves should care of about causes and try to reduce the above mention area of causes.

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