

Investigation on the Impact of Water Pollution on Human Health in Juba County, Republic of South Sudan

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Abstract Water pollution in Juba County is one the major problem affecting the community. In recent years, rural urban migration caused by internal conflict and small industrialization in Juba, has accelerated the problem of water pollution. This study was conducted to investigate the impact of water pollution on Human health in Juba County. The study used combination of participatory, qualitative and quantitative method to collect the necessary data. A sample size of 50 respondents was taken for this study. The result revealed main sources of drinking water in Juba County is from water tank according to 57.5% of the respondents. The majority of respondents 52.5% revealed that the major factor that leads to water pollution in Juba County is the random dumping of garbage to water bodies. The obtained results revealed that, the majority of people in the area treat their water by using Chlorine tablets (chlorination) which is represented by 57.5% of the respondents. About 42% of the respondents said that water pollution kill life that habitat in water, causes diseases and destroying ecosystem both on the environment and human health. About 55% of the respondents revealed that, there should be awareness for the communities about the effects of water pollution and they perceived it as the best way to prevent water pollution. Bacterial, viral and parasitic diseases like typhoid, cholera, encephalitis, poliomyelitis, hepatitis, skin infection and gastrointestinal are spreading through polluted water. It is recommended that there should be proper management of water bodies and waste disposal system. Awareness programs and formulation of laws should be carried out to control the pollution. Further research studies, including epidemiological studies, are necessary to determine better the impact of water pollution on Human health and on the environment in Juba County.

Keywords: water pollution, garbage, chlorination, ecosystem, gastrointestinal, epidemiological studies

Cite This Article: John Leju Celestino Ladu, Andrew L. Athiba, Stanislaus Tombe Venusto Lako, and Moses Lomoro Alfred, "Investigation on the Impact of Water Pollution on Human Health in Juba County, Republic of South Sudan." *Journal of Environment Pollution and Human Health*, vol. 6, no. 3 (2018): 89-95. doi: 10.12691/jephh-6-3-2.

1. Introduction

Water pollution is a major global problem which requires ongoing assessment and amendment of water resource policies at all levels (international, down to individual aquifers and wells). Water pollution is the leading worldwide cause of deaths and diseases and accounts for the deaths of more than 14,000 people daily [1]. It is therefore referred to as polluted water when it is impaired by anthropogenic contaminants and does not support a human use, such as drinking water and/or undergoes a marked shift in its ability to support its constituent biotic communities. Infectious diseases, like cholera, typhoid fever [2] and other diseases such gastroenteritis, diarrhea, vomiting, skin and kidney problem are spreading through polluted water [3]. Water pollution is defined as the contamination of water bodies such as streams, lakes, rivers, oceans, aquifers and groundwater [4]. It occurs when pollutants are discharged directly or indirectly into water bodies without adequate treatment to remove harmful compounds. Natural phenomena such as volcanoes, algae blooms,

storms, and earthquakes cause major changes in water quality and the ecological status of water.

Water pollution usually happened when discarded materials come into contact with bodies of water and thus changes the quality of water [5] and are deleterious to the environment and human health [6]. Water is one of the paramount natural resource of all living organisms including human, food production, and economic development used for drinking and other domestic and developmental purposes in our day to day activities [7]. Consumption of clean water is necessary for human health all over the world. Since water is a universal solvent, it is a major source of infections. According to world health organization (WHO) 80% diseases are water borne. Drinking water in various countries does not meet WHO standards [8]. About 3.1% deaths occur due to the unhygienic and poor quality of water [9].

Today there are many urban and rural areas worldwide facing an acute shortage of water and almost 40 percent of the world's food supply is grown under irrigation and a wide variety of industrial processes depends on water. The environment, economic growth, and developments are all highly influenced by the quality of surface and groundwater. The quality of water is affected by human activities and is

declining due to the rise of urbanization, population growth, industrial production, climate change and other factors. The resulting water pollution is a serious threat to the well-being of both the Earth and its population.

South Sudan flow over by numerous rivers and the main one is River Nile; the land is also consistently nourished by their water flows. Pollution of water (rivers) bodies has become a major problem that is becoming critical because of inadequacy or non-existence of surface water quality protection measures and sanitation. Lagoons, rivers and streams are sinks for wastes. Wastes are most often discharged into the receiving water bodies with little or no regard to their assimilative capacities. The discharge of raw sewage, garbage, as well as oil spills are threats to the diluting capabilities of the lagoons and rivers. The natural purification of polluted waters in itself is never fast, while heavily polluted water may traverse long distance in days before a significant degree of purification is achieved [10,11]. In addition, rivers and streams are becoming increasingly polluted from domestic and industrial wastewater dumped by residential and small factories. The water pollution threatens food production and is raising both environmental and human health concerns [12].

Juba city is flow over by River Nile and a number of streams of which Lobuleit, Khor Bou and Khor Romula are the important ones considered in this study. Because of the lack of the water resources management plan and policies, both the quality and quantity of water in these streams and River Nile have reached a very critical situation that does not allow its instant use (for the case of the mentioned three streams).

The pollution of these water sources have not only been killing its aquatic life but also been posing health hazards

to the dwellers of the city. The river Nile receive partially treated and untreated sewage effluent, sewage polluted surface run-off and untreated domestic, agricultural and industrial effluent from nearby residential and commercial/industrial areas. Sources of pollution of the water in these streams and river Nile also include various industrial discharges, domestic wastes; indiscriminate throwing of pathological and commercial wastes, etc. Because of this, water quality of these streams and river is deteriorating day by day [13]. Polluted river have intolerable smell and contains less flora and fauna. 80% of the world’s population is facing threats to water security [14].

River Nile pollution has been one of the main topics in the environmental issue of Juba County. The streams that flow in the capital city, including the Lobuleit have been steadily experiencing complicated problems like pollution and encroachment. However, the specific objectives of the study were as follows: To investigate the source of water used and the factors that lead to water pollution in Juba County, methods of water treatment, effect of water pollution and way of prevention of water pollution.

2. Material and Methods

2.1. Study Area

Juba County is located in the capital city of the Republic of South Sudan and it comprised of Juba payam (district), Kator payam and Munuki payam and characterized by houses of low income. It consists of several streams (khors) and River Nile.

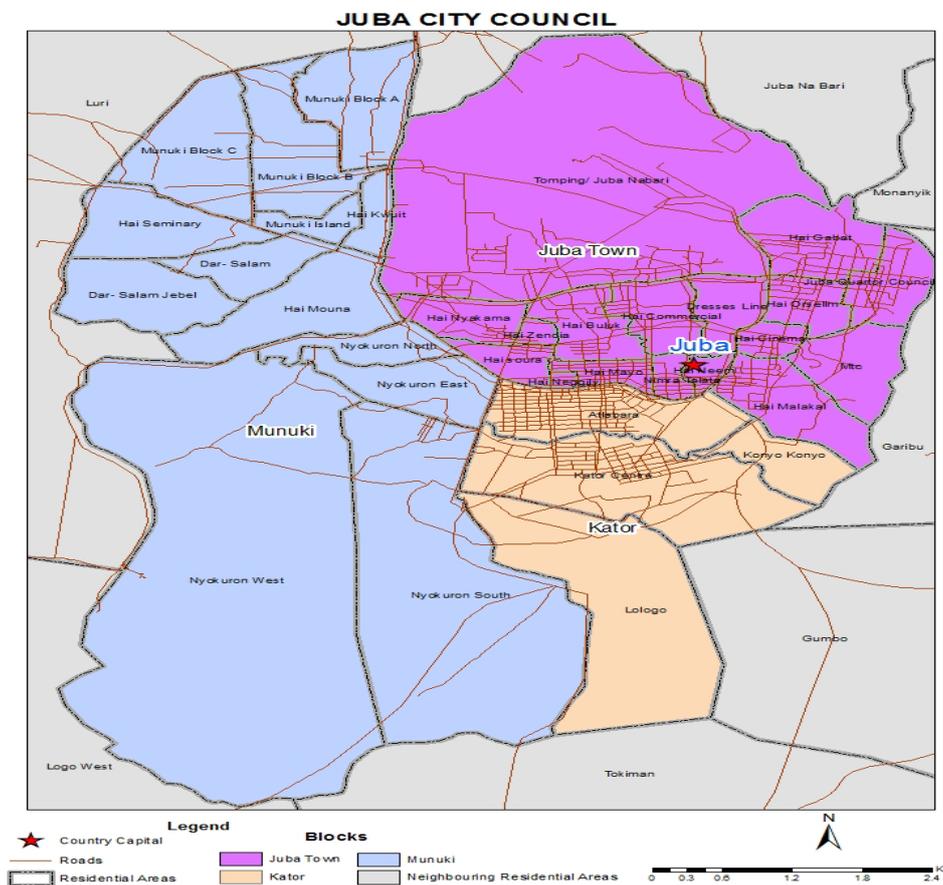


Figure 1. Map showing Juba City Council with it three payams (Juba, Kator and Munuki Payam)

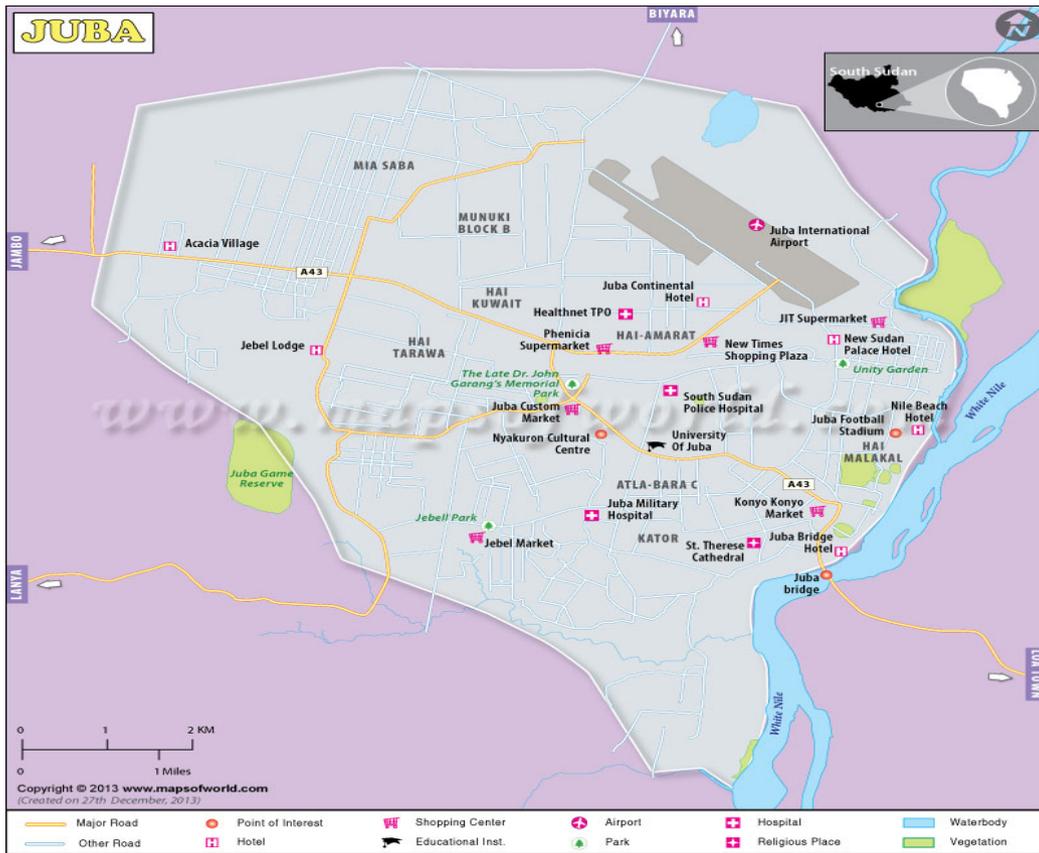


Figure 2. Map showing Juba County

2.2. Sources of Data

This study used combination of participatory, qualitative and quantitative method to collect the necessary data. The sources of data are divided in to two categories. The data which were collected from the field or study area are called the primary data. Primary data were collected by interviewing the people of study area through questionnaire and/or by making survey on a topic of the study. The secondary data are the data which were collected from any books, journals, conferences, previous research papers or any other document which contain the topics related to the study.

The qualitative information and quantitative data was gathered through primary and secondary data sources. The collection was carried out into two stages:

1. Primary data collection

This data was acquired directly from the field involving combination of methods, namely: Interviews and using questionnaires, face to face interviews and Personal observation.

2. Secondary data collection

This data was derived from documentaries (literature reviews) e.g. journal papers, conference papers, books from libraries and short communications.

2.3. Sampling Size

The sample size taken for this study was 50 respondents who were expected to provide representative information and view of all other people in Juba County. Approach to study was based largely on primary data collection from field visits.

Table 1. Sample size in Juba County

Residential Areas	Frequency	Percentage
Juba Payam	15	30%
Kator Payam	15	30%
Munuki Payam	20	40%
Total	50	100%

2.4. Sample Design and Analysis

The sample design used for the collection of the data was randomized system and the data was analyzed by the use of excel sheets to produce results which were then presented in tables, graphs, and charts.

3. Results and Discussions

3.1. The Sources of Drinking Water

The Figure 3 below shows the sources of drinking water in Juba County. According to the interview carried out with the respondents, the main sources of drinking water in Juba County is from water tank and that was revealed by 57.5% of the respondents, while 15% and 15% of the respondent said that they obtained their water from River Nile and Boreholes which they consider as not safe for drinking. While 12.5% of the respondents revealed that they get their water from shallow wells because the payams in Juba County are swampy during wet season.

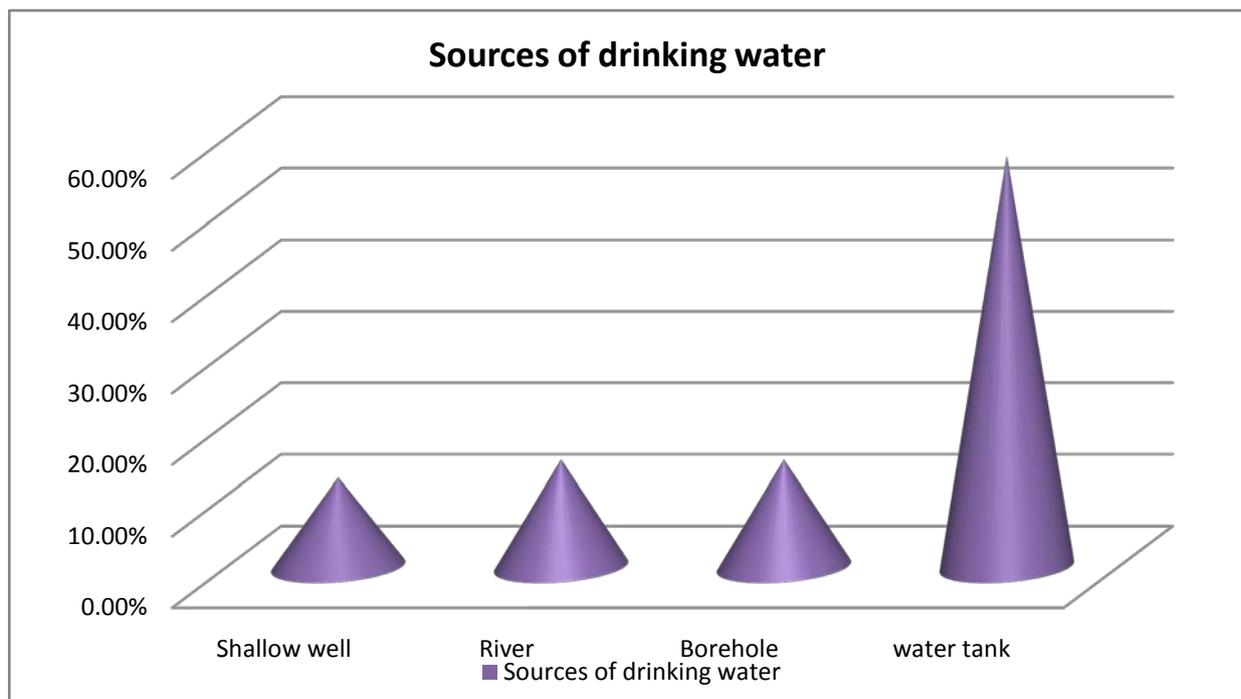


Figure 3. Shows the sources of drinking water in Juba County

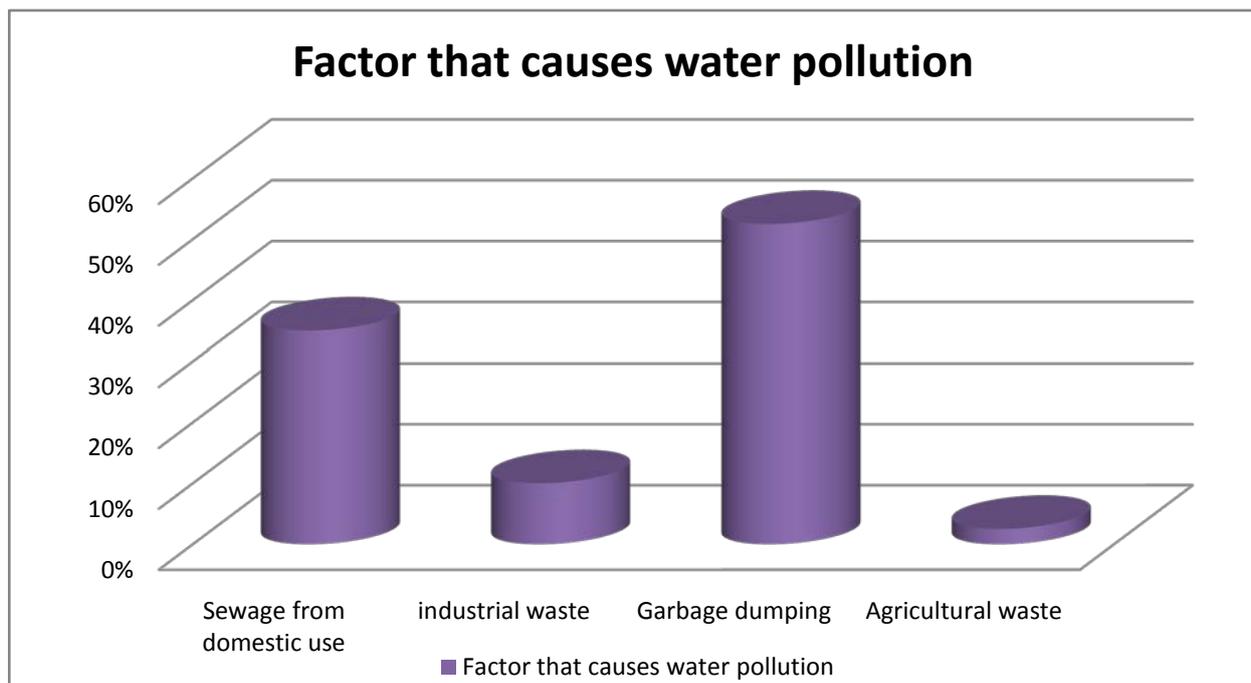


Figure 4. Shows the factor that causes water pollution

3.2. Factors that Lead to Water Pollution in Juba County

Water pollution has often been a concern amongst residents and government state authorities interviewed. In the Figure 4., the majority of residents believe that the factors that leads to water pollution in Juba County is the random dumping of garbage to water bodies accounting to 52.5% of the respondent (first major factors). The discharge of domestic sewage to water bodies' accounts becomes the second factors leading to water pollution which accounts to 35% of the respondent. The discharged and dumping of industrial wastes to water bodies becomes

the third factors leading to water pollution which accounts to 10% of the respondents and dumping and discharging of agricultural wastes ranks the fourth factors leading to water pollution; accounting to 2.5% of the respondents interviewed respectively.

Increasing population is creating many issues but it also plays negative role in polluting the water. Increasing population leads to increase in solid waste generation [12,15]. Solid and liquid waste is discharged in to rivers. Water is also contaminated by human excreta. In contaminated water, a large number of bacteria are also found which is harmful for human health [11,16].

3.3. The Treatments of Water in the Study Area

Figure 5 below revealed that, the majority of people in the area treats their water by using Chlorine tablets (chlorination) which is represented by 57.5% of the respondents and about 17.5% and 17.5% of the respondents revealed that they treat their water by filtration and sterilization processes and only 7.5% of the respondents said they treat their water by boiling process. The results indicated that most people in Juba County treats their water by using chlorine most probably because chlorine tablets is the easiest way of drinking water treatment and always available and sometimes being provided free to the locals by NGOs and many households in the area has been trained how to do filtration and sterilization of water since cholera outbreak in Juba.

3.4. Effects of Water Pollution on the Environment in the Study Area

From the study conducted and shown in Figure 6 below, water pollution has several severe effects on human and other aquatic life. The most predominant of these effects is that, polluted water is one of the leading causes of disease among human. About 42% of the respondents said that all of the mentioned effects (all above are correct) of water pollution (kill life that habitat in water, causes diseases and destroying ecosystem), both on the environment and human health are corrects while 40% of the respondents believe that polluted water can only cause diseases to human life. While 10% of the respondents believed that polluted water can kill life of aquatic organisms that habitat in the water and only 7.5% of the respondents said polluted water can destroy the ecosystem.

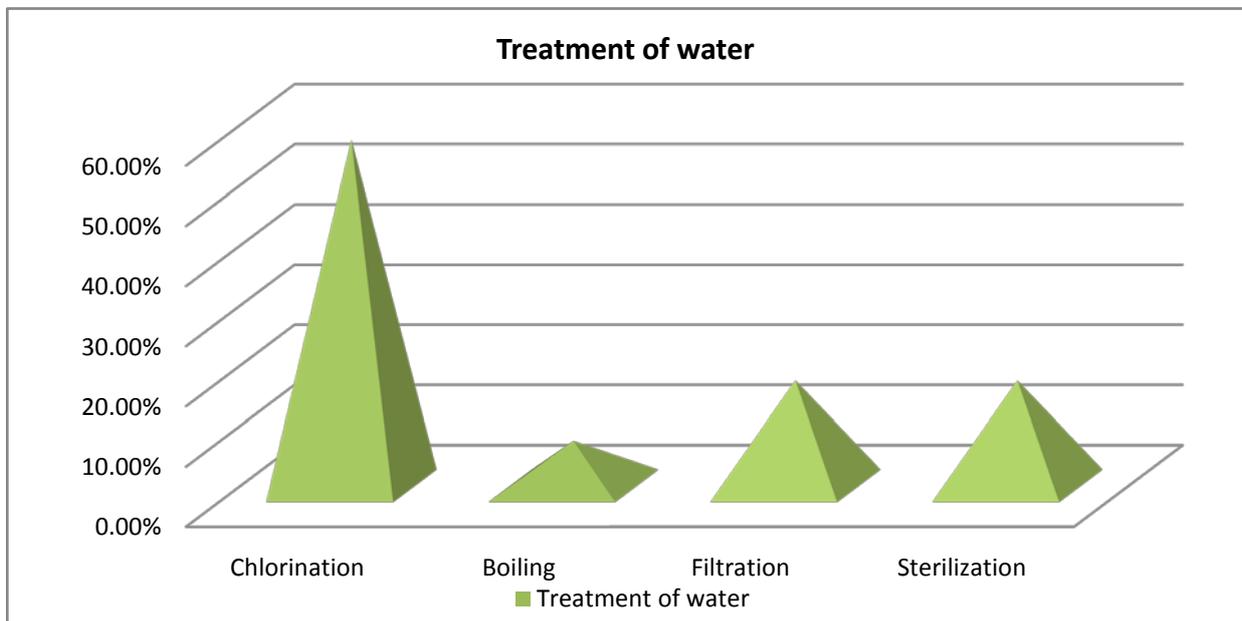


Figure 5. Shows the treatment of water in the study area

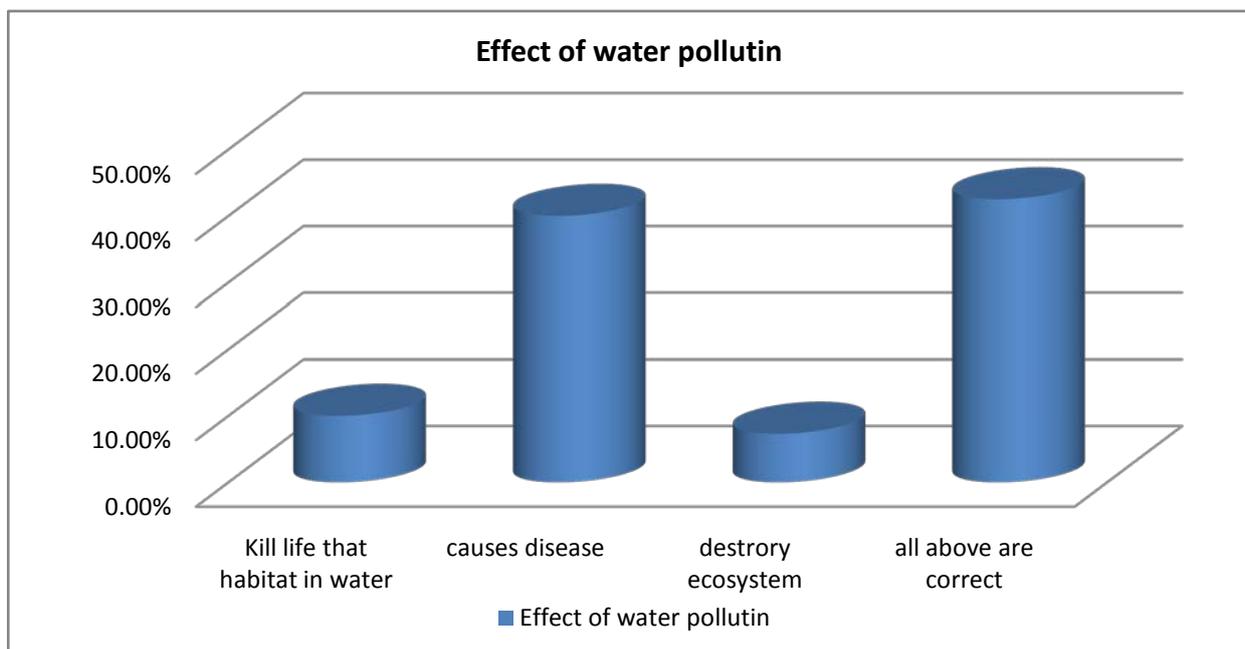


Figure 6. Shows the effects of water pollution on environment in Juba County

There is a greater association between pollution and health problem. Disease causing microorganisms are known as pathogens and these pathogens are spreading disease directly among humans. Some pathogens are worldwide and some are found in well-defined area (Khan MA, 2011). Heavy rainfall and floods are related to extreme weather and creating different diseases for developed and developing countries. About 10% of the population depends on food and vegetables that are grown in contaminated water. Many waterborne infectious diseases are linked with fecal pollution of water sources and results in fecal-oral route of infection [17].

3.5. The Prevention of Water Pollution in the Study Area

From Figure 7 illustrated below, 55% of the respondents revealed that, there should be awareness for the communities about the effects of water pollution and its perceived as the best way to prevent water pollution. About 22.5% of the respondents believed that law should be formulated in regards to water pollution to avoids the effects of water pollution on human life, while 15% of the respondents believed that treatments of sewage before discharge to water bodies can prevent water pollution and only 7.5% of the respondents said that sediment traps should be built to avoid the effects of water pollution on human health. From the results obtained, the majority of respondent needs awareness in regards to water pollution prevention and that law should be formulated to penalize people causing pollution.

3.6. Summary

Improper management of water can leads to Poor

quality water and in turn caused poor crop production and contaminates our food which is hazardous for aquatic life and human life [7,18]. Pollutants disturb the food chain [17,19] and heavy metals, especially iron affects the respiratory system of fishes. An iron clog in to fish gills and it is lethal to fishes, when these fishes are eaten by human leads to the major health issue [20,24]. Metal contaminated water leads to hair loss, liver cirrhosis, renal failure [21,25] and neural disorder [22].

3.7. Bacterial Diseases

Untreated drinking water and fecal contamination of water is the major cause of diarrhea. *Campylobacter jejuni* spread diarrhea 4% to 15% worldwide.

3.8. Viral Diseases

Hepatitis is a viral disease caused by contaminated water and infects the liver. Jaundice, loss of appetite, fatigue, discomfort and high fever are symptoms of hepatitis. If it persists for a long time it may be fatal and results in death. Vaccine is available for hepatitis and by adopting good hygienic practice; one can get rid of this disease [23].

3.9. Parasitic Diseases

Cryptosporidiosis is a parasitic disease caused by the *cryptosporidium parvum*. It is worldwide disease and symptoms are diarrhea, loose or watery bowls, stomach cramps and upset stomach [24]. *Cryptosporidium* is resistant to disinfection and affects immune system and it is the cause of diarrhoea and vomiting in humans [25].

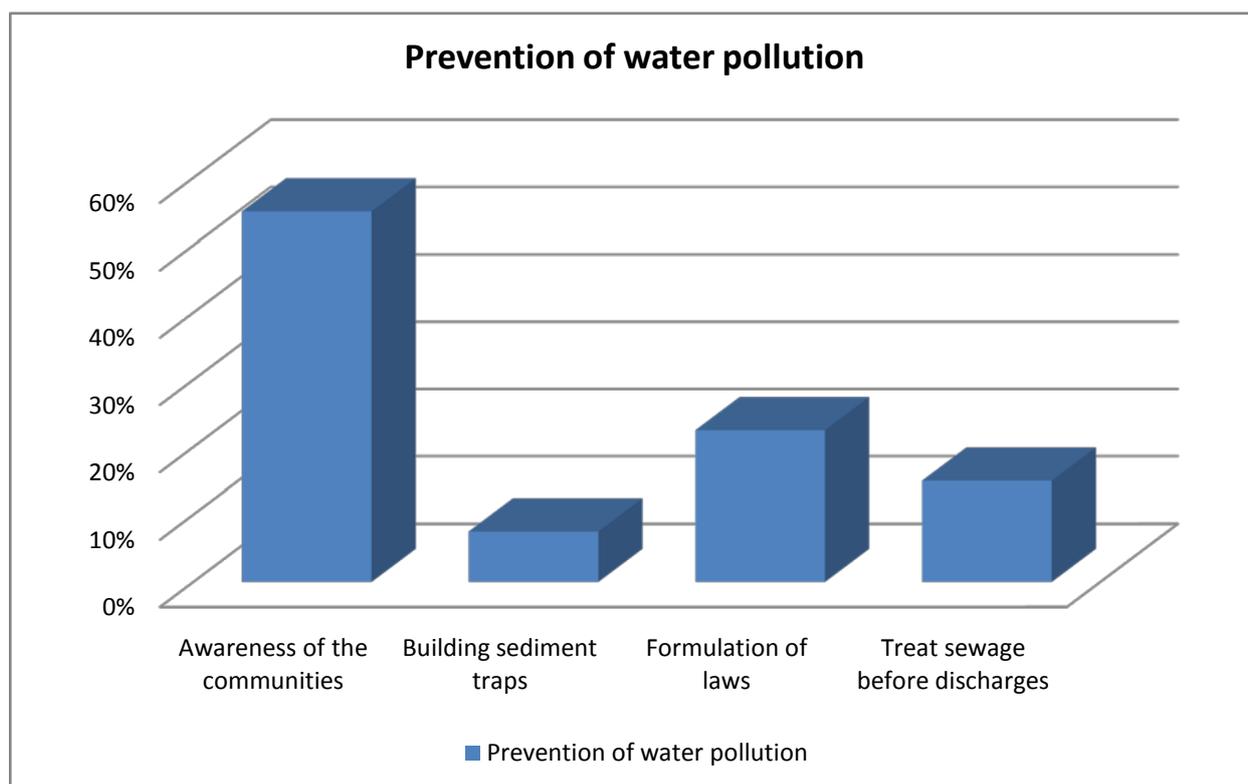


Figure 7. Shows the prevention methods of water pollution suggested by respondents

4. Conclusion and Recommendations

Water pollution in Juba County is one the major problem affecting the community. In recent years, rural urban migration caused by internal conflict and small industrialization in Juba, has accelerated the problem of water pollution. The main source of drinking water in Juba County is from water tank. The major factor that leads to water pollution in Juba County is the random dumping of garbage to water bodies. The obtained results revealed that, the majority of people in the area treat their water by chlorination. Bacterial, viral and parasitic diseases are spreading through polluted water and affecting human health.

It is recommended that there should be proper management of water bodies and waste disposal system and waste should be treated before entering in to water bodies. Awareness programs and formulation of laws should be carried out to control the pollution. Further research studies, including epidemiological studies, are necessary to determine better the impact that water pollution on Human health and on the environment.

Acknowledgements

The authors wish to acknowledge Rev. Dr. Milton Melingasuk Lado, Dean of the College of Natural resources and Environmental Studies, University of Juba and the entire staffs and Students of the Department of Environmental Studies, CNRES, University of Juba.

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