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Isolation and Identification of Bacterial Contamination Water Supply in Shendi City-Sudan

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Abstract: ***Background***: Microbial contamination of water persists to be a significant problem; the usual source is human and animal fecal matter that has contaminated the water systems. The presence of bacteria and pathogenic organisms is of great concern when considering the safety of drinking water, as pathogenic organisms can cause watery diarrhea, cholera, typhoid fever, and other illnesses. ***Objective***: This is a prospective tap water examination study to find groundwater microbiological fecal contamination. ***Materials and Methods:*** Water samples for laboratory examination were collected from a different area of Shendi city, which were classified as Tap water. Each sample was a collection in a sterile container and then isolated and Confirmation by biochemical test. ***Results***: Tap water samples were found to be contaminated with *E. coli* about 80 (63.6%) samples, an indicator of contamination with the fecal matter of animals and humans. It was the isolation of other Gram-negative enteric bacteria such as *Salmonella* and *pseudomonas* these were not scientific indicators of water contamination by animal and human fecal matter. ***Conclusions***: Tap Water was contaminated with feces and posed a health risk to consumers of that water and was found to be contaminated with *E.coli* bacteria. Future studies are needed to understand the complicated issues concerning water quality in the city. Community-led sanitation and hygiene education and better water source protection are urgently required.

Keywords: Contamination water, *E. coli*, *Salmonella*, Diarrhea, Tap water.

Research Paper

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INTRODUCTION

Water is the most important substance on earth. It makes up about 80% of our body weight and comprises about 92% of the blood and nearly 98% of gastrointestinal secretions. Water holds all nutrient factors in solution and acts as a transportation medium for these substances. One of the most important functions of water is to flush toxins from the body [1]. According to World Health Organization, there were estimated 4 billion cases of diarrhea and 2.2 million deaths annually in these countries [2]. Water is essential in our life. It is a basic necessity for a man's survival. Regardless, water may be infected with microorganism, and the build-up of microbes and microorganism in faucets, that's the access problem for water, can motive water contamination. Water is taken into consideration an automobile for the propagation and dissemination of human-related microorganism [3]. Safe ingesting water is an essential human proper and if infected with opportunistic pathogenic environmental microorganism, it is able to have fitness implications for consumers [4, 5]. Tap water is used to meet daily needs that require water, such as drinking, preparing food, washing, and for various personal hygiene purposes. When control and safety conditions are in place, tap water can be used to drink directly without subsequent treatment, but if necessary, household water purification devices such as water filters or even boil should be made. Water pollution: Pure uncontaminated water does not occur in nature. It includes impurities of various types natural and manmade. (E.g. nitrogen, carbon dioxide, hydrogen sulfate, etc., which may pollution is that caused by

human activities [6]. Water may be contaminated by microorganisms (bacteria, viruses, helminths, and parasites) usually of fecal origin. The most widespread danger associated with drinking water is contamination either directly or Sewage which contains decomposable organic matter and pathogenic agents. Agricultural pollutants comprise fertilizers and pesticides, physical pollutants such as thermal pollution, and radioactive substances [6]. Using contaminated water for drinking or in food preparation may then result in new cases of infections [7]. In most countries, the principal risks to human health associated with the consumption of contaminated water are microbiological. The presence of bacteria and other pathogenic (disease-causing) organisms in water can cause intestinal infections, dysentery, hepatitis, typhoid fever, cholera, and other illnesses [8]. Bacterial contamination can result from several sources. Human and animal wastes are primary sources of bacteria in water. These sources of bacterial contamination include runoff from feedlots, pastures, dog runs, and other land areas where animal wastes are deposited [9]. Additional sources contain seepage or release from septic tanks and sewage therapy facilities. Bacteria from these sources can enter wells that are either open at the land surface or do not have water-tight casings or caps [10]. The most important pathogenic pathogens transmitted by the water route were S*almonella typhi, E.coli, Campylobacter, Shigella, cryptosporidium, and Giardia,* the organisms causing diarrheas [11]. Hence, Human pathogenic microorganisms which are transmitted through water encompass bacteria, viruses, and protozoa. Most of them normally develop within side the human intestinal tract and attain out via the feces. Ideally, drinking water should not contain any microorganisms known to be pathogenic or any bacteria indicative of fecal pollution [12]. This study is of obvious importance in preventing the spread of human diseases. It begins by comprehensively describing the microbial contamination of tap water. World Water Development Report (WWDR, (2003) from its World Water Assessment Program indicates that 40% of the world's inhabitants currently have insufficient fresh water for minimal hygiene. It evaluated 80% of all diseases and over one-third of deaths in generating countries are caused by the consumption of polluted water and on average as considerably as one-tenth of each person's effective time is sacrificed to water-related diseases.

MATERIALS AND METHODS

Study design:

This is a cross sectional descriptive study was conducted in Shendi town in the period from March to September 2018.

Study area:

Shendi Town is well known historically, and it is the third largest Town in River Nile State. It is in River Nile State, where the headquarters of Shendi locality is located. Shendi is located about 176 km north of Khartoum , and 130 km south of El Damer (capital of River Nile State). It is bound by River Nile in the west and Kasala State in the East, also bound by the south Shendi administrative unit in the South and the north Shendi administrative unit in the North.

Study sample and sample size:

126 sample of tap water from a different area of Shendi city was collected in a sterilized container.

Data collection tools and variables:

The data were collected by observation and facilities of storage at household and laboratory samples were a collection from the identification site of drinking water supply and were analyzed to determine the bacteriological quality of drinking water.Sampling and data collection Proportional stratified sampling was followed to enroll the sources, the means of transportation the storage vessel of water, and household units. Water samples were collected in sterile glass bottles, and care had been taken to prevent accidental contamination of water during collection and transportation and sent to the microbiology laboratory at Shendi University. Data regarding the mode of transportation and method of storing utilization means of water were collected.

Sample processing:

The membrane Filtration (MF) technique for water quality analysis was used to investigate the water collected from the sources (Standard method for the examination of water & wastewater, 1993). Water samples collected during transportation and from storing vessels were tested using multiple tube methods. The total bacterial count was performed according to standard techniques.

Collection of samples:

Water samples were collected in sterile bottles used for collection of water samples by the health authorities and the laboratory analysis was performed afterward. Sample preparation: Each sample was first prepared by centrifugation of the whole container and 5ml from the residual solution was collected to direct examination then the whole containers water was filtered three times with a sterile syringe single-use filter unit 0.45 (Difco) and cultured in three types of media. Direct microscopic examination using the direct slide method was done to decide the presence or absence of microorganisms. Culture for microorganisms: Filter papers of syringe units were cultured for bacteria using Petri dishes containing nutrient agar and kept for 36 hrs. at 37 C° to isolate bacterial contaminants. Microbial examination and diagnosis were performed after the isolation of pure colonies and the following tests were done to identify the type of bacteria and other microorganisms in water samples.

Ethical Considerations:

Ethical approval for the study was obtained from the Board of the Faculty of Graduates Studies at Shendi University. The written informed consent form was obtained from each guardian of the participant as well as from the subject himself before recruitment into the study. All protocols in this study were done according to the Declaration of Helsinki (1964).

RESULTS

A total of 126 water samples were collected. 116 samples (92.1%) showed positive bacterial growth and 10 samples (7.9%) non-growth (Table 1). The most commonly isolated bacteria from tap water were *E.coli* 80 (63.6%), *pseudomonas* 13(10.3%), and *Salmonella Paratyphi* A 20(15.9%) (Table 2). The positive growth showed 3 samples (2.3%) that were Gram-positive and 113 samples (89.8%) that were gram-negative (Table 3).

Table 1: Frequency and percentage of bacterial growth organisms

Bacterial growth	*Frequency*	*Percentage*
Growth	116	92.1
No growth	10	7.9
Total	**126**	**100**

Table 2: The isolated bacteria in tap water

No	*Gram staining*	*Bacterial isolated*
80	*Gram–bacilli*	*E.coli*
13	*Gram–bacilli*	*Pseudomonas*
20	*Gram–bacilli*	*Salmonella Paratyphi A*
3	*Gram+cocci*	*Different spp*
10	*No growth*	-

Table 3: The distributions of microorganism according to Gram staining

Gram staining	*Frequency*	*Percentage*
Gram-positive	3	2.3%
Gram-negative	113	89.8%
Total	**116**	**92.1%**

DISCUSSION

Microbial contamination of water persists to be a major problem; the usual source is human and animal fecal matter that has entered the water systems. The presence of bacteria and pathogenic organisms is of great concern when considering the safety of drinking water, as pathogenic organisms can cause intestinal infections such as dysentery, cholera and hepatitis, and other serious illnesses. This is a descriptive study done for tap water examination to find out tap water microbiological fecal contamination either from animals or humans. The city's tap water supply is from different city sources. 126 samples were taken randomly. The growth was identified in 116 Samples (92.1%). The growth rate of *E.coli* which was an indicator of fecal contamination was found in 80 samples (63.6%). The other Gram-negative bacilli isolated were *Salmonella paratyphoid A* in 20 samples (15.9%) and *pseudomonas* in 13 samples (10.3%), so it may be environmental contamination. This result agreed with the study done in Basrach. This concluded that Tap water samples were found to be highly contaminated with many types of pathogenic bacteria such as Coli form (*E.coli* 64.3% occurrence in tap water) *Salmonella*, *Shigella*, and *Pseudomonas* [13]**.** The frequency of contamination of drinking tap water in Shendi water-supplying wells was 80 samples (63.6%). significant *E.coli* count which indicates real contamination. In comparison between the study and study done by Eltagni which found the frequency of drinking water contamination was 27.1% in Shendi town [14]. Another study was conducted in Guadalajara, Mexico, This pilot study was conducted in July 2018 to examine the microbiological quality of drinking water in Guadalajara. Samples were tested for free available chlorine residual, total coliform bacteria, and *Escherichia coli* [15]. Also, in another study conducted in rural villages of Mohale Basin by Gwimbi and his colleagues, we found a significant association between *E. coli* counts in drinking water samples and lack of water source protection, high prevalence of open defecation (59%, n = 100), unhygienic practices, livestock feces and latrine detections in proximity to water sources was found in the study ($P < 0.05$) [16]. Another study in Turkey was done by Kaplan ES, and Karahan AG After the total and fecal coliform counts were determined, the most probable colonies that can be identified to be *E. coli were* chosen and confirmation tests were performed. In total, 397 colonies were isolated from water samples, and 55 of those were confirmed as *E. coli* strains. Also, 151 strains were determined to be part of the coliform group. *E. coli* strains were studied with a real-time PCR to determine some virulence genes [17]. Further studies are needed to characterize the impact storing water in roof-top tanks or cisterns has on water quality, environmental scientists will need to work together with city planners

and residents members to not only provide clean drinking water but to improve the infrastructure and build the public's preference of water.

CONCLUSIONS

Tap Water was contaminated with feces and posed a health risk to consumers of that water and was found to be contaminated with *E.coli* bacteria. Future studies are needed to understand the complicated issues concerning water quality in the city. Community-led sanitation and hygiene education and better water source protection are urgently needed.

RECOMMENDATIONS

Keeping in view the quality of drinking water in the area under study following recommendations has been made:

1. The drinking water should be boiled before drinking it.
2. The reported case of waterborne bacterial pathogens in drinking water is alarming. Government should fulfill its basic complacency of providing safe drinking water to the community.
3. Regular chlorine disinfection treatment of drinking water may be ensured.
4. The quality of drinking water may be checked in light of the drinking water guideline established by WHO.
5. The source of drinking water may be protected from unnecessary human and animal access.
6. The general cleanliness and hygiene of water main storage reservoirs may be maintained.
7. Sewage water should be treated and disinfected before disposing of it.

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