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Assessment of microbial quality of drinking water in Rabak Town – White Nile State – Sudan 2010

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ABSTRACT: *The primary concern with health problems caused by water supply is infectious diarrheal diseases transmitted by the fecal- oral route, there for the principal concern in water quality is the microbiological quality of the water. After determination of sample's size according to number of population, (30 samples).then samples were collected in sterile glass bottles from different locations of Rabak Town carefully to avoid cross contamination of samples. Samples were analyzed at laboratory by using membrane filtration method, then the Study revealed on many findings: 16.7% of samples were indicated that the water quality is high satisfactory (i.e. total coli form bacteria in 100 ml 0), and 23.3% of samples were showed water is doubtful (total coli form bacteria in 100 ml 3-10) while 60% of examined samples were indicated that drinking water quality is unsatisfactory (i.e. total coli form bacteria count in 100 ml more than 10. The present study revealed that there is high growth of microorganisms in water supply system. Finally the study recommended that review all stages of water treatment plant to product pure drinking water.*
Keywords*: microbial quality, treatment, coli form, water quality, harmful, Rabak Town.*

I. Introduction

Microbiological quality may change very rapidly over time and short distances, there for requires frequent testing (Howard, 2002). Water for drinking and cooking purposes must be made free from disease-producing organisms (pathogens), these organisms include viruses, protozoa, helminthes (worms), and bacteria. Some organisms, which cause diseases in people, originate with fecal discharge of infected individuals. Other are from the fecal discharge of animals (Davis &cornwell , 1998). Other organisms naturally present in the environment and not regarded as pathogens in drinking water may also cause occasional opportunist disease such as organisms in drinking water may cause infection predominantly among people whose local or general natural defense mechanisms are impaired, this is most likely to be the case in very old and young children, those organisms such as pseudomonas, flavor bacteria, acineto bacteria, klebsiella, and serratia (WHO, 1987).

1.1 Viruses

Drinking water should be free from any viruses infectious to man. Disinfection with 0.5 mg/L of free chlorine residual after contact period of at least 30 minutes at PH of 8 is sufficient to in activate viruses. Ozone has been shown to be effective viral disinfectant, preferably for clean water, if residual of 0.2-0.4 mg/L are maintained for 4 minutes, it is not possible to maintain ozone residual in distribution system (Park, 2005).

1.2 Protozoa

Drinking water should not contain any pathogenic intestinal protozoa. Species of protozoa known to have been transmitted by ingestion of contaminated drinking water include Entamoebahistolytica, Guardia ssp, and rarely blantidium coli. Rapid or slow sand filtrations have been shown effective in removing a high proportion of pathogenic protozoa (Park, 2005).

1.3 Helminthes

The infective stages of many parasitic round worms and flat worms can be transmitted to man through drinking water. A single mature larva or fertilized eggs can cause infection and such infective stages should be absent from drinking water. However the water rout is relatively unimportant except in case of darcunculusmedinesis

(guinea worm) and the human schistosomiasis which are primarily hazards of unpiped water supplies. The methods for detection of these parasites are unsuited for routine monitoring (Park, 2005).

1.4 Free living organisms

Free living organisms that may occur in drinking water supplies include fungi, algae, and etc. The most common problems with these are their interference in operation of water treatment process, color, turbidity, taste, and odor of finished water, thus drinking water must be free from these free-living organisms (Park, 2005).

1.5 Bacteria

The word bacteria (singular bacterium) come from the Greek word meaning (rod) or (staff). Bacteria are single celled microscopic organisms that multiply by spitting in to binary fission. In order to multiply they need carbon obtained from carbon dioxide (CO2), if they are autotrophic or from organic compounds (dead vegetation and meat) if they are heterotrophy. Their energy comes either from sunlight if they photosynthetic or from chemical reaction if they are chemosynthetic. Bacteria are present in air, water, earth, rotting vegetation, and the intestines of human and animals. Under ideal conditions bacteria may be divided (generation time) every 20 minutes. Never the less they are taking up food quickly that they are likely to be limited by shortage food, oxygen, or water (Abdel- magid, 1995).

1.5.1 Coli form group bacteria

The coli form of organisms includes all the aerobic and facultative an aerobic, gram-negative, non- spores-forming, rod-shaped bacteria that ferment lactose with acid and gas formation within 24-48 hours at 35-37 deg. C (Salvato, 1982). These organisms as well as typical coli forms can consider indicator organisms (APHA, AWWA & WEF, 1998). Fecal coli form bacteria more than 99% of which are E. coli are an indicator of the level of human /animal waste contamination in water and the possibility of presence of harmful pathogen i.e. microbiological contamination. Coli form organisms may not always be directly related to the presence of fecal contamination or pathogens in drinking water, but still the coli form test used for monitoring the microbial quality of the treated piped water supplies (Oxfam, 2001). The indicator bacteria that most surveillance bodies use in routine assessment of risk of fecal contamination is Escherichia coli (E. coli) or as an alternative thermo tolerant coli form. E. coli provides the closest match to criteria for an ideal indicator, however it is not perfect and it is possible to find pathogens in drinking water supplies when E. coli is absent. Basic characteristics of the ideal indicator are:

1- Present wherever pathogens are present.
2- Present in the same of higher numbers than pathogens.
3- Specific for fecal or sewage pollution.
4- At least as resistant as pathogens to conditions in natural water environments and water purification and disinfection process.
5- Nonpathogenic.
6- And detected by simple, rapid and inexpensive methods (Howard, 2002).

The second edition of the WHO guide lines for drinking water quality published in 1993 strongly recommended the use of E. coli as the preferred fecal indicator because its provides the closest match to the criteria for an ideal indicator (WHO, 2002).

1.5.3 Thermo tolerant bacteria

Thermo tolerant coli form bacteria are coli form organisms that are able to ferment lactose at 44-45 deg. C., the group include the genus E. coli and some species of klebsiella, Enterobacter and citrobacter. Because thermo tolerant coli form organisms are readily detected they have an important secondary role as indicators of the efficiency of water treatment process in removing fecal bacteria (WHO, 1997)

Classification of drinking water quality according to coli form count in 100 ml water sample

Class NO	Coli form in 100 ml	Water quality
Class 1	0	Highly satisfactory
Class 2	1-2	satisfactory
Class 3	3-10	doubtful
Class 4	More than 10	unsatisfactory

II. Materials and methods

2.1 study area:

Rabak town is the capital of White Nile state; it lies in the eastern bank of White Nile channel. Geographically it lies between two lines length32-33 north and two lines width 12-13 East. Rabak Town distance from Khartoum Town (capital of Sudan) about 360 kilometers.

2.2 Sample Size

Determination of samples werecompleted according to WHO guidelines for drinking water quality in distribution system (1993) volume one and manual of standards of quality for drinking water supplies (30 samples).

2.3 Analysis of samples:

After collection of samples from different locations at Rabak Town,samples were analyzed in laboratory by using membrane filtration method according to standard methods for water examinations.

2.4 Analysis of data:

After revealing on data, the data had been analyzed by using computer programmes such as Microsoft word and excel. Also in this study we used WHO guidelines and Sudanese standards for drinking water in interpretation of results.

III. Results

Table (1) bacterial count of drinking water samples taken from treatment plant

Sample No	Total coli form count in 100ml	E. coli count in 100 ml
S_1	8	Nil
S_2	10	Nil
S_3	12	2
S_4	18	17
S_5	Nil	Nil
S_6	6	Nil

The above table shows that coli form bacteria are presence in 83.3% of samples, while E.coli bacteria are presence in 33.3% of samples

Table (2) bacterial count of drinking water samples taken from distribution system

Sample No	Total coli form count in 100ml	E. coli count in 100 ml
S_1	8	2
S_2	Nil	Nil
S_3	13	7
S_4	28	19
S_5	10	8
S_6	Nil	Nil
S_7	7	6
S_8	55	42
S_9	11	3
S_{10}	14	6
S_{11}	58	12
S_{12}	4	4
S_{13}	8	6
S_{14}	22	20
S_{15}	Nil	Nil

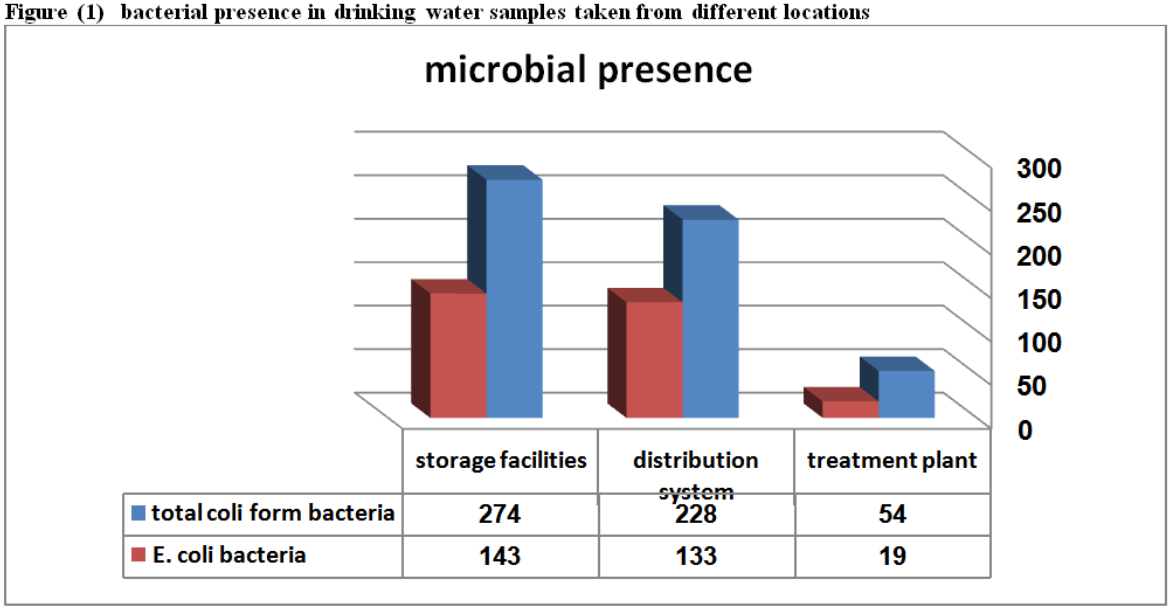
The above table shows that coli form bacteria and E. coli bacteria are presence in 80% of samples

Table (3) bacterial count of drinking water samples taken from storage facilities

Sample No	Total coli form count in 100ml	E. coli count in 100 ml
S_1	4	Nil
S_2	14	6
S_3	107	47
S_4	60	31
S_5	uncountable	uncountable
S_6	34	26
S_7	27	12
S_8	28	21
S_9	Nil	Nil

The above table shows that coli form bacteria are presence in 88.9% of samples, while E.coli bacteria are presence in 77.8% of samples

Figure (1) bacterial presence in drinking water samples taken from different locations



The above figure shows that presence of coli form and E. coli bacteria in storage facilities more than distribution system and treatment plant respectively.

IV. Discussion

Unsafe drinking water is the one of the basic health problems in the Sudan. This study aims to assess drinking water qualitybased on microbial presence. The study detected coli form bacteria in 83.3% from examined water samples size 100 ml, and showed presence of E. coli bacteria in 70 % of water samples among total coli form bacteria. Guideline values for bacteriological quality texts on all water intended for drinking, treated water entering the distribution system and treated water in the distribution system: total coli form and E. coli or thermotolerant coli form bacteria must not be detected in any 100 ml sample, in the case of large supplies when sufficient samples are examined must not be present in 95 % of samples. If we compare the results of this study with this guideline values we find this water unfit for drinking, thus it need to immediate interventions.Alsothe study revealed that 23.3% and60% of examined samples were indicated the quality of water is doubtful and unsatisfactory respectively, while just 16.7% of samples showed that water quality is satisfactory.The present study revealed that the microbial presence in storage facilities more than it density in distribution system and treatment plant (figure 1).This mean insufficient of treatment process and growth of coli form bacteria during water supply, also may be due to absence of free residual chlorine to control post contamination.

V. Conclusion

All people whatever their stage of development and social and economic conditions, have the right to have access to drinking water in quantities and quality equal to the basic needs, throughout the results ofthis studywe observed treatment of drinking water is insufficient because the presence of coli form bacteria and E.coli bacteria in most of examined water samples, also there are high growth of microorganisms in water supply system.

Recommendations:

According to results of this study it is recommendedthat: review all stages of water treatment plant to product pure drinking water.And local health authorities must checkdrinking water supply system regularly according to WHO guidelines for drinking water to insure from efficiency of treatment process.

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