The chemical, microbiological and sensory evaluation of three samples of drinking water in three localities in Khartoum North Sudan

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Abstract

The samples of water were taken from Elhag yousef, Caffori and Dardog localities (ground water).The chemical analysis proved that Elhag yousef and Dardog water samples possess hard ness of 199mg/While Cafori was 100mg/l The samples of water were subjected to bacteriological analysis, using most probable number (MPN) test. These examinations showed no detection of total coliform, fecal coliform and fecal streptococci. The result showed no detection of the mineral carbonate in all the three samples. Sensory evaluation cleared that Elhag yousif water sample is the worst in taste, texture, flavor appearance and general acceptability compared with the other samples.

Key words: ground drinking water, chemical, microbiological, sensory evaluation.

Introduction

Sudan is the largest country in Africa, lies mostly in the arid region where water is a scarce commodity; it is consider being rich in water sources (Ginawi 1994, Ibrahim 2005). Water used in Sudan derives almost exclusively from surface water resources, and ground water is used in only limited area, surface water is provided mainly by the Nile River. As the population increases, the water demand for domestic, industrial, and agricultural uses increase too. When these demands exceeds the naturally renewable supply, water shortage occur in the area (Jamshid,Z and S.A 2011). According to the world health organization drinking water must be free from, chemical and microbial contaminations which are risk to human health. Good drinking water quality is essential for the wellbeing of people, so the natural water analysis for physical, chemical properties including trace elements content are very important for health studies.

(Anonymous 1992). water can be soft or hard, natural or modified, bottled or tap (Kandall ,1992).Ground water: is the water that found below the surface of the earth, where it occupies all or part of void spaces geological layers, It is also called subsurface water to distinguish it from surface water.(ماجدة بشير).The contamination of drinking water, will occur through increased leaching of toxic method into both surface and ground water. Standard methods for drinking water analysis should be tested under local conditions. For accuracy and precision, and agreed at National level. It is reported that 80% of all illness in developing countries is related to water insanitation (Nkawihe, 2006).Historically water was played significant role in the transmission of human disease, typhoid fever, cholera, infective hepatitis, bacillary and amoebic dysentery and many varieties of gastro intestinal diseases can be transmitted by water (Romper, 2002). It has been estimated that over 90% of deaths from developing world today occur in children less than 5 years old is caused by inadequate supplies of safe water and inadequate sanitation facilities and lack of hygiene behavior by the mother (WHO, 2005). UNICEF 1995 reported that, about 90% of major epidemics in Sudan are water borne and water rebated, causing the death of 40% of children who die under five.

The objectives of the present study were to determine the chemical and microbiological analysis for drinking water from three localities in Khartoum north Sudan.

Material and method

Three samples of ground water from three localities Elhag yousef, Cafori and Dardog in Khartoum North, Sudan were collected .Analysis of Calsium Magnissium was done by the method ofChaupuan and Pratt (1961).Level of Carbonate in water was done by the methods of Fadi(1997). The PH was done by the Photometer. Sodium (Na) and potassium (K) were determined by the method of AOA (1984). And the level of salts….. In water by the (Flamephoto meter).The determination of electrical conductivity (EC) by the EC meter. Microbiological analysis by the most probable number test (MPN) .Three samples of water were subjected to bacteriological analysis, using the most prop able number (MPN) test(APHA 1995). three examination including detection of total coliform fecal coliform and fecal streptococci, as well as total viable count.(Harrigan and Mac Cance 1976)were carried.

Sensory Evaluation was done by the scoring method of Ihekronye and Negoody (1985) and the statistical analysis was done by the method of SAS(1997).

Result and discussion

Physiochemical properties

The Electric conductivity (E C) ms/cm) of the water sample of Elhag yusef locality is 0.55ms/cm which is higher significantly (P<0.05) than the water sample of the control (0.14ms/mc) the other two samples of Cafori and Dardog were in the middle (0.39 and 0.43) respectively. (table1.) it is clear that all the samples were lower than the recommended permissible limit for EC which is300ms/cm. Dardog sample of water (8.2) was higher significantly (P<0.05) in pH compared to the water sample of the control 7.63) while the two water samples of Elhag yousef and Cafori is in the middle 7.7 and8.9 respectively, according to WHO (1995) the permissible limit for pH is6.9-9.2 It is clear that the pH is in the range of the WHO (1995). The pH value of drinking water is an important index of acidity or alkalinity, pH usually has no direct impact on human health. The total dissolved solid(TDS) consists of inorganic salts (Ca, mg, K, Na, Hco3 and Cl) The TDS of WHO(1996).is 50-150mg/L .The level of Na, ca, Mg, Hco_3 and cl in the water sample of Elhagyousef(3.22, 0.7, 3.3, 6.0, 1.0) were higher significantly (P<0.05)compared with control (0.6, 0.5, 0.5, 1.0, 0.5)respectively. While the other sample of Cafori and Dardog is in the middle. Cafori samples are (1.01, 0.7, 1.3, 3.0, 0.5) respectively and Dardog samples are (2.04, 0.7, 3.3, 6.0, 0.5) respectively. All the samples in the study were lower than the WHO1996. The hardness of water sample of Elhagyousef (199mg/L) was higher significantly (P<0.05) than water sample of control (50mg/L) and the two other samples were in the middle (100 and198 mg/L) respectively. But co_3 was not found in the three samples of water. According to WHO Ca in water must not exceed (200mg/L) and the accepted level is (75mg/L).

Sensory evaluation

The best appearance, (4.8) texture (4.9) odor (4.1) taste(4.8) and general acceptability (4.8) were recorded in the water sample of the control while the worst is in the water sample of Elhagyousef, appearance (3.0),texture(2.5) odor(2.0) taste (4.0) and the general acceptability(3.00), While the two other water samples are in the middle appearance (4.0 , 3.7), texture(4.2,3.0)taste(4.4,4.0) odor(4.3,4.2) and the general

acceptability(4.0,3.5) were recorded. Table (3) All samples were lower than the permissible level of Sudan and Saudi Arabia which is (15TCU).WHO1995 cleared that good drinking water must have no color, taste, or odor and define safe water as water that does not represent any significant risk to health over life time of consumption, including different sensitivities that may occur and between life stages.

Conclusion

The higher EC, minerals (Ca, mg, K, Na, Hco3, Cl) and hardness found in ground drinking water from Elhag yousef locality. The pH and K were higher in Dardog, least in control sample. Appearance, taste and texture were worst in Elhag yousef.All the samples were free from (co_3).No bacterial growth in Elhag yousef water sample, while there are some in Cafori and Dardog.It was clear that Elhag yousef water sample was the worst because it contain more salts and high EC that is why E.coli Bactria is not detected. While the highest level of Bactria is in Cafori and Dardog water sample. Colon Bactria was not founded in all samples

Table (1) Chemical Composition of ground drinking water in three localities in Khartoum North

Minerals	Control	Elhagyousef	Cafori	Drdog
Electeric conductivity (E C) ms,cm	14.0.±0.03^{d}	55.0+0.05a	39.0±0.06c	43.0±0.08b
PH	7.00±0.02^{d}	7.70±0.07^{c}	8.00±0.09^{b}	8.20±0.04^{a}
Na	60.0+0.05^{d}	22.3±0.11^{a}	101.0±0.12^{c}	204.0±0.09^{b}
K	60.0±0.02^{d}	0.08±0.01^{c}	0.09±0.03^{b}	0.15±0.01^{a}
Ca	50.0±0.02^{b}	70.0±0.01^{a}	70.0±0.03^{a}	70.0±0.02^{a}
Mg	50.0±0.06^{c}	330.0±0.08^{a}	130.0±0.04^{b}	3±.03^{a}
Co3	00.0±0.00^{a}	00.0±0.00^{a}	00.0±0.00^{a}	00.0±0.00^{a}
Hco^{3}	100.0±0.01^{c}	600.0±0.06^{a}	300.0±0.04^{b}	600.0±0.05^{a}
Cl	50.0±0.03^{b}	100.0±0.05^{a}	50.0±0.02^{b}	50.0±0.04^{b}
Hardness	50.00±0.11^{b}	199±0.13^{a}	100±0.15^{a}	198±0.11^{a}

Table (2) Sensory Evaluation of ground drinking water in three localities in Khartoum North.

Physical characteristic	Control	Elhagyousef	Cafori	Dardog
Appearance	4.8±0.01^{a}	3.0±0.06d	4.0±0.08b^{b}	3.7±0.09^{c}
Texture	4.9±0.01^{a}	2.5±0.07^{d}	4.2±0.04^{b}	3.0±0.11^{c}
Taste	4.8±0.02^{a}	2.0±0.08^{d}	4.4±0.07^{b}	4.0±0.06^{c}

Oduor	4.9±0.01[a]	4.0±0.11[c]	4.3±0.09[b]	4.2±0.08[b]
General acceptability	4.8±0.02[a]	3.00±.05[d]	4.0±0.06[b]	0.0±3.50[c]

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