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MICROBIAL AND BIOCHEMICAL ASSESMENTS OF STREAMS USED FOR DRINKING IN AFIKPO NORTH L. G. A., EBONYI STATE NIGERIA

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ABSTRACT
Water samples were collected from sixteen water sources (streams) used for drinking purposes. Chemical analysis and assessments of the potable water were carried out using standard techniques. The results showed that the concentration of most elements analyzed were within the World Health Organization standard for portable water, while some were above maximum permissible limit. Also, water samples from the rivers were highly turbid which might be attributed to surface run-off, flood, human activities in the area such as farming, fishing construction of bridges, channels etc. The results obtained from microbial assessments showed that the bacterial counts of the water bodies ranged between 0.12 x 102 cfu/ml in Nutrient agar and 0.20 x 102 cfu/ml – 4.30 X 102 cfu/ml in Mac Conkey agar. The organisms isolated from the water samples include the following genera of microorganisms *Escherichia, Streptococcus*, *Staphylococcus* and *Bacillus*. From the results obtained, the microbial flora found in the water bodies were mainly from the soil, surrounding trees, feaces.

KEYWORDS: water samples, chemical analysis, WHO, Microorganism.

INTRODUCTION

Water is one of the most abundant commodities on earth. It occupies about 70% of the earth's surface. Because of the abundance and its everyday use, water is usually taken for granted in most parts of the world. Water, is in fact a chemical compound with unique properties (Kemmer, 1998). Water has been described as a universal solvent and occurs naturally on the planet earth. Water is life (Kemmer, 1998).Wholesome and portable water is one that is not only free from poisonous and undesirable substances, such water must also aesthetically be attractive. Natural water sources which are originally pure become contaminated by receiving wastes. Although there may not be any manufacturing industry near a source of rural water supply, such water could be polluted by run-off, fertilized farmland, mechanic workshop, petrol filing stations or by substances discharges into it upstream. If metals are present in large amounts, dysentery, hypertension, heart attack, may result. Other common diseases, which can be contacted from drinking bad water, include gastroenteritis, typhoid fever, cholera, infections hepatitis etc. As a result of the presence of nitrogen in form of nitrate or phosphorus in such water, there could be oxygen deficiency (Kemmer, 1998). Generally, water is said to be polluted once it does not comply with the standards set up by consumer. Water quality standard differs from one country to another and although the World Health Organization (WHO) has approved standards to be adopted internationally (WHO, 1994). Apart from health hazards, water pollution could lead to severe economic and social consequences including reduction in fish population, recreational paralysis and civil disorder. The extent of pollution of any water depends on the quality and quantity of effluent discharged into the water as well as other run-off (Kemmer, 1998). Water is important because it is an essential part of every living thing. Plant use water in carrying nutrient round the plant and also in the transportation of minerals from the soil to the plants. Water is taken into the body by eating plants, vegetable, fruits, by drinking beverages and by drinking clean water. Humans can go for a month without eating but will die in 3-5 days without water because our bodies are made up of about 70% water (Kemmer, 1998). There are some microorganisms that contaminate water such as bacteria, viruses or protozoa. These include coliform bacteria, *Giardia lamblia*, *Cryptosporidium parvum*, *Hepatitus* A, *Helminths*, *E. coli*, *E. histolytica*, *Staphycoccus aureus* (Cheesbrough, 2002). There are also chemicals that contaminate water such as Calcium, iron, magnesium, sodium *etc*. (Cheesbrough, 2002). Contaminated water can be made pure by boiling, filtration, use of activated charcoal adsorption method, ultraviolet purification, solar water disinfection and solar distillation (Ajiwe *et al.,* 2006).The Federal Emergency Management Agency and the American Red Cross agreed on three acceptable ways of treating drinking water which include; boiling, use of chlorine to bleach the water and distilling (Distillation)(WHO, 1994).Since water has no close substitute, there is need for regular analysis to identify the physical, chemical and bacteriological characteristics of any water in order to ascertain its acceptability, colour and odour. These are physical properties that are always used to indicate the quality of any water (Kemmer, 1998).

MATERIALS & METHODS

Study area

The study was carried out in Afikpo North Local Government Area of Ebonyi State, Nigeria. Afikpo is located between latitudes $5^0$4N and 6^o3N and longitudes 7^o5E and 7^o55E of the equator. There are two main seasons in this area, that is rainy season which is between April– October and dry season between November - March. The annual rainfall is about 160mm – 220mm with maximum precipitation occurring between July and September. The temperature ranges between 23.4^{o}c and 29.9^{0}c. The relative humidity is between 60 – 80% (Iloege, 1981) Federal Ministry of Aviation and Metrological Services 2000; NPC, 2006). Afikpo North L.G.A. is bounded in the North by Ohaozara L.G.A of Ebonyi State. By the East by Afikpo South L.G.A. Afikpo is bounded in the south by Cross River State and also in the West by Abia State (Iloege, 1981,NPC, 2006). According to the 2006 national census, the population of Afikpo people is about 672,000 persons. The area is hilly with undulating plains. The people are predominantly farmers producing rice, cassava, yam, vegetables, palm oil, cocoyam, etc. They are also fishermen, hunters and a good number of them deal on timbers.

There are different bodies of water in the study area which serve for the purposes of drinking and domestic uses. The different bodies of water which were used for the research were mainly streams.

Methods of collection of water from the sample sites

Water samples were aseptically collected from various water sources in Afikpo North L.G.A. The different water sources were mainly streams from which the people get their drinking water. They include; include Iyiugwu, Ebuji, Ataper Amaoge, Nnaeko, Iyinkumelu, Mmiriuji, Ohia ezeke, Iyiohia, Ubeyi, Ogberehi, Iyi Amuncha, Ogwuite, Whyworry, Ogbanala, Ogwuelu, Ndukwe, Ogwumbe. The collection bottles were washed with detergent and rinsed with cold water after which it was allowed to dry. The dried bottles were placed inside the oven and at 160^{0}C and was sterilized for 1 hour. At the water sites, the cap of the sterile sample bottles were aseptically removed and the mouths were plunged downwards below the water surface and tilted until the bottle was almost completely filled up before the cap was carefully replaced and the bottles labeled.

Method of water analysis

The chemicals were analysed using lovibond water kit, to determine the quality, colour, etc of the water. The quantity of nitrate, ammonia, iron, acid, alkaline (pH), nitrate, total solids, magnesium, chloride and oxygen were determined for the water samples collected. The microbial assessment of the water was done by culturing the water, using culture media. The microorganism were isolated, and identified, using appropriate chemicals after culturing and microbial manuals of Cheesbrough, 2002; Arora, 2005).

RESULTS

Sixteen water samples were collected from 16 different streams which serve as sources of drinking water in Afikpo North L.G.A. The names and locations of the streams are given in table 1. The streams were randomly chosen, using the table of random numbers.

TABLE 1: Name and location of water samples from Afikpo North L.G.A

S/N	Locations	Name of streams
1	Amuro	Iyiugwu
2	Mgbom	Ebuji
3	Ozizza	Ataper Amaoge
4	Amankwo	Nnaeko
5	Ndibe	Iyinkumelu
6	Unwana	Mmiriuji
7	Amasiri	Ohia ezeke
8	Ugwuegu	Iyiohia
9	Amangballa	Ubeyi
10	Amaizu	Ogberehi
11	Enohia	Iyi Amuncha
12	Amachi	Ogwuite
13	Ukpa	Whyworry
14	Amachara	Ogbanala
15	Akpoha	Ogwuelu Ndukwe
16	Kpogirikpo	Ogwumbe

TABLE 2: Physico-chemical analysis of water samples collected from Afikpo North L.G.A.

Parameters	Unit	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Temperature	C	25	28.5	26.5	27	26.2	25.2	26.5	25.5	28.5	27.5	26.5	27.5	28	26.1	26.2	25.5
PH	-	60	5.5	6.2	6.O	6.4	5.5	6.2	6.4	6.0	6.8	5.5	5.8	5.6	6.4	6.0	6.20
Nitrates	Mg/l	0.30	0.40	0.35	0.20	0.35	0.10	0.10	0.25	0.15	0.20	0.10	0.10	0.15	0.20	0.15	0.20
Iron	Mg/l	0.10	1.30	0.15	1.30	1.25	0.20	0.10	1.32	1.25	0.10	0.15	0.20	1.30	0.20	0.15	0.20
Ammonia	Mg/l	0.15	0.25	0.20	0.15	0.20	0.25	0.15	0.10	0.10	0.15	0.20	0.15	0.20	0.20	0.10	0.15
Chloride	Mg/l	80	80	40	40	60	80	40	60	60	40	40	80	40	60	60	40
Total Alkalinity	Mg/l	40	60	80	40	60	40	80	40	60	60	40	40	80	60	40	60
Total Hardness	Mg/l	20	80	40	60	20	40	60	60	40	80	20	40	60	40	80	40
Colour	Haze.	40	40	28	20	25	30	35	20	20	24	40	35	30	25	20	30
Turbidity	Haze.	7	10	9	8	7	6	9	5	4	8	9	7	8	6	5	4
Nitrate	Mg/l	0.002	0.003	0.01	0.025	0.025	0.004	0.002	0.010	0.004	0.015	0.025	0.01	0.01	0.004	0.05	0.04

From table 2, the temperature ranges, the pH, nitrates, ammonia, chloride, total alkalinity, total hardness, colour, turbidity and nitrite all conform to the WHO standard but the Iron levels of the following streams Ebuji, atapeer amaoge, iyiohia, Ubeyi and why worry were above the WHO standard for drinking water and does not conform to the WHO Standard.

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Table 3 shows the total number of bacterial counts obtained from the water samples. It was observed that samples from why worry and Ogwuelu Ndukwe had the highest and lowest number of colonies 184cfu/ml and 12cfu/ml respectively, when cultured with nutrient agar.

TABLE 3: Bacterial count from water samples using nutrient agar

S/no	Sample name	Plate count	Colony forming unit CFU/ML X 10^2
1	Iyi Ugwu	36	0.36
2	Ebuji	74	0.74
3	Ataper Amaoge	87	0.87
4	Nnaeko	34	0.34
5	Iyi nkumelu	48	0.48
6	Mmiri uyi	23	0.23
7	Ohia-ezeke	20	0.20
8	Iyiohia	135	1.35
9	Ubeyi	30	0.30
10	Ogherehi	154	1.54
11	Iyi Amuncha	104	1.04
12	Ogwuite	54	0.54
13	Why worry	184	1.84
14	Ogbanala	28	0.28
15	Ogwuelu ndukwe	12	0.12
16	Ogwumbe	28	0.28

TABLE 4: Bacterial count from water samples using macconkey agar

	Sample name	Plate count	Colony forming unit CFU/ML X 10^2
1	Iyi ugwu	40	0.40
2	Ebuji	242	2.42
3	Ataper Amaoge	88	0.88
4	Nnaeko	128	1.28
5	Iyi nkumelu	70	0.70
6	Mmiri uyi	51	0.51
7	Ohia –ezeke	70	0.70
8	Iyiohia	68	0.68
9	Ubeyi	40	0.40
10	Ogberehi	138	1.38
11	Iyi Amuncha	430	4.30
12	Ogwuite	50	0.50
13	Why Worry	401	4.01
14	Ogbanala	30	3.0
15	Ogwuelu ndukwe	20	0.20
16	Ogwumbe	196	1.96

When the water samples were cultured using Mac Conkey Agar majority of the water samples were contaminated, with microorganisms. Iyiamucha had the highest number of coliform counts of 4.30 x 10^2 CFU/ML while ogwuelu ndukwe had the lowest number of coliform count of 0.12 x 10^2CFU/ML.

Table 5 shows different species of bacteria obtained from the water samples. Four genera of bacteria isolated from the water samples after analysis were identified. They include; *Escherichia, Streptococuss, Staphycococuss* and *Bacillus.*

TABLE 5: Bacteria obtained from water samples and their reactions in the chemicals used in identifying them

Bacteria obtained from water samples	Colour On MacConkey And nutrient agar	Gram Rxn	Oxidaxe Test	Catalase test	Sugar Fement-ation	Cultural Xteristic	Cellular Morpho-logy
Escherichia	Pink colony	-	-	+	+	Aerobes And facultative Anaerobes	Rod
Streptococcus	Purple colony	+	+	-	-	Anaerobic	Cocci
Staphylococuss	White colony	+	-	+	+	Facultative anaerobes	Cocci
Bacillus	White colony	+	+	+	-	Aerobic	Rod

DISCUSSION

Chemical and microbial assessments of portable water (streams) used for drinking were assessed in Afikpo North L.G.A., Ebonyi State, Nigeria, to determine the level of chemicals and microorganisms. The research was carried out between June, 2010 to July 2011. During the survey, sixteen streams used for drinking by the people were analyzed. The streams were chosen at randomly using the table of random numbers. The names and locations of the streams are given in table 1. Table 2 shows the physico chemical analysis of the streams. The temperature ranges, the pH, nitrates, ammonia, chloride, total alkalinity, total hardness, colour turbidity and nitrate, all conform to the WHO standard for drinking water (Ajiwe, *et al*; 2006). However, the Iron levels of the following streams Ebuyi, Atapeer amaoge, Iyiohia, Ubeyi and Why-Worry were between 1.25mg/l - 1.32 mg/l which is above the WHO standard for drinking water(Kemmer, 1998; WHO, 1994). The high Iron contents in the streams may be as a result of the runoff from the surrounding top soils of the areas which is made up of clay and humus, with high Iron contents can flow into the water bodies (Ajiwe *et al*., 1996) had similar results from their findings. The high iron contents in the water lead to heart attack, stroke, kidney failure *etc* (Kemmer, 1998) reported same. In conclusion, the following microorganisms *Echerichia*, *Staphycococus*, *Streptococus* and *Bacillus* were isolated and identified from water sources used for drinking in Afikpo North L.G.A. Therefore, it is recommended that motorized boreholes be dogged for the people and equally educate them on how to treat their drinking water and to avoid contaminating the water, which will highly endangered their health and lives.

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