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ASSESSMENT OF BACTERIOLOGIC PROFILE OF RESERVOIR WATER IN EKPOMA, EDO, NIGERIA

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ABSTRACT

Ekpoma is a town characterized by lack of portable water supply for several years, with majority of the inhabitants relying on vended water from water trucks or rain-water collected in underground water reservoirs. This study therefore, assesses the bacteriologic profile of water samples in Ekpoma, Edo, Nigeria, considering the vulnerability of the inhabitants to water-borne diseases often associated with unhygienic environment and lack of safe drinking water. The simple random sampling technique was adopted and water samples were collected from 20 water reservoir sites using sterile containers. The samples were then subjected to laboratory investigations using the total viable count and most probable number techniques, as well as some biochemical methods to determine the bacteria status of the samples collected. Data was analyzed using descriptive statistics (mean and percentages). The results indicated that the water reservoirs have high inorganic matter and relatively high indicator organisms; hence the reservoirs contained unsafe water. It is recommended that relevant government agencies should ensure provision of safe water to communities as the cost of doing that is much cheaper than the human, economic and social costs of an epidemic. Individuals using such water reservoirs are also advised to adopt affordable water treatment measures.

Key Words: Bacteriologic profile, Water reservoir, Water safety, Ekpoma

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INTRODUCTION

Water is an indispensible commodity to humans and constitutes about 60% of an adult human body weight, as well as a medium in which several biochemical processes takes place in all living things (Turgut et al., 2005). It is also very essential for domestic and industrial purposes (Husman et al., 1981). However, the sanitary surveillance of water is important as over 80% of all diseases in the world are associated with unsafe water; often times due to contamination by microorganisms (WHO, 1996; Hunter, 1997).

Available scientific evidence has shown that water in certain circumstances can constitute a hazard to human health; especially when it contains pathogenic microorganisms from the feaces of sick people or carriers. Agbonlahor et al. (1990) asserts that sewage and human excreta are the greatest source of danger that can be encountered by drinking such contaminated water, while the WHO (2012) had acknowledge that the suitability of water for use is based on very extensive precedents and relates to its bacteria status.

Of particular interest is the water supply situation in Ekpoma –a town characterized by lack of portable water supply for several years, with majority of the inhabitants relying on vended water from water trucks or rain-water collected in cemented underground water reservoirs. This study therefore, assesses the bacteriologic profile of water samples in Ekpoma, Edo, Nigeria, considering the vulnerability of the inhabitants to water-borne diseases like cholera, diarrhea, hepatitis, amoebiasis and bacillary dysentery.

MATERIALS AND METHOD

Study Area: This study was carried out in Ekpoma, the administrative headquarters of Esan West Local Government area of Edo State. It lies between latitude 60 40°N to 60 45°N and longitude 60 05°E to 60 10°E (Obabori et al, 2006). The inhabitants of Ekpoma speak the language known as 'Esan' and are

predominantly farmers whose main produce are rice and cassava.

Before 1976, Ekpoma was characteristically rural with isolated settlements, few houses, health, educational, commercial and transportation facilities (Olomo, 1991). However, since the designation of Ekpoma as local government headquarters and as host of the State owned Ambrose Alli University, the town has grown into an urban centre with a very good road network credited to the late Professor Ambrose Alli, the former governor of old Bendel State, and a significant growth in population (Aziegbe, 2006).

While the population was 13,036 by 1975, it rose to 45,489 in 1991 (NPC 1992) and approximately 125,842 (63785 males and 62,057 females) in 2006 (NPC 2006). With only 8.62Km^2 of the total 62Km^2 of land used in 1979 (Ufuah, 1993), physical growth and expansion have increased to 29.28 Km^2 by 2003 (Aziegbe, 2006).

Sampling Technique and Size: The simple random sampling technique was adopted and water samples were collected from 20 water reservoir sites using sterile containers. The water samples were immediately transported to the diagnostic laboratory at the College of Medicine, Ambrose Alli University, Ekpoma, for analysis.

Sample Analysis: The detection of coliform bacteria and other organisms, and the level of contamination, was done using the most probable number (MPN) and the total viable count methods described by Cruickshank et al. (1980). The Gram staining technique was used to differentiate Gram positive and negative bacteria respectively.

Statistical Analysis: The descriptive statistical method (mean and percentages) was used to analyze the data collected from the water samples analyzed.

RESULTS

Table 1 below shows the organisms isolated from the water samples collected from the 20 water reservoir sites. Prominent amongst the organisms isolated was *Escherichia* coli from seven reservoir sites, followed by *Streptococcus faecalis* from six reservoir sites. Other isolated organisms included *Clostridium perfringens, Enterobacter species Klebsiella pneumonia* and *Staphylococcus aureus*.

However figures 1, 2, and 3 below, shows the percentage distributions of reservoir contamination, bacterial count of reservoir sites, and the most probable number of coliform distribution respectively. The results indicated that the water reservoirs have high inorganic matter and a relatively high index of indicator organisms; hence unsafe.

Table 1: Distribution of Organisms Isolated from water samples examined

Number of Reservoirs examined	Organism Isolated
4	*Clostridium perfriugens*
7	*Escherichia coli*
2	*Enterobacter species*
5	*Kiebsiella pneumonia*
3	*Staphylococcus aureus*
6	*Streptococcus faecalls*

DISCUSSION

Based on the high MPN values recorded in this study, one can assert that the water reservoirs investigated contain unsafe water. This is supported by the fact that the total number of viable coliform organisms in a given sample of water determines its quality and the maximum CFU/ml of water should not be more than 500 CFU/ml.

On the other hand, the portability and suitability of water is not determined by the presence of other pathogenic organisms but rather, by the coliform load of that water sample. The organisms isolated are commonly found in the soil, sewage, vegetables, and water, and they are normal flora in the gastrointestinal tract, as well as skin and nasal cavity of humans/animals. As such, there presence in the sampled water might be due to run-off water containing high inorganic matter (Decco, 2002). The bacteria could also have found their way into the reservoirs due to improper sitting of the reservoirs – being close to toilet plumbing system and/or undulating land areas where flood water can easily enter into them (Pelezer et al., 1993).

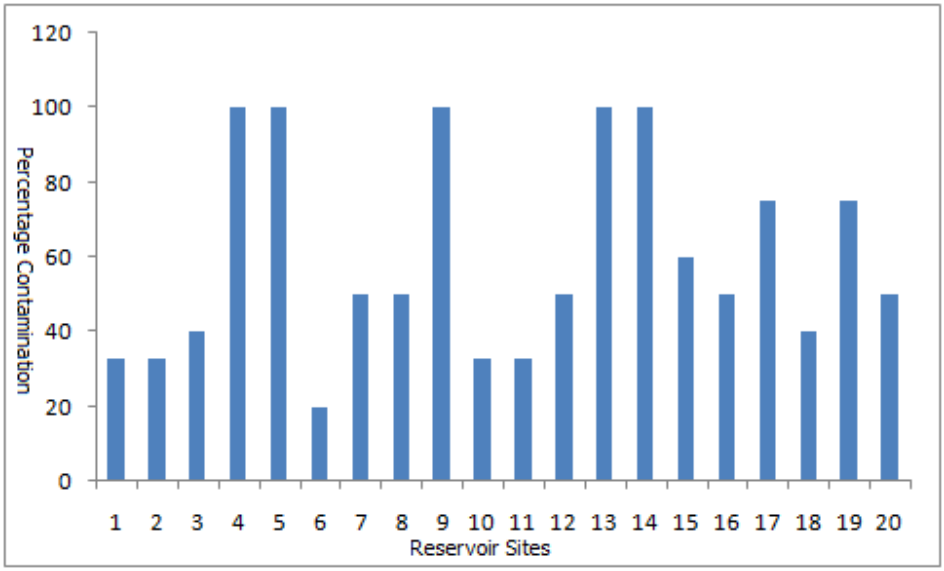

Figure 1: Percentage Distribution of Reservoir Site Contamination

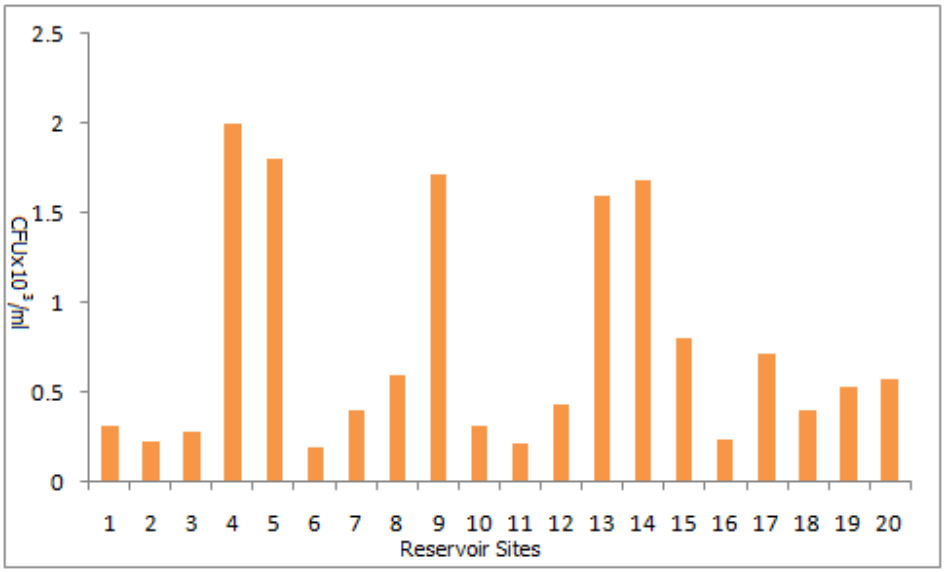

Figure 2: Bacterial Count of Reservoir Sites

According to WHO (1993), the suitability of any water for domestic purposes is determined bacteriologically by its coliform load and not by the presence of bacteria. The coliform organisms indicate that the water is polluted or contaminated. It was further stated that if the mean *E.coli* count at 44^0c per 100ml for 24 hours is zero, then the water is excellent for drinking; if 1-10, then the water is said to be acceptable for drinking, but regular sanitary checks is required.

On the contrary, however, if the value in question ranges from 10-50, then the water is unacceptable for drinking and efforts should be made to correct the possible structural faults or poor maintenance. If the range is 50 and above, then the water is said to be grossly polluted and as such, a complete reconstruction and disinfection is required.

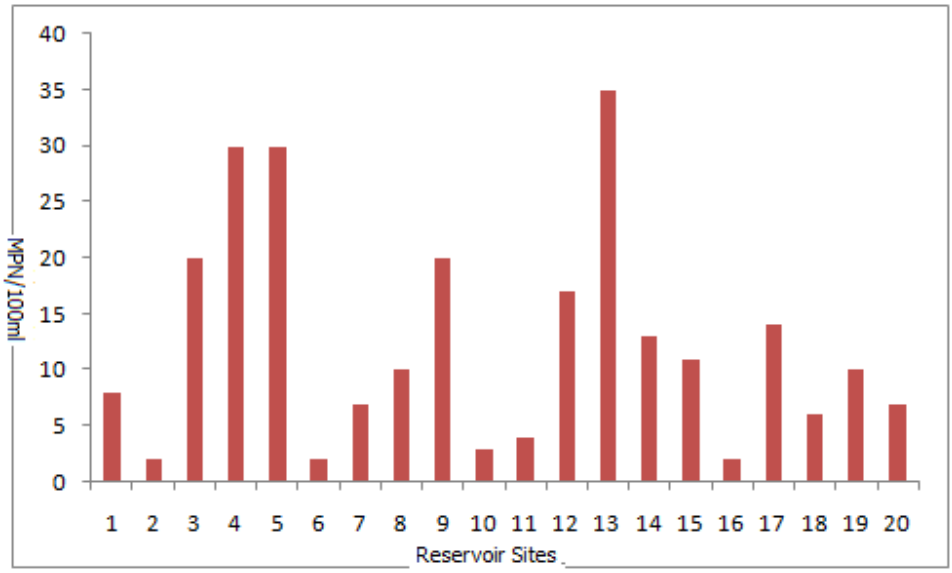

Figure 3: Water Reservoir's Most Probable Number (MPN) distribution

Judging by the results, it is obvious that only very few of the reservoirs assessed have suitable water for drinking, while the rest do not. It is our recommendation therefore, that individual should adopt adequate sanitary and affordable water treatment strategies in order to prevent portable water bones diseases. Reservoirs should be well sited and constructed with proper coverings to prevent pollution by run off water. It should also be properly maintained and reconstructed when the need arises. Proper routine sanitary checks should also be ensured by owners of water reservoirs, while relevant government agencies should ensure the provision of safe water to communities as the cost of doing that is much cheaper than the human, economic and social cost of an epidemic.

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AUTHOR(S) CONTRIBUTION

This study was conceptualized by Turay, A.A., while Ejovwoke, I. supervised the sample collection. Sample Analysis, manuscript preparation and presentation, as well as literature search and article revisions, were done by the authors listed in this paper.