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**Research Article**

# QUALITY ASSESSMENT OF SOURCES OF PORTABLE WATER IN OGHARA COMMUNITY, ETHIOPE WEST LOCAL GOVERNMENT AREA OF DELTA STATE

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**Abstract**

This research investigated the quality of portable water sources in Oghara Community, Ethiope West Local Government Area of Delta State. Three portable water samples- borehole, well and surface (river) were sampled from Oghara Community, Ethiope West Local Government Area of Delta State and physiochemical, microbiological and heavy metal analyses were investigated using titrimetric, spectrophotometric, serial dilution and chromatographic methods respectively. The results revealed that all the physicochemical parameters were below WHO and FMENV standards except temperature ($28.2^0$C) in surface water, The presence of TCC and THB in all the water sources with *Salmonella sp.*($1.8 \times 10^2$ cfu $ml^{-1}$ ), *Shigella sp.*( $3.8 \times 10^2$ cfu $ml^{-1}$ ), *Vibrio cholera* ($0.2 \times 10^2$ cfu $ml^{-1}$), and *E. coli* ($2.1 \times 10^2$ cfu $ml^{-1}$), found in surface water and only *Salmonella sp* and *E. coli* were found in borehole and well water sources. Surface water had the highest levels of all the microorganisms detected. Concentrations of Cu, Cr and Ni in all the three sources of water were higher than WHO and FMENV recommended values while Cd, Lead, mercury and Zn were below WHO and FMENV values with surface water having the highest concentrations for all the metals investigated. Quality Assessment of sources of portable water in Oghara Community, Ethiope West Local Government Area of Delta State, showed that all the water sources under investigation were contaminated with microorganisms and heavy metals above WHO and FMENV standards with surface water showing the highest level of contamination hence unfit for consumption and could exhibit health hazard.

**Keywords:** Oghara, Ethiope, *Salmonella sp.*, *Shigella sp.*, *Vibrio cholera*, *E. coli*.

## INTRODUCTION

Water is one of the most abundant and essential resources of man. Water in its pure state is acclaimed key to health and general contention is that water is more basic than any other essential things to life (Edungbola and Asaolu, (1984). Man requires a regular and accessible supply of water which forms a major component of protoplasm and provides essentiall requirements for vital physiological and biochemical processes (Muyi, 2007). Nigeria as a country is facing the problem of adequate supply of portable water. There are states in Nigeria especially in the Niger Delta where more than 80% of the population consumes polluted water as a result of inadequate treatment and disposal of waste from humans and livestock.
Pollution in water not only affects the quality of water, but also could be detrimental to human and aquatic life. Microorganisms, hydrocarbons and heavy metals could lead to pollution of water. Among the hydrocarbons which are found in water are the PAHs some of which are known to be toxic and carcinogenic (Costlow, 1969 and Grimmer, 1983) and fall within the priority list of Federal Ministry of Environment, Nigeria. The toxic PAHs include benzo (a) pyrene, acenaphthrene, acenapathylene, fluorine, phenanthrene, naphthalene, pyrene and flouranthene. In addition to toxicity, some of these polycyclic aromatic hydrocarbons cause tainting to seafood (Connel and Miller, 1981). The aim of this study is to assess the level of PAHs, heavy metals, physiochemical and microbiological properties of water samples collected from borehole, well and surface water sources in Oghara Community, Ethiope West Local Government Area of Delta State as shown in Figure 1 (The Map of Delta State and the River source) and compare results with WHO and FMENV standards with a view to determining its portability.

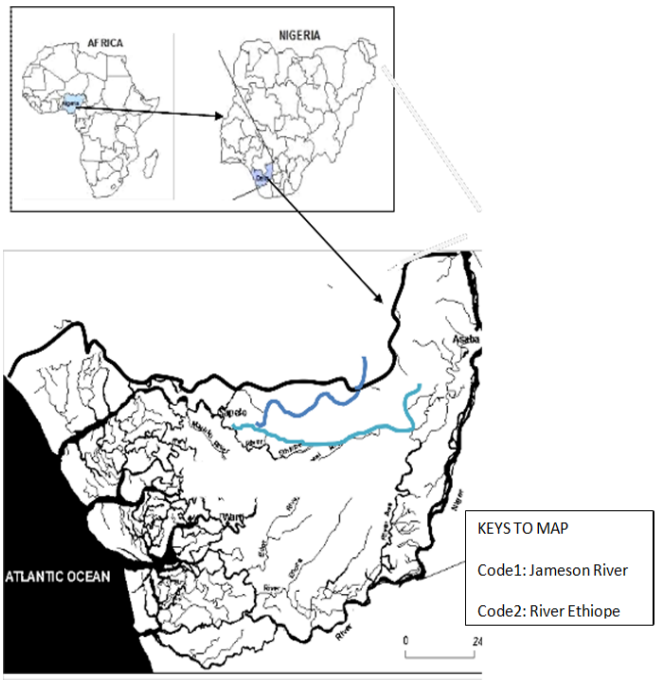


**Fig. 1. The Map of Delta State and the River source**

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## MATERIALS AND METHODS

The water samples were collected from three different source locations. A sample each was collected from a borehole, a well and a river. The borehole sample was collected from a compound tap. The tap was allowed to run for 2-3 minutes before samples were obtained. The well water samples were collected from a public well using a fetching bucket. The river water sample was collected from a point in the river 4-5 meters away from the bank. Samples were collected using amber bottles however, samples for microbiological analysis were collected in accordance with the procedures described in standard methods for water and waste water analysis (APHA, 1995).

The same is accepted and adapted by FEPA and DPR as standards for Nigeria. According to the procedure, 200ml of sterilized sample bottles were used for collecting water samples. All the samples were preserved in an ice cooled container and transported to the laboratory for analysis. Physical parameters were analyzed using extech meter, the chemical parameters were analysed using titrimetric method. Serial dilution procedure as described by Ofunne (1999); Obire and Wemedo (1996) was employed for cultivation and enumeration of bacteria in water samples. Aliquots (0.1ml) of the required dilutions were spread plated in duplicates and incubated at 37ºC for 24-48hours. Heavy metal analysis was carried out using the atomic absorption spectrophotometric method.

## RESULTS AND DISCUSSION

**Table 1. Level of physical parameters in water samples collected from oghara community in delta state**

| S/NO | Parameters | Surface water | Well water | Bore Hole water | WHO STANDARD | FMENV STANDARD |
|---|---|---|---|---|---|---|
| 1 | pH | 5.7 | 5.2 | 5.0 | 6.5-8.5 | 6.5-8.5 |
| 2 | Temperature ºC | 28.2 | 27.9 | 27.8 | 25ºC | $25^0$C |
| 3 | Turbidity (NTU) | 4.8 | 0 | 0 | 5(NTU) | 1 (NTU) |
| 4 | Electrical conductivity (µs/cm) | 14.8 | 204 | 35.9 | 500(µs/cm) | |
| 5 | Salinity ($‰_0$) | 0.01 | 0.01 | 0.02 | | |
| 6 | Total dissolved solids | 10.6 | 140 | 24.2 | 600mg/l | 500mg/l |
| 7 | Colour | colourless | colourless | colourless | colourless | Colourless |
| 8 | Odour | Odourless | Odourless | odourless | Odourless | Odourless |

All the physicochemical parameters except temperature were below the WHO and FMENV standards

**Table 2. Level of chemical parameters in water samples collected from oghara community in delta state**

| S/NO | PARAMETERS | SURFACE | WELL | BORE HOLE | WHO STANDARD (mg/l) | FMENV STANDARD (mg/l) |
|---|---|---|---|---|---|---|
| 1 | Alkalinity (mg/l) | 2 | 2 | 2 | 250 | |
| 2 | Chloride (mg/l) | 6.9 | 13.3 | 11.3 | 250 | 250 |
| 3 | Sulphate (mg/l) | <1.00 | 2.9 | 1.2 | 250 | 500 |
| 4 | Phosphate (mg/l) | <0.05 | <0.05 | <0.05 | 0.5 | 0.5 |
| 5 | Nitrate (mg/l) | 0.3 | 4.7 | 1.4 | 10 | 10 |
| 6 | Total hardness (mg/l) | 7.6 | 69.1 | 7.6 | 100-300 | 200 |
| 7 | Calcium | 1.5 | 23.0 | 1.5 | 75 | |
| 8 | Magnesium as (mg/l) | 0.9 | 2.8 | 0.9 | 150 | |
| 9 | DO(mg/l) | 8.12 | 8.9 | 10.6 | 8 | 7.5 |
| 10 | BOD(mg/l) | 7.2 | 4.3 | 5.8 | 6-9 | 0 |

**Table 3. Level of microbiological parameters in water collected from oghara community in delta state**

| Parameters | Surface water | Well water | Bore Hole water | WHO STANTARD | FMENV STANDARD |
|---|---|---|---|---|---|
| TCC (MPN/100) | $2.1 \times 10^2$ | $1.5 \times 10^2$ | $2.1 \times 10^2$ | 0-2 (MPN/100) | 0 (MPN/100) |
| THB (cfu $ml^{-1}$) | $1.8 \times 10^4$ | $1.2 \times 10^4$ | $2.5 \times 10^4$ | <100 (cfu/ml) | 0 |
| *Salmonella sp.*(cfu $ml^{-1}$) | $1.8 \times 10^2$ | $0 \times 10^2$ | $0 \times 10^2$ | 0 | 0 |
| *Shigella sp.* (cfu $ml^{-1}$) | $3.8 \times 10^2$ | $1.1 \times 10^2$ | $0.6 \times 10^2$ | 0 | 0 |
| *Vibrio cholera* (cfu $ml^{-1}$) | $0.2 \times 10^2$ | $0 \times 10^2$ | $0 \times 10^2$ | 0 | 0 |
| *Echerichia coli* (cfu $ml^{-1}$) | $2.1 \times 10^2$ | $1.1 \times 10^2$ | $0.3 \times 10^2$ | 0 | 0 |

**Table 4. Concentration of heavy metals in portable water sources in ajanesan in oghara community of delta state**

| Parameters | Borehole water (ppm) | Surface water (ppm) | Well water (ppm) | WHO standard(Mg/L) permissible limit | FMENV standard(Mg/L) permissible |
|---|---|---|---|---|---|
| Copper | 1.7 | 2.5 | 3.8 | 0.5 - 2.0 | 0.1 |
| Cadmium | <0.001 | <0.001 | <0.001 | 0.003 - 0.03 | 0.01 |
| Lead | 0.0249 | 0.0014 | 0.0142 | 0.4 - 0.4 | 0.05 |
| Chromium | 1.7 | 2.8 | 3.7 | 0.05 – 0.05 | 0.05 |
| Mercury | <0.001 | <0.001 | <0.001 | 0.001 – 0.001 | 0.001 |
| Zinc | 1.7 | 3.4 | 2.1 | 1.0 – 3.0 | 5.0 |
| Nickel | 2.1 | 2.1 | 3.4 | 0.01 – 0.02 | 0.05 |

## DISCUSSION AND CONCLUSION

The physicochemical properties of water can be affected by several factors; increase in industrial activities, high exploitation of lands, increase in population, domestic activities and method of waste disposal. Result from Table 1 revealed that All the physical parameters except temperature were below the WHO and FMENV standards while all the chemical parameters were below the WHO and FMENV standards in all the three sources of water in Table 2. Result from Table 3 revealed the presence of TCC, TBH, *Salmonella sp., Shigella sp., Vibrio cholera and Echerichia coli* in surface water at levels above WHO and FMENV standards. Microorganisms in water can affect human health and can cause a number of water borne diseases and possibly death if diseases are not detected and treated promptly and properly. The result of the total coliform count and the total heterotrophic bacteria showed that the water contained pathogenic organisms, this led to further analysis. Result from Table 3 revealed that mean counts of bacteria in surface water were *Salmonella sp.*($1.8 \times 10^2$ cfu $ml^{-1}$), *Shigella sp.*( $3.8 \times 10^2$ cfu $ml^{-1}$), *Vibrio cholera* ($0.2 \times 10^2$ cfu $ml^{-1}$), and *E. coli* ($2.1 \times 10^2$ cfu $ml^{-1}$), borehole water *Shigella sp.*($0.6 \times 10^2$ cfu $ml^{-1}$) and *E. coli* ($0.3 \times 10^2$ cfu $ml^{-1}$) and well water: *Shigella sp.*($1.1 \times 10^2$ cfu $ml^{-1}$) and *E. coli(*$1.1 \times 10^2$ cfu $ml^{-1}$). All organisms were confirmed to be gram negative rods. Surface water had all bacteria types analyzed for while borehole and well water samples had *Shigella sp*. and *E. coli* and absence of *Salmonella sp.* and *Vibrio sp*.. Generally speaking, the presence of all or some bacteria types that were encountered in this analysis showed that the water samples were contaminated from external sources. Presence of feacal coliform such as E. coli in water samples shows likely presence of pathogenic bacteria (WHO, 1996) and possible faecal contamination of water source. This was the case for the water samples analyzed in this study. Results of the bacterial analysis revealed that the water samples are of low quality because they contain faecal coliform as well as pathogenic bacteria; hence they failed to meet the permissible standard for drinking water. All the heavy metals analyzed were detected however concentrations of Cu, Cr and Ni in all the three sources of water were higher than WHO and FMENV recommended values while Cd, Lead, mercury and Zn were below the values in Table 4. Due to the high concentrations of copper, chromium and nickel in all the water samples, portable waters from these sources can be said to be polluted with heavy metals of health implications hence not suitable for drinking. This can be attributed to anthropogenic activities in the areas which are hazardous to the water quality.

### Conclusion

Quality Assessment of sources of portable water in Oghara Community, Ethiope West Local Government Area of Delta State, showed that all the water sources under investigation were contaminated with microorganisms, heavy metals above WHO and FMENV standards with surface water showing the highest level of contamination hence unfit for consumption and could exhibit health hazard.

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### Conflict of interest

The authors declare that they do not have any conflict of interest.

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