ASSESSMENT OF WATER QUALITY IN EBOYA COMMUUNITY OF OKPOKWU LOCAL GOVERNMENT AREA OF BENUE STATE NIGERIA

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ABSTRACT
The research work investigate the water quality of Eboya community in Okpokwu Local Government of Benue State analyzing samples of its boreholes (underground water) and stream (surface water) to ascertain its safety for drinking or potential health risk when water from these sources are consumed. The contents analyzed include the physical, chemical, and microbiological content respectively and the basic parameters analyzed under this content are Temperature, Turbidity, Colour, Taste, Odour, PH, Hardness, Dissolve Oxygen, Chloride, Chemical Oxygen demand (BOD). Most of the samples analyzed were done using the spectrophometer where the programme numbers of the respective parameters were inputted and the result displayed except the microbiological parameters which was tested using the "Thomas approximate method" in computation of the values. The results obtained were compared with the international standard for drinking water by (WHO) 1958 and NAFDAC. The results revealed that most of the parameters monitored fall within the WHO recommended standards for portable water. On this basis therefore, it is recommended that the Boreholes (underground) and stream (surface waters) can be used for domestic purposes, since it meets most of the WHO and NAFDAC standards for water quality.

Keywords *– Biological, Chemical, Physical, spectrophometer, WHO and NAFDAC,*

1. INTRODUCTION
Over the years water has been considered as one of the requirements of living things since the beginning of time. Human beings have 75% of their total body mineral content made up of water. As a result of this, water has to be readily available but suitable for consumption.[1-3]
It is also estimated that 70% of the earth surface is covered by water in the form of lakes, rivers, streams and oceans. This implies that water covers about 60 million km^2 surface area of the earth. Below the earth surface (underground water can be reached by digging wells, drilling bore holes e.t.c [4-7]. In as much as there abundance of water, the supply of portable and drinkable water is a major problem in the worl till today. Portable water is that which is suitable, for drinking and it's physical, Chemical, and biological parameters meet the world health organization standards[8-10]
[11, 12] Suggested that the prominent water bodies that serve as a source of portable water supply have mostly been contaminated by the action of industrialization, organization, urbanization and all other life activities
Water is physically meant to be odourless and tasteless. Chemically, it is made up of an atom of oxygen and two atoms of hydrogen. Water contains several minerals and salts when in its natural form, these include fluorides, calcium, sulphates, iron and magnesium; oxygen, carbon dioxide, nitrogen are contained in a gaseous state [13-16].
Impurities in water can cause a lot of illness like Cholera, Guinea worm disease Typhoid, Legionella, Dysentery, Malaria etc. These can lead to poverty and ultimately death if the quality and portability of these water sources are not checked.[17]
Benue State in particular is faced with a water purity problem which covers most part of the state[18]. The common finding is that water degradation quality is a recurrent issue in Benue state and in some local government area in Benue - South senatorial district, the people are faced with cases of typhoid, cholera , dysentery etc.
This study therefore investigates the role of some physical,chemical,biological and social economic factors in determining quality water enhancement in Eboya community and these can be achieved by the following objectives;

i. To determine the properties of Borehole water samples from different areas and towns within the area of study.
ii. To assess the physical, chemical and biological water quality parameters as given below;
   - Physical test/treatment: This includes colour, odour, taste, temperature, turbidity and total suspended solid (TSS).
   - Chemical test/treatment: This includes PH, Chloride, hardness, acidity and alkalinity, dissolved salt.
   - Biological test/treatment: This includes Total Coli Form Bacteria, Chemical Oxygen Demand (C.O.D), and Biochemical Oxygen Demand (B.O.D).
iii. To compare the evaluated water quality parameters above with WHO and NAFDAC water quality standards.

2. MATERIALS AND METHOD

2.1 Sample Collection

The samples were collected using a liter of bottle for each sample. The sampling method used was random sampling.

2.2 Sources of samples

Samples was collected from group of boreholes and streams located in the study area i.e. Iwewe, Olanyega, Olago, Oduda and Onyayi all in Eboya community of Okpokwu local government area of Benue state. These are boreholes and streams that are dependent upon by house hold for drinking and other domestic uses. Water was collected from the boreholes with the aid of ropes and bucket. More so, water was fetched from the streams with the help of bowl and was taken to the laboratory for analysis in bottles.

2.2 Designation of sample

2.2.1 Designation of sample boreholes

Water from borehole at Iwewe - - - B_1
Water from borehole at Olanyega - - - B_2
Water from borehole at Olago - - - B_3
Water from borehole at Oduda - - - B_4
Water from borehole at Aclusha - - - B_5
Water from borehole at Ijegeh - - - B_6
Water from borehole at Umabeh - - - B_7

2.2.2 Designation of sample streams

Water from stream at Iwewe - - - S_1
Water from stream at Olanyega - - - S_2
Water from stream at Olago - - - S_3
Water from stream at Oduda - - - S_4
Water from stream at Aclusha - - - S_5
Water from stream at Ijegeh - - - S_6
Water from stream at Umabeh - - - S_7

2.3 Sample Analysis

The samples of water obtained was taken to Benue State Water Board central laboratory Makurdi immediately after collection and tested for the following Physical, Chemical and biological parameters. The taste and odour of the various samples was determined by direct tasting and smelling of the samples.

3 RESULTS AND DISCUSSION

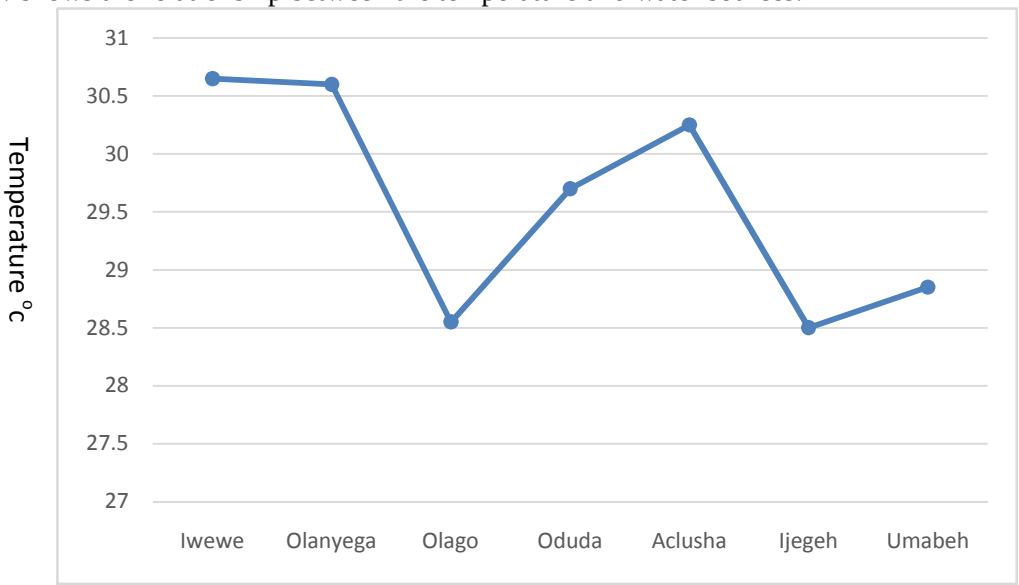
3.1 Guidelines on drinking water by World Health Organization (WHO) and National Agency for Food and Drug Administration and Control (NAFDAC).

Table1: Guidelines on drinking water by World Health Organization (WHO) and National Agency for Food and Drug Administration and Control (NAFDAC).

Parameter	Max. Acceptable Conc. (WHO)	Max. Allowable Conc. (NAFDAC)
Physical parameter		
Taste	Unobjectionable	Unobjectionable
Colour	5(Pt colour)	----------
Odour	Unobjectionable	Unobjectionable
Turbidity	5(FTU)	----------
Suspended	(SS) 50mg/L	----------
Temperature (^{0}C)	----------	----------
Chemical Parameter		
PH	7.0-8.5	6.5-8.5
Calcium (Ca)	50mg/L(Max)	75mg/L
Magnesium (Mg)	50mg/L	30mg/L
Iron (Fe)	0.05-0.3mg/L	----------
Sulphate (SO_4)	200mg/L	200mg/L
Chloride (CL)	200mg/L	200mg/L
Nitrate (NO_3)	3mg/L	----------
Chromium (Cr)	0.05mg/L	----------
Zinc (Zn)	50mg/L	----------
Aluminum (Al)	0.5mg/L	----------
Biological Parameter		
Coliform count/ml	0.0 in 100ml per sample	1 max

3.2 Temperature

Temperature had values ranging from (27.8-28.9) the high value was in sample of Borehole (underground water); this could be as a result of the presence of lesser amount of bacteria activity in the sample as well as lesser effect of atmospheric temperature on the water source. The temperature was low in sample of stream (surface water). The Fig.1 and Fig.2 below shows the relationship between the temperature and water sources.



Mean values of the water samples

Fig1 The graph of temperature showing the behaviour of water samples for boreholes

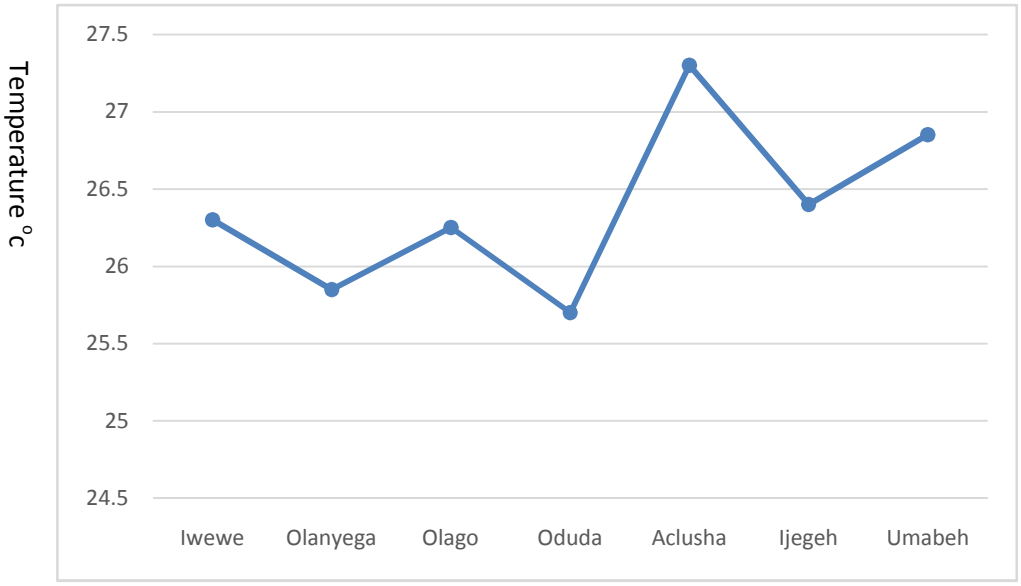


Fig 2 The graph of temperature showing the behaviour of water samples for streams

3.3 Turbidity

Turbidity refers to the amount of particles in water. The higher the turbidity in water; the lower in quality of the water. The values as obtained from the result ranges from 6.9FTU – 22.6 FTU which is within the WHO stipulated standard for portable water. The turbidity graph shown in Fig.3 and Fig.4 of boreholes (underground water) and stream (surface water) explains that turbidity level of the water obtained in the area decreases from the discharge point as it gets away from the source and then increases back again as its get to the body. This is an indication that the stream water (predominantly) is better obtained not too close from the discharge point. However, at the point where the graph falls, shows how clear the underground water is at that point.

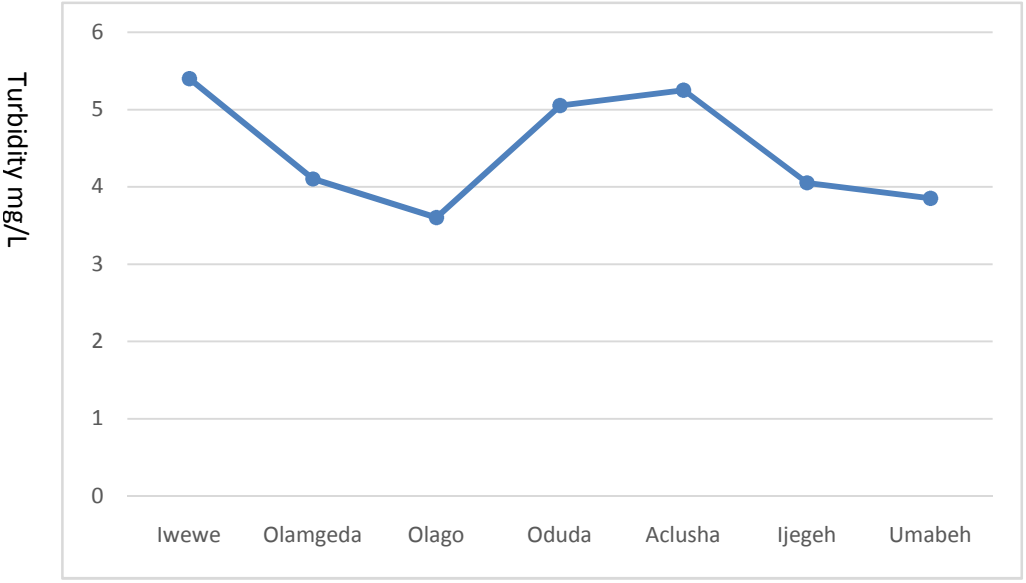


Fig 3: The graph of Turbidity showing the behaviour of water samples for boreholes

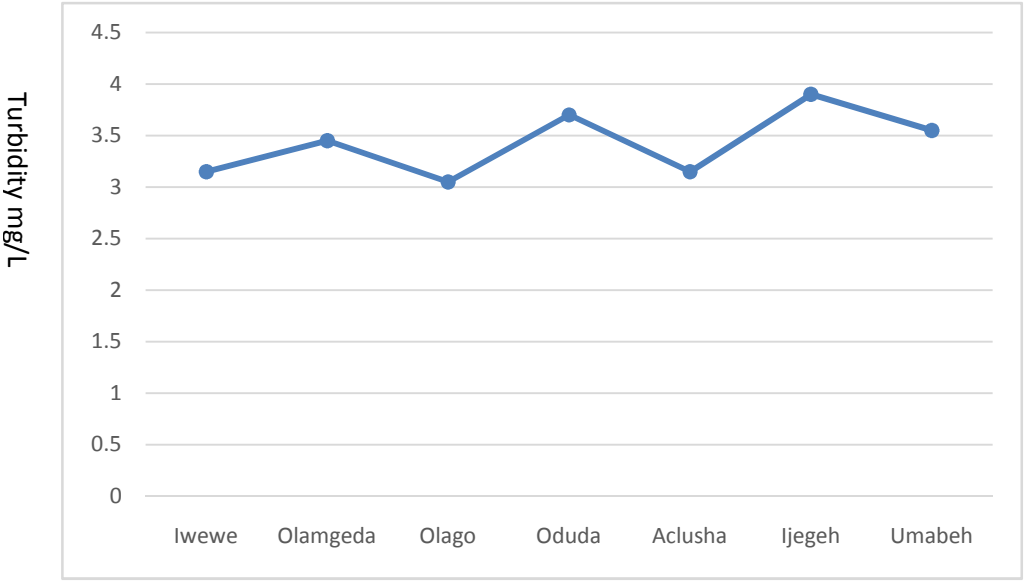


Fig 4 The graph of turbidity showing behaviour of water samples for streams

3.4 Colour

. The water samples appear colourless and clear which signifies unobjectionable with a lesser value (1pt.c) compared with WHO and NAFDAC standards. This is a clear indication that the water in Eboya community is okay for use; but it is worthy of note that the stream waters (surface water) contains some dissolve compounds or chemicals as well as eroded soil particles.

3.5 Taste

All the samples of boreholes (underground water) and stream (surface water) was tasteless.

3.6 Odour

The odour of the water sample is objectionable due to domestic sewage, decomposition of organic matter and Faecal dissemination of the community habitants/dwellers.

3.7 PH

PH is a measure of acidity or alkalinity of a solution. A PH below 7 indicates acidity while, that above 7 indicate alkalinity. The permissible PH required by WHO is 7.0-8.5 (ppm) mg/l while NAFDAC is 6.5-8.5 (ppm)mg/l. from the result obtained from the analysis shown in indicates that, the water is slightly out of WHO range, but is found to be adequate comparing the range by NAFDAC, the values also highlight that, stream water are more alkaline in nature as they can form soap easily. From the graph of the water samples PH attached in Fig.5 and Fig.6 shows the variation in PH in the different communities.

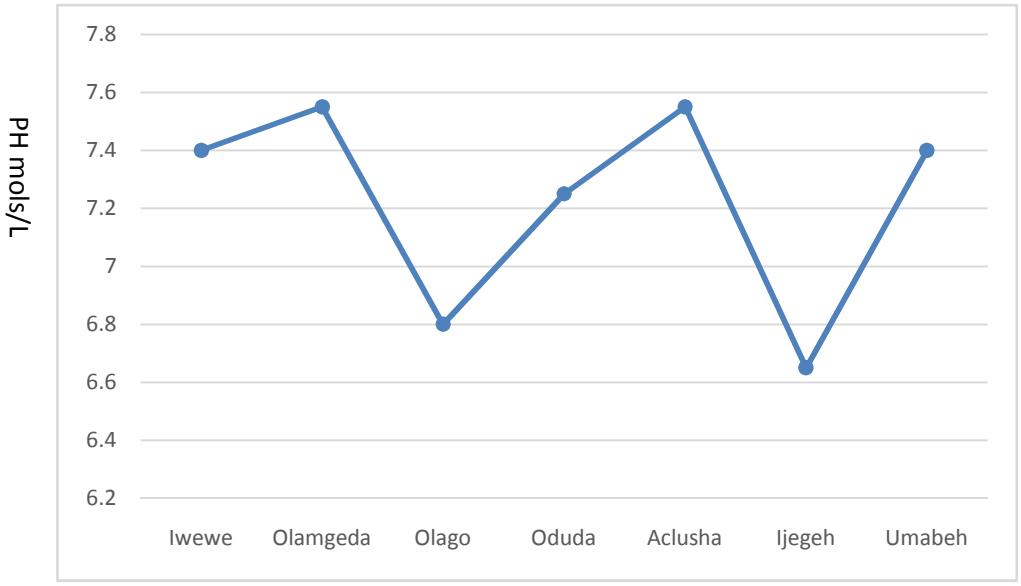


Fig.5 The graph of PH showing the behaviour of water samples for boreholes

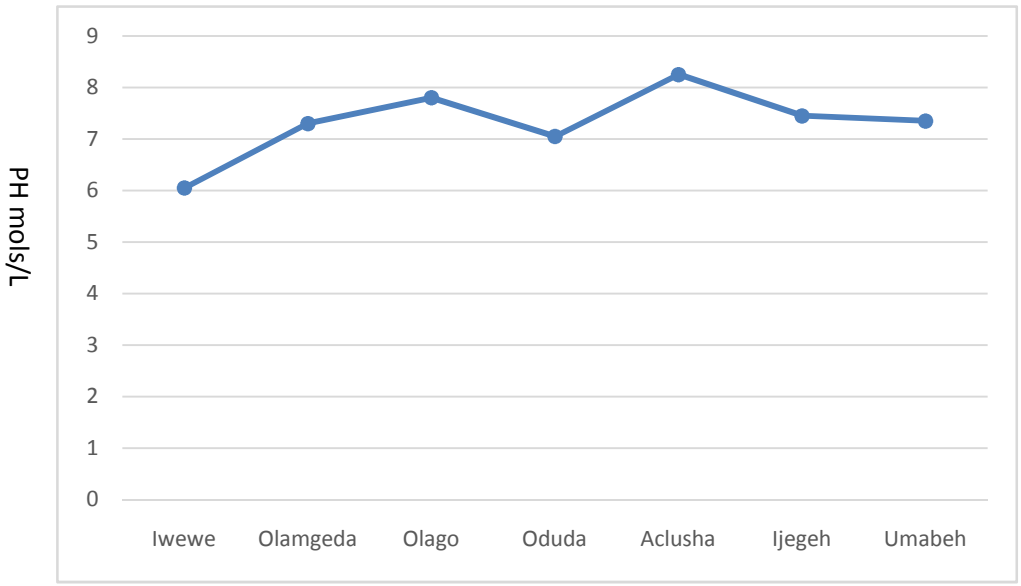


Fig.6 The graph of PH showing the behaviour of the water samples for streams

3.8 Hardness

Water is said to be hard when it contains a very high value of calcium or magnesium ions thereby making it difficult to form lather with soap. The test results tabulated at 4.3 revealed that all the boreholes water samples analysed were hard when compared with stream but moderately hard when compared with WHO standard and McCarthy (1967) hardness classification chart. The behaviour of the hardness of the water samples is shown in the graph attached in Fig.7 and Fig.8 Below

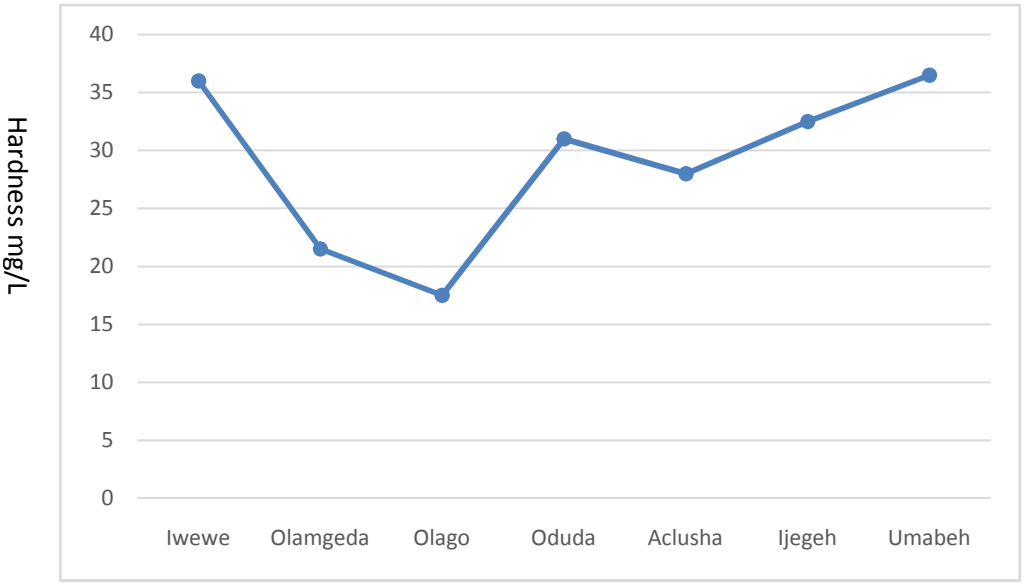


Fig.7 The graph of Hardness showing the behaviour of water samples for boreholes

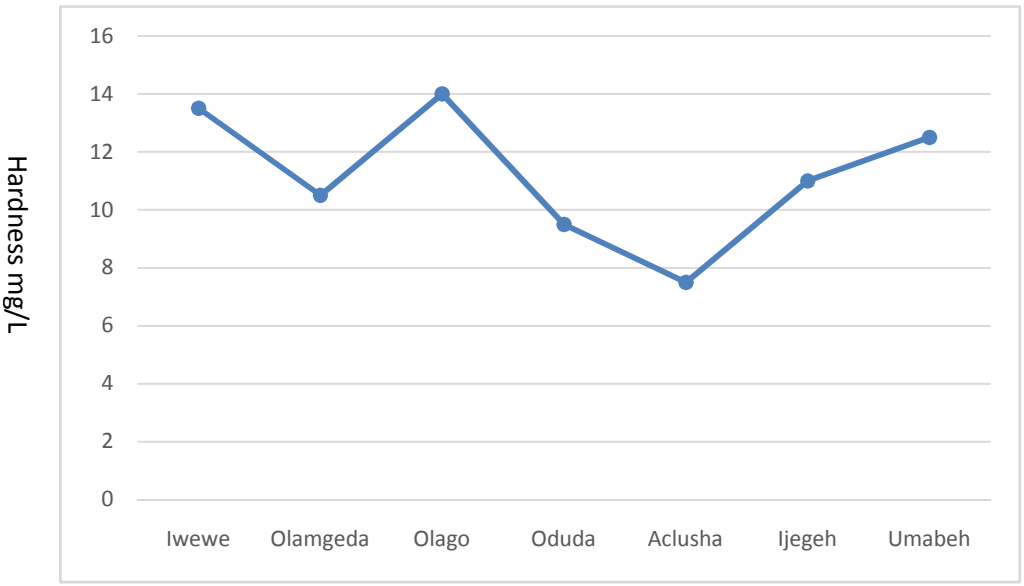


Fig.8 The graph of Hardness showing the behaviour of water samples for streams

3.9 Dissolved Oxygen (DO)

The dissolved oxygen (DO) is the amount of oxygen dissolved in a specified sample of water. The value of DO decrease with temperature increase, the DO of the (surface water) stream were higher due to atmospheric conditions and algae activities and waste discharge found in the water compare the boreholes (underground water). The graph shown in Fig.9 and Fig.10 below, explains better the behaviour of the DO using the mean values of the water samples.

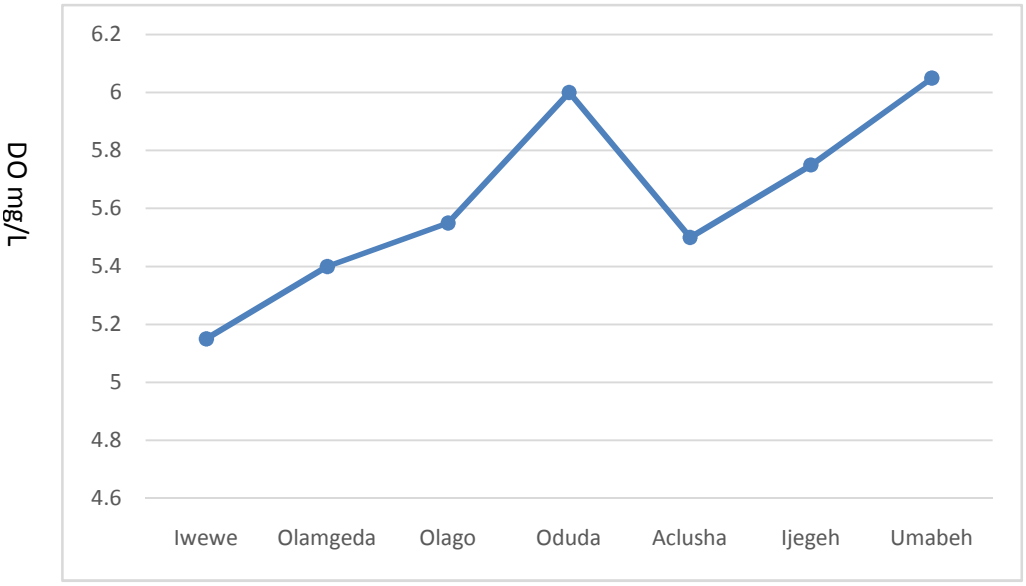


Fig.9 The graph of DO showing the behaviour of water samples for boreholes

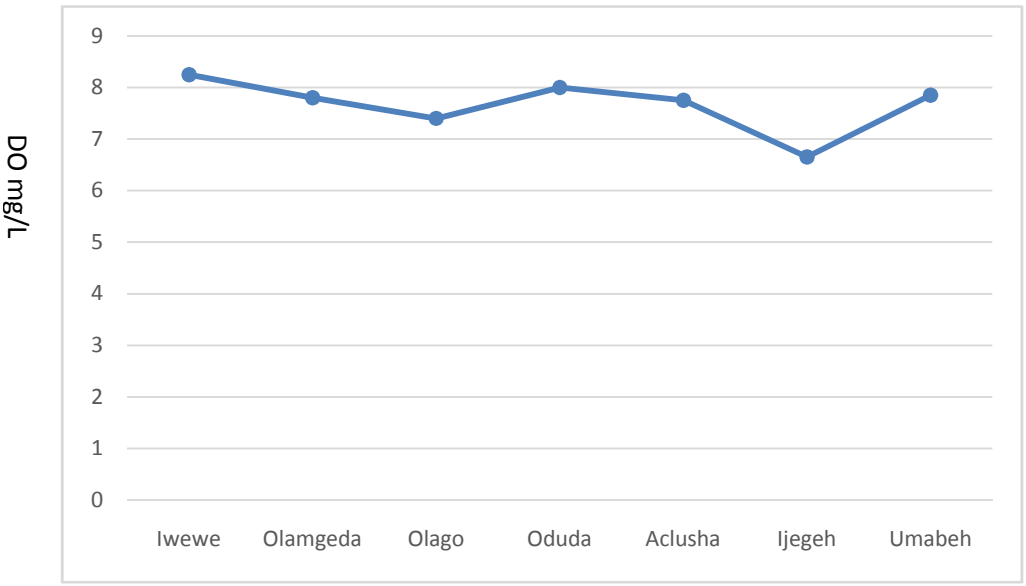


Fig.10 The graph of DO showing the behaviour of the water samples for streams

3.10 Chloride

Chloride produces salty taste in water which varies with the quantity of sodium ion (Na+). The concentration of chlorides from ranges from (3.98-23.84)mg/l which is within range of WHO and NAFDAC permissible limits according to international standards. The highest values was in borehole (underground water) which reveals higher concentration of chlorides in the ground/soil, while the lowest is in stream (surface water) as shown on Fig.11 and Fig.12 below; the concentration of chlorides in all the tested samples indicates that the samples are safe for human consumption because the chloride concentration is relatively low compared to standard in Table.1.

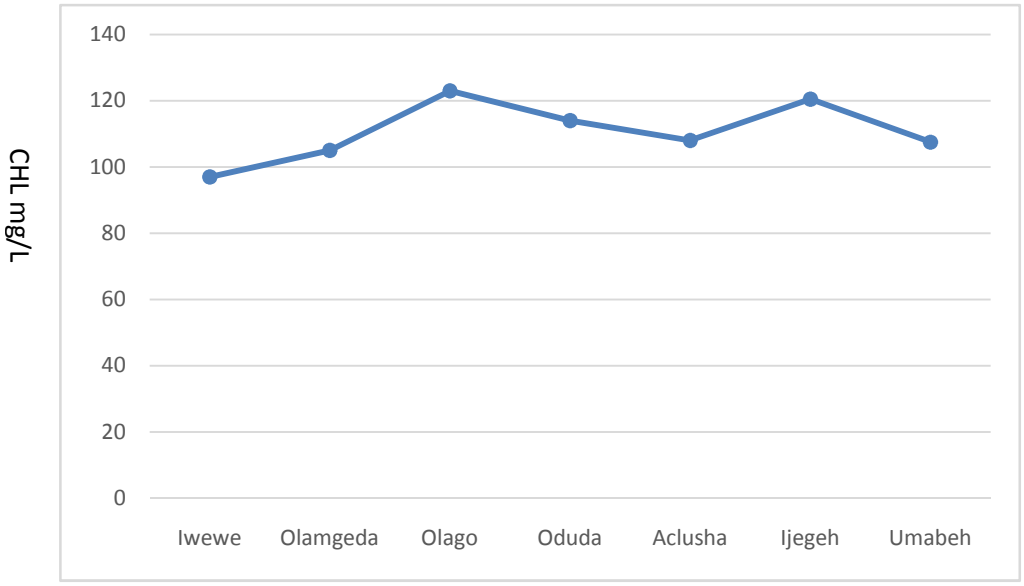


Fig.11 The graph of CHL showing the behaviour of the water samples for boreholes

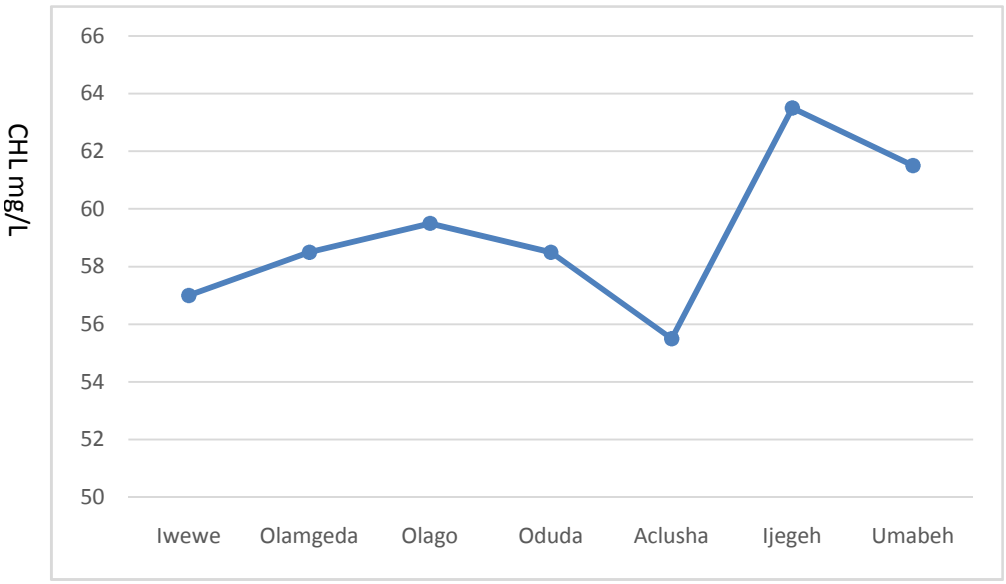


Fig.12 The graph of CHL showing the behaviour of the water samples for streams

3.11 Chemical Oxygen Demand (COD)

This was used as a measure of the oxygen equivalent of organic matter content of a sample that is susceptible to oxidation by a strong chemical oxidant. It had values from (1-160)mg/l which is in range of NAFDAC stipulated limits, but slightly differs in range of WHO limits. The highest value of COD was found in stream (surface water) as shown on the graph in Fig..13 and Fig.14 below.

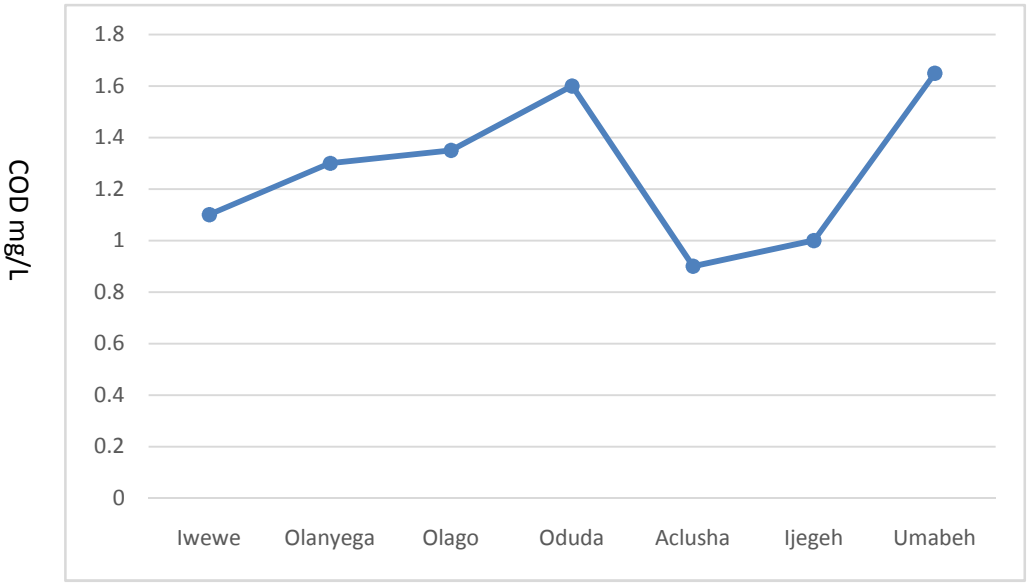


Fig.13 The graph of COD showing the behaviour of water samples for boreholes

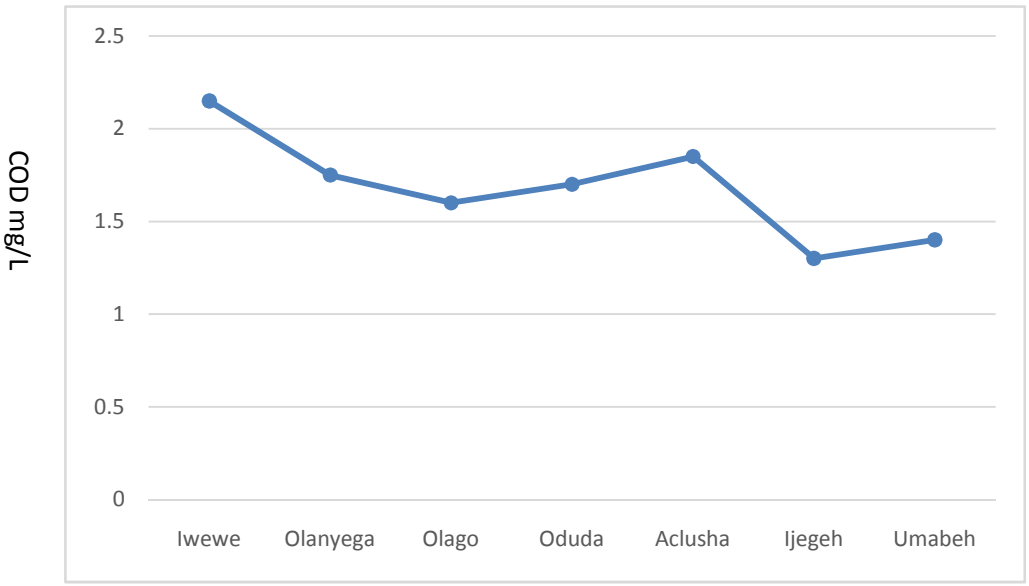


Fig.14 The graph of COD showing the behaviour of water samples for streams

3.12 Total Coli Form Bacteria

The contamination of water by the microbiological means is the process by which pathogenic or bacterial organisms are introduced into water to render it unfit for human use. One of such bacterial is E-coli which were also examined in the water sample. E-coli bacteria have been commonly found in waters and their presence is used to indicate the presence of recent Faecal contamination. From the water samples analysed, it is crystal clear that the water is contaminated since MPN/100 of the water samples is higher that the 10ml per 100ml set as standard. From the microbiological result as presented in Fig.15 and Fig.16, it has revealed that the water obtained from the borehole (underground water) and stream (surface water) is partly below standard and therefore should be treated before drinking.

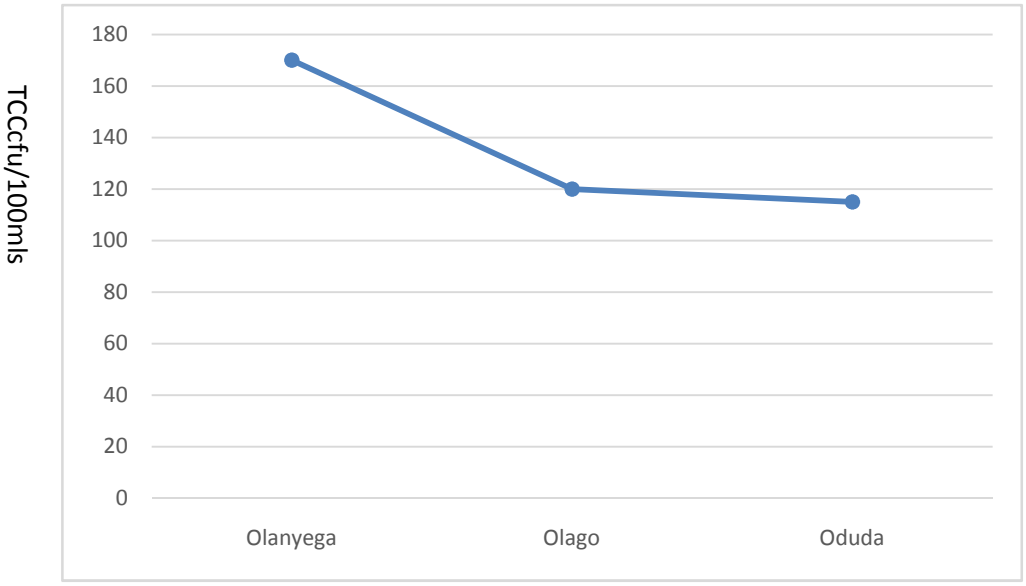


Fig.15 The graph of TCC showing behaviour of the water samples for boreholes

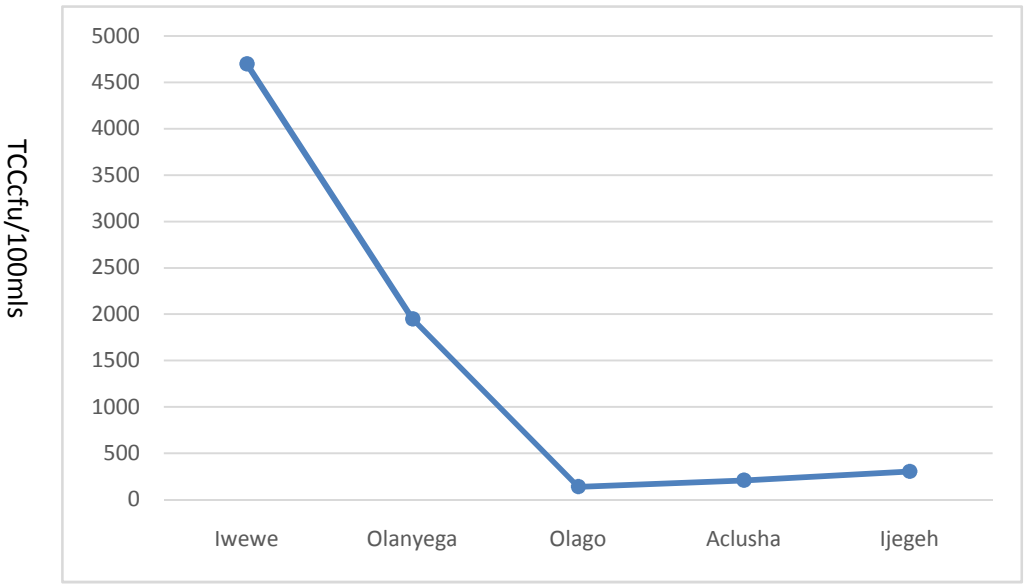


Fig.16 The graph of TCC showing the behaviour of water sample for streams

3.13 Biochemical Oxygen Demand (BOD)

The BOD test was used to determine the relative oxygen requirement to oxidize organic matter in a sample through action of micro organisms in the sample. A high BOD signifies the presence of a large amount of organic pollution, thus from the samples of water analysed from Eboya community of Benue State area within the prospective locations, the values of the BOD were lesser in amount than the WHO and NAFDAC standards in (table1), this is an evidence that the water is not polluted. The graph of the mean values of the water samples is plotted in Fig.17 and Fig.18 respectively illustrating the level or strength of waste content of the spring water.

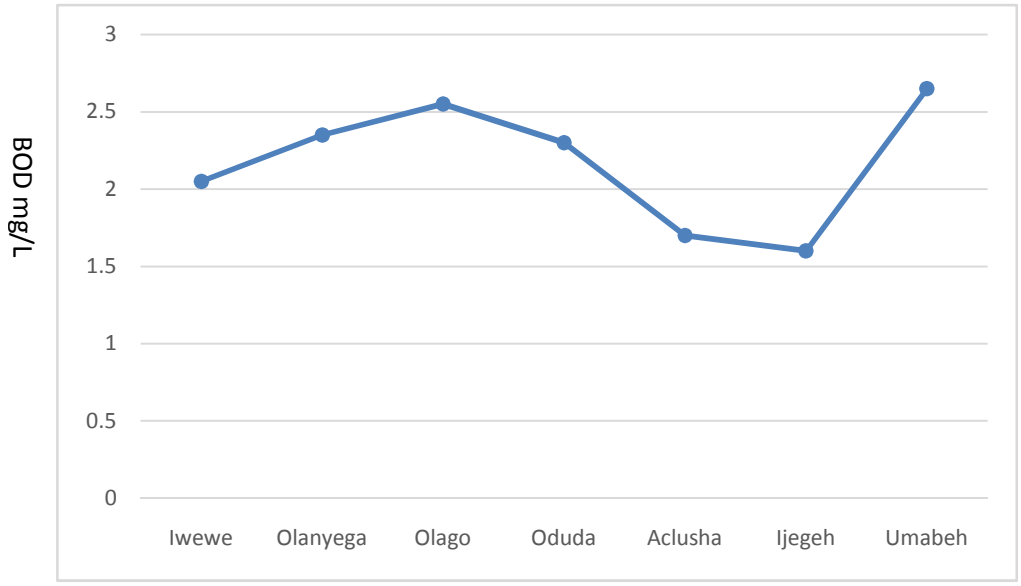


Fig.17 The graph of BOD showing the behaviour of the water samples for boreholes

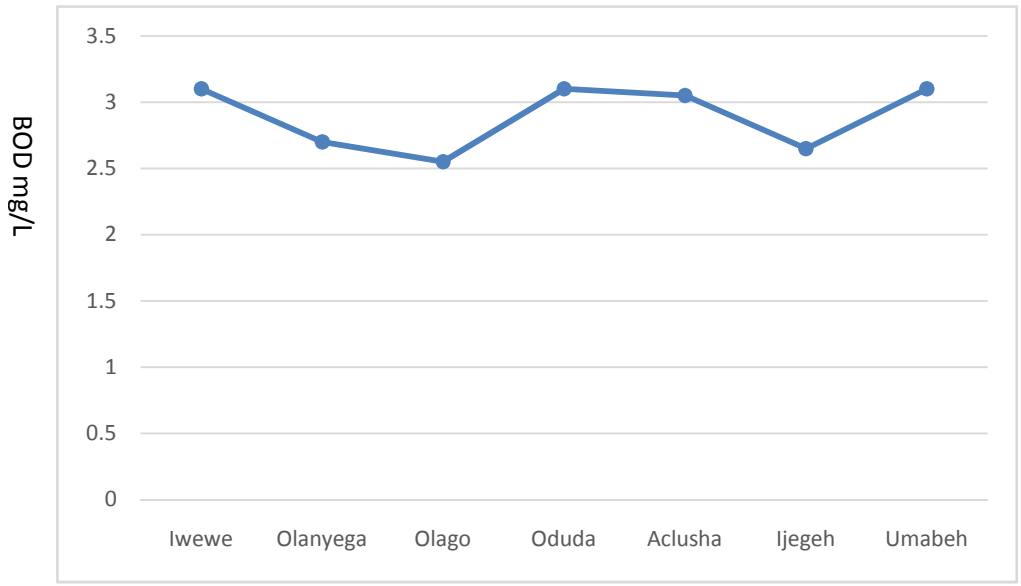


Fig.18 The graph of BOD showing the behaviour of water sample for streams

4. CONCLUSION

The importance of providing clean and reliable water in the state and the country are large and cannot be over emphasized. This project work considered the borehole (underground water) and stream (surface water) in Eboya community of Okpokwu Local Government Area to ascertain its portability for the people of the community.

Based on the investigation, it has been reviewed that the boreholes and stream water meets both the WHO and NAFDAC standards for water quality when compared. However, the odour and total coli form parameter of the water needed to be improved upon through treatment means such as (clarification, coagulation, sedimentation and filtration) followed by effective disinfection since the values were outside the permissible limits given by WHO and NAFDAC.

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