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Assessment of the Quality of Borehole Water Sample in Federal Housing Estate and Sites and Services Areas of Owerri, Imo State, Nigeria

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Abstract
Assessment of the quality of borehole water samples from Federal Housing Estate and Sites and Services areas of Owerri, Imo State, Nigeria was conducted to determine the suitability of these borehole water samples. Six samples of borehole water gotten from six different families living in these areas were analyzed for microbial, chemical and physicochemical parametersusing standard analytical method of National Agency for Food and Drug Administration and Control (NAFDAC). The result of microbial analysis revealed that all the water samples (samples D, E, F, G, H, and M) had total coliform count of 64.0cfu/100ml, 5.0cfu/100ml, 41.0cfu/100ml, 16.0cfu/100ml, 124.0cfu/100ml and 0.0cfu/100ml respectively. This showed that sample D, F, G, and H exceeded the standard of 10 coliform counts/100ml. The entire samples resulted at 0 counts for *Escherichia coli*. Samples D, F, G and M tested negative for *pseudomonas* test, whereas samples E and H did not. The chemical analysis showed that all the samples did not meet up with the recommended standard of pH (6.5-8.5).However, there was significant difference ($p<0.5$) between samples D and E. samples F and J were significantly the same, also as samples G and M. Sample M was the least significant while sample D was the most significant at pH 4.6 and 6.4 respectively. The temperatures were all significantly the same and did not exceed standard limit of 37^0C. The total dissolved solid also did not exceed the limit of 500ppm and the conductivity limit was not exceeded. All the samples did not exceed limits for zinc, copper, lead, magnesium, cadmium and iron which are 3mg/l, 1mg/l, 0.01mg/l, 0.02mg/l, 0.03mg/l and 0.3mg/l respectively except for calcium, where samples D, E, G and H were beyond standard of 0.4mg/l. All the samples were significantly different for each parameter except for lead of which the entire sample were all the same. The depth of the borehole in relation to the distance of septic tank, distance of neighbor's septic tank and distance of refuse dump as obtained from these families revealed that sample M had the highest distance and was the least contaminated, whereas sample H had the closest distance and the greatest microbial contamination. The depth of Sample G borehole was according to the regulatory standard of 150 ft., and from the analysis the entire parameters were within standard except for pH.
Keywords: Water, Standards, Microbial analysis, Total Dissolved Solid, Metals, Septic tank

1 Introduction

Water is a chemical substance with the formula H_2O (Evans *et al.*, 2004). Its molecules contain one oxygen and two hydrogen atoms connected by covalent bonds. Water covers 70.9% of the Earth surface and is vital for all known form of life. On Earth, it is found mostly in Oceans and other large water bodies (CIA, 2008). Research claims that Ocean holds 97% of surface water such as rivers lakes, ponds (Gleick, 1996). A very small percent of Earth's water is contained within biological bodies and manufactured products (Gleick, 1993). Water presently on earth moves through a cycle of evaporation, precipitation and runoff, usually reaching the sea(Gedney*et al.*, 2006) describedas evapotranspiration.To have safe drinking water is a human right and need for every man, woman and child. Having good water also is essential in breaking the cycle of poverty since it improves people's health, strength to work and ability to function, yet over 884 million people around the world live without safe drinking water (WHO, 2008).In urban and predominantly rural communities with over 85% of the population living below an average income, traditional drinking water sources such as open reservoirs, springs and open wells are still being used. Water from such sources seldom complies with WHO limits for drinking water. Borehole water has become the most used source of water dating back to ancient China (202BC- 220AD), the Han dynasty used deep boreholes, reaching as deep as 600m (2000ft) (Loewe, 1968). This borehole water fills the spaces between the rocks and soils making an aquifer (Driscoll, 1986). Ground water depth and quality varies from place to place and this affects the quality of water obtained. Also, the various kinds of rocks and soils which it moves through affect it too. Water moving through underground rocks and soils may pick up natural contaminants, even with no human activity or pollution in the area (Beltaos*et al.*, 2006). In addition to nature's influence, water is also polluted by human activities, such as defecation, dumping garbage, poor agricultural practices and chemical spills at industrial sites (Coe, 2001). Even though water may be clear, it does not necessarily mean that it is safe for drinking. It is very important to judge the safety of water with respect to its physical, chemical and bacteriological property. Over time, regions of Owerri enjoyed the municipal water supply that the government provided, including World Bank, Federal Housing areas and Sites and Services. As time passed, the distribution of municipal water supply seized and some areas like Federal Housing and Sites and Services were affected. With little or no municipal water supply, no rivers or nearby streams and the urgent need for safe water, indigenes of these localities faced the only source which is underground borehole water. As much as underground borehole water seemed to be a remedy, several factors affect its usage. Distance between the site of the borehole and septic/ suck away tank, distance between borehole and refuse dump unit, depth of the borehole and the distance between borehole and neighbor's septic tank are all factors to be solely considered prior to drilling borehole due to limited plot allocation.

However, according to WHO standard and guidelines, borehole water should be sunk 150ft below the ground level. It should be situated far and opposite from refuse disposal and sewage disposal unit. But in an area like Federal Housing and Sites and Services where houses are closely situated, these standards by default are not met. Additionally, the increasing rate of sinking of borehole in these areas could likely result into environmental hazard if not checked.

Hence, the necessity to check for the quality of borehole water in these regions is paramount, considering the rise of water borne diseases which is as a result of the alteration of some physiochemical and biological quality of the water.

This work covers the physical, chemical and microbiological composition of borehole water samples from Federal Housing areas and Sites and Services area of Owerri, on a notion to see to its compliance with WHO/UNICEF standard. The objectives of this study are

i. To collect water samples from six different households from Federal Housing and Sites and Services areas of Owerri and carry out microbiological analysis on these water samples as this is a major parameter for safe drinking water.
ii. To carry out physical/ chemical analysis on the water sample.
iii. To carry out heavy metals analysis on the sample, checking their composition. Metals like lead, calcium, magnesium, iron, cadbium, zinc and copper.
iv. Finally, to check if the results from the analysis comply with WHO standards for drinking water quality

1.1Significance of the Study

i. The study should provide information on the status of borehole water in Federal Housing and Sites and Services area of Owerri, Imo State.
ii. At the end of the study members of these communities would have full knowledge about their borehole water and measures of adequate treatment where necessary.
iii. As much as the study creates awareness to the members of the community, it also gives the government an insight on the quality of borehole water in the region and ways to regulate borehole sinking.

2 Materials and Methods

2.1 Area of Study

Borehole water from Federal housing and Sites and Services areas of Owerri, in Owerri North-West Local Government Area of Imo state were sampled because their only source of drinking water is borehole and they are well populated to fit into the scope of this study.

2.1.2 Sample Collection and Types of Samples

Six samples of water were collected from six different houses in these areas. They were obtained by pumping water fresh from the borehole through the tap, which was collected in sterilized labeled bottles.

Table 1: Showing the sampling point and location of borehole.

Sampling Point	Location of Borehole
Sites and Services	Church (Sample D) Eze's residence (Sample G) Uzo's residence (Sample H)
Federal Housing	Oke's residence (Sample M) Agba's residence (Sample F) Nwi's residence (Sample E)

2.2 Materials
Sampled bottled borehole water, autoclave, incubator, spatula, petri dish, pH meter, thermometer, conductivity meter, beaker, evaporating dish, desiccator, hot plate, measuring cylinder weighing balance, watch glass, microscope, atomic absorption spectrophotometer, culture media (Chromocult agar and Centrimide agar), masking tape, conical flask.

2.2.1 Sterilization of Materials
All the glass wares used for this experimental study which include beakers, measuring cylinders, petri-dishes, were sterilized in an autoclave at $121^{o}c$ for 15 minutes to avoid cross contamination of the samples.

2.2.2 Experimental Methods:
The testing of the borehole water samples consist of the following; Physicochemical, Chemical, Microbiological analysis. These analyses were carried out according to the procedures of National Agency for Food and Drug Administration Control (NAFDAC) inIsolo-Oshodi expressway, Lagos state and as described by AOAC (2005), Mustafa, (1988) andItah and Ekpombok, (2004).

2.2.3 Physicochemical Analysis of the Borehole Water Samples

2.2.3.1Determination of Temperature
The temperature was determined with a centigrade thermometer capable of reading from $0^{o}C$ to $110^{o}C$. The thermometer was dipped into the borehole water samples and the reading taken after equilibrium.

2.2.3.2. Determination of pH
The pH was determined with a pH meter equipped with a glass electrode. The pH meter was calibrated using standard buffers, buffer 4 and 7 and de-ionized water. The electrode was cleaned, dried and dipped into the different samples and the reading was recorded when the reading became stable. After the pH of the first sample was recorded, the electrode were re-washed with distilled water before dipped into subsequent samples until all the samples was tested.

2.2.3.3Conductivity
The conductivity was determined with a conductivity meter which was calibrated using conductivity solution at $25^{o}C$. 50ml of each of the borehole water samples were poured inside different beakers then the meter was switched on and inserted into the beakers containing the borehole water samples. The conductivity value was recorded when the reading was stable.

2.2.3.4Total Dissolved Solids
A clean platinum evaporating dish was placed in an oven set at $100^{o}C$ for one hour. Then it was placed in a desiccator to cool and it was weighed. It was then transferred into a hot plate; thoroughly mixed with $100cm^3$and was transferred by a means of measuring cylinder. The cylinder was rinsed several times with distilled water to make sure that all suspended matter was transferred to the dish. After the sample was evaporated the dish and the residue were dried in an oven set at $103^{o}C$ for one hour, cooled in the desiccator and then reweighed.

2.2.4Chemical Analysis of the Borehole Water Samples
These were done using NAFDAC procedure which is also described by Adeyeye (1994) and it was done in triplicate.

2.2.4.1Determination of Metals:
The metals determined include**;** zinc, copper, calcium, magnesium, cadmium, iron and lead using atomic adsorption spectroscopy.The procedure was carried out as follows:

2.2.4.2Pretreatment of sample for the determination of Zn, Cu, Ca, mg, Cd, Fe andPb.
One hundred centimeter cube ($100cm^3$) of the thoroughly mixed sample was transferred into a beaker and $5.0cm^3$ of concentrated nitric acid was added to it. The beaker was placed on hot plate and evaporated to near dryness making sure that the sample did not boil. The beaker containing the residue was cooled and another $5.0cm^3$ concentrated HNO_3 added. It was covered with a watch glass and returned to the hot plate and heated until a gentle refluxing occurred. Heating was continued with additional conc. HNO_3 as necessary until digestion was completed as signaled by a light coloured residue. Two ($2.0cm^3$) of conc.HNO_3 was added and the beaker warmed slightly to dissolve the residue. The walls of the beaker and the watch glass were washed with deionized distilled water and the resultant solution filtered to remove silicate and other insoluble materials that clogged the atomizer before making up the volume to $50cm^3$.

2.2.4.3 Preparation of standard curve and determination of concentration of the different metals:
All the stock solution prepared were equivalent to 1g metal in $1dm^3$ solution giving $1000mg/dm^3$ concentration. From these standard solutions equivalent to 5, 10, and $15mg/dm^3$ of the metals under determination were prepared. Each set of the standard solution was fed into the computerized spectrophotometer which calibrates itself internally. After feeding, the sample was aspirated into the oxidizing air- acetylene flame and a direct reading of the metals' concentration was obtained at the metal's absorbance wavelength which is as follows:
Zn-213.9nm,Cu – 324.8nm, Ca – 423nm, Mg – 285.2nm, Fe – 508nm, Cd – 228.8nm and Pb – 217nm.

2.2.5 Microbiological Analysis of the Borehole Water Samples
NAFDAC procedure was used as described by Itah and Ekpombok, (2004) and the analysis was done in

triplicate. Plate count method was used for the analysis This method relied on micro-organism growing a colony on a nutrient medium so that the colony becomes visible to the naked eyes and the number of colonies on the plate can be counted. Cultured plates with about 30 to 300 colonies were used for enumeration. Samples were cultured on a nutrient media in a petri dish that is sealed and incubated. Typical one set of plates is incubated 22^{o}c for 24hrs and second plate at 37^{o}c for 24hrs. The composition of the nutrient media contained reagents that resist the growth of non – target organisms and made the target organism easily identified often by a color change in the medium. At the end of the incubation period the colonies were counted by microscope for accurate counting. The nutrient agar used and the respective color change for each of the micro-organisms includes: Chromocult agar used for coliform with a color change of pink, Chromocult agar used for *E. coli* and color change blue and centrimide agar was used for *Pseudomonas auregenus* with a color change of green.

2.2.6 Statistical Analysis

Data obtained were subjected to Analysis Of Variance (ANOVA) and the least significant difference (LSD) was used to separate their means.

3 Results and Discussion

3.1 Physicochemical Parameters

The results of the physicochemical analysis carried out on the different samples of water are shown in Table 2. From the analyses of pH, all the samples fell within pH 4.62- 6.41 with sample M and G tending towards acidity at pH 4.62 and 4.85 respectively. Sample E, F, H fell at pH 5.79, 5.37 and 5.25 respectively and sample D at 6.41 which is the closest to the pH 7.0 i.e. neutral. Even though pH has no direct effect on human health, its indirect action on physiological process cannot be over emphasized (Adenkunle*et al*., 2004; NSDWQ, 2007).From the table, the pH of the samples shows that sample D and E weresignificantly different ($p < 0.5$). Sample D was the most significant and it tended towards the regulatory standard of 7.0. Sample F and H were significantly the same and sample G and M were also significantly the same.The table also revealed that sample M had the least significance to the standard and it had the highest tendency towards acidity.The temperature of all the water samples was within the range of 26^{0}c -27^{0}c. This result shows that the water is safe for drinking, with respect to the temperature, as it did not exceed WHO limit of 37^{0}C. From table 2, all the temperatures of the samples were significantly the same. They all were in line with the standard of 0-37^{0}C. According to Nigerian Standard for Drinking Water Quality, the temperature of drinking water should not exceed ambient temperature. Table 2 shows that the total dissolved solid (TDS) was lowest at 12ppm in sample H and highest in sample M at 37ppm, not exceeding NAFDAC standard of 500ppm.

The TDS is the term used to describe the inorganic matter present in solution or water. The principal constituents are usually calcium, magnesium, sodium and potassium cation, carbonate, hydrogen carbonate, chloride and nitrate anion (WHO, 1996). The presence of TDS in water may affect the taste. It has been reported that drinking water with extremely low concentration of TDS may be unacceptable because of its flat insipid taste (WHO, 1996). The turbidity of all the water samples used in this study is in agreement with both WHO and NSDWQ standard. Water turbidity is very important because high turbidityis often associated with higher level of disease causing microorganism, such as bacteria and other parasites (Shittu*et al.,* 2008).Also from Table 2, the total dissolved solid showed a significant difference ($p <0.5$)among the samples. Samples E, F and G were significantly the same and sample G and H were significantly the same. Sample H had the least total dissolved solid and sample M had the highest.

From the conductivity test carried out,the table revealed that the entire samples fell within the range of 6.9- 30.9 uS/cm. samples E F and G were significantly the same and samples D, E and M were significantly different. Sample M had the highest conductivity (30.9uS/cm) and sample E had the least conductivity (6.9uS/cm).

3.2 Chemical Parameters

3.2.1 Heavy Metals

Results of heavy metals analysis carried out showed that sample E had the lowest zinc content at a concentration of -0.0465mg/l and sample H had the highest at -0.0914mg/l but did not exceed WHO limit of 3mg/l. From Table 3, there was significant difference among all the samples for zinc, although they do not pose any health effect. Lead concentration did not exceed WHO limit of 0.01mg/l, with sample H,at -0.4514mg/l being the lowest and sample E highest at -0.3102mg/l. From the table, it is conspicuous that all the samples were significantly the same. High level of lead in the body can cause death or permanent damage to the central nervous system, the brain and kidney (Jennings *et al.,* 1996). All samples did not exceed the standard for copper (2mg/l) but the entire samples were significantly different. Sample G had the highest significance at -0.0718mg/l, while sample M had the lowest significance at -0.1348. None of the samples exceeded limits for magnesium and calcium with a standard of 1 and 5mg/l respectively. From table 3, sample D, E F, G, H and M were all significantly different for calcium analysis ($p<0.5$). Sample D was the most significant (2.6444) and sample M was the least significant (0.0983). From this result, there will be little or no hardness of the water as a result of low calcium content. All samples were significantly different for magnesium analysis ($p<0.5$). From table 3, sample M had the highest significance (-0.1531mg/l) whereas sample D had the least significance (-0.3868mg/l). Magnesium also contributes to water hardness but with these results, there will be no hardness. Cadmium limit of 0.03mg/l was also not exceeded with sample H and Msignificantly the same and highest at -0.0476mg/l and sample G lowest at 0.0219mg/l. From the table, there will be little or no hardness of the water as a result of low calcium content, results of the sample did not exceed calcium limit of 5mg/L. All samples were significantly different for magnesium analysis. They did not exceed the permissible standard of 0.2mg/l. Sample M had the highest significance whereas sample D had the least significance. All the samples were significantly different for cadmium analysis except sample H and M which were significantly the same; they all did not exceed the standard limit of 0.03mg/l. All samples for iron analysis did not exceed the permissible standard of 0.3mg/l. they were all significantly the same.Results for iron analysis showed that the entire samples were significantly different ($p< 0.5$). Sample G had the highest significance (-0.124mg/l) while sample M had the least significance (-0.4102mg/l). Iron is essential in the body as it helps in blood circulation, it does not pose any health effect except it is excessive in the body.

3.3 Microbiological Examination

The result of the microbiological quality of the borehole water samples shown in table 4revealed that the coliform count ranged from 0-124cfu/100ml. Samples E and M fell at 0 and 5 respectively which is not beyond the standard of 10 coliform count/100 ml of sample. Samples D, F, G and H were above NAFDAC standard hence did not conform to standard. High total coliform counts vividly indicate that the water from samples D, F, G and H boreholes arefaecally contaminated.

Table 2: Ranked means and standard deviation of the physicochemical parameters

Samples	pH	Temperature (^{0}C)	TotalDissolved solid (ppm)	Conductivity (uS/cm)
D	6.4±0.1528^{a}	27±1.000^{a}	30±3.000^{b}	13±1.000^{b}
E	5.8±0.1000^{b}	26±1.155^{a}	16±2.000^{c}	9.7±0.200^{c}
F	5.4±0.2000^{c}	27±0.000^{a}	15±1.000^{c}	9.8±0.200^{c}
G	4.9±0.2000^{d}	27±1.000^{a}	16±2.000^{cd}	10.1±0.400^{c}
H	5.3±0.2517^{c}	26±0.000^{a}	12±1.000^{d}	6.9±0.200^{d}
M	4.6±0.1000^{d}	27±2.000^{a}	37±2.000^{a}	30.4±0.110^{a}

Table 3Showing the mean and standard deviation of the heavy metals analysis

Samples	Zinc(mg/l)	Copper(mg/l)	Lead(mg/l)	Calcium(mg/l)	Magnesium(mg/l)	Cadmium(mg/l)	Iron (mg/l)
D	-0.0902±0.0002^{e}	-0.0912±0.0002^{c}	-0.5302±0.0002^{a}	2.6444±0.0002^{a}	-0.3868±0.0001^{f}	-0.041±0.0001^{c}	-0.184±0.001^{b}
E	-0.0465±0.0001^{a}	-0.0959±0.0001^{d}	-0.2058±0.7125^{a}	1.01710±0.0001^{d}	-0.2815±0.0001^{c}	-0.0391±0.0001^{b}	-0.2668±0.00003^{e}
F	0.0855±0.0003^{d}	-0.1299±0.0001^{e}	-0.4954±0.0001^{a}	0.10950±0.0002^{e}	-0.1642±0.0001^{b}	-0.0419±0.0002^{d}	-0.236±0.0002^{d}
G	0.0819±0.0003^{b}	-0.0718±0.0002^{a}	-0.4825±0.0003^{a}	1.98520±0.0002^{c}	-0.2912±0.0001^{d}	-0.0219±0.0002^{a}	-0.124+0.0002^{a}
H	0.0914±0.0003^{f}	-0.0865±0.0001^{b}	-0.4814±0.0003^{a}	2.5821±0.0001^{b}	-0.3617±0.0001^{e}	-0.0476±0.0001^{e}	-0.2149±0.0001^{c}
M	0.0845±0.0028^{c}	-0.1348±0.0001^{f}	-0.5138±0.5324^{a}	0.0983±0.0001^{f}	-0.1531±0.0001^{a}	-0.0476±0.0001^{e}	-0.3102±0.0002^{f}

Table 4: Microbiological Quality of the Borehole Water Samples

Sample	Coliform (cfu/100ml)	Escherichia. Coli(cfu/100ml)	Pseudomonas aerogenus(cfu/100ml)
D	64	0	-ve
E	5	0	+ve
F	41	0	-ve
G	16	0	-ve
H	124	0	+ve
M	0	0	-ve

This finding is not surprising considering the high population and close proximity of these boreholes to septic tanks. The sewage could seep slowly into underground water, thereby polluting it. Also, long term usage of boreholes may lead to deterioration of the water quality, because the pipeline may become corroded with random cracks and in most cases clogged with sediment (Onemano and Otun, 2008). This will allow the passage of inorganic metals and bacteria.

The implication of this finding is the possibility of the presence of pathogens that may cause acute intestinal illnesses, which are generally considered discomfort to health and could become fatal for some susceptible groups (such as infants, elderly and those who are sick) (Addo*et al.,* 2009; Olowe*et al.,* 2005; NSDWQ, 2007). In addition to human and animal waste contamination, parasitic organism such as *Giardia* and *Cryptosporidium* may be present (EPA, 2003; Shittu*et al.,* 2008). Generally, underground water is often considered as the purest form of water (Shittu*et al.,* 2008), although it's vulnerability to contamination could be due to improper construction, animal waste, proximity to toilet facilities, sewage, refuse dump site and various human activities surrounding it (Bilton, 1994; Shittu*et al.,* 2008). However, no *E. coli* were detected in all the water samples, which indicate that all the water samples are free from recent faecal contamination. The ability to detect faecal contamination in drinking water is necessary, as pathogenic microorganisms from human and animal faeces in drinking water pose the greatest danger to public health. The E. coli test carried out revealed that all the samples had a total of 0 counts at the end of the third day. This shows that the borehole water samples do not contain any fecal contamination. Pseudomonas aerogenus analysis carried out tested positive for samples E and H. This microbial analysis revealed that sample H had the highest form of contamination, as it tested positive for pseudomonas test and had the highest count of coliform.

3.4 The Correlation of the Distance between the Borehole, Septic Tank and Refuse Dump Unit

The correlation of the questions generated from the questionnaire was shown in Figure 1. From the histogram, it is clear and can be derived that sample H had the closest distance from borehole to septic tank and borehole to refuse dump unit. This was made obvious in the result as sample H had the highest coliform count of 124cfu/100ml. High total coliform counts vividly indicate that the water from the wash boreholes is faecally contaminated. Water from this environment must be treated before drinking. Also, the graph revealed sample I had the farthest distance of borehole from neighbor's septic tank and refuse dump unit and it was proven with a total coliform count of 0cfu/100ml.

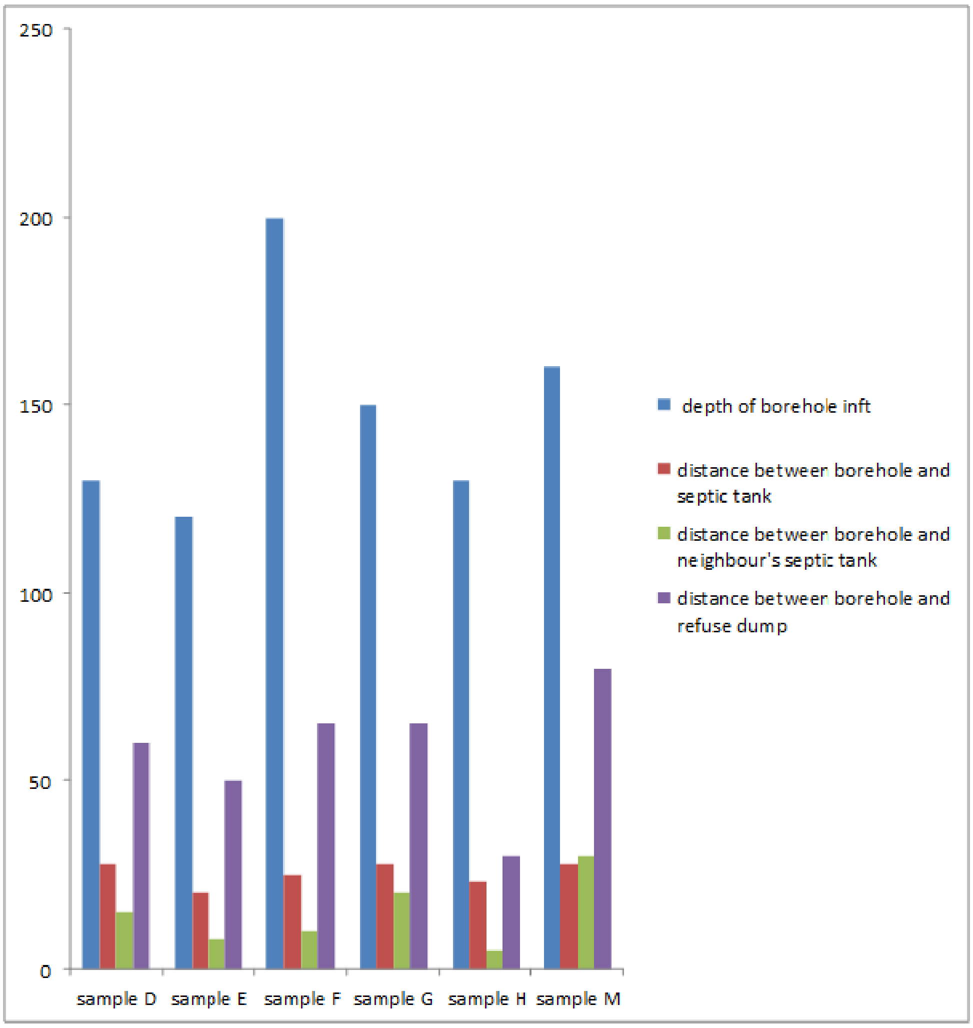

Figure 1 showing depth and distances derived from Questionnaire.

All samples labeled are according to Table 1

This statistically proves that all these factors affect the drinking water quality so they should be adequately monitored before drilling of borehole.

3.5 Comparison of Results of Physicochemical Parameters

Results of the pH, temperature, total dissolved solids (TDS) and conductivity were shown in Figure 2. Sample M had the highest conductivity and TDS. Sample D had the highest pH and the temperature of the entire sample ranged from 26- 27^0C. The physicochemical parameters do not have any direct effect on the water samples but are very necessary to fall within standard.The depth of the borehole of water sample Dis at 130 feet (figure 1) and the same sample has the most significant pH (6.4) tending towards neutrality. Sample G is the only borehole that was sunk at the standard depth of 150 feet and from the result, the temperature was appropriate, the TDS was not beyond standard, the conductivity also fell within the range but the pH was acidic (4.9). The acidity of this pH could be due to the topographical/geological status of the region or from the depth of the borehole, indirectly opposing the standard of 150 feet.

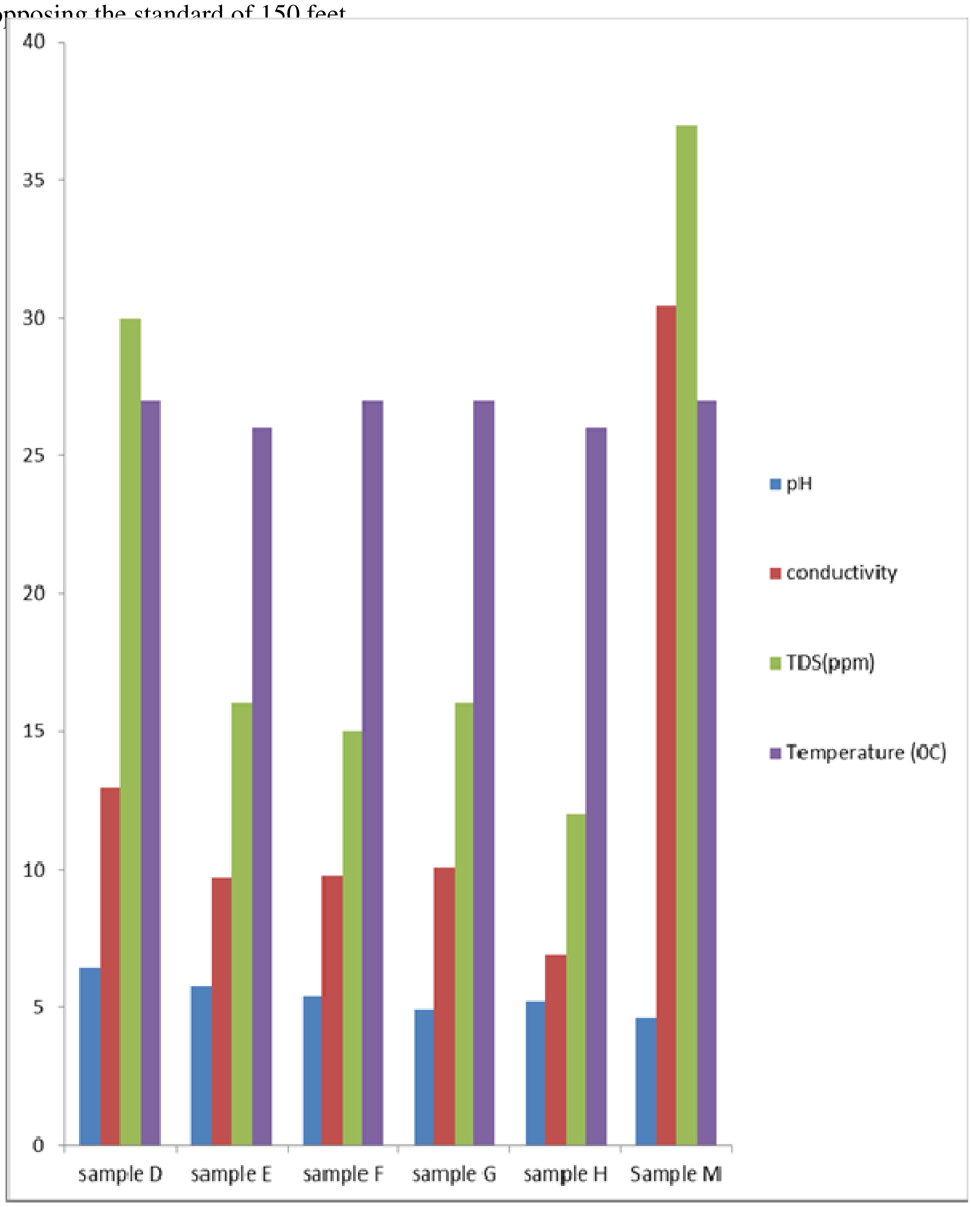

Figure 2 showing the pH, conductivity, TDS and temperature.
All samples labeled are according to Table 1

4 Conclusion and Recommendation

4.1 Conclusion

The principal aim of monitoring drinking water is to prevent the spread of water borne diseases and to protect the health of the community. The importance of access to good quality water cannot be overemphasized. Increase in population in Federal Housing Area and Sites and Services Area of Owerri coupled with the rise in human activity pose a great pressure on provision of safe drinking water. However, the aim of the study was achieved. Therefore, there is an urgent need for awareness to be created about the present situation of these boreholes, to enlighten the people on the necessity for further treatment of this water where necessary before they can be used for drinking and domestic purposes.

4.2 Recommendation

As much as food is ensured to be consumed wholesome, so is the need for good water consumption. Therefore to reduce contamination in drinking water, a comprehensive laboratory test should be carried out. This can be enforced and supported by the government and on the other hand indirectly reduce inordinate drilling of boreholes. Also borehole water samples that do not meet the standard should be treated before consumption. Moreover, seminars and talk forum can be held on the necessity of consumption of potable water, as held by Nestle periodically in Lagos. This would help to insight inhabitants on the importance of potable water and its adequate quality.

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