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Appraisal Of Drinking Water Quality In Ijebu-Jesa, Oriade Local Government, Osun –State, Nigeria.

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ABSTRACT: *The study determined thephysico –chemical parameters of water sources in Ijebu-Jesa, Oriade Local Government in Osun state and compared the result with WHO and NIS(Nigeria Industrial Standard) for potability purpose. Eight water samples were obtained from the different drinking water sources; one river, one spring, 3boreholes and 3shallow wells. The sites were selected based on factors such as distance of sources from individual homes, frequency of usage, frequency of supply and authority in charge of the source. The physico-chemical parameters were determined using standards methods (APHA, 1989). Generally, the results compared favorably with WHO (2006) and NIS(Nigerian Industrial Standard) (2007). Exception to this are nitrates with values as high as 52.8mg/L and 78.2mg/L. Trace metals; (As, and Zn) were found to be within the WHO acceptable limits for drinking water while Fe concentrations in some wells exceeded the limits of WHO (0.3mg/L) in some of the samples.Microbiological analysis revealed a high population of E.coli ranging from > $1.2X10^{3}$ to $2.4 X 10^{2}$in the water samples and this is an indication of pollution. It is recommended that proper monitoring coupled with periodical assessment of the water quality of the area should be carried out.*

Key words :*Waterquality, drinking water, ijebu-Jesa.*

I. INTRODUCTION

Water is essential to maintain and sustain human life, animal and plant (Patil and Patil, 2010). The availability of good water is an indispensable feature for preventing disease and improving quality of life (Oluduro and Aderiye, 2007). Report indicated that water borne diseases killed more than six million children every year arising from lack of access to save drinking water. Various researchers have reported on the serious and severe illness like typhoid fever, cholera and dysentery as being caused by the use of contaminated water (Talabi and Ogundana,2014) Once water is available at home through a yard or house taps, hygiene and maintenance of water become easier. Major improvement in household health usually accompany the use of piped water at home. Extensive research in rural areas found that people satisfy their basic need for water if the water source can be reached in a round trip for 30mins or less (WHO/UNICEF, 2004). When it takes more than 30 mins to get to the water source and back, people typically haul less water than they need to meet their basic requirements. Also water of poorphysico-chemical quality may have adverse health effect causing unavoidable economic and human losses (Mather, 1984).Water is generally obtained from two principal natural sources which are surface water such as fresh waterlakes, rivers, streams and groundwater such as boreholes(McMurry and Fay,2004).Groundwater is the major source of drinking water in the world because of its availability and constant quality.Studies have shown that majority of the populations in developing countries are not adequately supplied with potable water and are most times compelled to use water from sources like shallow wells and boreholes without treatment that render the water unsafe for domestic purposes due to high possibilities of contaminations (WHO,2006 and 2011).Most towns and villages in Osun State are not supplied with piped treated water and so a larger percentage concentrates on untreated groundwater and unsafe surface water. The case is even worse in villages with low level of education and low standard of living. Many of the residents might be at risk of water borne or water related diseases and this becomes bad when there is no record or any awareness.

II. METHODOLOGY

Study Area

The study area is Ijebu-Jesa and it isthe capital of Oride local Government area in Osun State, Nigeria. The map of study area is presented in Figure 1. It lieswithin the rain forest and recorded a population of 23,804 from 2006 population.

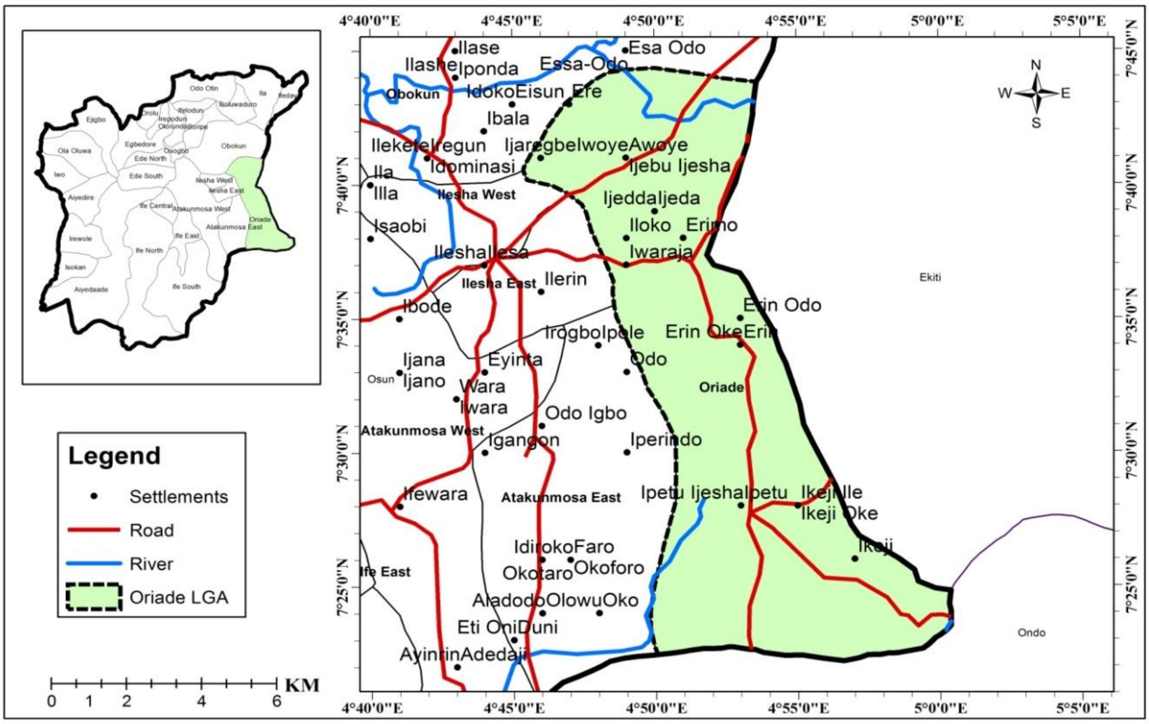

Figure 1: Map of Osun State and Oriade Local Government

Sampling sites.

Reconnaissance survey was carried out to identify the different drinking water sources in the study area. Water samples for analysis were collected from 3boreholes, 3 wells 1 spring and 1 river. The selection of the sites was based on frequency of usage, nearness to the community and authorities in charge. A potable hand-held Global positioning System (GPS) device was used to take location points.

Collection of water samples

The sampling was done 2 times in two seasons (rainy and dry). Prior to sampling, all the plastic bottles were washed with detergents and soaked in nitric acid for 2 days. They were rinsed with distilled water and were rinsed with water samples three times before final sampling on the site. Samples from the spring and stream were taken at different depths and points along the course. Samples taken were mixed and analysed as composite samples. Water samples from dug wells were taken with resident's water drawal pails. Water samples from boreholes were taken from the different stand pipes attached to the source. Parameters analysed are temperature, pH, Electrical conductivity(EC), nitrate, chloride, sulphate, turbidity, color, and alkalinity. The physical parameters were analysed using hand-held pH meter while the chemical parameters were analysed accordingto standards methods (APHA, 1999). Trace metals; Zn, Fe and As were analysed using Atomic Adsorption Spectrophotometers.A microbiological analysis was done using Most Probable Number (MPN) of counting coliforms. The results obtained were compared with WHO and NIS permissible limits of drinking water.

III. RESULT AND DISCUSSION

Thelocation points of the sample site is presented in Table 1 and the results of range of concentration levels of parameters are presented in Table 2.

Table 1.Sample location, coordinates and physical characteristics.

S/N	Source	Location	Naming	Coordinates	Physical Status
1	Well	Behind St.Peters' Anglican .church,Iloko road.	Sample A	7.676^{0}N 4.817^{0}E	Circular shaped ringed well of 1.2m diameter
2	Well	Oke-inisha	Sample B	7.679^{0}N 4.818^{0}E	Circular shaped rendered well of 7.5m deep
3	Well	Motor park along Ilesha road	Sample C	7.683^{0}N 4.809^{0}E	Circular shaped Ringed well 8.4m deep
4	Borehole	Ode Eruru	Sample D	7.684^{0}N 4.819^{0}E	Motorized pump is used
5	Borehole	OkePaadi	Sample E	7.689^{0}N 4.821^{0}E	Motorized pump is used
6	Borehole	EsaOdoroad	Sample F	7.692^{0}N 4.805^{0}E	Motorized pump is used
7	River	Ofefe river, along Iloko road	Sample G	7.668^{0}N 4.819^{0}E	Dirty water with and oily surface
8	Spring	Abojaspring behind Anglican church Iloko road.	Sample H	7.672^{0}N 4.817^{0}E	Clear and clean water for drinking

Table 2. Range of concentration levels of physico-chemical parameters

S/N	PARAMETERS	UNITS	SAMPLES							
			A	B	C	D	E	F	G	H
1	Colour	^{0}H	-	-	62	-	-	-	82	-
2	Turbidity	NTU	4	3	14	2	2	1	17	2
3	Temperature	^{0}C	25-27	25-28	25-28	25-27	25-28	25-27	25-26	25-28
4	EC	µS/cm	0.0591-0.0681	0.788-0.798	0.600-0.623	0.801-0.865	0.890-0.149	0.711-0.759	0.120 -0.125	0.132-0.139
5	pH		6.5-6.8	6.5-6.8	6.9-7.1	6.9-7.2	7.5-8.3	7.0-7.7	8.2-8.4	6.1-6.4
6	Chloride	Mg/L	48.0-53.0	28.0-25.0	21.0-29.0	10.0-16.0	15.0-17.0	10.0-18.0	28.0-34.0	50.0-56.0
7	Alkalinity	Mg/L	12.0-15.0	66.0-75.0	68.0-70.0	58.0-65.0	66.0-70.0	79.0-80.0	8.0-10.0	19.0-20.0
8	Sulphate	Mg/L	8.9-9.0	61.0-63.0	4.0-6.0	8.0-11.0	7.0-11.0	6.9-7.0	2.5-4.0	12.0-14.0
9	Nitrate	Mg/L	32.1-44.0	51.7-78.2	20.2-26.4	44.3-52.8	3.4-4.4	3.0-4.4	10.0-17.6	18.0-26.4
10	As	Mg/L	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

11	Zn	Mg/L	0.10-0.11	0.10-0.13	0.01-0.05	0.20-0.34	0.10-0.11	0.20-0.26	0.01-0.03	0.02-0.04
12	Fe	Mg/L	0.00-0.31	0.00-0.02	0.00-0.01	0.00-0.01	0.00-0.02	0.00-0.02	0.40-0.44	0.02-0.40

IV. Physical parameters

All the samples have colour values below WHO standards with the exception of samples C and G. Sample G is a river and on-site inspection revealed a dirty and oily surface in both raining and dry season. The topography of the site is sloppy and prone to runoff from all activities of residents from the town.

Temperature at which samples are collected and at which physico-chemical measurements are made is important for data correlation and interpretation purposes (Ogunfowokan*et al.*, 2007). On-spot temperature readings are 25^0 for wet season and 26^0- 28^0 for dry season. The minimum values were recorded for sample G in both rainy and dry season. The values obtained in all the samples were higher than the WHO (2006) standard of 25^0. There are no known health impact with temperatures higher than 25^0 however, high water temperature enhances the growth of micro-organisms and may increases problems related to taste, odour, color and corrosion (WHO, 2011).

Turbidity is described as the measure of amount of particulate matter suspended in water. Most of the samples do not exceed the desired limit of 5NTU given by the WHO except for samples C and G. When small particles are suspended in water, they tend to scatter and absorb light rays. This gives the water a murky or turbid appearance and this effect is called turbidity. Clay silt, tiny fragments of organic matter and microscopic organisms are some of the substances that cause turbidity. They occur in water naturally or because of human activities and pollution. Turbidity is very important in drinking water quality. Because suspended particles can provide hiding place for harmful microorganism and there by shielding them from disinfection process in a water treatment plant. Because of this shielding effect, the microbes can be consumed by people who drink the water and spread of diseases may result. It is also unacceptable for aesthetic reasons (Nathanson,2000).

Conductivity, or specific conductance, is a measure of the ability of water to conduct anelectric current. It is sensitive to variations in dissolved solids, mostlymineral salts. The degrees to which these dissociate into ions, the amount of electrical charge on each ion, ion mobility and the temperature of the solution all have an influenceon conductivity. Electrical conductivity of a water body is related to its concentration of dissolved mineral salt (Department of Environment, 1972), and it is affected by the total concentration of ions and by other factors such as the mobility of the individual ions (Egborge, 1994). It is a useful indicator of the extent of mineralization in a water sample. The effect of high EC may include disturbances of salt and water balance and high salt concentration in water and effluent sample .some of the adverse ecological high salt concentration include heart problem, high blood pressure and a renal disease. Results obtained for all water samples are in the range of 0.0623µS/cm and 0.798µS/cm. Generally the values are low and agree well with WHO and NIS(2007) of 1000µS/cm permissible limit.

The pH indicates the acidity or alkalinity of a substance from 1.0 to 14. Acidity increases as the pH gets lower. The values of the pH ranged from about neutral to slightly alkaline (6.8-8.4). the pH values of all water sources fall within the acceptable limit of 6.5-8.5 set by NIS (2007) and 6-9 set by WHO(2006). Thus the water from all the sources is suitablefor domestic, agricultural and recreational uses.

Chloride usually occurs as NaCl, $CaCl_2$ and MgCl in widely varying concentration in all natural waters. Chloride levels for all the water samples fall within the permissible limit of NIS (2007) of 250mg/L.

The alkalinity of water is its capacity to neutralize acid. The amount of a strong acid neededto neutralize the alkalinity is called the total alkalinity, (T) and is reported in mg/L as $CaCO_3$.The alkalinity of some waters is due only to the bicarbonates of calcium and magnesium. ThepH of such water does not exceed 8.3 and its total alkalinity is practically identical with its bicarbonate alkalinity.Water having a pH above 8.3 contains carbonates and possibly hydroxides in addition to bicarbonates (Batram and Ballace, 1996).The maximum value of alkalinity in the water sample is 80mg/L for sample F and the minimum is 10mg/L for sample G. Generally, the values are below WHO permissible limit of 200 to 600mg/l for drinking water.

Sulphateconcentrations in natural waters are usually between 2 and 80 mg/L, although they may exceed 1,000 mg/L near industrial discharges or in arid regions wheresulphate minerals, such as gypsum, are present. High concentrations (> 400 mg/L) maymake water unpleasant to drink. Commonly present in brine water and in some industrial wastes, large amounts have a laxative effect on some people and, in combination with other ions, give a bitter taste. Sulfate in water containing calcium forms a hard scale in steam boilers. The highest value of sulphate was found in sample B with 63mg/L and the minimum value was recorded in sample G with 4.0mg/L. These values are far below the recommended values of NIS (2007) making the water suitable for drinking if all other parameters are within limits.

The values of nitrates of 78.2mg/L and 52.8mg/L in samples B and D respectively are higher than the highest permissible limit of NIS (2007) of 50mg/L. High concentrations of nitrate in drinking watermay present a risk to bottle-fed babies under three months of age because the low acidity oftheir stomachs favours the reduction of nitrates to nitrites by microbial action. Nitrite is readilyabsorbed into the blood where it combines irreversibly with haemoglobin to formmethaemoglobin, which is ineffective as an oxygen carrier in the blood. In severe cases, acondition known as infantile methaemoglobinaemia may occur which can be fatal for youngbabies (Batram and Balance, 1996).In amounts less than 5mg/L, nitrate has no effect on the value of water for ordinary uses.The sources of high concentrations of nitrate are mostly anthropogenic, particularly indiscriminate waste disposal and agricultural practices (Anilkumar et al., 2015). In order to delineate the possible origin of groundwater nitrate, Madison and Brunett (1984) presents a concentration criteria for determining if nitrate (as an equivalent of nitrogen e.g NO_3-N) originates from natural or potentially anthropogenic sources using nitrate levels of less than 0.2 mg/L to represent natural or background level. Concentrations ranging from 0.21 to 3.0 mg/L are considered to represent a transition between natural and human influences and between 3.1 and 10.0 mg/L are interpreted to indicate possible human influences, such as agricultural runoff or seepage from septic tanks

The value of As is 0.0mg/l in all the water samples while the values of Zinc falls below the NIS (2007). Drinking arsenic-rich drinking water over a long period result in various health effects including skin problems (such as color changes on the skin and hard patches on the palm and soles of feet). Skin cancer, cancer of the bladder, kidney and lung, diseases of the blood vessels of the legs and feet, and possibly also diabetes, high blood pressure and reproductive disorders. Arsenic in drinking water is an established cause of lung, bladder, and skin cancers in adults and may also cause kidney and liver cancer.

The value of Zn deficiency symptoms include nausea, dizziness, gastric ulcers, lethargy, muscle pain, impairment of immune function, headaches, vomiting, dehydration, stomach aches, poor muscle coordination, fatigue, fever, depression, malaise, cough, possible renal failure and increased blood level of insulin-like growth factor and testosterone, both of which are related to prostate cancer (Michael and Stanford, 2003).

The values of Fe in samples A,G and H are 0.31mg/L ,0.44mg/L and 0.40mg/L respectively. Fe is a metal that occur naturally in soils and rocks. In aquifer, groundwater comes in contact with these solid materials dissolving them, releasing their constituents including Fe and Mn to the water. At concentration approaching 0.3mg/L, the waters usefulness may become seriously impaired, e.g there may be a metallic taste to the water and staining of plumbing fixtures may become common. At these concentration however, the health risk of dissolved Fe and Mn in drinking water is insignificant. Daily iron intake of 10mg for adult men and 15mg for adult women is adequate for growth(heamoglobin formation) and body metabolic processes (Languon, 2002).

V. Microbiological analysis.

The result of the microbiological analysis is presented in Table 3. The presence of *E.coli*should be zero from drinking water for the water to be safe. The presence of *E.coli*represent a more serious contamination issue than coliform bacteria since it is can only originate from human or animal waste. A total 37.5% of the water sources have *E.coli* while the remaining sources are free of the bacteria. Sources of total and fecal coliform in groundwater can include agricultural runoff, effluent from septic systems or sewage discharges and infiltration of domestic or wild animal fecal matter. Poor well maintenance and construction (particularly shallow dug wells) can also increase the risk of bacteria and other harmful organisms getting into a well water supply (WSIS, 2007).

Table 3.Result of the Microbiological Analysis

SAMPLES	COLIFORM TESTS		
	Coli MPN Presumptive(cell/100ml)	Confirmatory	Completed
A	15.0	ECNP	NA
B	$>1.1\times10^3$	ECP	++
C	4.0	ECNP	NA
D	10.0	ECNP	NA
E	2.4×10^2	ECP	+
F	10.0	ECNP	NA
G	1.1×10^3	ECP	++
H	43.0	ECNP	NA

LEGEND

MNP = Most Probable Number : ECNP = Escherichia Coli not present

ECP = Escherichia Coli present :+ = Positive tube at 37^0c only

++ = positive tube at 37^0c and 44^0c: NA = not applicable

VI. CONCLUSION

The result obtained provided information on the potability status of water in Ijebu-jesa. Generally the water is safe for drinking with treatment except for the nitrates levels that calls for concern. Since the high levels are detected in a well and a borehole, it can be prevented through proper maintenance of the facilities. Most times nitrates levels become elevated in groundwater due to agricultural practices. There should be a combination of educational programs so that residents will become aware of water quality issues and proper management of wells.

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