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Bacteriological Analysis of Water, From Multiple Sources in Omupo, Kwara State

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Abstract

Water is one of the most indispensable resources for the continuing existence of all living things including man. Provision of safe and potable drinking water is one of the main purposes of community development and improvement. The study assessed bacteriological analysis of water in Omupo, Kwara State, Nigeria. The study design was descriptive cross-sectional; study population includes all sources of water in Omupo metropolis that satisfied the criteria for inclusion. Data was analysed using Statistical Package for Social Sciences (SPSS) software version 20.0. Level of significance was pre-determined at p-value < 0.05 at a confidence level of 95%. The result revealed high Coliform bacteria count, about 79% of water examined has a value higher than the acceptable maximum limit prescribed by World Health Organization (WHO) which requires that coliform count must not be detectable in any water intended for drinking. All the water samples collected were colourless with a pH range of 6.3-7.4 and temperature was between 22 - 28^{0}C. The study revealed that untreated water from the studied wells, River and some boreholes used for drinking and domestic purposes were not suitable for water consumption and may pose a serious threat to the health of consumers. There is high coliform bacteria count in majority of the water sources in Omupo community. The community in general should be kept under good sanitation condition by encouraging individual house owners to provide modern toilet facilities for their conveniences, so as to prevent or minimise pollution of water sources.

Key words: Water Sources, Microbes, Consumers, Analysis, Coliform Counts.

1. Introduction

Water covers about 71% of the earth's surface and is vital for all forms of life. Access to safe drinking water has improved over the last decades in almost every part of the world, but approximately one billion people do not have access to safe water and over 2.5 billion lack accesses to adequate sanitation (Centre for Environmental Health, 2005). Water plays an important role in the world's economy, as it functions as a solvent for a wide variety of chemical substances and facilitates industrial cooling and transportation.

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Well water is susceptible to contamination from a variety of sources, including septic tanks, pesticides and household chemicals. However, shallow and permeable water table aquifers are most susceptible to contamination (Borchardt *et al*., 2003). Contaminants such as bacteria, viruses, heavy metals, nitrates and salt have polluted water supplies as a result of inadequate treatment and disposal of waste from humans and livestock, industrial discharges, and over-use of limited water resources (Borchardt *et al*., 2003). The geological nature of the soil determines the chemical composition of the groundwater. The water potential to harbor microbial pathogens and cause illness is reported for both developed and developing countries (Borchardt *et al*., 2003).

In Nigeria, increasing population and infrastructural breakdown have made municipal pipe borne water to be inadequate in quantity and quality but, less than 30% Nigerians have access to safe drinking water due to these inadequacies and most of the populations have to resort to drinking water from wells and streams especially in the rural and suburban communities (Oyedeji *et al*., 2011). These water sources are largely untreated and might harbor waterborne and vector-borne diseases such as cholera, typhoid-fever, diarrhoea, hepatitis and guineaworm. Globally over one billion people do not have access to safe and potable drinking water and 2.6 billion lack adequate sanitation (WHO, 2004). This leads to 1.8 million people dying every year from water and sanitation related diarrhea diseases, 90% being children under 5 years, and mostly in developing countries (WHO, 2004). Growth and nutrition in young children are also adversely affected by contaminated water supplies, poor hygiene and inadequate sewerage. The study determined the physical properties and faecal coliform count in water samples in Omupo metropolis and to relate these to the promotion of healthy living in the community.

2. Materials and Methods

Study Area: The study was conducted in Omupo, Ifelodun Local Government area of Kwara state which lies on latitude 8.2^0N and longitude 4.87^0E. Omupo or Omu-ipo is an ancient town in Igbomina-Yoruba land of Kwara State. It is one of the prominent towns in Ifelodun Local Government Area of the State. It is situated in the north-eastern part of Yoruba land in north central Nigeria. Omupo community has an estimated population (males and females) of about 18,798 (population Census, 2006)**.** Majority of the people of Omupo are indigenous Yoruba tribe, although Hausas, Igbos, Agatus, Normadic Fulani and other minority ethnic groups also constitute a substantial proportion of the citizenry. The major religions are Islam and

Christianity, the people are mainly farmers, traders and artisans, there are 3 community health centres (2 basic health care centres and 1 private medical center).

Community advocacy/mobilization: Omupo town was visited where permission for the study in the community was taken from the District Head and the council of elders. Awareness about the study, purpose, benefit, duration, for the maximum co-operation, support and their involvement regarding the study was also done for members of the community.

Study design: This study was a descriptive cross-sectional study.
Study population: The study population included all sources of water in Omupo metropolis (One Hundred and Twenty) that satisfies the criteria for inclusion. Abandoned wells, wells without water and homes that were locked (Inaccessible) were excluded.
Sample size: All sources of water in Omupo metropolis that met inclusion criteria were sampled.

Data collection and analysis: Samples of water for investigation from various sources were collected in sterile plastic bottles of about 100ml. The neck and top of the bottles were covered with aluminum foil to prevent any external contamination. Both Physical and bacteriological examinations of samples were carried out. After collection, the samples were transported immediately to Medical Microbiology and Parasitology Laboratory (UITH) for analysis. The water samples were examined on arrival within 6 hours of collection. Statistical analysis was performed using the Statistical Package for Social Sciences (SPSS) software version 20.0 and the results were expressed as percentages for qualitative variables and as mean/ standard deviation for quantitative variables. Comparative analysis of the variables were done using chi square(X^2) and level of significance (p value) was set at $p< 0.05$.

Ethical consideration: Approval for the study was granted by the Ethical Review Committee (ERC) of the Kwara State Ministry of health; prior to water sample collection
Limitation of the study: The study did not cover the two seasons of the year but limited to the late dry season.

3. Result and Discussion

A total number of one hundred and twenty sampled water from different sources were analysed in this study. Table 1 revealed the sources of water in Omupo community, borehole water was

found to be significantly portable compared to well and river water. The overall pH of water sources has a range of 6.0-7.4 and the Temperature has a range of 21.0-28.9^{0}C, as shown in Table 2. Figure 1 shows the coliform counts of the sources of water.

Over one billion people lack access to potable water around the world (WHO, 2004). This leads to 1.8 million people dying every year from water and sanitation related diarrhea diseases, 90% being children under 5 years, mostly in developing countries (WHO, 2004). The study made use of laid down maximum and minimum values, that is, tolerant limit, for the microbes and the physical properties of good quality water set by WHO and which was adopted by the state water Agencies and the federal Ministry of water Resources in Nigeria. About 20.8 % of water sources in Omupo, Kwara-state are potable. Therefore, the remaining 79.2% are not fit for human consumption as they are potential sources of infections (Diarrhea, Dysentry Gastroenteritis, Cholera, Typhoid, Goitre, etc) to the people of Omupo community.

In this study, a large proportion (79.2%) of sampled water sources have high coliform counts. Well water is the predominant source of water in Omupo community. This may be due to less financial implication for its construction compare to bore hole and accessibility to the community people. By implication, the reported prevalence (90.2%) for non-portable well water is a potential source of contamination to the community people. It is noteworthy to mention that 64.7% of the boreholes in Omupo community had zero coliform count. The result of total coliform obtained in this study is similar to that of Agbabiaka and Sule (2010) with 60.0% of boreholes had zero coliform counts and Rogbesan *et al*. (2002) obtained 70% of boreholes had zero coliform count result. The presence of *E. coli* in some of the boreholes is unacceptable from the public health point of view. This organism is pathogenic, therefore there is need for cautions when using these contaminated borehole water sources for any purpose.
The only river in the community that was examined is not safe for human consumption. This closely agrees with findings by other researcher who conducted similar studies along Asa River, Ilorin (Salami, 2003).The high coliform count are very undesirable, unsafe and not acceptable for human consumption. Possible sources of contamination of the river water sources include human and animal faeces or introduction of micro-organisms by birds and insect, and heightened ecological activities.

Only 9.8 % of well water sampled was portable among the 102 wells sampled. In similar studies by Adetunji et al. (2011) and Yusoff (2011) also recorded high values for coliform counts in Well water. These high coliform count might have arisen due to poor level of hygiene

and sanitation observed in this community. Wells in Omupo community are constantly exposed to contamination from human and animal activities. Any water source used for drinking or domestic purposes should not contain any organism of faecal origin (Akeredolu, 1991).

In this study, the pH value obtained for the water samples ranges between 6.0-7.4 with a mean of 6.7 and this is within the acceptable standard limits set by the World Health Organization (WHO, 2004). Eniola *et al*. (2007), Agbabiaka *et al*. (2010), Olusiji *et al*. (2011) obtained similar pH range of 6.0-7.5.At variance, with a pH value of 7.63-8.3 as observed in a study by Odikamnoro *et al*. (2011) with pH value of 7.0-8.0 recorded from bore-hole waters to be highly alkaline is likely caused by organic contamination. Scientifically, the pH range is close to neutrality and would allow for the growth of most bacterial species.

The temperature value ranges between 21-28^{0}C. This could be said to be suitable for the growth of heterotrophic bacterial species when present in the samples (Griffith's *et al*., 2003). The temperature reported in this study is comparable to temperature reported by other researchers in similar study 22-28^{0}C (Agbabiaka and Sule, 2010). In contrast to the temperature reported by Olubiyi *et al*., (2013) of 30^{0}C of water samples, the high temperature is believed to have been influenced by the intensity of the sun. There is strong association between covered water sources and portability, as covered water were found to be 7.6 times more potable than the uncovered. The covered water sources in dirty environment and uncovered water in dirty environment that demonstrated high coliform count might have possibly originated from environmental factors. Dirty environment easily breed microorganisms. This is in agreement with the fact that coliform bacteria are widely found in nature (Binne *et al*, 2002; Griffiths *et al.*, 2003). Hence, there is a need for periodical treatment of the water and improved environmental sanitation in Omupo township to forestall preventable epidemic.

Table 1: Sources of water and portability.

Source	**n=120**	**Portability (%)**
Well	102	(10)9.8
Borehole	17	(11)64.7
River	1	(0)0

X^2=30.6, p=0.000

Table 2: Physical characteristics and water sources.

Physical Characteristics		**Well (%) n=102**	**Borehole (%) n= 17**	**River (%) n= 1**	**Mean**	**SD**
Odour	Odourless	96.1	82.4	100		
	Metallic	3.9	7.6	0.0		
pH	6.0-6.4	41.2	41.2	0.0	6.7	0.7
	6.5-6.9	47.0	35.3	100		
	7.0-7.4	11.8	23.5	0.0		
Temperature	21.0-22.9	14.7	5.9	0.0	25.1	1.7
	23.0-24.9	32.4	47.1	0.0		
	25.0-26.9	37.3	23.5	0.0		
	27.0-28.9	15.7	23.5	100		

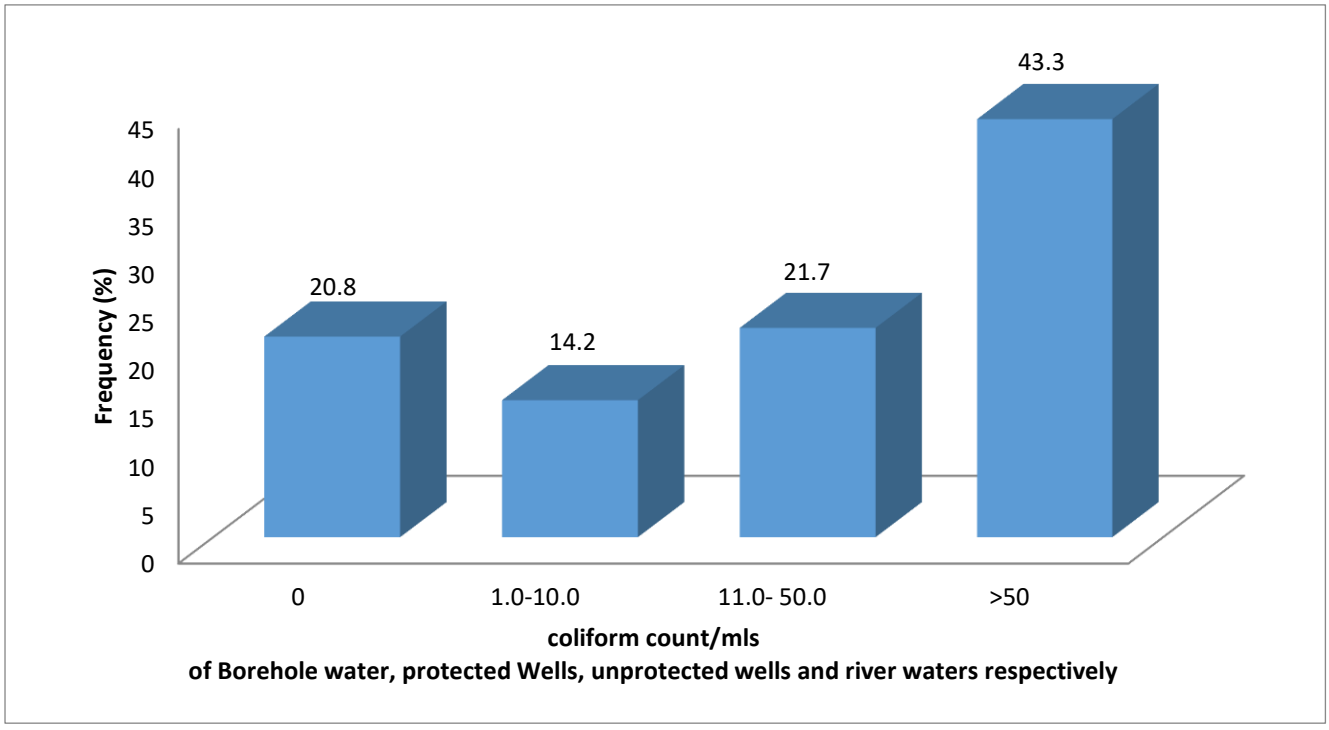

Figure 1: Coliform count on the water samples present in Omupo metropolis.

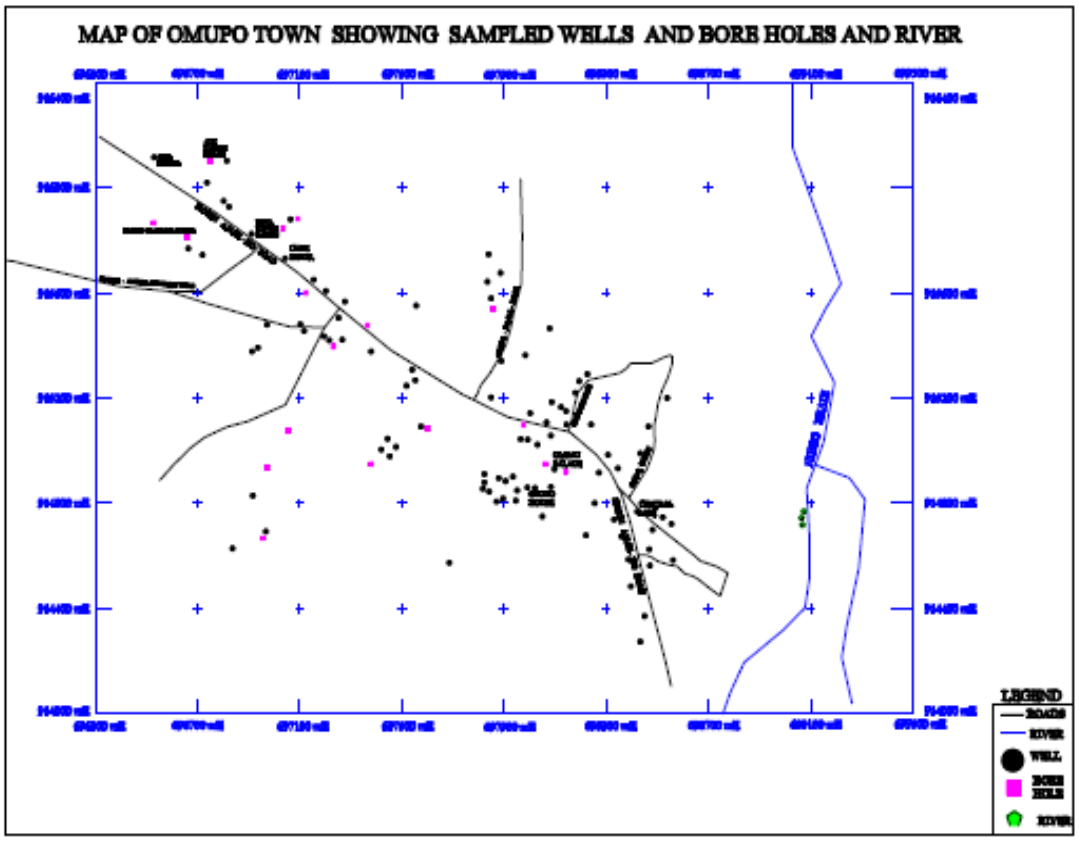

Figure 2: map of Omupo Town showing Wells and Bore Holes and River.

4. Conclusion

The result of the research work has given a snap of the extent of which the sources of water in Omupo metropolis are contaminated by coliform bacteria (79.2%). Thus, disclaiming the usability and potability of some of these water samples for consumption and other domestic purposes. Since these are the major sources of water in the location, there is high tendency of diseases outbreak. Factors that were found to be associated with these include inadequate protection of the sources of water, high number of people accessing the sources of water, high level of damage to the wells and inappropriate citing of water sources.

Having assessed the contamination of water sources in the study area the following recommendations are proffered in the enhancement of the water supply from the sources of

water. Government and Non-Governmental organisations (NGOs) should assist members of the public in constructing more and good boreholes which penetrates deep into the aquifer zones in these areas so that the consumption of contaminated water is reduced and the risk of contracting diseases through such water is minimized. Government should constitute water management efforts and support sustainable ecosystems and water security through the following means; drafting, passing water laws and providing standard of dischargeable effluents and appropriate points of discharge, providing well equipped laboratories for water analysis and examining the possibility of universal water distribution machinery. The community should ensure that existing sources of water are kept clean and be well developed while the uncovered and partly covered wells are to be provided with good covers. The general public should be kept under good sanitation condition by encouraging individual house owners to provide modern toilet facilities for their conveniences.

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References

Adetunji V.O. and Odetokun I. A. (2011): Ground water Contamination in Agbowo Community, Ibadan Nigeria: Impact of Septic tanks distances to wells. *Malaysian Journal of Microbiology*. **7**(3), 159-166.

Agbabiaka T. O. and Sule I.O. (2010): Bacteriological assessment of selected borehole water samples in Ilorin metropolis. *International Journal of Applied Biological Research*. **12**(2), 31-37

Akeredolu, F. A. (1991): *Setting water Quality – Water Quality Standard for Nigeria*. In: Proceedings of procedure of first – natural conference on water quality monitoring and status in Nigeria, Kaduna. 216-224.

Binnie, C., Kimber, M. and Smethust G. (2002): Basic water treatment. *Royal Society of Chemistry*. **4**, 345-352.

Borchardt, M. A., Bertz, P. D., Spencer, S. K. and Battigelli, D. A. (2003): Incidence of enteroviruses in groundwater from household wells in Wisconsin. *Applied Environmental Microbiology*. **69**, 1172-1180.

Center for Environmental Health (2005): *Coliform bacteria in drinking water supplies*. New York State Department of Health. **1**, 800-858.

Eniola, K. I. T, Obafemi, D. Y., Awe, S. F., Yusuf, I. I. and Falaiye, O. A. (2007): Effect of containers and sewage conditions of batching quality of Borehole water. *Nigeria Journal of Microbiology*. **21**, 1578-1585.

Griffiths, J. F., Welsberg, B. S. and Mcliee, D. C. (2003): Evaluations of microbial source

Tracking methods using mixed faecal sources in aqueous test sample. *Journal of water and Health*. **1**, 141-151.

National Population Commission (2006): Censors Report. Official gazette of the Federation Republic of Nigeria. 2007, January 19th. **94**(4), B47-53

Odikamnoro, O. O., Omowaye, O. S. and Aneke, G. U. (2014): The quality and Composition of Borehole Water in Ebonyi State, Nigeria. *Sci-Afric. Journal of Scientific Issues, Research and Essay*. **2**(1), 15-18.

Olubiyi, A. A., Adekunle, O. A., Oluwatosin, A. A., Bukola, A. B. and Adeyanju, S. O. (2013): Bacteriological and Physico-Chemical analysis of well water samples in Ibadan, South-East Local Government, Ibadan, Nigeria. *Academia Arena*. **5**(5), 8-14.

Olusiji, S. A. and Adeyinka, O. A. (2011). Portability Status of Some Hand Dug Wells in Ekiti State, South Western Nigeria. *International Journal of Science and Technology.* **1**(2), 102-109.

Oyedeji, O., Olutiola, P. O., Owolabi, K. D. and Adeojo, K. A. (2011): Multi resistant Faecal indicator bacteria in stream and well water of Ile-Ife City, Southwestern Nigeria: Public health implications. *Journal of Public Health and Epidemiology*. **3**(8), 371-381.

Rogbesan, A. A. Eniola, K. I. T. and Olaeyemi, A. B. (2002): Bacteriological Examination of some boreholes within University of Ilorin. *Nigerian Journal of Pure and Applied Science*. **5**(3), 117- 223.

Salami, A. W. (2003): Assessment of the level of water pollution along ASA River Channel, Ilorin, Kwara-state, Nigeria. *Nigerian Journal Pure and Applied Science*. **18**, 1423-1429.

WHO (2004): *The Sanitation Challenge: Turning commitment into reality*. World Health Organization. **2**, 26-32.

Yusuff, M. S. and Akinbile C. O. (2011): Environmental impact of leachate pollution on groundwater supplies in Akure. *Nigeria International Journal Environmental Science and Development*. **2**(1), 81-86.