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ASSESSMENT OF WATER QUALITY OF BOREHOLE WATER IN ALBASU LOCAL GOVERNMENT AREA, KANO STATE, NIGERIA

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ABSTRACT

It was estimated that the need of water increases globally due to constant increase in population. Water samples Water samples collected from boreholes located in six wards in Albasu town were assessed for some physio-chemical parameters on collection and after one week of storage using standard analytical methods. Furthermore the quality indices were determined for the water samples on collection and after one day of storage. The parameters determined include temperature, turbidity, suspended solids, total dissolved solids, conductivity, pH, nitrate – nitrogen, phosphates, chlorides, alkalinity and E-coli bacteria. After comparing the result obtained with WHO (2011) standards for portable water, it was confirmed it within the standard. It was concluded that the water is safe for drinking.

KEYWORDS: *Water samples, drinking, E-coli bacteria, dug wells,*

1.0 INTRODUCTION

Water indeed is an essential component of life (Osunkiyesi, 2012). Growing population, increased economic activity and industrialization have not only created an increase in demand for fresh water, but also resulted in the misuse of natural resources. According to a survey conducted by United Nations Environmental Program (UNEP), 20% of world's population lacks access to safe drinking water, and 50% lacks access to safe sanitation (WHO, 1997). In addition, polluted water is estimated to affect about 1200 million people and contribute to the death of 15 million children in the world per year (WHO, 1997).

A major source of groundwater abstraction for use is by means of a hand dug well. A well is a hole or shaft sunk into the earth for the purpose of obtaining water and other fluid from an underground supply. Such a hole can be constructed in different ways upon which wells are commonly classified as hand dug wells, borehole, among others. Hand dug wells and motorized dug wells are of vital importance as source of domestic water supply for the majority of Nigerians. Hand dug well water remain the major source of domestic (drinking) water in Albasu LGA. The quality of this hand dug well water across Nigeria is rarely analyzed nor treated before use. Until recently, most artificial wells in the country do not have pump. Hand dug wells and motorized dug wells are usually between 1 and 50 meter deep depending on the geological characteristics of the area, and lined with stone, bricks, and recently cemented rings. For the chemist

therefore the quality of water is very important to ensure that it is potable for drinking (Agbazue, 2008).

Several studies on ground water quality have been conducted in southern and Central Nigerian (Abimbola *et al*., 2002, Adekunle *et al.,* 2007, Akaahan *et al.,* 2010, Emmanuel, 2011, Obasi *et al.,* 2001) and findings have shown that our water contain many impurities especially disease causing microorganism, also, harmful physical and chemical agents.

Therefore, to maintain a good health, water must be safe to drink and meet the local and international standard to taste, odour and appearance (WHO, 2006). The study provides baseline information on the quality of borehole waters in Albasu Town. In addition, the hardness of the water sources may be an indication of the presence of underlying minerals in the ground.

The main aim of the study is to find the suitability of the borehole water for safe drinking, and the objectives are; to determine the physiochemical parameters of the borehole water, E-coli bacteria test and compare the result with WHO standard for drinking water 2011. The research considers only the boreholes in the following locations; Tsangaya cluster, Daho, and Faragai all in Albasu LGA in Kano State.

2.0 MATERIALS AND METHOD

2.1 Sample selection

Some 4-6 2litres plastic bottles were washed thoroughly in and out and allowed to air dry and then sealed with their covers. The water level of the borehole was noted from the data obtained during borehole design. A bottle was filled with the well water and sealed immediately to avoid intrusion of other elements that are not from the well. The sample was

2.2 Chemical analysis

2.2.1 Alkalinity test

The burette was rinsed with distilled water and then filled to zero mark with the 0.1N hydrochloric acid.100ml of the water sample was poured into a baker. Two drops of the methyl orange indicator was added to the sample. The sample was titrated with the 0.1N hydrochloric acid in the burette until a pink colour appeared in the sample. The titre value was noted and recorded

2.2.2 Hardness test

50ml of the water sample was poured into a clean beaker. 0.5ml of the 0.1N HCL was added to the sample. The sample was then boiled to expel CO_2 and allowed to cool to a temperature of 50 ^{0}C. 2ml of the buffer solution was added to the heated sample. 2 drops of Erichrome T indicator was added to the solution. The solution was titrated with ETDA until the colour changes from wine red to blue. The quantity of the titrant used was noted and recorded.

2.2.3 Chloride test

The burette was filled to zero mark with the standard silver nitrate. 100ml of the water sample was poured into the eriemeyer flasks. 1ml of potassium chromate indicator solution. The solution was titrated with silver nitrate until the brown colour changed to yellow. The titrant value was noted and recorded.

2.3 Determination of solids

2.3.1 Suspended solids

100ml of the water sample was poured into the beaker. Then filter paper was weighed and recorded. The water sample was filtered through the filter paper which was folded and inserted into the funnel. The filter paper was allowed to dry for 24hours and then re-weighed.

2.3.2 Dissolved solids

The evaporating dish was weighed and recorded. 50ml of the filtrate in the above experiment was poured into the evaporating dish. The sample was evaporated to dryness in the oven and allowed to air cool. The evaporating dish was re-weighed and recorded.

2.4 Physical analysis

2.4.1 Temperature determination

The mercury end of the thermometer was cleaned. Some quantity of water was collected from the well (2 litres). The mercury end of the thermometer was inserted immediately into the water sample and allow to stay until the mercury stop rising. The value of the rise in mercury was noted and recorded.

2.4.2 pH determination

100ml of the water sample was poured into a clean beaker. The electrode of the p^H meter was inserted into distilled water to sterilize it. The electrode was then inserted into the water sample and allowed to stay in it until the reading on the screen was stable. The observed value was recorded as the pH the sample.

2.4.3 Turbidity determination

The glass bottle in the turbid meter was rinsed. The glass bottle was filled to half with water sample, sealed and dry with towel. The bottle was then inserted into the slotter for auto sensing by the meter. The reading on the screen was observed until it was first stable. The value was then recorded as the turbidity.

2.4.4 Conductivity determination

The electrode of the conductivity meter was inserted into the distilled water to sterilize it. 100ml of the water sample is poured into the beaker. The electrode was then inserted into the sample. The

meter was then switched on calibrated to a reasonable range. The conductivity value was read from the meter and recorded.

2.5 Biological analysis

2.5.1 Determination of e-coli bacteria

The procedure for the determination involves step wise analysis, these are as follows;

2.5.1.1 Presumptive test

The test tube was half filled with lactose broth after which the Durham tube was immersed into it. 1ml of the water sample was inoculated into the lactose broth. The solution was incubated under 37c for 24hours. These test tubes that contain gas in their Durham's tube are used to proceed to the next step of the test.

2.5.1.2 Confirmatory test

Few quantity of Eiosin methylene Blue (EMB) agar was placed carefully in the Petri-dish and turned in that the agar will reach all the points in the dish and avoiding air intruding in. 1ml of the sample that shows positive result in presumptive test was inoculated into the EMB in the Petri-dish. The Petri-dish with the sample inside was incubated for 24hours under a temperature of 37^0C. Dark green metallic sheen was checked if present.

2.5.1.3 Completed test

The test tube was half filled with lactose broth after which the Durham tube was immersed into it. 1ml of the water sample which is suspected to contain the E-coli bacteria was inoculated into the lactose broth. The solution was incubated under 37^{oc} for 24 hours. The test tube that contains gas in its Durham tube is confirmed to be E-coli bacteria.

3.0 RESULT AND DISCUSSION

3.1 Alkalinity

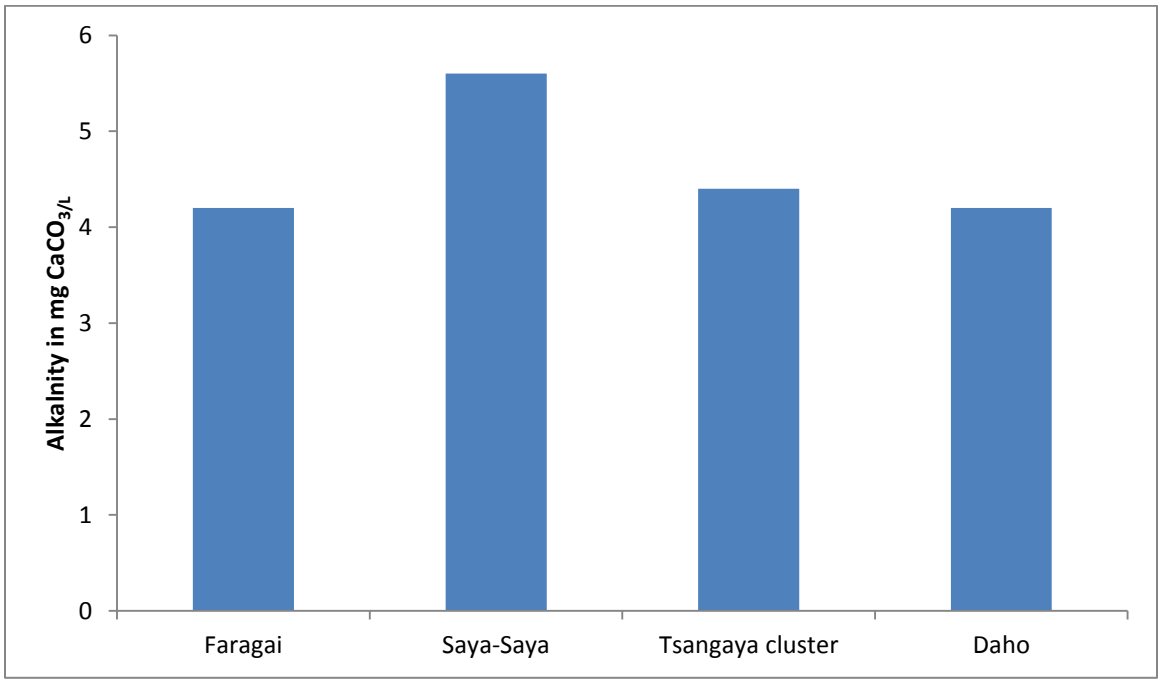

Figure 3.1 Alkalinity of the water samples

3.2 Hardness

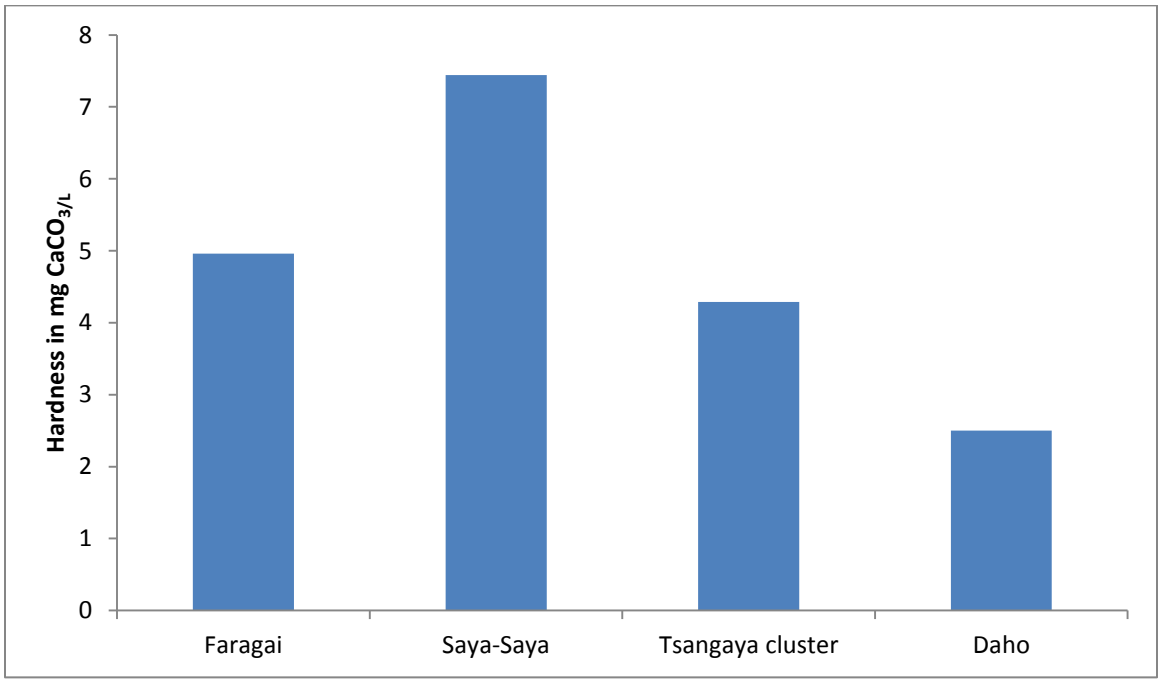

Figure 3.2 Hardness of the water samples

3.3 Chloride test

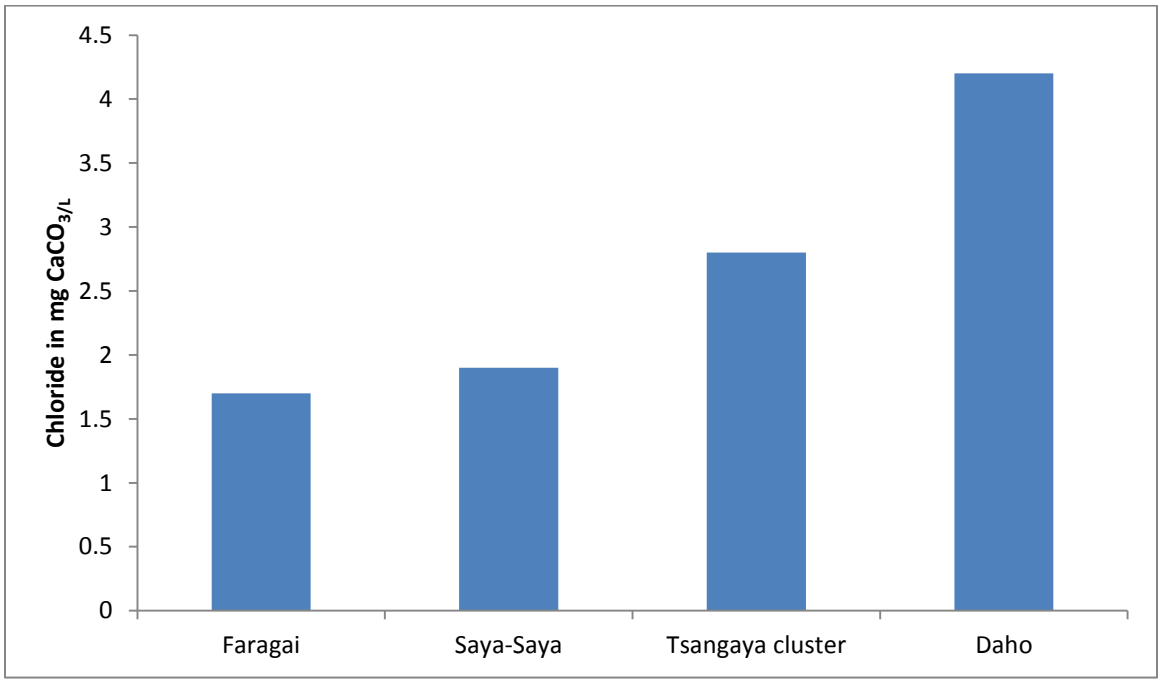

Figure 3.3 Hardness of the water samples

3.4 Biological test results: Test for e-coli bacteria

Table 3.1 : Result for the test for E-coli bacteria for all the samples.

SAMPLE	PRESUMPTIVE TEST	COMPLETED TEST	CONFIRMATORY TEST
Faragai	negative	negative	negative
Saya-saya	negative	negative	negative
Tsangaya cluster	negative	negative	negative
Daho	negative	negative	negative

3.5 Physical test results

3.5.1 Temperature of samples

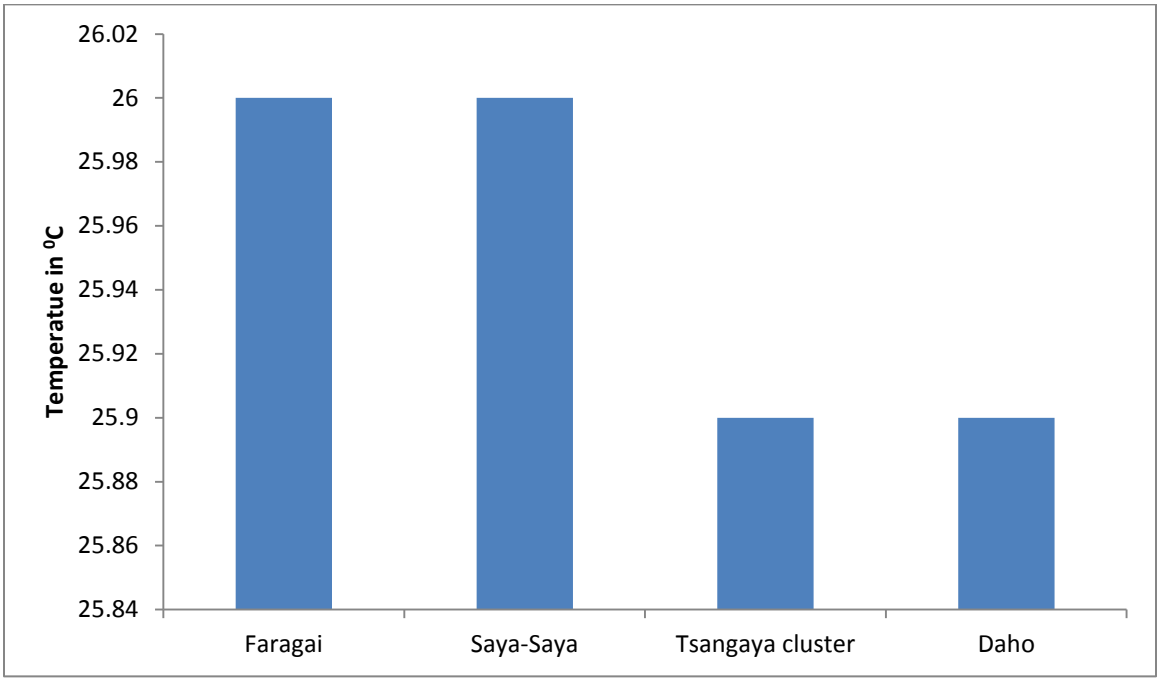

Figure 3.4 Temperature (^{0}C) of water samples

3.5.2 pH of Samples

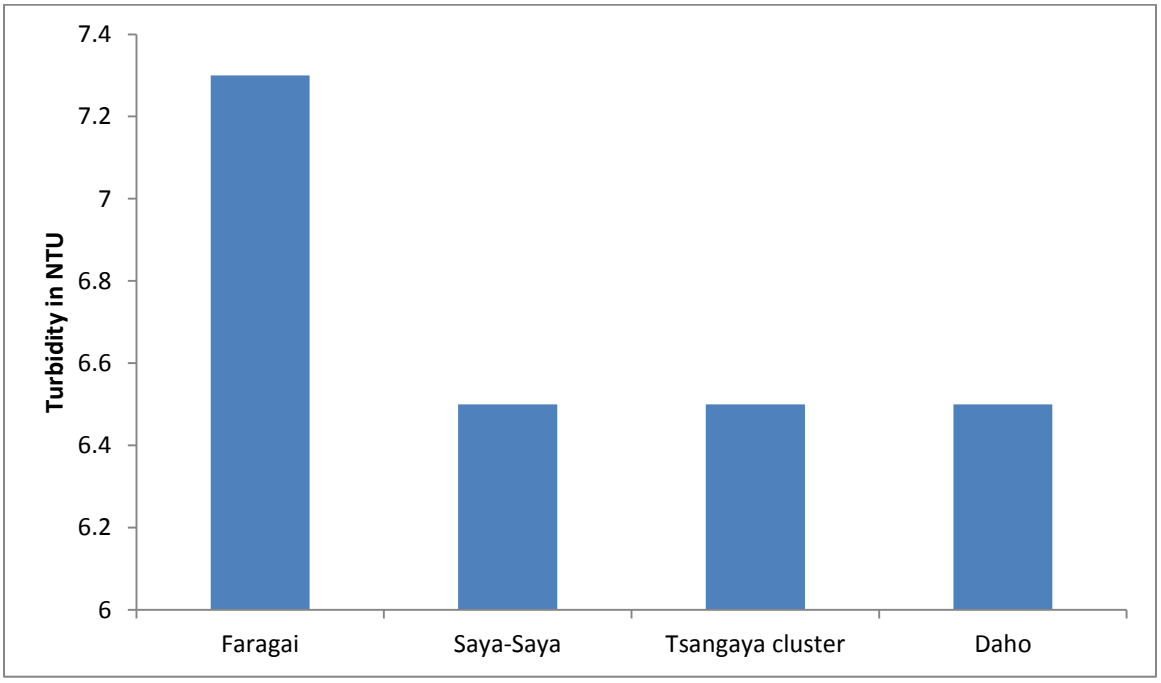

Figure 3.5 pH of water samples

3.5.3 Turbidity of water samples

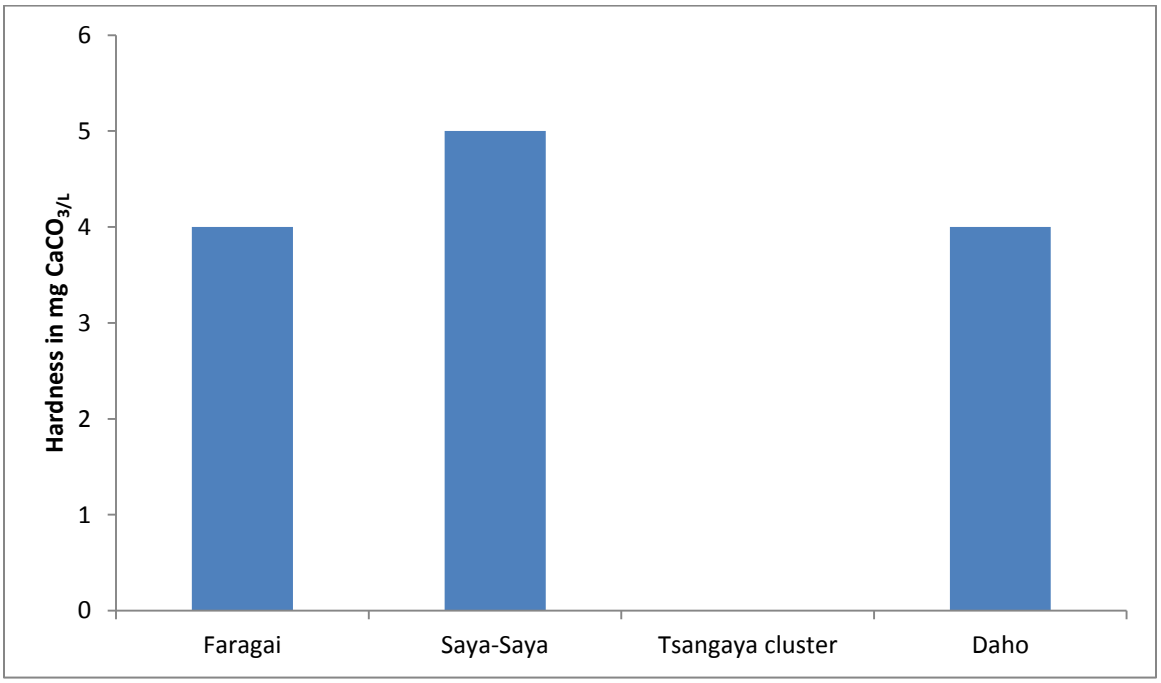

Figure 3.6 Turbidity of water samples

3.5.4 Conductivity determination

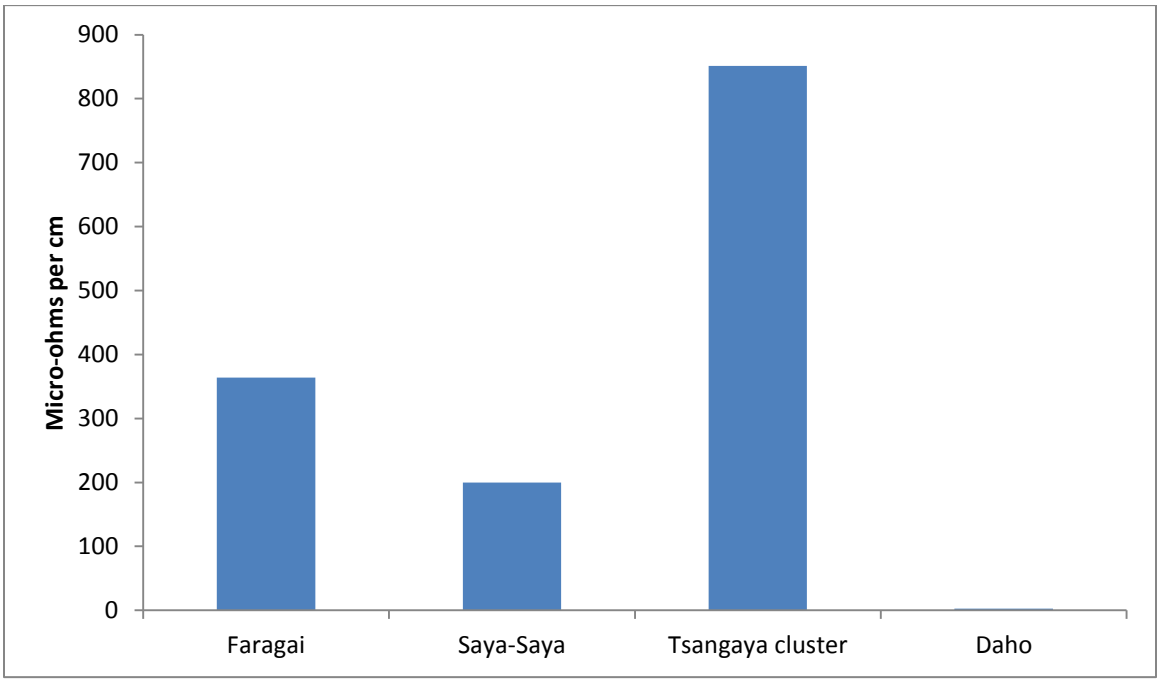

Figure 3.7 Conductivity of water samples

3.6 Solid determinatin

3.6.1 Suspended solids

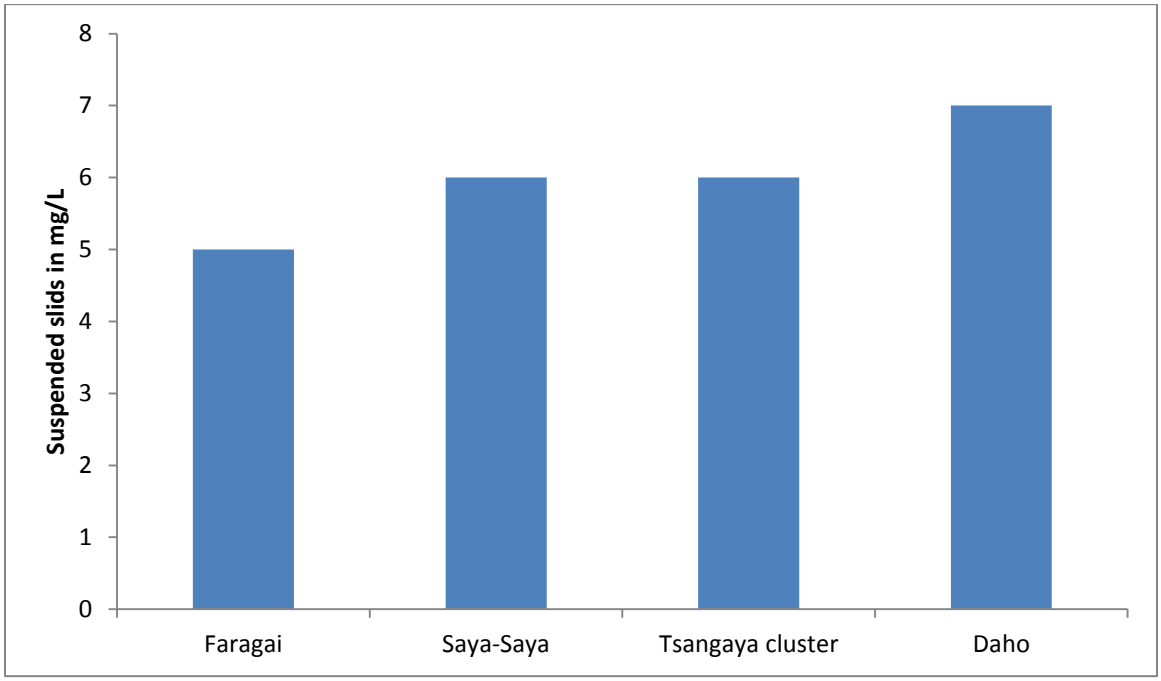

Figure 3.8 Suspended solids of water samples

3.6.2 Dissolved solids

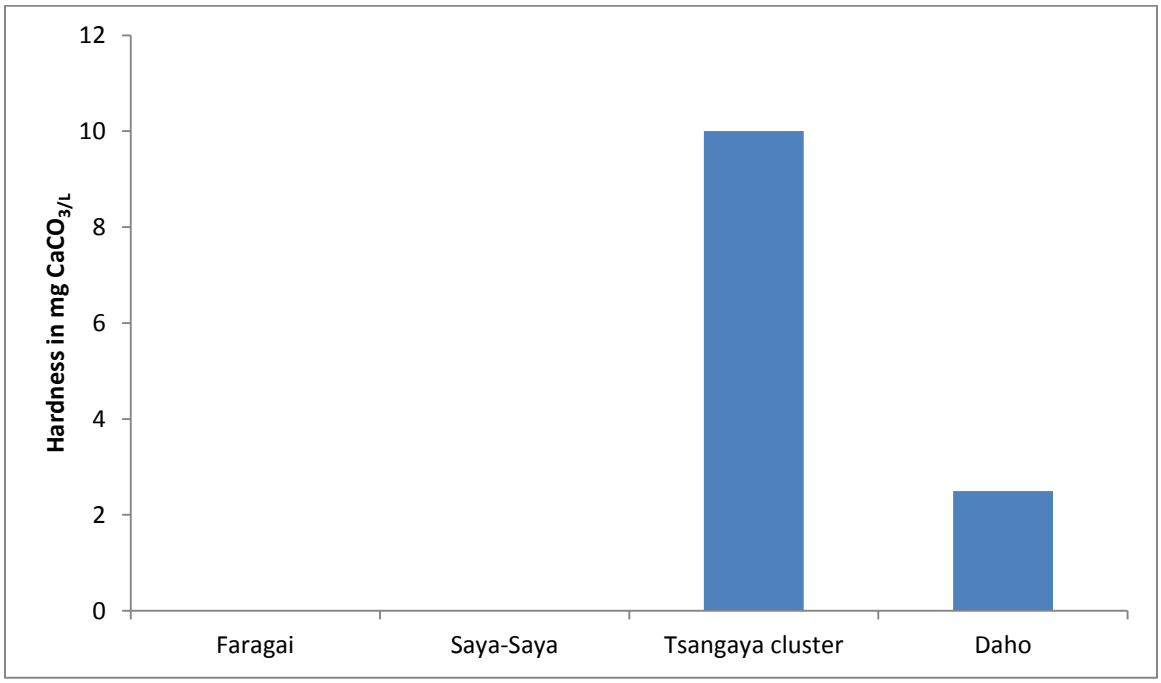

Figure 3.9 Dissolved solids of water samples

4.0 DISCUSSION

4.1 Physico-chemical parameter

The sampled wells have almost uniform temperature range of 25.9 ^{0}C – 26 ^{0}C, none of the water samples had temperature higher than 28 ^{0}C which is the maximum allowable standard for drinking water by WHO. A relative stable pH range of 6.50 – 7.30 was recorded across the months sampled. pH is one of the influencing parameter in chemical reaction within water. However, the observed pH is within the maximum acceptable limits for drinking water standards set by WHO. Similarly, turbidity range 0-5 NTU recorded in ground water during this study was acceptable for consumption base on WHO guidelines for drinking water. Turbidity in water may be caused by particulate matter that may be present from soil around water sources; it also contributes to the aesthetics of the water. Electrical conductivity of between 200-851 µ-ohms/cm was obtained from boreholes in Albasu area. EC of water is direct function of its dissolve mineral content, so high concentration of inorganic compound implies high EC of water as inorganic compound. Hardness of the water samples range was 89.78-268.86mg/L $CaCO_3$, Chloride range 1.8997-27.63mg/L, Dissolved solids range 0-10mg/L, no dissolved solids found and alkalinity. All the results found were within WHO (2011) standard for drinking water.

4.2 Microbiological analyses

From the results above, it is obvious that boreholes in Albasu area were not contaminated with E Coli bacteria causing pathogens in the water which can cause diarrhea, cramps, meningitis or other symptoms which may pose a special health risk for infants, young children and people with severely compromised immune system (Prescott *et al.,* 2008).

5.0 CONCLUSION AND RECOMMENDATION

The study revealed that investigated physiochemical parameters such as pH, temperature, turbidity, conductivity, total dissolve solids,, chloride, alkalinity were within the maximum permissible limit prescribed by WHO 2011 for portable water and also no E-Coli bacteria was detected in all the borehole water samples of Albasu LGA. Routine water quality analyses should be done to ensure quality of the water is sustained and further research should be done on heavy metal concentration in the well

REFERENCES

1. *Abimbola, A.F., Odukoya, A.M. and Adesanya, O.K. (2002) The environmental Impact assessment of waste disposal site on ground water in Oke, Ado and Lagos, southwestern Nigeria. Proceedings 15th Annual conference Nigerian Association of Hydrogeologists Kaduna, Nigeria, 42pp.*
2. *Adekunle, I. M., Arowolo, T.A., Ndahi, N.P., Bello, B. and Owolabi, D.A. (2007) Chemical characteristics of humic acids relations to lead, copper and cadmium levels in contaminated soil of South west Nigeria. Annals of environmental sciences, vol. (1), 2334.*
3. *Agbazue,V.E(2008)The chemist and self-employment. Book of Proceeding of the international conference of the chemical society of Nigeria Held in Effurun, Delta State.*
4. *Akaahan, T. J., Oluma, H.O.A. and Sha'Ato, R. (2010). Physicochemical and bacteriological quality of water from shallow wells in two rural communities in Benue State. Pak. J. Anal. Environ. Chem. Vol. 11, (1), 73-78*
5. *Emmanuel, S. A. (2011) Ground water quality assessment of some sampled boreholes in five rural communities of Misau local government area of Bauchi State, Nigeria. International Journal of Environmental Issues Vol.8No.2.*
6. *Obasi R.A. and Balogun, O. (2001) Water quality and Environmental impact Assessment of water resources in Nigeria. African Journal of Environmental Studies, 2(2), 228-231.*
7. *Osunkiyesi, A.A (2012) Physicochemical analysis of Ogun River(water samples) within two locations (Akin-Olugbade and Lafenwa) in Aboekuta, Ogun State. IOSR Journal of Applied Chemistry.1(4):24-27.*
8. *Prescott, M.L., Harley, J.P. and Klein, D.A. (2008) Microbiology. New York: Mc Graw Hill publication.*
9. *WHO (2006). Guidelines for drinking water quality. First addendum to 3rd ed. Vol. 1. Geneva. WHO press, P515.*
10. *WHO (World Health Organization) (1997) "Surveillance control of community supplies-in; Guidelines for drinking-water quality, WHO water quality, WHO Geneva*
11. *WHO (World Health Organization) (2011) "Surveillance control of community supplies-in; Guidelines for drinking-water quality, WHO water quality, WHO Geneva*

Appendix 1: Faragai water sample result

	PARAMETER	RESULT	WHO GUIDE LEVELS	NSDWQ MPL	UNITS
1.	Temperature	26	25		^0C
2.	Suspended solids	0.0000005			mg/L
3.	Dissolved solids	0	<500		mg/L
4.	PH	7.3	6.50-8.50	6.50-8.50	
5.	Alkalinity	2.1			mg/L $CaCO_3$
6.	Hardness	176.56	500	150	mg/L $CaCO_3$
7.	Chloride	16.77	250	250	mg/L Cl
8.	Conductivity	364	1000	1000	micro-ohms/cm
9.	Turbidity	4	5-25	5.00	NTU
10.	E-Coli bacteria	nil	nil		cfu/100m

Comment: All values are in conformity with both WHO (2011) and NSDWQ MPL for drinking water.

Appendix 2: Saya-saya water sample result

	PARAMETER	**RESULT**	**WHO GUIDE LEVELS**	**NSDWQ MPL**	**UNITS**
1.	Temperature	26	25		^0C
2.	Suspended solids	0.0000006			mg/L
3.	Dissolved solids	0	<500		mg/L
4.	PH	6.5	6.50-8.50	6.50-8.50	
5.	Alkalinity	2.8			mg/L $CaCO_3$
6.	Hardness	264.86	500	150	mg/L $CaCO_3$
7.	Chloride	1.8997	250	250	mg/L Cl
8.	Conductivity	200	1000	1000	micro-ohms/cm
9.	Turbidity	5	5-25	5.00	NTU
10.	E-Coli bacteria	nil	nil		cfu/100m

Comment: All values are in conformity with both WHO (2011) and NSDWQ MPL for drinking water

Appendix 3: Tsangaya cluster water sample result

	PARAMETER	RESULT	WHO GUIDE LEVELS	NSDWQ MPL	UNITS
1.	Temperature	25.9	25		^{0}C
2.	Suspended solids	0.0000006			mg/L
3.	Dissolved solids	10	<500		mg/L
4.	PH	6.5	6.50-8.50	6.50-8.50	
5.	Alkalinity	2.2			mg/L $CaCO_3$
6.	Hardness	152.63	500	150	mg/L $CaCO_3$
7.	Chloride	27.63	250	250	mg/L Cl
8.	Conductivity	851	1000	1000	micro-ohms/cm
9.	Turbidity	0	5-25	5.00	NTU
10.	E-Coli bacteria	nil	nil		cfu/100m

Comment: All values are in conformity with both WHO (2011) and NSDWQ MPL for drinking water

Appendix 4: Daho water sample result

	PARAMETER	RESULT	WHO GUIDE LEVELS	NSDWQ MPL	UNITS
1.	Temperature	25.9	25		^{0}C
2.	Suspended solids	0.0000007			mg/L
3.	Dissolved solids	10	<500		mg/L
4.	PH	6.5	6.50-8.50	6.50-8.50	
5.	Alkalinity	2.1			mg/L $CaCO_3$
6.	Hardness	89.78	500	150	mg/L $CaCO_3$
7.	Chloride	19.74	250	250	mg/L Cl
8.	Conductivity	449	1000	1000	micro-ohms/cm
9.	Turbidity	4	5-25	5.00	NTU
10.	E-Coli bacteria	nil	nil		cfu/100m

Comment: All values are in conformity with both WHO (2011) and NSDWQ MPL for drinking water