ASSESSMENT OF THE GROUND WATER QUALITY IN OGBOMOSO TOWNSHIP OF OYO STATE OF NIGERIA

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ABSTRACT

Physicochemical and bacteriological qualities of well water in the Ogbomoso North and South local government areas of Oyo State, Nigeria were investigated. Water samples were collected from 20 hand dug wells in the Ogbomoso North and 20 hand-dug wells in the Ogbomoso South local areas. The results showed that most of the physical and chemical parameters were within the acceptable guide line limits of the WHO for drinking and domestic water. The well water is mostly soft, alkalinity ranged from 30- 390mg/l and 40- 236mg/l for North and South respectively. pH ranged between 6.2- 8.8 in both areas, SO_4^{2-} and CL^- ions concentrations fell within WHO set standards, CL^- ranged between 17.5-400mg/l and 27.5-220mg/l and $SO4^{2-}$ ranged between 10-120mg/l and 12-175mg/l in North and South areas respectively. Those at elevated levels may cause serious health effects and risks might arise after prolong and continuous intake. Hardness ranged between 40- 504mg/l and 60-384mg/l for North and South areas respectively. Well water in some areas is moderately hard to very hard. However, the bacteriological quality of the samples in both areas was poor rendering them unsafe for human consumption without treatment. Faecal coliforms ranged between 04 and 36 MPN/100ml in North area with a mean value of 16 MPN/100ml while it ranged between 04 and 29 MPN/100ml, with a mean value of 15.7 MPN/100ml in the South area. Total coliform ranged between 09 and 52 MPN/100ml with a mean value of 29.1 MPN/100ml in the North area while in the South area total coliform counts ranged between 11 and 47 MPN/100ml with a mean value of 26.25 MPN/100ml.Total viable bacterial counts in North area and South areas ranged between 10 and 34cfu/ml X $10^7$and between 10 and 22cfu/ml X 10^7 respectively. Such microbial contamination posed a threat to well water quality and could lead to an increase risk level of outbreak of water borne diseases in the two local government areas of Oyo State.

KEYWORDS: *Ogbomoso, Orire, Suru-lere, Ogo-oluwa, Oyo State, Total Coliforms, Fecal coliform*

1. INTRODUCTION

Ground water, surface water (rivers, streams and ponds), atmospheric water (rain-water, snow and hail) and springs are the main source of water available to the people in general. The qualities of these water bodies vary widely depending on the location and environmental factors.(Tay,2007). The major source of ground water is precipitation that infiltrates the ground and moves through the soil and pore spaces of rocks. Other sources include water infiltrating from lakes and streams, recharge ponds and waste-water treatment system. As ground water moves through soil, sediment and rocks, many impurities such as disease-causing micro-organisms are filtered out.(Freeze and Cherry,1979).Many water resources in developing countries are unhealthy because they contain harmful physical, chemical and biological agents. To maintain a good health however, water should be safe to drink and meet the local standards and international standards to taste, odour and appearance. (Chessbrough,2000). To monitor the water resource and ensure sustainability, national and international criteria and guidelines established for water quality standards are being used.(WHO,1993; 2005)

Oyo state government of Nigeria and Local government councils within the state provide mechanised bore-holes and hand-dug well for the people as an alternative source of drinking water in those areas where treated water from state water corporation does not reach. The number of bore-holes and hand-dug well keep increasing annually to the extent that ground water is becoming the principal and sometimes the only source of drinking water for the communities within **O**gbomoso township. The increasing ground water usage is based on the fact, ground water is less polluted, since this water is filtered and percolated down the ground.

Hence there is the need to evaluate the suitability of water used for domestic purposes and identifying potential sources of pathogenic bacteria. The result generated will contribute to the understanding of the physical, chemical and biological behaviour of other bore-holes and hand-dug wells in **O**gbomoso township.

2. MATERIALS AND METHODS

THE STUDY AREAS

Ogbomoso township(North and South local government councils) are located in western part of **O**yo state of Nigeria.

Ogbomoso North Local Government Area came into existence as a result of the splitting of the former **Og**bomoso metropolis into two on Tuesday, September 24, 1991. **O**gbomoso North Local Government Area is bounded in the North and the East by Surulere Local Government Area, in the **S**outh by **Og**bomoso South Local Government Area and in the West by **O**rire Local Government Local **G**overnment Area. **O**gbomoso North has its headquaters located at Kinnira, **Og**bomoso and **O**gbomoso North is urban in outlook. The principal occupation of the population is farming, trading, teaching and artisans. The local government is mainly populated by the Yoruba but other tribes are found in their thousands. The predominant regions of the people are Christianity and Islam while other traditional religious worshippers are worshipping their gods unhindered. The local government council is made up of Ten (10) wards and they are: Masifa/ Aguodo, **S**abo/ Taara, Isale-Afon, **O**kelerin, **O**supa, Aaje/ **O**gunbado, Jagun, Ita-Alasa, Isale-**O**ra/ Saja and Abogunde. The local government area is a growing city with developed educational facilities. The economic life is boisterous with banks and some industrial enterprises.

Ogbomoso South Local Government Area came into being as a result of the splitting the former **Og**bomoso metropolis into two in September,1991 by the then Federal Military Government. **O**gbomoso South which is located in the North-Eastern part of **Oyo** State occupies an area land mass of 15 square kilometres and is bounded in the north by **Og**bomoso North Local Government, in the south by **Ogo**-**O**luwa Local Government, in the east by Surulere Local Government and in the west by **O**rire Local Government. **O**gbomoso South has its headquarters located at **S**unsun /**A**rowomole, **O**gbomoso. Its being in the savaanah zone makes farming the major occupation of the people of the area. Other occupation they engage in are trading, teaching and artisans. The council is mainly populated by the Yorubas but other tribes can be found in their thousands. The predominant religions of the people are Christianity and Islam while other traditional religious worshippers are there. The Ten (10) wards of the local government are: Ibapon, Ijeru I, Ijeru II, **Arowo**mole, Akata, **A**lapata,Isoko, Ilogbo, Lagbedu/ Isapa and **O**ke-**Ol**a/ Farm settlement.

WATER SAMPLING

A total of forty water samples were collected from both north and south local government areas. Twenty (20) hand-dug wells used for drinking purpose were collected and sampled from each local government area and from each ward within the councils.Sampling protocols described by Claasen,(1982) and Barcelona et al.,(1985) were used during sample collection. In all, forty (40) water points were sampled and at each sampling site, duplicate samples were collected. Samples were collected using clean and sterilised plastic container in a steam under pressure (autoclave) at 121^0C for 15 minutes. At the point of collection the tap of the bore-hole was sterilised using flame for few minutes and the water was carefully taken with the containers. All the samples were kept in an ice-chest and transported to the laboratory, stored in a refrigerator at a temperature of $<4^o$C and analysed for bacteriological examination. Analysis was done immediately. For physicochemical quality, samples were analysed by appropriate certified and acceptable international standard methods (APAH, 1998) and the water quality assessment.

PHYSICAL ANALYSIS

Turbidity was determined using the Nephelometric method (APAH,1998) in which the sample was shaken vigorously and transferred into a sample cell to at least two-thirds full. The sample cell was placed in the turbidimeter and the appropriate range on the turbidimeter was selected. The stable turbidity reading was then recorded on site. PH, temperature and electrical conductivity were recorded on site. Total dissolved solids (TDS) were determined using gravimetric method (APHA, 1998) in which the sample was vigorously shaken and a measured volume was transferred into a 100ml graduated cylinder by means of a funnel. The sample was filtered through a glass fibre filter and a vacuum applied for about 3 minutes to ensure that water was removed as much as possible. The sample was washed with deionised water and suction continued for at least 3 minutes. The total filtrate was transferred to a weighed evaporating dish and evaporated to dryness on a water bath. The evaporated sample was dried for at least 1 hour at 1800C.The dried sample was cooled in desiccators and weighed. Drying and weighing process was repeated until a constant weight was obtained.

CHEMICAL ANALYSIS

Total Alkalinity, total hardness and chloride concentrations were determined using titrimetric methods. Alkalinity was determined by titration of the 50mls water sample with 0.1M hydrochloric acid to PH 4.5 using methyl orange indicator while total hardness was analysed by titration of 50mls water sample with standard EDTA at PH 10 using Erichrome black T indicator. The chloride content was determined by argentometric method. The sample was titrated with standard silver nitrate using potassium chromate indicator. Iron, manganese and lead concentrations were determined using Unicam 969 Atomic Absorption Spectrophotometry (AAS). Calcium ions concentrations

were determined using EDTA titrimetric method. Sulphate ions concentration was determined using colorimetric method (APHA,1998)

ISOLATION AND ENUMERATION OF TOTAL AND FEACAL COLIFORM

Total coliforms, faecal coliform and enterococci were enumerated by membrane filtration using 100ml aliquots of the water sample as described by Obiri-Danso and Jones (1999a,b) and Anon,(1994)

ENUMERATION OF TOTAL HETEROTROPHIC BACTERIA OR TOTAL VIABLE COUNT

Total heterotrophic bacteria in the water samples were obtained using the pour plate method. Dilutions of 10^{-6} to 10^{-8} of the samples were prepared in 0.1% buffered peptone water (oxoid) and duplicate 1ml aliquots of each dilution inoculated into 10ml each of molten plate count agar(PCA) in universal bottles. These were then thoroughly mixed poured into sterile Petri-dishes and incubated at 35^0C for 24 hours. Petri-dishes from dilutions containing between 30 and 300 discrete colonies were counted and the result expressed as the numbers of bacteria per millilitre (Anon,1994)

3. RESULTS AND DISSCUSSION

The physicochemical and bacteriological qualities of hand-dug well water in **Og**bomoso North and **S**outh local governments areas are presented in Table 1,2 and 5,6 respectively. The Mean value of the samples are presented in Table 3, and Table 4 showed the comparison with WHO (2005) guidelines

TABLE 1: PHYSICO-CHEMICAL QUALITY OF WELL WATER IN OGBOMOSO NORTH LOCAL GOVERNMENT OF OYO STATE.

Locations	pH	Colour Hz	Conductivity us/cm	Turbidity (JTU)	Alkalinit ymg/l)	Hardness (mg/l)	Ca Hardness(mg/l)	Ca ions (mg/l)	Cl ions(m g/l)	SO4 ions (mg/l)	Fe ions (mg/l)	TDSmg/l)	Mg ions(mg/l)
Masifa	7.0	5	560	2.35	60	150	120	48	95	24	0.02	170	7.2
Kuye	7.0	5	440	2.38	60	240	180	72	140	32	0.5	165	14.4
Oke-anu	6.9	5	500	2.55	50	44	30	12	17.5	12	0.02	280	3.36
Oke ado	7.0	5	540	2.40	60	70	54	21.6	27.5	48	0.02	300	3.84
Stadium	6.2	5	790	2.67	40	30	18	7.2	17.5	54	0.02	420	2.88
General	8.0	5	130	2.46	80	40	30	12	20	24	0.02	320	2.4
Owode	6.2	5	860	2.44	50	210	126	50.4	105	30	0.5	480	20.16
Laka	6.9	5	480	2.55	240	404	140	56	160	120	0.70	1120	3.36
Ode aremo	7.0	5	380	2.51	390	840	640	256	400	14	0.75	460	48
Sabo	6.0	5	265	2.57	30	120	84	33.6	45	14	0.02	150	8.64
Adiatu	6.4	5	830	2.60	80	60	42	16.8	22	32	0.1	375	4.32
Oja igbo	6.4	5	760	2.52	78	100	78	31.2	35	51	0.1	330	5.28
Randa	6.8	5	900	2.41	120	170	120	48	40	26	0.30	325	12
Okelerin	8.0	5	210	2.34	106	340	160	64	152.5	32	0.70	580	43.2
Aaje	7.7	5	340	2.34	164	200	120	48	177.5	30	0.70	400	19.2
Apake	7.4	5	160	2.19	60	80	58	18.2	22.5	51	0.01	280	5.28
Bolanta	8.8	5	150	2.31	210	504	284	113.6	160	27	0.01	175	52.8
Iwagba	6.8	5	560	2.34	56	80	56	22.4	17.5	10	0.1	85	5.76
Igbo agboin	6.0	5	950	2.43	50	80	60	24	20	50	0.1	120	4.8
Saja	7.0	5	420	2.42	100	140	90	36	50	18	0.1	300	12

TABLE 2: PHYSICO-CHEMICAL QUALITY OF WELL WATER IN OGBOMOSO SOUTH LOCAL GOVERNMENT OF OYO STATE

Locations	pH	Colour (HU)	Cond(us /cm)	Turb (JTU)	T.Alkalinity (mg/l)	T.Hardness (mg/l)	Ca.Hardness (mg/l)	Ca ions (mg/l)	CL ions (mg/l)	SO4 ions (mg/l)	Fe ions (mg/l)	TDS (mg/l)	Mg ions (mg/l)
Ilogbo	6.8	5	600	2.38	130	384	280	112	215	12	0.7	165	24.96
Aromole	6.8	5	550	2.50	140	164	120	48	95	21	0.2	100	10.56
Ojude ajawa	6.8	5	580	2.55	110	340	180	72	172.5	40	0.7	845	38.4
Ijeru	6.4	5	240	2.61	180	376	100	40	210	175	0.7	1225	66.24
Obandi	6.2	50	790	2.83	60	60	48	19.2	25	14	0.01	80	2.88
Ahoyaya	7.4	5	330	2.33	90	250	140	56	77.5	40	0.7	130	2.64
Akata	7.2	5	380	2.26	40	116	84	33.6	62.5	32	0.03	280	7.68
Oke alapata	7.5	5	340	2.29	84	140	100	40	80	24	0.02	380	9.6
Idi oro	8.8	5	140	2.52	130	220	146	58.4	50	40	0.7	230	17.76
Caretaker	7.2	5	450	2.69	78	100	80	32	32.5	50	0.01	230	4.8
Odo koto	7.4	5	230	2.50	140	228	180	72	55	30	0.02	320	11.52
Seminary	6.8	5	580	2.42	70	88	64	25.6	55	60	0.01	125	5.76
Lagbedu	7.5	5	310	2.31	236	278	220	88	220	20	0.7	245	13.92
Baaki	7.0	5	240	2.51	100	170	100	40	210	74	0.2	230	16.8
Ayegun	7.2	5	310	2.46	60	360	192	76.8	172.5	48	0.5	435	40.2
Oremerin	7.4	5	570	2.30	200	240	150	60	152.5	26	0.5	250	21.6
Molete	7.4	5	350	2.38	120	262	154	61.6	140	92	0.3	456	25.92
Esanu aje	7.6	5	340	2.41	240	100	64	25.6	27.5	12	0.2	100	8.64
Sunsun	7.0	5	420	2.27	80	180	120	48	40	18	0.1	300	14.4
Oke-ola	7.0	5	220	2.42	100	140	90	36	50	18	0.1	250	12

TABLE 3: THE MEAN VALUES AND RANGES OF THE HAND-DUG WELL WATER QUALITY IN THE OGBOMOSO NORTH AND SOUTH LOCAL GOVERNMENT AREAS

Parameters	Ogbomoso North		Ogbomos South	
	Means	Ranges	Means	Ranges
Ph	7.3	6.2-8.8	7.56	6.2-8.8
Conductivity(us/cm)	552	130-950	424	140-790
Colour(HU)	5	5	7.25	5-50
Turbidity(JTU)	2.57	2.19-2.67	2.45	2.26-2.55
Total Alkalinity(mg/l)	111.7	30-390	119.4	40-236
Total Hardness(mg/l)	203.1	40-504	209.8	60-384
Calcium Hardness(mg/l)	132.6	18-640	130.6	64-280
Calcium ions(mg/l)	41.27	7.2-256	52.24	19.2-112
Chloride ions(mg/l)	101.33	17.5-400	107.13	27.5-215
Sulphate ions(mg/l)	37.15	10-120	42.3	12-175
Iron ions(mg/l)	0.24	0.01-0.7	0.32	0.01-0.7
TDS (mg/l)	363.5	85-1120	334.5	80-1225
Magnesium ions(mg/l)	13.94	2.4-52.8	17.81	4.8-66.24
Total Coliform (MPN/100ml)	29.1	9-52	26.25	11-47
Faecal Coliform(MPN/100ml)	16	04-36	15.7	04-29
Total viable bacterial counts(cfu/ml) $x10^7$	14.9	10-34	15.6	10-22

TABLE 4: WELL WATER QUALITY OF OGBOMOSO NORTH AND SOUTH LOCAL GOVERNMENT COMPARED WITH THE LIMITS RECOMMENDED FOR DRINKING WATER

PARAMETERS	OGBOMOSO NORTH MEAN VALUES	OGBOMOSO SOUTH MEAN VALUES	WHO GUIDELINES
Ph	7.3	7.56	6.5-8.5
Colour(HU)	5	5	0-15
Conductivity(us/cm)	552	424	400
Turbidity(JTU)	2.57	2.45	0-5
Total Alkalinity(mg/l)	111.7	119.4	80-120
Total Hardness(mg/l)	203.1	209.8	100-500
Calcium Hardness(mg/l)	132.6	130.6	
Calcium ions (mg/l)	41.27	52.24	75-200
Chloride ions(mg/l)	101.3	107.13	0-200
Sulphate ions(mg/l)	37.15	42.3	0-250
Iron ions(mg/l)	0.24	0.32	0-0.3
TDS(mg/l)	363.5	334.5	1000
Magnesium ions(mg/l)	13.94	17.81	0-200
Total Coliform (MPN/ml)	29.1	26.5	0-10
Faecal Coliform (MPN/ml)	16	15.7	0
Total viable bacterial counts (cfu/ml) $x10^7$	14.9	15.6	-

TABLE 5: BACTERIOLOGICAL QUALITY OF WELL WATER IN OGBOMOSO NORTH LOCAL GOVERNMENT AREA

LOCATIONS	TOTAL COLIFORM (MPN/100ML)	FAECAL COLIFORM (MPN/100ML)	TOTAL VIABLE BACTERIAL COUNTS (CFU/ML) $X10^7$
Masifa	32	17	14
Kuye	40	24	11
Oke anu	44	26	14
Oke ado	09	04	10
Stadium	14	05	11
General	20	10	12
Owode	22	12	12
Laka epo	52	36	34
Ode aremo	22	12	18
Sabo	38	19	18
Adiatu	42	24	12
Ojaigbo	31	09	10
Randa	35	09	14
Okelerin	42	30	24
Aaje	31	13	14
Apake	27	17	14
Bolanta	27	13	15
Igbo agboin	14	04	10
Iwagba	13	04	11
Saja	27	16	20

TABLE 6: BACTERIOLOGICAL QUALITY OF WELL WATER IN OGBOMOSO SOUTH LOCAL GOVERNMENT AREA

LOCATIONS	TOTAL COLIFORM (MPN/100ML)	FAECAL COLIFORM (MPN/100ML)	TOTAL VIABLE BACTERIAL COUNTS (CFU/ML)X10^7
Ilogbo	21	14	16
Aromole	34	26	22
Ojude ajawa	30	18	18
Ijeru oja	42	26	20
Obandi	17	10	20
Ahoyaya	44	29	18
Akata	34	24	21
Oke alapata	24	14	14
Idi oro	10	04	12
Caretaker	13	04	10
Odo koto	47	28	20
Seminary	12	06	16
Lagbedu	22	15	10
Baaki	14	08	11
Ayegun	24	14	13
Ore merin	12	05	10
Molete	20	11	12
Esanu aje	28	13	10
Sunsun	47	30	22
Oke ola	30	15	17

pH: The pH of water samples in the North area varied from 6.4 to 8.8 while in the South area pH value varying from 6.2 to 8.8. South area recorded the lowest pH of 6.2 while both areas had higher pH value of 8.8. According to Stumn and Morgan,(1981) pH value of natural water ranged from 6.0 to 9.0, hence the pH Value of both areas fall within the WHO,2005,set standard for drinking water.

Conductivity: The conductivity values of water samples in both areas fall within the limits of acceptable standard for drinking and domestic purpose. In the North area the conductivity value of the samples varied from 130 to 950us/cm with a mean of 552us/cm while in the South area, the conductivity varied from 140 to 600us/cm. North area recorded the minimum and maximum conductivity value of 130 and 950us/cm.

Colour: The colour of the samples in both areas fall within the WHO set limits of acceptable standard for drinking and domestic water. They all had 5HU, except Obandi sample in the South area which had 50HU.

Turbidity and TDS: Table 1 and 2 showed that the turbidity values of the samples in both areas were within the set limits of acceptable standard. The turbidity values in the North area varied from 2.19-2.67 JTU while the South area varied from 2.27- 2.88 JTU. The South area had the highest turbidity value of 2.88 JTU and the North area recorded lowest turbidity value of 2.19 JTU.

TDS: This shows indicator of polluted water. TDS concentrations in the North area water samples varied from 85-1120mg/l with value of 363.5mg/l while that of South area varying from 80- 1225mg/l with a mean value of 334.5mg/l.The maximum acceptable limits of TDS in drinking water by WHO,1993 was 1000mg/l. The TDS concentrations of samples from both areas fell within the acceptable standard for drinking and domestic water except Ijeru-Oja with 1225mg/l and Laka with 1120mg/l in the South and North respectively which recorded the concentrations higher than acceptable limits.

Total Alkalinty: The alkalinity of the sample in both areas is within the set limits of WHO and did not vary significantly. In the North area alkalinity ranging from 30-390mg/l with a mean value of 111.7mg/l while in the South area the alkalinity ranging from 60-236mg/l with a mean value of 119.4mg/l.The North area recorded the lowest and the highest alkalinity value of 30mg/l and 390mg/l.

Total Hardness: Water hardness in the North area varied widely with the values ranging from 30-840mg/l and mean value of 203.1mg/l while the South area had hardness values ranging from 60-384mg/l with a mean value of 209.8mg/l.The North area recorded the highest and lowest hardness values of 840mg/l and 30mg/l respectively. Well water in both areas is generally soft, except sample from Ode-aremo and Ita-popo in the North area which had 840mg/l and 504mg/l respectively, higher than the acceptable limits of WHO.

Chloride ions concentrations: Water samples in the both areas had low chloride ions residual. In the North area, the chloride ions contents varying from 20-400mg/l with a mean value of 101.3mg/l.In the South area the chloride ions contents varying from 25- 215mg/l with a mean value of 107.1mg/l. The highest chloride ions content was recorded in Ode-aremo of the North area with 400mg/l while the lowest chloride ions content was recorded in General of North area with 20mg/l. Although the chloride ions contents of both areas fell with the WHO set guide lines of drinking and domestic water, but according to Dallas and Day (1993), chloride ions are non-cumulative toxins, an excessive amount of which, if taken over a period of time can constitute a health hazard(WHO,1984,1993). Excess chloride in water impacts bad tastes and may indicate contamination from urine and sewage.

Sulphate: The sulphate ions residual of the samples in the areas fell within the WHO guidelines of drinking and domestic purposes. In the North area the sulphate contents varied from 10- 120mg/l with a mean value of 37.15mg/l while in the South area the sulphate residual varied from 12-175mg/l with a mean value of42.3mg/l. The lowest sulphate ions content was recorded in the South area with 10mg/l while the highest sulphate ions content was recorded in the South area with 175mg/l

Iron ions contents: The well water samples in both areas were characterised by low iron concentrations and fell within the WHO maximum acceptable limits for drinking and domestic water. Although some samples in both areas recorded iron residual values higher than the acceptable limits. Excess iron residual in water may cause taste and odour problem in water and result in red colouration of water. In the North area the iron residual of the samples ranging from 0.01-0.75mg/l and in the South area it varied from 0.01-0.7mg/l.

Calcium ions and Magnesium ions concentrations: There is no adverse health effects specifically attributable to calcium and magnesium in drinking water. But the presence of Ca^{2+} and Mg^{2+} ions in drinking water may result from their ability to cause hardness of water. Water samples in both areas were characterised by low Calcium ion and Magnesium ions contents. Both fell within the WHO maximum acceptable limits for drinking and domestic water. Calcium ions contents in the North area ranged from 7.2-64mg/l with a mean value of 41.27mg/l while in the South area, it ranged from 19.2-122mg/l with a mean value of 52.24mg/l. The North area had the lowest Ca^{2+} ions content of 7.2mg/l while the South area recorded the highest Ca^{2+} ion content of 112mg/l .

For Magnesium ions contents, the North area samples varying from 4.0- 105mg/l with a mean value of 26.8mg/l and the South area samples varying from 4.8-110.4mg/l with a mean value of 31.68mg/l. Sample from the North area recorded the lowest Mg^{2+} contents of 4.0mg/l while the highest Mg^{2+} contents of 110.4mg/l was recorded in the South area.

Table 5 and 6 showed that all the well water samples in both areas were contaminated with both total coliform and faecal coliform bacteria. The observation on the bacteriological quality of water samples is not entirely a new findings, some water drawn from an improved source of water such as stand-pipe, bore-hole and well water are not always free from contamination. The level of Total coliform and faecal coliform bacteria contamination of all water samples in both areas may be as a result of the location of the hand-dug well water, domestic animals that normally visit the site to drink and defecate around the well water. These activities could enhance bacterial spores to contaminate the water through the opening of the well. The use of contaminated drawers/ containers to draw water from some well is another source of contamination. Moreover total and faecal coliform contamination may be due to environmental factors especially human activities in around the well. Most pathogens from faecal matter remain near the point of origin or source may travel along with the water flow through pore in the surrounding soil and may enter the well through cracked drum/casing.

4. CONCLUSION AND RECOMMENDATIONS

The study indicates that the hand-dug well water samples in the Ogbomoso North and South local government areas are generally soft. Most of the physicochemical parameters of the samples were within acceptable limits for drinking purposes. However the concentrations of TDS in some samples in both areas were above maximum acceptable limits. These constituents should be monitored over a period of time because of possible threats to health at higher concentrations. Moreover, in terms of bacteriological quality, the samples in both areas are poor and unsuitable for human consumption without treatment. The bacteriological quality of the samples should be monitored by conducting a periodic on-site inspection by assessing how vulnerable the source of water is, to nearby sources of faecal contamination, testing its source-water quality periodically and disinfect water to eliminate any form of pathogens present in water.

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