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A Comparative Analysis of Safe Water and Sanitation in Selected Urban and Rural Areas of Osun State, Nigeria

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Water is an absolute necessity, yet, it can be a carrier of many diseases. Degradation of water quality is almost invariably the result of human activities like poor personal, domestic and community hygiene. This paper therefore examines and compares the quality of drinking water and sanitation in selected urban and rural areas of Osun Sate, Nigeria. Water samples were collected and analysed in a laboratory with a focus on physical, chemical and microbiological characteristics and the result compared with World Health Organisation (WHO) recommended standards. Invariably, the result compared favourably in respect of physical and chemical characteristics but failed to pass microbiological tests of safe drinking water. A total of 200 questionnaires were administered to the residents to access necessary information on drinking water and sanitation situation in the study areas. After comparing them, the study revealed a measure of differences in drinking water qualities and sanitation situation in the study areas, furthermore, the study discovered that poor drinking water qualities are a direct consequence of poor sanitation. The paper therefore, recommended better water and sanitation policy, immediate as well as long-term remedies. The paper will be of immense benefit to policy makers, city planners, international and local aid agencies as well as ordinary citizens.

Keywords: Comparison, Safe water, Sanitation, Parameters, Rural and urban areas.

INTRODUCTION

Water, just like air is fundamentally essential for all forms of life and sustenance of wellbeing. It is an important input for industries whether agricultural, manufacturing, transportation or mining just to mention a few. It covers about 70% of the earth surface, yet, accessibility to safe drinking water is uneven, and man rather than nature has mishandled it to his own disadvantage. Human activities that resulted from urbanization, industrialization, agriculture, mining and the likes have combined to render this essential substance unsafe for human consumption in many places. Settlements of developing countries across the globe are the worst affected, they suffer adversely from water pollution that resulted from poor handling of water sources.

Many industries in Nigeria, for instance, dispose-off their wastes without due regard to sound environmental management practices. The rapid population growth is not accompanied with the delivery of water supply, sewage and sanitation services. The gap between those areas that have reasonable access to safe drinking water supply and sanitation and those without is growing wider. Moreover, urban areas experience greater coverage whereas peri-urban, semi-urban and rural areas are experiencing stagnation or a decline in service (USAID 2014). A Water and Sanitation Program (WAP) reported that 70 million Nigerians use unsanitary or shared latrine, 32 million have no latrine e at all and they defecate in the open and the poorest quintile is ten times more likely to practice open defecation than the richest. The supply of potable water for domestic uses is a major challenge to the rapidly growing Nigerian cities. It is estimated that only 48% of the inhabitants of the urban and semi-urban areas of Nigeria and 39% of rural areas have access to potable water supply (NWSSP, 2000).

In the face of increased demand for water, the average delivery to the urban population stands at only 32 liters per capita per day (lpcd) while that of rural areas stands at 10 (lcpd). Unfortunately, the widening gap between the demand and supply of water is of crisis proportion in Nigeria (Emmanuella, 2010).

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STATEMENT OF THE PROBLEM

Inadequate accesses to safe water and sanitation services coupled with poor hygiene practices kill, sicken and lead to impoverishment and diminished opportunities for thousands. Many children especially girls are denied their right to education because their school lacks private and adequate sanitation; women are forced to spend a large part of their day fetching water. Poor farmers and wage earners are less productive due to illness, health system is overwhelmed and national economy suffers, without water, sanitation and hygiene (WASH), sustainable national development is impossible.

REVIEW OF RELEVANT LITERATURE

Water is a liquid without colour, smell or taste that falls as rain in lakes, rivers and seas and is used for drinking washing and so on (Oxford Advanced Learners' Dictionary 2007). It is indeed a wonderful chemical medium which has unique properties of dissolving and carrying in suspension huge varieties of chemicals. Thus, it can be contaminated easily. Natural surface water often has impurities from various sources some of which may be suspended particles, colloidal materials and may also be dissolved cationic and anionic substances (Santra, 2013).

Hence, Mebeck *et a*l, (1996) have stated that the quality of water may be described in terms of concentration and state of (dissolved and particulate) of some or all the organic and inorganic materials present in the water, together with certain physical characteristics of the water. These authors identified the effects of human activities on water quality as both widespread and varied in degree to which they disrupt ecosystem and or restrict water use.

Similarly, groundwater is water under the earth crust and it gets polluted when it comes in contact with either at the point or non-point pollution sources. Point pollution areas include municipal landfill, leaky sewer lines, spill from industrial waste, underground injection into wells through latrines and graveyards. The non-point sources of pollution include spray of fertilizers, pesticides and herbicides on agricultural land and through acid rain (Press and Siever, 1985). Ground water quality assessment examines the chemical, biological and physical qualities of water, including temperature, turbidity colour, taste and odor (Thomas, 2003).

Sanitation is the equipment and system that keep places clean especially by removing human waste (Oxford Advanced learner's Dictionary, 2007). It is a safe disposal of human excrement. It also involves handling community of water supply and, disposal of sewage and refuse; it is equally used to denote the control of those elements in the environment that affect or may affect human health, hence, it is the whole adjustment of the environment for the prevention of diseases.

Recent studies indicate that at least 250million households worldwide have no access to piped water, 400million lack adequate sanitation. The affected lives are in areas without sewage or sanitation facilities (Aribigbola, 2010). In Africa, UN habitat estimates that over 70% of urban population suffers shelter deprivation in terms of inadequate housing water supply and sanitation (Aribigbala citing Kessides, 2006).

Water and sanitation is still not top priority for Africa governments, they have given cacophony of excuses for their failure to provide the people with safe water and adequate sanitation, among which are; inadequate human capacity, insufficient private sector and civil society interest in water provision, inability to collect revenue for water, unsustainability, inadequate accessibility to donor funds, and slowness in mobilizing financing as well as inadequate necessary laws.(National Water Supply and Sanitation, 2000).

Access to safe drinking water refers to the percentage of the population that uses drinking water from improved sources; improved drinking water sources include household connection, public standpipes, boreholes, protected wells and springs (Water and Sanitation Sector Coverage 2008). The proportion of population having access to safe drinking water from improved sources has decreased from 1990 to 1996 while the report of Joint Monitoring Program (JMP) compiled from national data source show that in 1990 half (50%) of the population uses water from improved source while in 2006, the number slightly less than half (47%) used water from improved sources, the same report showed slight improvement in sanitation coverage in Nigeria.

Nigeria is among the least 25 countries worldwide in terms of sanitation coverage. In 1990, just about 26% of the population enjoyed improved sanitation facility while in 2006; almost 30% used improved sanitation facilities. The marginal increase on improved coverage is a clear indication that not more progress has been achieved in meeting the millennium development goals (MDGs) target of 75% water from improved sources and 63% accessing improved sanitation facilities by 2015, even though, the National Water Supply and Sanitation Policy Paper (2000) of Federal Republic of Nigeria put forward a robust policy with the centerpiece of provision of sufficient potable water and adequate sanitation for all Nigerians in affordable and sustainable ways through participatory investment by three tiers of government, the private sector and the beneficiaries: with the initial target of improving service coverage from 40% to 60% by year 2003, extension of coverage to 80% of the population by 2007 and 100% by 2011, the sustenance of 100% full coverage of water supply and wastewater services for the growing population beyond 2011.

Groundwater is water under the earth crust and is a major source of domestic commercial and industrial water source from time immemorial for people across the globe, but it do gets polluted when it comes in contact with either the point or non-point pollution sources. Point pollution areas include municipal landfill, leaky sewer lines, and spill from industrial waste, underground injection, latrines and graveyards. The non-point sources of pollution include spray of fertilizers, pesticides and herbicides on agricultural land and through acid rain (Press and Siever, 1985). Basir *et al* (2007), identified agriculture and industrialization as the major sources of water pollutant while Ogbuagu and Nnodu (2006) described industrialization, urbanization and poor waste management services as the root cause of unsafe drinking water.

Careless dumping of waste at odd places, unhygienic disposal of human waste, indiscriminate disposal of toxic waste in estates and crowded settlement, poor development planning and chronic unhygienic habit resulted in water pollution and contamination cumulating in rendering water unsafe for drinking (Ovrawah and Hymore, 2001). Lithological and radioactive (major and trace) materials are capable of reducing the quality of water to some extent, the major course and source of miss handling of wells arise from closeness to pit latrine, filths, refuse dump and chemical leachate (Olusoji, 2010), and hence, less water remains suitable for human consumption. More and more countries and relevant organizations have paid growing attention to drinking water issues, especially drinking water safety (DWS). Ensuring the safety of drinking water has become a focus drawing attention of the whole world (Chao *et al*. 2011).

THE STUDY AREA

Osun State is located in southwestern part of Nigeria, on latitude $05^{0\,1}$ and $05^{0\,8}$N and $07^{0\,1}$ and $08^{0\,1}$ E longitudes with a land area of about 14, 875sq km. (see fig 1) The climate is Koppens Af humid tropical climate characterised by double maximal rainfall distribution of 168cm mean annual and temperature of about 29^{0}C in average coupled with high humidity of about 80% in early hours. The State is peopled mainly by Yoruba ethnic group who are majorly farmers, traders and artisans.

The 2006 population and housing census put the population of the State at 4, 423, 535 people. Not unlike other African societies, the State has rapidly growing cities one of them is Ilesa with the population of about 300,000 projected from 2006 census. The city has two Local Government Areas; East and West with 20 political wards in the city, in the same vain, 20 villages with the average of 20 kilometers to any city were selected within the neighboring rural Local Governments Areas (Atakunmosa East and West) with the average of 20 houses.

AIMS AND OBJECTIVES OF THE STUDY

The study investigated the peoples' drinking water quality, using WHO recommended standard as a yard stick. It also examined sanitation situation in selected urban and rural areas and then compared both accessibility to quality drinking water and sanitation in both urban (Ilesa) and rural (the villages). The study equally considered the roles of personal, domestic and community hygiene on accessibility to safe drinking water situation in the study areas.

RESEARCH SETTING, METHODS AND MATERIALS

The methodology adopted for this study is multistage; reconnaissance survey together with oral interviews was first carried out to access preliminary information on sources of drinking water and their qualities in the study areas. Adopting systematic data collection method, one drinking water source was randomly chosen to represent a political ward in the city and one source in each village. Samples were taken from drinking water sources into sterilized plastic bottles between 6 – 8am for onward movement to Federal Ministry of Water Resources' Laboratory, Akure, Ondo State, Nigeria and analysis were carried out immediate to ascertain the level of safety when compared the result with WHO recommended standard. Since a comprehensive data set on socio-economic, demographic, safe water and sanitation situation was required, a structured questionnaire was designed and systematically administered on the residents.

Average of 200 houses existed in each political ward. National Population Commission (NPC 2006). 10 houses (5%) were chosen systematically in each political ward. Questionnaires were administered to the 20th house head preferably women, 10 copies of the questionnaire in each political ward making a total of 100 copies in the city. The same method was adopted in the villages, only that, the number of houses were less, questionnaires were therefore administered proportional to the number of houses in each village and a total number of 100 copies were also used making the total number of questionnaires administered to be 200 copies. The villages include; Arigbabu, Balogun, Alagbon, Isaobi, Fadugba, Ijana, Imoro, Ijila, Aroaji, Itagunmodi. 100 copies of the questionnaire were administered in proportion to the number of houses in the selected villages.

Reconnaissance survey and oral interview reveal that both Ilesa and selected villages are not connected to any form of water scheme, the people, therefore meet their water needs using hand-dug-wells; only one tenth of the population uses deep wells. These hand-dug-wells are situated at individual compound usually at the back of the houses close to pit latrine; dump site, bathroom and burial site of dead family members (See plate 1). The rural dwellers in the study areas depend mainly on streams, rivers but a few uses hand-dug-wells, the streams and river pass through many villages and they are used at different points for different purposes without due regard for other users down the stream.

These rivers and streams are seasonal; with ample variation in the volume of water at wet and dry seasons, during the dry season, the volume of water reduced greatly, they cease to flow and since the demand for water is higher at this period, people keep using and drinking the water since no alternative exists. Residents directly wash their dresses, kitchen utensils, motorcycle and vehicles in the streams resulting in the introduction of petroleum materials in the drinking water. Children and young adults swim and even birth with soap in these same stagnant waters sources. (See plate 2).

Some villagers do farm along river channels using chemical fertilizers which somehow get into stream/river waters which is another human careless activity contributing to poor drinking water quality in the study area. Wide and free ranged domestic animals like duck, goat, ship and pigs equally depend on these same stagnant pools for their water needs, they do not only drinking directly from them but sometimes, some of them also swim, urinate and defecate in them, leading to the introduction of coliforms that inhabit the intestines of humans and animals and are very harmful to human health.

In the same vein, villagers from Isaobi, Afon, Fadugba, Igun, Ijana, Imoro, Ipole, and Igila source their drinking water mainly from Eripa River while residents of other villages like Aroaji, Afon, Oloronbo source theirs in both Alapata and Eeju streams. The villages are situated along the stream/river channels and the villagers access and use the stream/river waters in different places for different purposes without due consideration for other users in other places. It was also revealed that the study areas have no regular routine coverage of sanitation; people dump or burn their refuse in odd places, many houses have no working toilet, since most houses are old, many over 100years old, the few available pit latrines are also old, full, flows out occasionally and get into poorly constructed, poorly covered, and shallow and unlined wells especially when it rains and either run-off or flood run through the overpopulated and unplanned neighborhood (see plate 3).

Although, sanitation should be the responsibility of local government authorities; this third tier of government is the weakest, it has no wherewithal to solder the full responsibility of sanitation in a country like Nigeria where state governors meddle with the fund meant for it and even decide whether directly or otherwise who governs at this level of government since the constitution put the state at unwarranted advantage over local government level of government.

The state government promised to tackle the problem, a waste disposal van was procured for each local government area, under Osun Youth Empowerment Scheme (OYES) and some youths were offered a 24 month revolving temporary jobs and some of whom were charged with the responsibility, these youth are paid stipend of N10,000 about $200 monthly and the payment is not regular, sometimes not paid over as long as eight months. Therefore, the youths are discouraged and the problem remains unsolved.

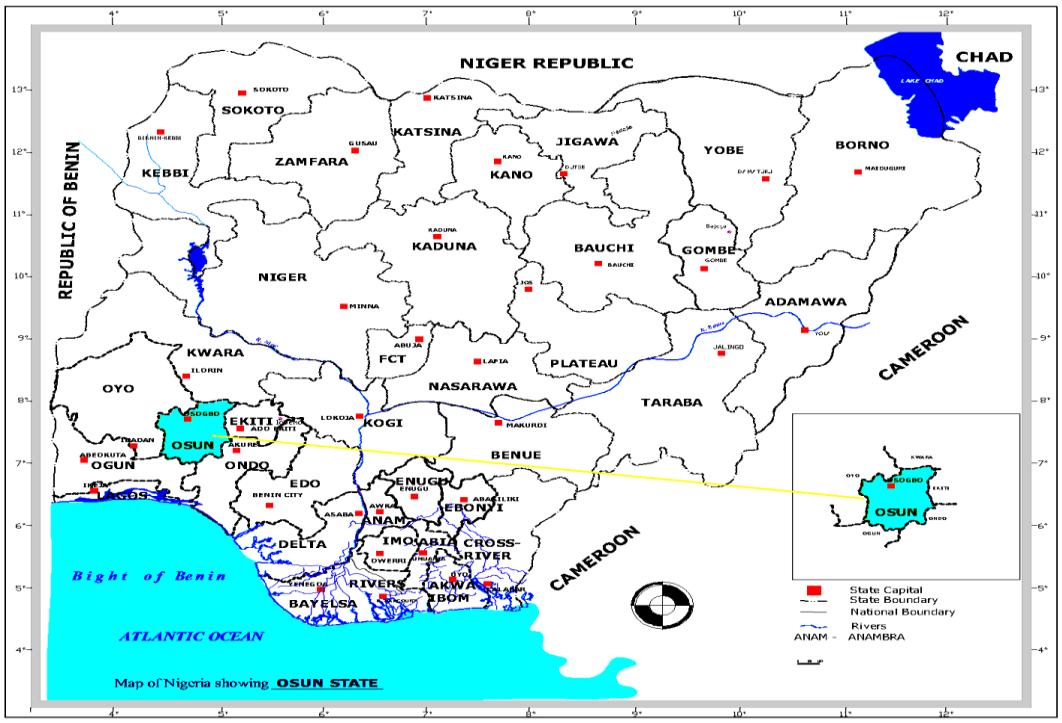

Fig. 1. Map of Nigeria showing Osun State.
Source: Osun State Ministry of land and physical planning, Osogbo. (2016).

Plate 1. An unkempt drinking water source in urban area

Plate 2. A drinking Water source in rural area

RESULT OF LABORATORY ANALYSIS, DISCUSSION AND COMPARISON

The appearance of drinking water sourced from urban area are clear while about two-third of those sourced from rural areas are slightly cloudy or completely cloudy this may be due to various reasons; the drinking water sources in rural areas are mainly streams and rivers and they flow through thick forest region of tropical Africa. Materials from organic sources like leaves, decaying fruits, detached branches of trees may find their ways into them, high rainfall of the region resulted in much run-off and high deposit of load in the streams and rivers.

The Acidity may also be due to contamination resulting from the presence of dissolved carbonate, hydroxide, calcium, magnesium and sodium. Acidic water favors corrosion of pipe and utensils, highly acidic water may also be hazardous to human health. Although, The acidic nature of drinking water samples in both the urban and rural areas fall within World Health Organisation WHO recommended values of (6.5-8.5). Visual Hardness or Turbidity (NTU) are insoluble suspended particle, it is higher than expected the value of WHO and it may render the samples unsafe for drinking because the particles may serve as piggy-back to micro-organisms which are dangerous to human health. WHO recommended value for Total Dissolved Solids is 100Mg/L while the values obtained in both the urban (44.4-51.4) and rural areas of (47.1-63.0) drinking water samples fall within the expected range. On Conductivity, the entire water samples both taken from rural and urban drinking water sources fall within the required range of WHO values of 900-1200µs/cm-^{1}.

Calcium Hardness ($CaCO_3$) is due to the presence of calcium and magnesium in water, although, the recommended value of WHO was not stated but it is average between (50-120Mg/L) or 3-7 grains per gallon because water becomes acidic at low hardness level, hence, the result obtained from drinking water samples in both urban (10.0-15.1) and rural sources (15.1-27.4Mg/L) are acceptable.

For Magnesium Hardness ($CaCO^3$), WHO recommended an average value of between 50-120Mg/L, samples from drinking water sources in both urban (20-60.0Mg/L) and rural (19.1-72.0Mg/L) areas falls within the acceptable range.

Nitrate (NO_3^{2-}); the WHO maximum acceptable value is 50mg/L while the values obtained from urban (11.3-15.3Mg/L) and selected villages (13.4-16.3Mg/L) which is low and preferred especially when the high concentration of calcium in water is harmful to both human health and aquatic animals. Iron (Fe) concentration in the samples is below required value compared with WHO required value of 1Mg/L, the values obtained in urban center selected range between (0.01-0.04Mg/L), while that of rural is (0.1-0.6Mg/L). Hence, they are acceptable.

Alkalinity level is also good and preferred when compared with WHO recommended standard range obtained from samples taken in urban center is between (10.0-40.3Mg/L) and rural (9.0-13.9Mg/L) with WHO recommended value of 100Mg/L.

Magnesium (Mn); WHO recommended 0.1-04, while the values obtained in the samples collected from drinking water sources in urban center ranged between (0.01-.0.02) while that of rural areas is between (0.01-0.03), hence, they both fall within acceptable values. The values of Calcium (Ca^{2+}) obtained in the samples drawn from urban center ranged between (8.2-96.9), while that of selected villages range is within (26.1-62.3). National Agency for Food and Drugs Administration and Control (NAFDAC) recommended 75Mg/L for drinking water. therefore, all the samples fall within recommend value, this is also applicable to Sodium (Na^2), the values obtained from urban center is 1.00-26.1-87 and that of rural areas is (26.1-87.0Mg/L) while the WHO recommended value is 200Mg/L. WHO acceptable value for Sulphate (SO_4^{2-}) is 200Mg/L, samples taken from rural areas range from (13.4-42.6Mg/L) while the ones taken from the urban center is between 1.00-36, hence, it is also acceptable.

It must be noted that chemical water quality is not as important as the microbiological quality of drinking water except when levels of certain chemicals are high from natural sources such as fluoride and nitrate. Hence, the number of Total Bacterial Count in the water sampled from urban center range from (3-24cfu/ml) and coliform stands between (3-6) while for rural areas, the Total Bacterial Count stands at (13-27) while that of coliform ranged between (7-12), whereas, the WHO recommended value is zero (0) for both Total Bacterial Count and coliform. All the water samples from both urban and rural areas failed the microbiological tests. Therefore, all the water samples drawn from both selected urban and rural areas are unfit and unsafe for drinking. Nevertheless, a careful consideration of the result of analysis of those water samples collected revealed that samples obtained in the rural areas are poorer than those from urban center.

Samples of water were mostly clear in urban center but were slightly cloudy or cloudy in the villages, besides, the number of coliform and Total Bacterial Count is higher in water sampled in rural areas, this is not different from what is obtainable in the other physical and chemical characteristics of water sampled. Certain bacteria species particularly coliform are normal inhabitant of large intestine of human and other animals and are consequently present in feaces, thus, they find their ways into drinking water through the ways individual and communities handle their water sources and water itself, the presence of these bacteria in drinking water is an evidence of fecal pollution or contamination which may arise from sewage influence, pit latrine, or refuse dumps resulting in various diseases. Microbiological quality of drinking water has implication on the spread of important disease among which are dysentery, cholera, hepatitis giardiasis, guinea worm, typhoid and schistosomiasis and so many other diseases that are associated with intake or use of water from doubtful, unsafe or contaminated source.

Table 2 presents the economic profile of both rural and urban residents. 30.2% of urban and 37% of rural dwellers earn less than the minimum living wage approved by the government of Nigeria which is=N18, 000 ($90) per month. 25.8% of urban and 29% of rural respondents earn between N18000 -=N 27000. Also, 9.4% of urban and 9.5% of rural people earn between N 36000- N45000. Going by the data above, majority of the respondents are low-income earners, hence, they are poor, but the rural people are poorer. The implication of these is that the poor residents are not being able to meet their basic needs of decent living environment, adequate housing and access to safe drinking water.

With regards to waste management, table 3 reveals that 44.7% of urban dwellers and 54.6% of rural respondents use dump site/open space or undeveloped sites within the living space, even though, these sites are unofficial, they are open for everyone's use and have been in use for years, they have therefore, formed a huge deposit of refuse, (see plate 4). Whoever cares set the sites on fire at will lead to incessant air pollution. In rural areas, 54.6% of dwellers that use dump sites, dump sites, rather, individual house has its own dump site at their backyard close to pit latrines and hand-dug-wells which are sources of drinking water (where wells are available).

Table 1. Physical, chemical and microbiological characteristics of water samples drawn from both urban and rural areas

Urban				Rural		
Parameters	**Range**	**WHO Max**	**Remark**	**Range**	**WHO Max**	**Remark**
Appearance	Clear	Clear	✓	Cloudy	clear	×
Temp.	26-27^{oc}	10-25^{oc}	✓	27- 28^{oc}	10-25^{oc}	✓
pH	5.2-7^{oc}	8.50 pH	✓	6.5- 7.2	8.5 pH	✓
Turbidity	0.0-15.3	5.0 NUT	×	7.5- 17.4	5.0 NUT	×
Conductivity	60-693	1200µ/m^{-1}	✓	59-610	1200 µ/m^{-1}	✓
TDS	44-200	500 Mg/L	✓	56.0-215.1	500 Mg/L	✓
T/hardness	30.0-44	100 Mg/L	✓	56.1- 92.0	100 Mg/L	✓
C/hardness	10-56	75 Mg/L	✓	15.1- 67.3	75 Mg/L	✓
M/hardness	12-60.0	120 Mg/L	✓	19.1-92.1	120 Mg/L	✓
Nitrate	11-15.3	50 Mg/L	✓	13.4- 16.3	50 Mg/L	✓
Iron	.01-.04	3 Mg/L	✓	0.1-1.0	3 Mg/L	✓
Alkalinity	10.0-40	100 Mg/L	✓	09 – 32	100 Mg/L	✓
Manganese	.01-.02	0.4 Mg/L	✓	01- 0.3	0.4 Mg/L	✓
Calcium	7.21-61	75 Mg/L	✓	8.2 – 84	75 Mg/L	✓
Magnesium	2.9-14.6	20 Mg/L	✓	9.1- 16	20 Mg/L	✓
Chloride	9.99-35	250 Mg/L	✓	14.1-29.0	250 Mg/L	✓
Sodium	1.00-75	200 Mg/L	✓	26.1-87	200 Mg/L	✓
Sulphate	1.00-36	200 Mg/L	✓	13.4-42.6	250 Mg/L	✓
TBC	0-24	0	×	7 – 24	0	×
Coliform	0-6	0	×	3 -12	0	×

✓ - Acceptable × - Not acceptable
Source: Arthur's compilation (2016)

Table 2. Income distribution/economic profile of respondents

	Urban		Rural	
Income	**F**	**%**	**F**	**%**
Below ₦1800,000	29	30.2	36	37.1
₦18000 - ₦ 27000	25	25.8	29	29.0
₦27000 - ₦6000	13	13	11	11.3
₦36,000 - ₦45,000	09	9.4	09	09.5
₦45,000 - ₦54,000	07	7.3	07	07.7
₦54,000 - ₦63,000	04	4.2	03	03.8
ABOVE ₦63000	09	94	02	02 .1
Total	96	100	97	100

Source: Authors compilation (2016)

Table 3. Methods of waste Management

Statement	**Urban**		**Rural**	
	F	**%**	**f**	**%**
Deposit at open space/dumpsite	43	44.7	53	54.6
Burning / incinerator	17	17.7	14	14.4
River or stream channels	17	17.7	25	25.8
Van/point collection	11	11.5	00	00
Others	08	8.3	10	10.3
Total	96	100	97	100

Source: Authors' compilation (2016)

This scenario leads to pollution of groundwater and even well waters through latchet, seepage, run-off and flood during heavy rains. Only 11.5% has access to waste collection arrangement put in place by the government in urban center while the rural people do not have access to such coverage at all. Other methods of waste disposal include household collection by wheelbarrow pushers and individuals alike, they collect and dump refuse on river/stream channels which result in water pollution through flood, erosion, latchet, seepage and infiltration into drinking water especially when the wells are uncovered, shallow and poorly constructed. This results in the presence of coliform and bacteria in people's drinking water because waste generated largely remains in people living space/environment.

Table 4 reveals types of toilet being used by the majority of the respondents, only 11.4% of urban residents uses water closet type of toilet, which are manually flushed and not collected centrally since the city does not have and any form of water scheme nor sewage system. In contrast, no respondent in rural areas has water closet type of toilet. 46.9% of city people uses peat latrine while only 13% of rural residents uses it. 26% of urban resident uses open space/dump site, 57% of rural dwellers uses open space/dump sites.

Table 4. Type of toilets

Type of Toilet	Urban		Rural	
	No of houses	%	No of houses	%
Water closet	11	11.4	00	00
Peat toilet	45	46.9	13	13.4
Bush/open space	26	27.1	57	58.7
Pail/dust bin	5	5.2	00	00
Others	9	9.4	30	27.8
Total	96	100	97	100

Source: Author's compilation (2016)

Table 5. Effects of erosion and flooding

Statements	Urban		Rural	
	No of houses	%	No of houses	%
Erosion is rampant	39	40.6	43	44.3
Flooding	19	19.8	24	24.7
Not affected	38	39.6	30	30.9
Total	96	100	97	100

Source: Authors' compilation (2016)

Plate 3. Flooded living space

Surprisingly, 5.2% of city people still uses "pail method" whereby excreta are kept in dustbin, polythene bags or bowls during the day and empty them in a culvert, dump site or stream/ river channels at nights. Some residents still practice other unsafe methods include "short put" or "flying toilet" which means throw your excreta as short put into available but ignominious places, another method used mainly in rural areas is "dig and bury" this implies that people dig a shallow hole that can contain their excreta at once and bury it immediately. No doubt, high rainfall of the tropics facilitates how this filth finds their ways into people's drinking water through seepage, erosion, flood and latchet or people or free-ranged domestic animals direct contact.

Table 5 describes the number of houses affected by flood and erosion, 40.6% of urban and 44.3% of rural respondents suffer from consequences of run-off. This include deposition of load (materials carried by running water) and 39% of urban and 24% of rural residents find their drinking water sources polluted by erosion or flooding during the wet season (See plate 3). These pollutants include garbage, from household wastes, kitchen wastes, used polythene bags, human faeces, animal droppings, and industrial wastes all of which are direct effects of poor sanitation.

FINDINGS, IMPLICATIONS AND CONSEQUENCES

With reference to physical and chemical characteristics of the water samples taken from the urban and rural areas compared with WHO recommended standard, the water samples are safe, though, they failed the test of turbidity and only samples from the villages fail that of appearance; they are either slightly cloudy or cloudy. These are capable of serving as piggy-back for bacteria, although, people adopt application of limestone, filtration and sedimentation when the situation is worst during the dry season.

In contrast, all the water samples from rural and urban centres fail microbiological tests; they contain coliform and bacteria which is against WHO recommended standards and also harmful to human health. This precarious safe water situation resulted from high level the poor personal, domestic, and community hygiene discovered during reconnaissance survey, oral interview and empirical findings.

The rural people are poorer, they are less educated and less informed and hence pays less attention to the care of their environment. The work also reveals that the water sampled from villages are poorer than that of urban center because their water is more exposed to direct pollution, firstly because their surface waters, secondly because they are exposed to run-off and direct activities of rural dwellers like laundry, washing and swimming.

Rural families are faced with a number of special conditions that affect their sanitary environment and consequently their health. Rural dwellers depend to a very large extent on themselves and their resources for sanitary facilities that are precarious at best. Access to piped water supply and sewer are often impracticable, the safety of their food depends entirely on how they themselves handle it, the cleanliness of their surrounding is a matter of their own efforts. Moreover, they cannot fall back to services of skilled artisan, resources and time spent on care of their environment means a sacrifice on their livelihood, they are generally conservative and they do not readily change their habits.

There are certain similarities between sanitation and safe drinking water situations between rural and urban areas; people are generally poor and many live in informal and unofficial settlements where no provision is made for basic amenities like pipe water and routine sanitation coverage. Poor sanitation resulted from poor planning, rapid urbanization, overcrowded living condition and lack of adequate space do not allow people to build latrine even if they want to.

Sanitation in urban centres receives better attention when compared with rural, though not adequate, also, in urban centers, sanitation tends to be directed towards prevention of or control of epidemics which are always a fall out of consumption and or usage of unsafe drinking water. Moreover, it was discovered that both drinking water and sanitation in the study areas are poor, but that of rural are poorer than that of urban area in the study areas. The consequence of this is the unbearable number of death; high morbidity and mortality as well as the outbreak of diseases.

Among the diseases that are largely related directly or indirectly to unsafe water resulting from poor sanitation have their routes from feaces and urine and they are transmitted through the mouth. This implies that with improved sanitation, all the diseases could be checked and a good number of deaths could be prevented. It also implies that sustainable environmental management is essential for continued existence and the well-being of man.

RECOMMENDATIONS AND POLICY IMPLICATION

Central, state and local governments should collaborate and put forward an achievable water and sanitation policy that will cover not only urban, semi-urban but also rural areas. Since sustainable environmental sanitation involves both facility and behavioral change, the policy must involve the people from inception. Planners and policy makers need to institute structure that could be appreciated and embraced by the people in all settlements. In contrast to what is obtainable now, water and sanitation could be put under the same ministry for effectiveness and better accountability.

International organisations need to focus their attentions in rural areas more than ever before to further guarantee the safety of lives for the less privileged and vulnerable residents.

Immediate Strategies

Drinking water treatment should be given adequate attention. It should include boiling, filtering, disinfection and sedimentation. Public enlightenment campaign should be embarked upon by relevant stakeholders and community leaders on the dangers of unsafe water and poor sanitation. Hand-dung wells should be protected against all forms of contacts; they should be covered properly, made water tight with cement by using rings or paved walls in the wells. Motorized methods should replace manual methods of drawing water from wells in order to minimize external contact. Improvement of household and community sanitation through proper management of refuse, domestic and industrial wastes should also be prioritized.

Long Term Strategies

Government should embark on alternative water sources, standard water projects should be embarked upon to cover the city as well as the villages. The government should intensify her effort in the areas of environmental sanitation. Also, urban, semi-urban and rural areas should be covered. Environmental sanitation law should be enforced with renewed vigor. New and deeper well should be sunk and cited away from repository of filths like latrine, septic tanks, burial sites dumping site and where possible at upper gradients. More environmental officers/community health workers should be employed, trained and equipped to facilitate the restoration of environmental sanctity and enforcement of environmental laws in the study area.

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