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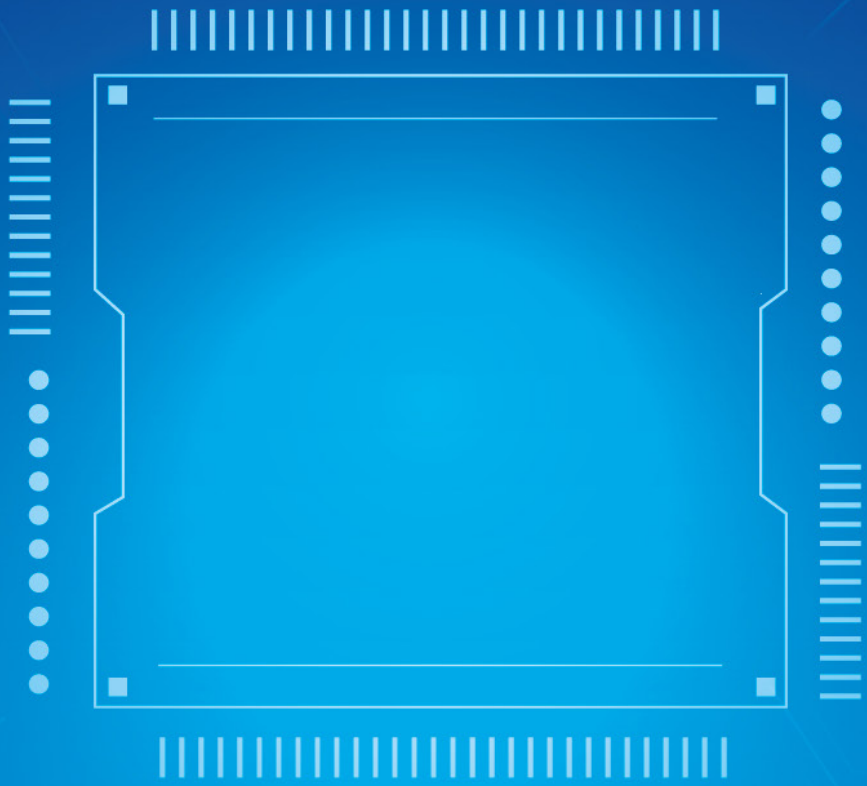

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Spatial Assessment of Water Supply Quality to Selected Private Students' Hostel Accommodation in Ede Township

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ABSTRACT

Adequate supply and distribution of quality water to hostel accommodations is one of the basic criteria for rating standard of hostel accommodations in schools. This study examined the major water supply sources available to students in hostel accommodations; assess the factors influencing the water demand, supply, and distribution; determine the quality of water supplied to some selected hostel accommodations in the study area. The study utilizes a mixed approach for data collection. The quantitative approach was conducted using handheld (GPS) to locate the satellite images of the hostels and sources of water within the neighborhood, three samples of water collected were examined critically at Osun State Water Corporation Laboratory. The data collected were queried using ArcMAP/ ArcGIS 10.7.1 with the specified NIS(554) Limit 2015. Similarly, the qualitative approach was conducted by distributing 50% of the entire student's population which represents 110 questionnaires to randomly selected students staying within the study area. Data collected were analysed using percentages and (mean score) ranking. The results show that the major sources of water are wells and boreholes; water supply are insufficient with 55.6% of occupant's daily supply between 75-125 liters. The critical factors influencing the adequacy and sufficiency of water supplied includes high electricity bills to pump water from wells, insufficient water in wells during dry season causing damage to water pumps, insufficient voltage drop by electricity authority to pump water regularly, insufficient capacity of water pumps to raise water head and poor maintenance of water pumps were ranked high. The study further shows that the physio-chemical analysis of the sources of water is soft and can corrode metal ion, an evidence of both biological and chemical pollution, moderately hard with high settle-able solids, micro-organism and the non-pathogenic which might have influence on the taste and this may serve as indicator that the water is not fit for human consumptions. The study concluded that the sources of water supply needed to undergoes water treatment process before they are supply to hostel accommodations.

INTRODUCTION

Water is the most abundant natural resources that serves as a vital key to the prosperity of human health. Water is also one of the five basic needs of human among which are natural air, food, light and heat. That is why Adeleye *et al.*, (2014) was of the opinion that water remain critical to human life and one of the most valuable resources in the world which are of basic necessity to the lives of plants and animals. The survival of human beings is solely dependent on water that is why the body structure of human body is made up of about 70% of water (Adeleye *et al.*, 2014). It is also among the most prominent and the most valuable substance on the earth. With the absence of water the existence of man will be difficult. It is one of the major criteria in poverty reduction efforts and it also reflects the level of well-being and hygiene of people in any given nation (Lukman *et al.*, 2014). However, due to the hazard posed by pollution arising from various human actions, the availability of water supply resources is not capable of meeting the rapidly growing population (Gichana, 2014). The United Nations Environment Programme (UNEP, 2000) predictable that in 2020, 20% and 50% respectively of the world's population will not have access to safe drinking water and hygiene which are majorly attributed to developing countries like Nigeria. Hence, leading to severe water deficiencies and waterborne associated diseases. With the global annual growing population at an average of 80 million people, the addition of about 64 billion m3 of water annually will be required (Global Warming Potential, GWP 2000). Similarly, tertiary institution are not left out in the quest to meeting the global demand of water supply owning to the facts that the purpose of water in institutions are essentials to its community.

The shortage in the quantity, quality and pressure of water around the hostels in tertiary institutions community and surrounding hostels has tendencies of exposing students to various degrees of water stress and water borne diseases with serious implications on personal and public health and hygiene. Although, students leaving in hostel accommodations built around institutions areas operates under either privately-owned or public-private partnerships hostels arrangements (Babatunde & Perera, 2017). Insufficient access to safe and quality drinking water is a major challenges of hostel accommodations in Nigeria moribund ivory towers. This had provided easy access for developers from private sector within students' estate development and related water supply business and many other vital services in an unpleasant circumstances (Abdullahi *et al.*, 2017). However, Philip *et al.*, (2018)

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admitted that to guarantee a competitive, comfortable and supportive learning environment for students, crucial and auxiliary facilities and services including the provision of potable water supply must be provided. Nigerian students required a comfortable and cheap hostel accommodations situated within short distance from their various tertiary institutions, sufficient safety/ security of life and uninterrupted electricity supply. Again, Apart from inadequate quantity and irregularity of water supply (Azubuike, 2018), more worrisome is the continuous uncertainty in the quality of water available in privately operated students hostels in Nigeria which Nwanekezie & Mendie (2019); Ogunde *et al.*, (2017) recommended below required standards. The integrity of the student environment is solely dependent on the quality of water and the maintenance of the ecosystem because water has the ability of contributing significantly to economic productivity and societal wellbeing of the human race and global warming potential (GWP, 2000).

Furthermore, is the need for students staying in privately owned student hostels' to have access to unpolluted water in the preparation of food, snacks and beverages, clean drinking water, health and personal hygiene. But regrettably, most of the sources of water are not located within the private hostels' premises. Students staying in privately owned hostels accommodations spent quality time looking for water are likely to miss classes. Those who end-up attending lectures after utilizing much time in searching and fetching water ends-up in absenteeism from classes, loss of concentration, miss test and quiz and may later perform poorly in examinations (Hunter *et al.*, 2015; British Psychological Society, BPS, 2012). Also included, is the rate of dehydration and extreme decrease in cognitive abilities due to poor water intake by students (Chard *et al.*, 2019). Similarly, most of the privately owned students' hostel within Ede township primary sourced their water for drinking and other purposes at all season of the year from rainfall or groundwater available through drilled boreholes and hand-dug wells. Regrettably, the purity and as well as the drinkability of the water provided to this privately owned students' hostels around the institution is still uncertain. Thus, to ascertain the sources and the quality of water, it is essential to evaluate the physical, chemical and microbial indicators of the water sources vis-à-vis to establish the suitability with the view to ascertaining its purity for students' consumption. Thus, this study tends to assess the sources of water available in selected students hostel accommodations in the study area, assess the factors influencing the demand, supply and distribution of water and examine the quality of water supply available to selected student hostels' accommodation in the study area.

LITERATURE REVIEW

Source of Water in Students Hostel Accommodations

The major sources of water available to students' hostels accommodation in developing countries includes rainwater, hand dug well, boreholes and tap water. The rainwater when needed for used are usually collected from run-off of building roofs, harvested and stored in plastic buckets or plastic cistern. Hydro-meteorological studies emphasized that, there has not being any significant change in annual precipitation levels over time, but rather a significant change in the seasonal and monthly distribution (Adegbite *et al.*, 2018). Tap water are provided via the use of taps and water dispenser valves. Water obtained from taps is commonly used for drinking, cooking, washing of cloths and cutleries and flushing of effluents. Tap water obtained from indoors is also distributed via indoor plumbing fittings. The existence of tap water became significant in many regions during the 20th century, but very recently it is lack among occupants due to poverty in most in developing countries. The use of household water treatment methods which includes filtration, softening, sterilization or distillation can be adopted to treat tap water microbial contaminations which are meant to improve the purity of water (Ahuja & Satinder, 2018; Chinwe, 2010). The hand dug well is also a sources of water obtained via the excavation or structure constructed below the ground level by digging, driving or drilling to access water. It is among others, one of the oldest and most common sources of water available in developing nations (Ogeleka, 2014). In other to obtain the groundwater in underground aquifers the well water is drawn up via the use of pumps or the use containers such as buckets to raise the water mechanically or by hand. It is also possible to inject the water back into the aquifer through the wells (Ogeleka *et al.*, 2014). Wells have conventionally been sunk by hand digging, as it is still common in rural areas of the developing countries. The use of wells are economical and possess low-technology as they involve mostly manual labours, the internal surface can be lined with brick or stone after the excavation process (Ogeleka, 2014). A more current method is called caisson which involves the use of pre-cast reinforced concrete well rings that are lowered into the holes (Adegbite *et al.*, 2018; Idu, 2015). In addition to this source of water, is the artificially sunk bore holes water, this is a mechanised sources of water which is becoming most common due to the inabililty of government to provide sufficient and portable sources of water to residence through public water authorities. Private developers particularly in developing countries prefers to sunk bore holes around buildings in order to provide adequate and quality water for building occupants. This sources of water are usaully naturally free from contaminants due to its depth (Ogeleka, 2014).

Importance of Water Supply to Students in Hostel Accommodations

The relevance of water to hostel accommodations includes supplying water for cooking, bathing, flushing of excrements and washing of dishes cloths and sanitary. Studies have also shown that students staying in hostels accommodations among other things requires portable drinking water, this is due to the roles that water plays

in the human body which includes among others for flushing out waste products from body organs; a primary component of the human blood; aids digestion; enables the body to regulate its internal heat balance (via sweating); maintains the functioning of cellular; and helps maintain healthy metabolism (Adegbite *et al.*, 2018). Research also has it that students recollect more and stay more focused when they are hydrated. In fact, studies have also showed that drinking water has the ability to regulate the functionality of the brain (Pross, 2017). The human brains is also dependently on the appropriate hydration of water to perform optimally. Dehydration on the other hand has the ability to impair short-term memory functionality and the recall of long-term memory (Pross, 2017). This reveals the fact that the brain has no way to keep water within it (Chinwe, 2010; Watertech, 2014), it is compulsory to continually drink water frequently within the day. Because when the body system loses large amount of water than the amount of water intake, dehydration occurs and may affects the functionality of the brain. But, when the brain operates with large amount of water, students are able to gain greater clarity, creativity, stay focus and quicker thought processes (Ogeleka, 2014). This means that water fit for drinking is fundamentally required by the students in hostels accommodation because it serves as students' essential factor to success in school. Also, Pross (2017) was of the opinion that proper hydration is crucial for student success at all ages. Other study also found out that students who drank water during exams got better grades. Water not only helps improves the brain functionality an act of drinking water may play a part in relieving anxiety during tests.

Water Demand, Supply, Accessibility and Shortage in Hostel Accommodations

Hostel water demand and supply for students' accommodation involves issues of water availability, accessibility, demand, sufficiency, usage and quality. Availability of water is often influenced to a larger extent by environmental factors from hydrological changes (Akpoveta *et al.*, 2011; Chinwe, 2010). In meeting hostel water demand supply and security, it is necessary to satisfy evidence of water accessibility, reliability and timely availability of adequate safe water to basic human needs (Akpoveta *et al.*, 2011). In almost every part of the world, the demand for quality water has continued to escalate while the challenges of accessing the required quantity and quality of the water has been on the declined (Chard, 2019; Chinwe, 2010). The relevant role of water is synonymous in every aspect of human life and existence. It is also evident that even water is very fundamental to student survival and for sustainable development, water not only has life sustaining qualities, but strongly effects economic activity (both production and consumption) and social roles. The challenges of water shortage in hostel accommodation includes that of natural scarcity of drinking water in hostels, the siltation of borehole systems and as well as the contamination well water. The challenges are associated with water demand, supply and distributions in hostels' accommodation are surrounded mainly around issues of poverty, education, and diseases as a result of shortage in water distribution. Also, most of indigene around hostel depends on hostel water, which had contributed significantly to insufficient water for hostel occupants (Chard, 2019).

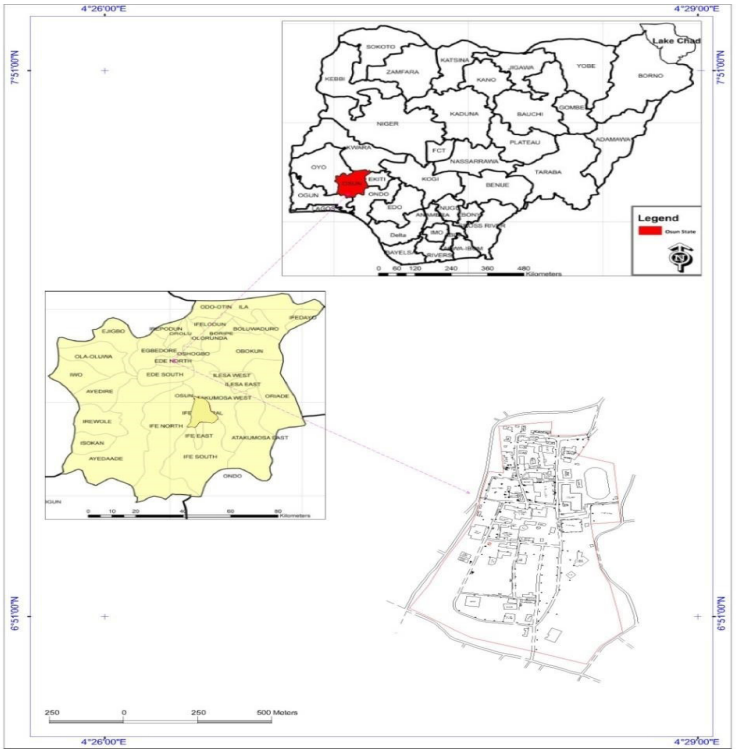

Figure 1: Geographical Map of the Case Study Area

METHODOLOGY

Study Area

Ede is an ancient town located in the south western Nigeria having two local government councils. It lies along river Osun at a point on the railroad from Lagos at an approximate latitude 07o 51 North and longitude 040 31 East. The geographical map of the case study area is in figure 1. The town has three predominant higher institutions with an approximate population of over sixteen thousand (16,000) students annual intakes, the institutions includes; Adeleke University, Ede, (Private) Redeemers University, Ede (Private) and Federal Polytechnic Ede (Public). The town is surrounded by numerous privately owned hostel accommodations due to insufficient hostel accommodations within the campus to accommodate large number of student's intake particularly in federal polytechnic Ede. In recent time, there is a noticeable increase in the development of new hostel accommodations within Ede North and South Local Government along Federal Polytechnic Ede and Adeleke University Ede main campus. Similarly, figure 2 shows the spatial distribution of the hostel accommodation using google earth and global position system (GPS) to locate various sources of water tagged with blue dots within the building space and neighborhoods for each of the hostels accommodation.

Figure 2: Satellite Image of wells location within Hostel Accommodation in the study area

Table 1: List of Selected Hostel Accommodation within the Study Area

S/N	Hostels	Number of Rooms	Number of Occupants	50% Representation	Categories of Hostels	Sources of Water
1	Eniola	9	12	6	Small	Borehole
2	Ponle	9	10	5		Well
3	No king as God	3	7	4		Well
4	Joshlad	6	8	4		Borehole
5	Castle villa	8	10	5		Well
6	Fortune villa	8	10	5		Well
7	Cornerstone	8	15	8		Well
8	Edward	10	12	6	Medium	Well
10	Jiboye	10	15	8		Borehole
11	Royal	10	15	8		Well
12	Africana	10	20	10		Well
13	Temitope	10	17	9		Well
14	Agbeke	15	16	8		Borehole
15	Maryland	16	20	10	Large	Borehole
16	Triple I	28	28	14		Borehole
	Total	**160**	**215**	**110**		

The study adopts stratified and random sampling techniques for the selection of hostel accommodations within the neighborhood. Sixteen (16) categories of hostels accommodation were first grouped/categorised into small, medium and large hostels and one hostel each was randomly selected from each categories of hostels for the quantitative data collection. The study was conducted using mixed method of data collection. The quantitative approach utilizes data collected using google earth and global position system GPS via satellite images to locate hostel accommodation and their sources of water respectively. The sample of water was taken for test and critical analysis at the Osun State water corporation laboratory in Ede. The data collected from the laboratory experiment was queried using ArcMAP/ArcGIS 10.7.1 with the specified NIS (554) Limit 2015. Similarly, the qualitative approach involved the administration of one hundred and ten (110) questionnaires representing 50 percentage of selected student accommodation in the study area to get their view on the sources of water supply, factors influencing demand, supply and distribution of water and the quality of water supplied in the study area. Data collected were analysed using both descriptive and mean score index. The descriptive statistics includes percentage representations and relative importance index (mean score values) ranking respectively.

Discussion of Results and Findings

Demographic Characteristics of Respondents

Table 1.0 shows the Demographic Characteristics of the randomly selected students in hostel accommodations in the study area. The age characteristics shows that 38.9% of the respondent were male and 61.1% of the respondent were female. It implies that the numbers of female respondents are more than the male respondents in the questionnaire survey. It was also reliably gathered that 16.7% of the respondent were below 18years, 22.2% of the respondent were between the age ranges of 19-22years, 27.8% of the respondent were between the age range of 25years and 33.3% of the respondent were between the age range of 26years and above. This also shows that all categories of age group were included in the respondent administrations among students within the study area. The table also shows that 61.1% of the respondent source of water is boreholes and 38.9% is through hand dug wells in the study area. The results also shows that boreholes and open wells are the major sources of water used in the student hostels' accommodation in the study area. The table also shows that 22.2% of respondents have access to water below 75liters daily, 16.7% have access to water between 75-100 liters daily, 16.7% have access to water between 100-125 liters daily, 27.8% have access to 125-130 liters daily and 15.7% have access to water above to 150 liters daily. The table further shows that 27.8% of the respondents asserted that the boreholes breaks down at least once monthly. 16.7% agrees once in two months, 16.7% agrees once quarterly, 22.2% agrees once in six months and 16.7% agrees yearly. The table also shows that 16.7% of the respondents agreed that over usage of the pumps is the major cause of breakdown of pumps. 27.8% claimed that poor voltage supply is the reason for the breakdown of the water pumps. 33.3% attributed breakdown of water to poor maintenance of the pumps while 22.2% of are of the view that insufficient capacity of the pumps to take water to high level is the cause of breakdown of water pumps in their hostels.

Again, the table shows that 22.2% of the respondents asserted that water regularities is once daily, 33.3% claimed that water is supplied more than once daily. The table also shows that 38.9% of the respondents agreed that the alternative source of water is rainfall and 44.4% respondents said tap water while 16.6% respondent were not specific.

Table 2: Demographic Characteristics of Respondents

Respondents Characteristics	Frequency	Percentage (%)
Gender of the Respondents		
Male	45	38.9
Female	65	61.1
Age of the Respondents		
Below 18years	20	16.7
19-22years	25	22.2
23-26years	30	27.8
27 and above	35	33.3
Major Sources of Water in hostels Accommodation		
Boreholes	65	61.1
Hand pump	-	-
Open well	45	38.9
Others	-	-
Quantities of Water Supply to Occupant /Head /Day		
Blow 75LT	25	22.5

75-100LT	20	16.7
100-125L	45	48.7
Above 150L	20	16.7
Frequency of breakdown of pumps		
Once a monthly	30	27.8
Once in two months	20	16.7
Once in quarterly	20	16.7
Once in six month	25	22.2
Once yearly	15	16.7
Major Cause of Breakdown of Pumps		
Over usage of pump	20	16.7
Poor voltage supply	30	27.8
Poor maintenance	35	33.3
Insufficient capacity of the pump to take water to high level	25	22.2
Regularity in water Supply		
More than once a day	25	22.2
Once a day	35	33.3
Once in two days	20	16.7
Once a week	30	27.8
Alternative Sources of water to Hostel		
Rainfall	40	38.9
Tap water	50	44.4
Others	20	16.6

Factor Influencing Water Supply and Distribution in Selected Hostel Accommodation in Ede Township. Table 3. shows the ranking of the factors influencing water supply and distribution to hostels accommodation in the study area. It was deduced from the study that the cost utilized on electricity bills for suppling water is very high with mean value of (0.8) was ranked 1st, non-availability of water in hand dug-well during dry season causing damage to pumps, non-constant power supply to hostels was also critical to water supply, poorly

Table 3: Factor Influencing Water Supply and Distribution in Hostel Accommodation

S/N	Factors	VR	R	N	LR	NR	Mean	Ranking
1	Energy bills for suppling water is high for occupants in the staying hostels.	30	20	15	15	10	0.8	1st
2	Non-availability of water hand-dug well during dry season causes damage to pumps.	15	40	5	20	10	0.7	2nd
3	Cost of maintaining water pumps used in well/ borehole is very high.	18	10	15	27	20	0.6	7th
4	Non-constant availability of power supply to hostels is a major factor affecting water supply.	35	15	10	18	12	0.7	2nd
5	Insufficient water pressure discharge to appliances is affecting the rate of water supply.	20	25	10	15	20	0.6	7th
6	Poorly designed and installed water pumps is influencing water supply.	33	12	20	17	8	0.7	2nd
7	Poor water distribution and supply pipes is affecting water supply pressure.	10	24	20	16	20	0.6	7th
8	Insufficient water storage facilities is affecting water supply.	25	10	20	18	17	0.6	7th
9	Water pipe leakages and erosion is affecting water supply.	20	27	18	15	10	0.7	2nd
10	Lack of sufficient technology to aid the supply of quality water particularly in tall hostels.	25	20	15	15	15	0.7	2nd

designed and installed water pumps influenced water supply, lack of sufficient technology to aid the supply of quality water particularly in tall hostels and water pipe leakages and erosion critically affects water supply in hostel accommodation having with mean value of (0.7) were ranked 2nd Similarly, the cost of maintaining water pumps used for well/borehole is very high, insufficient water pressure discharge to appliances, insufficient water storage facilities is affecting water supply, poor water distribution and supply pipes is affecting water supply pressure having a mean value of (0.6) were ranked 7th. It was deduced that the rate of electricity charge/per unit, issues related to of electricity supply, voltage drop across various pumps, poorly designed and installed water pumps, insufficient technology to aid water supply attributes majorly to the challenges of water supply. Other factors of water supply in the study area are attributed to inadequate maintenance of plumbing fittings and water pumps, insufficient water pressure discharge to appliances and insufficient water storage facilities were among others rated in the study area.

Quality of Water Supply to Hostel Accommodations in the Study Area

Table 4, 5 and 6 shows the results of the test carried out on the quality of water supply to selected hostels accommodation for Ponle(well), Agbake(borehole) and Triple I(borehole) respectively. Based on the result of water samples conducted for hostels accommodation, it was revealed through the physio-chemical analysis, that the water sample in Ponle hostel accommodation that the water is soft and can corrode metal ion, it also had an evidence of both biological and chemical pollution. Hence, the water needs to be disinfected before recommended for domestic and drinking purpose. Similarly the result of water sample for Agbeke hostel shows that the physio-chemical analysis and water sample is moderately hard with high settle-able solids. It also shows an evidence of the both biological and chemical pollution. Hence, the water needs to be properly treated. Also, the result of the sample of water from Triple 1 hostel based the result of the physio-chemical analysis that the water sample is soft and can corrode metal ions with high settle-able solids. There is also an evidence of both biological and chemical pollution. The three sample of water also have an evidence of biological pollution. The biological pollution also shows a wide variety of micro-organism and the non-pathogenic that may have influence on the taste and this may serve as indicator that the water is not fit for human consumption. In other word, the occurrence of eschinoery change (Cal) means that the pathogens are derived from faecal pollution and these could originates from defective hygiene practices especially poor sanitation habit. Similarly, the chemical pollution parameters that constitutes health hazard in water samples which include Arsenic, fluoride, Nitrate, chromium, lead, mercury, and cadmium which are not detected in all the water samples analysed and the water sample are above permissible level with reference to NIS 554, 2015. Furthermore, Elemental pollution which consist of aesthetic parameters and PH. The aesthetic parameters contains the presence of iron, manganese, and magnesium turbidity and coloured parameters. The magnesium contents of all the three samples are higher than the permissible level. Hence, there is tendency for the water to be infected. Similarly, the results of the PH content obtained are within the NIS 554, 2015 permissible level.

Table 4: Results of Salinity of Water Test in Ponle Hostel (Well Water)

S/No	Parameter	Result	NIS(554)Limit 2015	Remarks
1	Appearance	Clear	Clear	Satisfactory
2	Colour (H,U)	10.0	15	Satisfactory
3	Taste and odour	Unduly	No taste	Satisfactory
4	pH time of Collection	-	6.5-8.5	
5	pH at laboratory at 29.6oC	7.0	6.5-8.5	Satisfactory
6.	Turbidity (FIU)	6.00	5	Satisfactory
7.	Dissolved oxygen	-	0.4	
8.	Temperature oC	31.4	Ambient	Satisfactory
9.	Total alkalinity (mg/1)	58	200	Satisfactory
10.	Total Hardness (mg/1)	44	100	Satisfactory
11.	Magnesium ions (mg/1)	0.5	2	Satisfactory
12.	Chloride ions (mg/1)	28.0	100	Satisfactory
13.	Iron (mg/1)	0.06	0.3	Satisfactory
14.	Ammonia Nitrogen (mg/1)	ND	0.01	Satisfactory
15.	Nitrate nitrogen (NO22)(mg/1)	0.002	10	Satisfactory
16.	Nitrate nitrogen (NO22)(mg/1)	0.019	0.1	Satisfactory
17.	Copper (mg/1)	0.022	1	Satisfactory

18.	Manganese (Mg/1)	Nil	0.05	Satisfactory
19.	Aluminum (mg/1)	Nil	0.1	Satisfactory
20.	Lead (mg/1)	ND	0.01	Satisfactory
21.	Arsenic (mg/1)	ND	0.01	Satisfactory
22.	Chromium (mg/1)	0.02	0.01	Satisfactory
23.	Conductivity	769.4	1000	Satisfactory
24.	Sulphate (mg/1)	4	100	Satisfactory
25.	Zinc(mg/1)	0.10	5	Satisfactory
26.	Carbonate (mg/1)	120	100	Satisfactory
27.	Bicarbonate (mg/1)	122	250	Satisfactory
28.	Flocculation(PPM)	10	-	-
29.	Chlorine residual (mg/1)	Nil	0.3	Satisfactory
30.	Total Dissolve Solid (mg/1)	221.8	500	Satisfactory
31.	Silica(mg/1)	2.16	0.01	Satisfactory
32.	Phosphate (mg/1)	0.03	-	Satisfactory
33.	Potassium (mg/1)	Nil	0.01	Satisfactory
34.	Chemical oxygen Demand (mg/1)	0.00	-	Satisfactory
35.	Fluoride (mg/1)	-	1.5	Satisfactory
36.	Barium (mg/1)	-	0.7	Satisfactory
37.	Free CO_2	10	12	Satisfactory
38.	Cadmium (mg/1)	-	0.003	Satisfactory
39.	Hydrogen Sulphate (mg/1)	NO	0.05	Satisfactory
40.	Cyanide (mg/1)	-	0.01	Satisfactory
41.	Mercury (mg/1)	-	0.001	Satisfactory
42.	Total Plate Count (TPC), cfu/ml	64	Nil	Satisfactory
43.	Total Coliforms, MPN/ml	16	Nil	Satisfactory
44.	E coli cfu/ml	Visible granite	Nil	Satisfactory

Table 5: Results of Salinity of Water Test in Agbeke Hostel (Borehole Water)

S/No	**Parameter**	**Result**	**NIS(554)Limit 2015**	**Remarks**
1	Appearance	Clear	Clear	Satisfactory
2	Colour (H,U)	10.0	15	Satisfactory
3	Taste and odour	Unduly	No taste	Satisfactory
4	pH time of Collection	-	6.5-8.5	
5	pH at laboratory at 29.6oC	6.5	6.5-8.5	Satisfactory
6.	Turbidity (FIU)	20	5	Satisfactory
7.	Dissolved oxygen	-	0.4	
8.	Temperature oC	29.3	Ambient	Satisfactory
9.	Total alkalinity (mg/1)	120	200	Satisfactory
10.	Total Hardness (mg/1)	152	100	Satisfactory
11.	Magnesium ions (mg/1)	22.6	2	Satisfactory
12.	Chloride ions (mg/1)	28.0	100	Satisfactory
13.	Iron (mg/1)	0.16	0.3	Satisfactory
14.	Ammonia Nitrogen (mg/1)	ND	0.01	Satisfactory
15.	Nitrate nitrogen (NO22)(mg/1)	0.015	10	Satisfactory
16.	Nitrate nitrogen (NO22)(mg/1)	0.040	0.1	Satisfactory
17.	Copper (mg/1)	0.58	1	Satisfactory

18.	Manganese (Mg/1)	ND	0.05	Satisfactory
19.	Aluminum (mg/1)	0.01	0.1	Satisfactory
20.	Lead (mg/1)	ND	0.01	Satisfactory
21.	Arsenic (mg/1)	ND	0.01	Satisfactory
22.	Chromium (mg/1)	0.24	0.01	Satisfactory
23.	Conductivity	1042	1000	Satisfactory
24.	Sulphate (mg/1)	14	100	Satisfactory
25.	Zinc(mg/1)	Nil	5	Satisfactory
26.	Carbonate (mg/1)	58	100	Satisfactory
27.	Bicarbonate (mg/1)	73.2	250	Satisfactory
28.	Flocculation(PPM)	10	-	-
29.	Chlorine residual (mg/1)	Nil	0.3	Satisfactory
30.	Total Dissolve Solid (mg/1)	287.00	500	Satisfactory
31.	Silica(mg/1)	0.00	0.01	Satisfactory
32.	Phosphate (mg/1)	0.02	-	Satisfactory
33.	Potassium (mg/1)	Nil	0.01	Satisfactory
34.	Chemical oxygen Demand (mg/1)	ND	-	Satisfactory
35.	Fluoride (mg/1)	ND	1.5	Satisfactory
36.	Barium (mg/1)	Nil	0.7	Satisfactory
37.	Free CO2	10	12	Satisfactory
38.	Cadmium (mg/1)	-	0.003	Satisfactory
39.	Hydrogen Sulphate (mg/1)	-	0.05	Satisfactory
40.	Cyanide (mg/1)	-	0.01	Satisfactory
41.	Mercury (mg/1)	-	0.001	Satisfactory
42.	Total Plate Count (TPC), cfu/ml	83	Nil	Satisfactory
43.	Total Coliforms, MPN/ml	12	Nil	Satisfactory
44.	E coli cfu/ml	Visible granite	Nil	Satisfactory

Table 6: Results of Salinity of Water Test in Triple 1 Hostel Accommodation (Borehole)

S/No	Parameter	Result	NIS(554)Limit 2015	Remarks
1	Appearance	Clear	Clear	Satisfactory
2	Colour (H,U)	10	15	Satisfactory
3	Taste and odour	Unduly	No taste	Satisfactory
4	pH time of Collection		6.5-8.5	
5	pH at laboratory at 29.6oC	8.0	6.5-8.5	Satisfactory
6.	Turbidity (FIU)		5	Satisfactory
7.	Dissolved oxygen		0.4	
8.	Temperature oC		Ambient	Satisfactory
9.	Total alkalinity (mg/1)	100	200	Satisfactory
10.	Total Hardness (mg/1)	44	100	Satisfactory
11.	Magnesium ions (mg/1)	5.0	2	Satisfactory
12.	Chloride ions (mg/1)	13.5	100	Satisfactory
13.	Iron (mg/1)	-	0.3	Satisfactory
14.	Ammonia Nitrogen (mg/1)	-	0.01	Satisfactory
15.	Nitrate nitrogen (NO22)(mg/1)	-	10	Satisfactory
16.	Nitrate nitrogen (NO22)(mg/1)	-	0.1	Satisfactory
17.	Copper (mg/1)	-	1	Satisfactory

18.	Manganese (Mg/1)	-	0.05	Satisfactory
19.	Aluminum (mg/1)	-	0.1	Satisfactory
20.	Lead (mg/1)	-	0.01	Satisfactory
21.	Arsenic (mg/1)	-	0.01	Satisfactory
22.	Chromium (mg/1)	-	0.01	Satisfactory
23.	Conductivity	716.9	1000	Satisfactory
24.	Sulphate (mg/1)	-	100	Satisfactory
25.	Zinc(mg/1)	-	5	Satisfactory
26.	Carbonate (mg/1)	100	100	Satisfactory
27.	Bicarbonate (mg/1)	122	250	Satisfactory
28.	Flocculation(PPM)	10.0	-	-
29.	Chlorine residual (mg/1)	Nil	0.3	Satisfactory
30.	Total Dissolve Solid (mg/1)	207.6	500	Satisfactory
31.	Silica(mg/1)	-	0.01	Satisfactory
32.	Phosphate (mg/1)	-	-	Satisfactory
33.	Potassium (mg/1)	-	0.01	Satisfactory
34.	Chemical oxygen Demand (mg/1)	-	-	Satisfactory
35.	Fluoride (mg/1)	-	1.5	Satisfactory
36.	Barium (mg/1)	-	0.7	Satisfactory
37.	Free CO_2	-	12	Satisfactory
38.	Cadmium (mg/1)	-	0.003	Satisfactory
39.	Hydrogen Sulphate (mg/1)	-	0.05	Satisfactory
40.	Cyanide (mg/1)	-	0.01	Satisfactory
41.	Mercury (mg/1)	-	0.001	Satisfactory
42.	Total Plate Count (TPC), cfu/ml	Cluster	Nil	Satisfactory
43.	Total Coliforms, MPN/ml	0.8	Nil	Satisfactory
44.	E coli cfu/ml	Visible granite	Nil	Satisfactory

Data Base Query of PH Value and Chloride ions

Figure 3 and 4 shows the data base query for the PH value and chloride ions of the collected samples of water from the three selected sources of water in the hostel accommodation. Figure 3 shows the query chat which highlights a double blue colour indicating that the sources of water in Ponle and Triple A hostel accommodation have the standard NIS(554)Limit 2015 value between 6.5-8.5 respectively among the three selected hostel accommodation. Similarly, Agbeke did not meet the

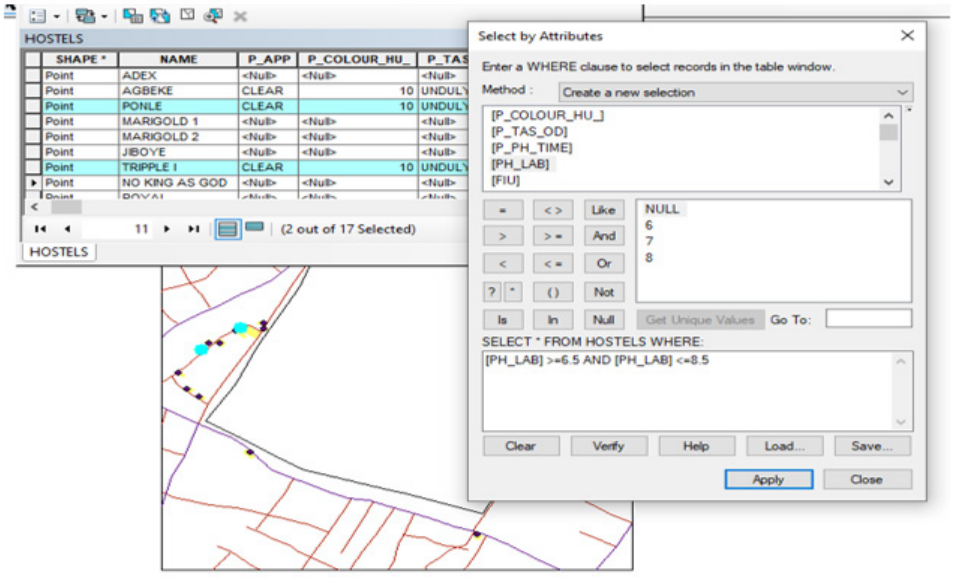

Figure 3: Data Base Query for PH Value of Water for Selected Sample of Water

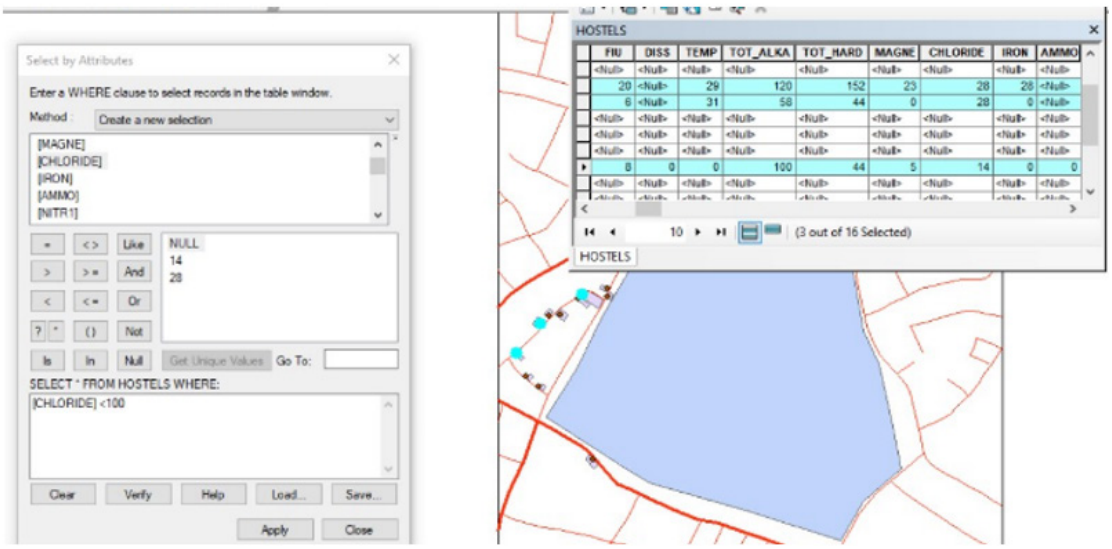

Figure 4: Data Base Query for Chloride ions of Water for Selected Sample of Water

required NIS(554) Limit 2015 value between 6.5-8.5 respectively. Furthermore, Figure 4 shows the data base query for the chloride ions of the three sources of water, the figures shows that the three sources of water in Ponle, Agbeke and Triple 1 sources of water respectively does contain chloride ions contents amounting to (28mg/1, 28mg/1 and 13mg/1 respectively) but the amount of chloride ions found in the sources of water are less significant to the amount that could be harmful as stipulated by the NIS(554) Limit 2015. The figure shows in this case, that the three sources of water highlighted in blue colours after the query are cleared.

CONCLUSION AND RECOMMENDATION

The study concluded that the sources of water available to student's hostels are hand-dug well and boreholes, the water supplied are fairly adequate with an average 55.6% of water supply between 75-125liters per/occupant/day. The generality of factors influencing the sufficiency of water supply are due to high electricity bills to pump water from wells and boreholes, insufficient water in hand dug-wells during dry season which cost severe damage to pumps, poor voltage supply, insufficient capacity of water pumps to raise water head and poor maintenance of water pumps. The study further concluded that the physio-chemical analysis of the sources of water is soft and can corrode metal ion, it also had an evidence of both biological and chemical pollution, moderately hard with high settle-able solid, micro-organism and the non-pathogenic may have influence on the taste and this may serve as indicator that the water is not fit for human consumptions. The study however, recommends the following sequel to the investigation on the water samples and with good compliance with NIS554, 2015 limit:

(i) Water supply to student accommodations in the study area should be improved by adopting high technology to ascertain the sufficiency of water supply in the study area.

(ii) In the case of high magnesium context in all the water samples, there is need to install aeration softener chemical in wells for ion exchange resin in borehole as well as installation of sand and carbon composite filters.

(iii) The presence of high faecal coliform should be improved by encouraging proper sanitation process, conducting an effective sanitary inspection before sinking wells and boreholes, and addition of disinfectant of water.

(iv) Provision of alternative water source(s) to the area where there is high faecal coliform to prevent outbreak of epidemics.

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