Challenges of Domestic Water Consumption in Bhahumono Communities of Abi Local Government Area, Nigeria

Otu, Judith E.

Department of Sociology, University of Calabar-Nigeria.
Email: judithesame@yahoo.com

Eja, Eja I.

Department of Geography and Regional Planning,
University of Calabar, Calabar.
Email: ejako2007@yahoo.com; ewaezeewa@yahoo.com

Agbor,Emmanuel A.

Inyang, Ita O.

Department of Urban and Regional Planning,
Cross River University of Technology, Nigeria.
Email: itoabia@yahoo.com.

Doi: 10.5901/mjss.2012.03.01.443

Abstract The menace of domestic water consumption and quality in Bhahumono Communities, in Abi Local Government Area has become of great concern especially among stakeholders saddle with the responsibility of maintaining quality water for domestic and public uses. This paper examines the challenges of domestic water consumption in Bhahumono communities with specific reference to sources of water supply, elemental contents of the difference sources, the rate of consumption and water borne diseases in the area. Seventeen water points were sampled in selected location and the water samples collected were analyzed using Gallenkamp flame analyzer (model F.A. 330-9 and atomic absorption spectromometer (model PYE UNICAM SP29007. The tritrimetric and observatory methods were used to determined the physical properties of the water. The analysis shows that most sampled location had a high level of iron (fe) and cadmium (cd) which makes the not suitable for drinking as evidence in F-value of 4.62 (calculated) higher than critical value of 3.04 (calculated). A calculated value of 4.60 at 0.05 significant level higher than critical value of 3.60 which indicate that distance was a major determinant factor affecting the quality of water supply in Bhahumono communities. Therefore, adequate measures must be put in place if the menace of domestic water quality in the area must be averted.

Keywords: domestic water, water quality, elemental contents, water supply.

1. Introduction

Human activities have influence directly or indirectly the quantity of the environment which at the same time man have aroused the public and government awareness on the important to secure the quality of the environment (Stanton, 1974). Today, water plays on significant role in the socio-economic development especially in rural communities were the inhabitant solely depends on rainfall and underground water for domestic and public uses (Shipman, 1967). This assertion was evidence in (Droonkamp, 1982) which according to him without water there would be no economic endeavour. The world Health Organization (WHO, 1984) emphasized the important of water to social and the health sector have set up a standard for water quality for human consumption. According to Eze and Abua (2003) the quality of water consumed by individuals is uncertained, Ekop (1994) in his empirical findings of Calabar urban water supply system state that during raining season more than 30% of the residents consume a daily average of 80 liters of water.

This situation in Abi local government area and Bhahumono communities in particular is patheticals were water supply is inadequate compared to demand (Ewa, 2010). However, despite the laudable efforts by the government to avert the impurities in domestic water and the crises of inadequate water supply in the rural communities, the quality of the water sources such rivers, streams and boreholes which the people solely depend for domestic and public uses constitute a serious problem to human health in the area (Ekpoh, 2004). Beside, most of the boreholes, streams and are dried up during dry season, hence causing pressure on the few surviving ones which makes the inhabitant to spend more hours in search of water. Moreo, these majority of communities whose source of livelihood depends on these sources of water supply in the area are pround to various sorts of bacterials and germs and the resultant effect is that cases of typhoid, diarrhea, dysentery and malaria becomes more prevalence in the area. Therefore, this paper seek to evaluate the challenges of domestic water consumption in Abi local government area with specific reference to the assessing the water sources, physico-chemical, properties, quality of water consume, associated disease in the area.

2. Methodology

This study was conducted within the confine of Bhahumono in Abi local government area of Cross River State. Six communities were selected for the study taken into consideration the sources of water supply within the sampled communities. The sources of water sampled include tap, borehole, stream and river. However, water sample were collected at different location around the sampled communities. Information on water borne diseases in the various community were obtained from field survey carryout in each health care centres found in the communities. Water samples were collected from seventeen sampling points, four points (4) were location for tap and borehole and river and five (5) points for streams in other to assess the water quality in the area. These water samples were analysed and the average recorded. The physic-chemical elements of the samples were analyzed using Gallenkamp flame analyzer (Model F. G. A. -330-C) and atomic absorption spectrophotometer (model PYE UNICAM SP2900). The titrimetric and observatory methods were used in determining some physical properties of the water. The values obtained were compared with the WHO standard values to assess the rate of pollution of the different water samples. However, two hypotheses were tested in this research which include, to assess whether or not there is significant difference in the sources and quantity of water consumed by residents in the sample location and to evaluate if there is or not significant relationship in the cost of obtaining domestic water and the quantity available to household for consumption.

3. Study Area

The study was conducted in Bhahumono communities in Abi local government area of Cross River State. Six majorly communities were selected for this work which include Usumutong, Ediba, Anong, Ebom, Igoniguni and Afafayi. The major sources of domestic water consumption in the area include, borehole, streams, taps and rivers. Although, tap and borehole were only useful during the raining season when the river and streams are polluted due to surface runoff which discharges effluence into the water bodies, hence making them not good for human consumption. However, Usumutong community depends basically on stream and tap with a few borehole which dry up during dry season. Other communities have common boundary and depend solely on rivers as a source of water for domestic use.

4. Literature Review

The issue of global environmental change entered international agenda during the mind and late 1980's; it has been accompanied and partly prompted by an ever-growing body of evidence of environmental

degradation. In the words of Miller (1982), the conceptual environmental pollution as an addition to air, soil, water or food that threatens the earth survival capacity or activities of humans and other living organisms.

Some experts make a distinction between contamination and pollution because of the similarity. Contamination is said to be a situation where a substance is present in the environment but not causing any obvious harm, while pollution is reverse for cases where harmful effects are apparent. According to Smith (2000), roughly 100 contaminants have been detected in public water supply in United State and virtually every major water source is vulnerable to pollution. About 60% of U.S population relies on surface water from rivers, lakes and reservoirs that may contain industrial and agricultural waste and pesticides washed off fields by rain. The other 40% uses ground water that may be tainted by chemical slowly seeping in from toxic-waste dumps, agricultural activities, leaking sewage and septic systems. In some areas where ground water are bearing gradually depleted, the chemical pollutants are becoming more concentrated. Most pollutants are probably not concentrated enough to pose significant health problems; however there are exceptions. The most widespread danger in water lead, which can cause high blood pressure and an array of other health problems. Lead is especially hazardous to children, since it impairs the development of brain ceils. The U.S. Environment Protection Agency estimates that at least 42 million Americans are exposed to unacceptable high level of lead and the U. S. Public Health Service estimates that perhaps 9 million children are at least slightly affected by it. The contamination comes from old lead pipes and solder that has been in plumbing for years. The materials are gradually being replaced in homes and water systems. Individuals may want to have their water tested by an official laboratory. If the level is too high they can investigate ways to deal with the problem or switch to boiled water for drinking and cooking. Even then, caution is called for some bottled water contained many of the same contamination teat-tap water does. The other four types of contamination in water supply according to Smith (2000) is shown in the table below.

s/n	Substance	Sources	Health effects
1	Persistent chlorinated organic compounds	Used as solvents in industry, past use as pesticides	Various; including reproduction problem and cancer
2	Trihalomethanes	Produced be chemical reaction when water is disinfected by chlorination	Liver and kidney damage and possible cancer
3	Nitrates	Formerly from fertilizer and efficient from concentrated livestock seasoning	Can react to reduce oxygen of blood particularly a problem with children
4	Lead	Old piping and water distribution solder in public systems, homes and other buildings	Nerve damage leaving difficult in children birth defect possible cancer.
5	Pathogenic bacteria, protozoan and viruses	Leaking septic tasks and serves Leaking septic Acute contamination of birds and mammals and inadequate disinfection	Acute gastrointestine illness and other serious health problems

According to (Bitisses, 1981) one of the greatest environmental problem today is water pollution. In the work of (Stapp and Mitchell, 1995) for instance, 80% of sickness in the world are one to unsafe water and poor sanitation over million children below the age of 5 die annually in the developed countries of the southern hemisphere one directly to water pollution. In work of (Ineas and Gilles, 1990: P. 289) the 1980s were designated the international water supply and sanitation decades during which a concerted effort has boon made by seven United Nations. Agencies to improve the environmental health of the world's poorer. The Eastern region of Nigeria has some unfortunate claim to fame, which might better, be felt unpublished except that it relates to a problem of monumental proportion and one of great interest and concern to geographers

hydrologist, agriculturist, conservationist as well as other scientist and the local people. A hydrological model for the humid tropics based entirely on the experiences of Southeast Nigeria has been provided by Ayoade (1976). The result revealed that only 25% variation in type of physico chemical concentration in the region is explainable in terms of variation in population density compared to 75% for their configuration. Also according to Ezeigbo (1989), asserts that the practice of indiscriminate disposal of waste of all types in our towns and villages, increase use of fertilizer and other agricultural chemicals and the accelerated erosion suggests strongly that there is *a* widespread pollution of streams, rivers, lakes, lagoons and other water bodies in the region.

"It is generally accepted that the pollution of water results from physical factor and chemical factor. The physical factor is the climatic condition of the region due to the emission of carbon in the atmosphere, at this stage the content of the bicarbonate ion level in the affected lakes declines, even though initially the buffering capacity of the drainage basin obviates any lowering of the PH level. Ayoade (1988), notes that one is concerned with the salinity buildup of the aquifers in general, the chemical composition of this salinity that limits the utilization of the water for specific uses and moreover the presence of anthropogenic pollutants introduced by Vivifies near the replenishment sites of the aquifers concerned. Moreover, he contended that this should be based on detailed monitoring network and an accepted hydrological model that should also account for Dart ways of chemical components and possible pollutants in the system. Further the option for remediation of the system need to be recognized. Ekpoh (1992), asserts that the hydrocarbons of petroleum references, the dust and fumes of metal smelting and cement works, the odorous gasses of chemicals and allied industries, the carbon monoxide of sulfur and nitrogen of internal combustion engines, the charred particulates and sulfur dioxide emission of pulp and paper industries for instance, are all pollutant which are increasing the acidification potentials of our lakes, stream and rivers meant for domestic and other uses.

5. Findings

5.1 Sources of Water

The sources of water supply presented in table 1 shows that Ediba community was provided with all the water sources with a high value of 32.12% compared to Usumutong and Ebom community with values of 21.8% and 15.75 respectively. Afafayi and Anong community were disadvantage in terms of the sources of water available for domestic use with a value of 4.84% and 8.48%. Table1 indicate that an average of 38.78 boreholes were provided in all the communities while 30.90% streams were available in all the communities out of one hundred and sixty five (165) sources of water provided in the area. However, table 1 shows that an average of 11.51% rivers were available in the communities which was on the least side compared to other sources of water supply in the area.

Table 1. Sources of water supply

Communities	Frequency				
	Tap	Borehole	River	Stream	Percentage
Usumutong	13	8	0	15	21.8
Ediba	10	10	13	17	32.12
Anong	8	4	-	2	8.48
Ebom	-	20	1	5	15.75
Igonigoni	-	6	2	7	9.09
Afafayi	-	-	3	5	4.84
Total	31 Av = 18.78	64 Av= 38.78	19 Av=11.51	51 Av=30.90	100

Source: Field survey (2011)

5.2 Analyses of Elemental Contents

It was observed that the elemental contents was carryout to examine the contents of the available elements in the water sources in the area, the contents of sodium (Na) between the lowest values of 1.1 in location 3 to the highest value of 9.6 in location 12. Table shows that an average value of 5.76 was obtained in location 17. It was observed in table 1 that location 15,16 have lowest values of 0.2 while the highest value of 7.1 was obtained in location 6. Table 1 calcium (ca) shows a lower value of 0.1 in location 3 and the highest value of 1.5 in location while an average value of 0.85 was obtained. The zero value for iron (fe) was obtained in locations of 9, 15 where iron was not detected at all in the samples. The highest value of 1.8 was obtained in location 13. The average value for all the 17 locations was 0.69. manganese (mn) had the lowest value of 1.01 in locations 3 and 11 and the highest value of 0.11 in location 5. The average value for the element was 0.08 for all the 17 locations. However, cadmium (cd) was not detected in locations 5, 13 and 17 while the highest value of 0.02 were obtained in 2,6,14 and 15. The average value for all the 17 locations was 0.01 as presented in table 1.

Table 2. Elemental analysis of public water supply in Calabar urban

Source		Contents (ppm)								
	Locations	Na	K	Ca	Fe	Mn	Mg	Cu	Pb	Cd
Tap	1.	1.4	6.5	0.8	0.6	0.03	0:036	0.04	0.01	0.01
	2.	1.5	6.7	0.8	0.07	0.05	0.36	0.03	0.01	0.02
	3.	1.1	4.7	0.1	0.5	0.01	0.25	0.03	0.03	0.01
	4.	1.3	6.5	1.5	0.8	0.06	0.50	0.04	0.02	0.01
	Locations	Na	K	Ca	Fe	Mn	Mg	Cu	Pb	Cd
Borehole	5.	6.6	6.0	1.4	1.3	0.11	0.50	0.04	0.04	0.00
	6.	9.9	7.1	0.3	1.3	0.07	0.63	0.05	0.01	0.02
	7.	4.3	2.2	1.5	1.0	0.05	1.13	0.04	0.09	0.01
	8.	8.9	6.2	1.0	0.1	0.10	1.64	0.04	0.09	0.00
	Locations	Na	K	Ca	Fe	Mn	Mg	Cu	Pb	Cd
Stream	9.	5.4	0.3	0.8	0.0	0.10	0.40	0.06	0.05	0.01
	10.	8.5	4.5	0.3	0.1	0.08	0.75	0.05	0.06	0.01
	11.	9.4	3.4	0.2	1.5	0.01	0.51	0.03	0.08	0.01
	12.	8.5	3.4	0.4	71.4	0.08	0.65	0.08	0.07	0.01
	13.	9.6	3.3	0.3	1.8	0.09	0.60	0.07	0.05	0.00
	Location	Na	K	Ca	Fe	Mn	Mg	Cu	Pb	Cd
River	14.	5.6	0.3	1.3	0.2	0.06	0.43	0.04	0.04	0.02
	15.	3.9	0.2	1.4	0.0	0.04	0.44	0.04	0.04	0.0
	16.	4.1	0.2	1.2	0.1	0.06	0.41	0.07	0.03	0.01
	17.	2.7	0.6	1.1	0.1	0.06	0.30	0.04	0.05	0.00
	Average	57	3.65	0.85	0.69	0.08	0.58	0.05	0.04	0.01

Note: Na = sodium; K = potassium; Ca= calcium; Fe= iron; Mn= manganese; Mg- magnesium; Cu –copper; Pb= lead; Cd= Cadmium; pp,= parts per million.

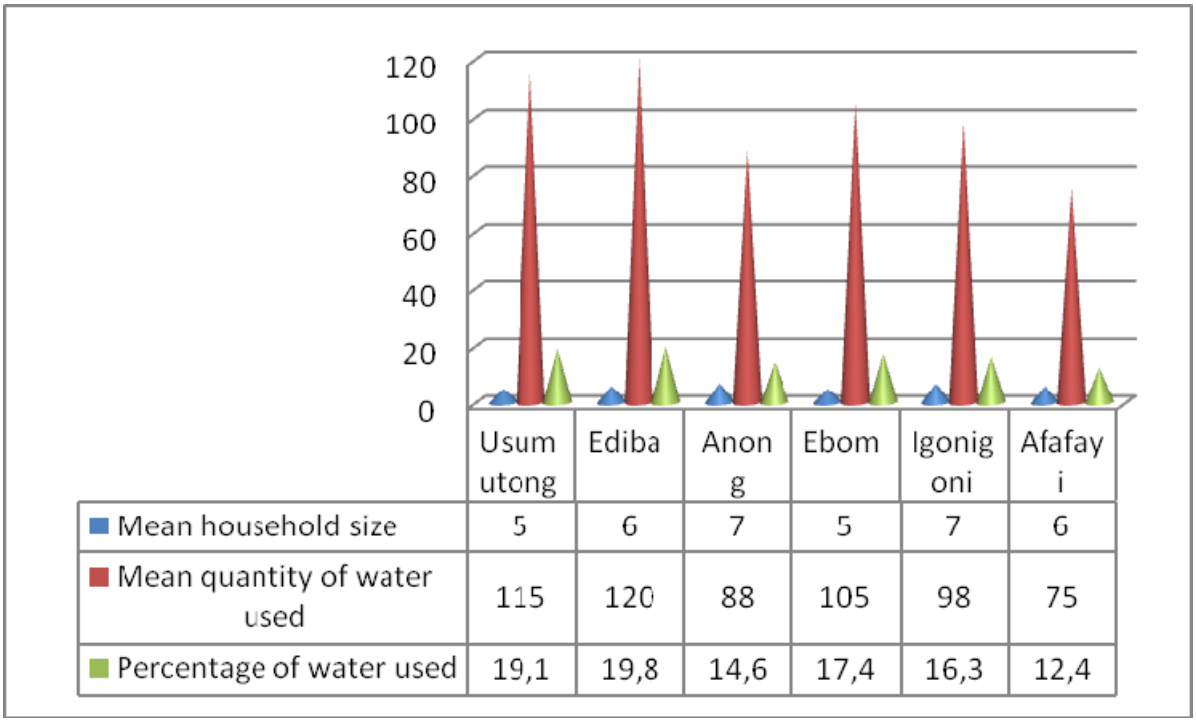
Source: Field survey (2011)

5.*3 Water Quality Consumed*

The mean quantity of water consumed in liters per day presented in figure 1 shows that the quantity of water consumed in Afafayi and Anong was below average with values of 12.4% and 14.6%, with mean quantity of water used as 75 and 88 liters per day. The table revealed that on the average, a person consumers 14.6

liters of water which in far below the quantity estimated by Ayoade and Oyebande (1983). This low consumption is caused by uneven and insufficient distribution of standpipes to serve the inhabitants. However, figure 1 revealed that the mean quantity of water used in Usumutong and Ediba was high with values of 19.1% and 19.8% and with a small household sized compared to Anong and Igonigoni community.

Figure 1. Mean quantity of water consumed in liters per day



	Usumutong	Ediba	Anong	Ebom	Igonigoni	Afafayi
Mean household size	5	6	7	5	7	6
Mean quantity of water used	115	120	88	105	98	75
Percentage of water used	19,1	19,8	14,6	17,4	16,3	12,4

Source: Field survey (2011)

5.4 Water Borne Diseases in the Area

The water borne diseases in the area presented in table 3 revealed that typhoid was the most prevalence water borne disease in the area followed by Diarrhea with values of one thousand fifty nine (1059) and one hundred and fifty nine (159) cases. Table 3 shows that cholera and dysentery were on the least side with values of ten (10) and thirty five (35) cases. It was noticed in table 3 that the sex ratio of infected male with typhoid was on the high side with value of five hundred and forty two (542) cases compared to diarrhea with a high rate of infected female with value of one hundred and thirty nine (139) cases. The number of infected cholera was on the least side with a corresponding values of five (5) case for both sex. Table 3 shows 27.6% reported case of typhoid in 2006 which was on the high side compared to other years and with also a corresponding increase of dysentery in 2008 with a value of 31.4% compared to a high case of diarrhea in 2007. Table 3 indicate that the incident of cholera in the various community was very low as presented with a grand total of ten cases.

Table 3. Water borne diseases in sampled communities

Year	Typhoid				Dysentery				Diarrhea				Cholera			
	M	F	Total	%	M	F	Total	%	M	F	Total	%	M	F	Total	%
2006	162	131	293	27.6	2	6	8	22.8	18	70	38	23.8	3	2	5	50
2007	122	110	232	21.9	3	4	7	20	20	25	75	28.3	1	1	2	20
2008	115	101	216	20.3	5	6	11	31.4	12	15	27	16.9	1	2	3	30
2009	120	114	234	22.8	1	3	4	11.4	10	12	22	13.8	0	0	0	0
2010	98	86	184	17.3	3	2	5	14.2	10	17	27	16.9	0	0	0	0
Grand total	617	542	1059	100	14	21	35	100	70	139	100	159	5	5	10	100

Source: Field survey (2011)

5.5 Water Quality Analysis

The water quality analysis of sampled points presented in table 4 shows eight hundred and seventy two (872) conductivity level in borehole of Enosokwe which was very high compared to other sampled points such as borehole located in Usumutong and Bazohure with five hundred and sixty two (562) and four hundred and fifty (450) conductivity level. Table 4 revealed that streams in Usumutong and Bazohure have twenty one (21) and twenty eight (28) conductivity level which was on the least side. However, table 4 indicate that residents in the area consumed low quality and unhygienic water. This was evidence in Rhohozi stream (Usumutong) with a colour of 86 units as against 5 to 50 units recommended by the US Environmental Protection Agency (1994). In the same vein some water are hard these include the borehole at Usumutong (204mg/1) Enosokwe-Ediba (260mg/1), Basohure (220mg/1) and the lola stream in Anong (201mg/1) which are far above the recommended standard of 81-160mg/1. However, lola stream, Usumutong and Rhohozi stream have aggressive taste which is capable of causing epidemic or diseases in the area.

Table 4. Water quality analysis of selected water samples points in the study area

Water samples	Parameters								
	Water temperature	Dissolve oxygen	Total dissolved solid	Total hardness	PH unit	Apparent colour	Odour	Taste	Conductivity
River	26.5	3.8	27.0	18.5	7.06	8	Odourless	Nill	53
Borehole Anong	26.7	3.8	18.8	18.5	6.25	2	Odourless	Nill	36
Tap Ebom	26.7	3.3	47.0	28.0	0.26	0	Odourless	Nill	92
Borehole Usumutong	26.6	3.6	28.2	204.0	7.09	0	Odourless	Mild	562
Borehole-Enosokwe, Ediba	26.5	3.1	43.6	260.0	7.09	0	Odourless	Mild	872
Borehole-Bazonure	26.7	3.8	25.5	230.0	7.90	0	Odourless	Mild	450
Lola stream – Anong	25.7	3.1	40.3	204.0	7.00	2	Odourless	Aggressive	80.6
Tap-Igonigoni	26.6	3.1	54.0	37.0	7.17	23	Odourless	Aggressive	107
Phohozi	26.7	3.8	11.0	18.5	6.27	86	Odourless	Aggressive	21

stream-Usumutong									
Bazohure Isazen stream	27.1	3.9	14.5	37.0	5.35	0	Odourless	Nill	28

Source: Field survey (2011)

6. Result Analysis

The result obtained in hypothesis one shows F-value of 4.62 (calculated) which was critical F-value of 3.04 (tabulated) at 0.05 significant level. The result shows that the (H_0) hypothesis was rejected while the (H1) was upheld. This however, indicate that the variables of water temperature and total hardness among others (water quality) have a significant relationship with the various sources at which water is obtained at different sample points. For instance, Igonigoni and Ebom relies mostly on streams and boreholes, Usumutong relies on taps and streams while Ediba relies on boreholes and river as their major source of domestic water supply. Water temperature fell within the average of 26.5^0 in all sample points but with a variation in hardness across the various study points.

Table 5. Analysis of water quality consumed in the area

N	X		SD	Sign. 0.05
95	24.01		2.04	Critical F-value
161	25.07			3.07
155	26.06			
400	23.95			F-calculated
Sources of variation	SS	df	Ms	4.62
Between group	32.62	2	14.31	
Within group	1071.36	388	2.82	
Total	1111.97	389		

Source: Data analysis (2011)

Table 6 which shows regression coefficient showing the various impacts of the independent variables and the relationship that exist between the variables indicate -2.772 value and a corresponding 0.000 at 0.05 significant level. This result revealed that distance was a major determinant factor affecting the quality of water available to rural dwellers in the area. The analysis of variance which was used to compared the mean value of the variable presented in table7 shows 4.60 calculated value and a critical value of 3.60 at 0.05 significant level. This result revealed that since the calculated value of 4.60 was greater than tabulated value at 0.05 level of significantly, the (H_0) which states that the social cost (distance, time and price) has no significant relationship with the quality of water available to household was rejected while the H_1 (alternate hypothesis) was upheld. Therefore, the result revealed that there is a significant relationship with the quality of water available to household and the social cost which include distance, time and price in the area.

Table 6. Regression coefficient showing the impacts of independent and dependent variables

Model	Unstandardized coefficients	Unstandardized coefficients		t	Sig
	B	Std. Error	Beta		
1. (constants)	9.060	1.251		0.040	000
Distance	.362	.344	0.62	-2.772	000
Price	-23E-02	.230	-0.10	-.155	.785
Time	-2.387	.601	-.274	1.012	.208
Model value	Sum of square	df	Mean square	f.	
Regression	272.832	3	81.311	4.60	
Residual	318.067	186	15.276		
Total	590.899	189			

Source: Data analysis (2011)

7. Recommendations

The menace of water supply and scarcity in Abi local government area has become an issue of concern to many stakeholders. However, inadequate drinking water supply and sanitation facilities constitute a key issue of water problem in Bhahumono communities. Therefore, this research put forward the following recommendations if the problem of water consumption must be tackled in the area.

- The various stakeholder involved in water management should provide a workable machinery that would help determine the cause of shortage of water supply in the area.
- Independent bodies should be taken to determine the extent of pollution in the various sampled locations.
- Water board charge with domestic water supply should undertake an intensive water treatment before supply to domestic users

8. Conclusion

The quality of water consumption is determine base on its physico-chemical elements. In Bhahumono communities in Abi local Government Area, most trace elements were found to be within WHO maximum permissible levels. It was observed that most samples from locations indicated a high levels of iron (fe) and cadmium (cd) which were said to be polluted by these two elements. However, it is hope that the above mentioned recommendations would help avert the problem of water supply and scarcity in the area.

References

Ayabande, B. (1983). Water resource: A geography of Nigeria development, Heinemann, pp321-333.

Ayoade, J. O. (1975). "On water resources development in Nigeria" Nigeria Journal of economic and social studies. Vol. 7, No.1

Ayoade, J. O. (1981). "Clean water for the third world" water supply and management. Vol. , no.3, pp, 245-251

Battises, M. (1976). Water needs and nature resources.

Doorukamp, J. C. (1982). "The physical basis for planning in the third world". Third world planning review, vol.4, No.1, Liverpool. Liverpool university press. Pp.11-30.

Ekop, O. B. (1994). "Spatial variations in quality and quantity of public water supply. In Calabar municipality, Nigeria". Nigeria journal of technical education. Vol. 11, No.1, pp.107-125.

Ekpoh, I. J. (2003). Environmental continuity and change, St. Paul's Publishing and printing Co., Calabar Nyene.

Ewa, E. E. (2011). Environmental Impact assessment of borehole water quality in Calabar for Intel's (Nig) Ltd, Cross River State.

Eze, E. B. and Abue, M. A. (2003). Water resource management, Ushie Printers and publishing company, Calabar

Ezeigbo , H. I. (1989). Ground water quality problems in parts of Imo State, Nigeria: Nigeria Journal of mining and geology. Vol. 2, No.2, pp.1-9.

Ezeigbo, H. I. (1989). "Groundwater quality problems in part of Imo State, Nigeria". Nigeria Journal of mining and geology, vol.2, No.1 and 2, pp1-9.

Miller, G. T. (Jr) (1982). Living in the environment (3rd ed). Wadsworth publishing. Co. Belmont, California.

Shipman, H. R. (1967) "Water supply problems in developing countries" Journal of the American works Association, Vol, 59, No.7, 767-772.

Smith, G. (2000). Conservation of national resources, John Willey and Song Inco. New York. Pp141-154.

Stanton, S. M. (1974). "Water population" American chemical society. Vol. 4-7. Pp. 237-262.

Umoh, M. J. (1984). The problems of domestic water supply in Calabar municipality. Ushie Printers and publishing company, Calabar.