International Scholars Journals

African Journal of Malaria and Tropical Diseases ISSN 4123-0981 Vol. 9 (9), pp. 001-005, September, 2021. Available online at www.internationalscholarsjournals.org © International Scholars Journals

Full Length Research Paper

Assesment of the water quality and prevalence of water borne diseases in Amassoma, Niger Delta, Nigeria

L. L. Nwidu[1]*, B. Oveh[1], T. Okoriye[1] and N. A. Vaikosen[2]

[1]Department of Pharmacology and Toxicology, Faculty of Pharmacy, Niger Delta University, Bayelsa State, Nigeria. [2]Department of Pharmaceutical and Medicinal Chemistry, Faculty of Pharmacy, Niger Delta University, Bayelsa State, Nigeria.

Accepted 18 July, 2021

The chemical and microbiological properties were investigated at the bank and midstream of the Ammassoma River used for domestic water consumption. Also, retrospective study was conducted at Amassoma General Hospital to ascertain the extent of water borne diseases by studying the case notes of 100 subjects from 2005 - 2007. The carbon-oxygen demand (COD) and biological-oxygen demand (BOD)5 at the bank and midstream of the river are 3.664 ± 0.289 (mean ± SEM) and 2.112 ± 0.864 mg/L (p < 0.0634), 2.236 ± 0.161 and 1.83 ± 0.792 mg/L (p < 0.328), respectively. The number of faecal coliform detected in the river, at the bank and midstream are 581.5 ± 225.57; 1100 ± 306.19 and 63.0 ± 28.362 (p < 0.0163) respectively. The number of patients with reported complaints and diagnosed with water related diseases are 13 (14.61%), 31 (34.83%) and 45 (50.56%) for the periods 2005, 2006 and 2007, respectively. The water related diseases that were consistently reported and diagnosed for the period are cholera (3.37%), diarrhea (44.94%), dysentery (16.85%), and typhoid fever (34.83%). The quality of the water and the prevalence of water related diseases in the hospitals were casually related to the contamination of the river in the community.

Key words: Water quality, heavy metals, faecal coliforms, health impact, retrospective study, Amassoma River.

INTRODUCTION

The quality and quantity of available water have implication on the health status of a community. Over 50,000 people die daily due to water borne diseases (Herschy, 1999) and mortality in children under five years from water related diseases annually is estimated to be about 4 million in developing countries (USAID, 1990; Warner, 1998). Worst still, 2.3 billion people worldwide have mortality and morbidity associated with water related ailment (WHO, 1997). These statistics though alarming definitely have impact on developmental efforts (Olshanky et al., 1997).

Amassoma is a community with a population of over twenty thousands people. They are dependent partially on the ceaseless flow of Amassoma aspect of the river Nun for their water supply. The topography of the town couple with lack of waste management efforts favours surface runoff and discharge of untreated water into the river. The attendant consequences of surface runoff water on water quality have been severally reported by Inanc et al. (1988), Martin et al. (1998), Bariweni et al. (2000) and Izonfuo and Bariweni (2001). The community utilizes this water for both bathing and drinking. Also, the public latrines are sited on the bank contiguous to the bathing and the drinking points. This practice contaminates and pollutes the river. Several studies have examined the physicochemical parameters and microbiological properties of surface and borehole water in Niger Delta areas (Ohagi and Akujieze, 1989; Imeopkaria and Offor, 1992; Ayotamuno, 1992, 1994; Onyeike et al., 2002; Ibe and Sowa, 2002; Oladeji, 2002; Erah et al., 2002; Nwidu et al., 2006). The main objectives of the study include: 1. To access the quality of surface water consumed by the Amassoma community by heavy metals analysis and microbiological assays. 2. To investigate the prevailing water related health diseases in the community hospital by evaluating 100 case notes of patients attending the hospital. 3. To discuss the possible impact

*Corresponding author. E-mail: menelucky@yahoo.com. Tel: +234 803 3417 432.

environmental abuse could have on the health status of the community.

METHODS

Location of study

This study was executed in Amassoma in June, 2007. The town is located outside the Capital of Bayelsa State in the Niger Delta Region of the South-South zone of Nigeria. The major economic activities in Amassoma are oil and gas exploration and exploitation, timber processing, peasant farming and fishing, land and water transportation.

Materials

These includes Atomic Absorption Spectrophotometer (model GBC 908, Austria), sampling bottles, ice packs, cooler, thermometers, used for estimation of heavy metals.

Collection of water samples

Water sampling was carried out at five points where each of the five villages conglomerate to bath, drink and defecate inside the rivers. Two samples were collected at each point, one at the bank of the river and the second sample at a tangential point mid-stream of the river about 100 ft apart. The five points at the bank of the river were designated $P1_b$, $P2_b$, $P3_b$, $P4_b$ and $P5_b$. The corresponding point midstreams were designated $P1_m$, $P2_m$, $P3_m$, $P4_m$, and $P5_m$. Each container used for water collection at each point was correspondingly labeled.

Grab samples of 2 L each from both collection points in each sampling point were collected into aseptic sampling 2 L bottles and sealed. The labeled samples were stored in iced coolers (0^oC) before taken to the laboratory where they were subjected to physico-chemical and bacteriological analysis within 24 h of sample collection.

Chemical parameters

The levels of heavy metals were determined for each sample by collecting a portion of 50 ml. These were subjected to fixing using concentrated hydrochloric acid and concentrated nitric acid in the ratio of 10:1 respectively. This assist in digesting particulate matter in the sample by heating to obtain thick yellow solution, on a water bath. The sample was later cooled and made up to 100 ml with distilled water after which analysis to estimate the concen-tration of heavy metal was done using the bulk Atomic Absorption Spectrophotometer. The COD and BOD5 mg/L were determined using standard procedure (APHA, 1998).

Microbiological assays

The traditional methods for detecting presumptive faecal coliforms, Escherichia coli and Streptococci which include filtration, followed by culture of filters on a medium that selectively permits growth of Gram negative bacteria and differentially detects lactose utilizing bacteria was adopted using standard procedures. Each water sample was subjected to vigorous agitation before collection. 10 ml of each untreated private borehole water was passed through membrane filtration apparatus. Suction was applied by electric pump to the water sample through membrane. Sterile blunt-ended forceps was used to remove the sterile membrane whatman filter paper (47 mm diameter with pore size 0.45 mm). The total coliform count (multiple tube fermentation technique) was evaluated using standard technique (American public health association, 1998).

Retrospective study of water related diseases

One hundred case notes were randomly selected from General Hospital, Amassoma. The case notes were assessed for diagnosis of various water related diseases and outbreak within the period of three years, January, 2005 to December, 2007. The nurses register assist in retrieving the patients name, age, sex and provisional diagnosis. 89 case notes with complete information were included and 11 case notes with incomplete information were excluded from the study.

Statistical analysis

The data obtained from the chemical parameters and subject's characteristics were analyzed by calculating the mean, standard deviation. Interval data from concentration of heavy metals, carbon-oxygen demand (COD) and biological-oxygen demand (BOD5) at the bank and the midstream were compared using the Student's-test with the aid of GraphPad Instat version 2.05a at 95% confi-dence interval.

RESULTS

The concentration (mean ± SEM) of iron, zinc, nickel, copper and chromium are 0.085 ± 0.008, 0.183 ± 0.01, 0.01 ± 0.0, 0.196 ± 0.02 and 0.01 ± 0.0 mg/L, respectively (Table 1). Cadmium, mercury, lead, arsenic, manganese and vanadium were not detected. COD, BOD5 and number of faecal coliform are 3.61 ± 0.18, 2.541 ± 0.24 mg/L and 581.5 ± 225.57 mg/L, respectively. The differences of the COD and BOD mg/L at the bank and midstream of the river are 3.664 ± 0.289 and 2.112 ± 0.864 ($p < 0.0634$), and 2.236 ± 0.161 and 1.83 ± 0.792 ($p < 0.328$) respectively. The number of faecal coliform at the bank and midstream of the rivers are 1100 ± 306.19 and 63.0 ± 28.362 ($p < 0.0163$), respectively (Table 1). There was no difference in concentration of Nickel and Chromium between the sampling points.

A total number of 89 out of 100 case notes selected were utilized for this study. The mean number of patients studied for the period 2005 – 2007 is 29.67 ± 9.26. The number of patients with reported complaints and diag-nosed with water related diseases are 13 (14.61%), 31 (34.83%), and 45 (50.56%) for the periods 2005, 2006 and 2007, respectively. The water related diseases that were consistently reported and diagnosed for the period are cholera (3.37%), diarrhea (44.94%), dysentery (16.85%), and typhoid fever (34.83%), (Table 2). A break down of the data reveal that 31 (34.83%) patients are under 1 year, 11 (12.34%) patients are under 5 year, 3 (3.37%) patients are below 15 years. 7 (7.87%) patients are above 45 years.

Table I. Heavy metals concentrations (mg/L) and microbiological assays of Amassoma River, Niger Delta Areas.

Location	Parameters (mg/L)													Fecal coliform
	Fe	Cd	Zn	Ni	Cu	Cr	Mn	Hg	As	Pb	V	COD	BOD_5	
Bank of river														
$P1_b$	0.10	ND	0.18	0.01	0.10	0.01	ND	ND	ND	ND	ND	4.72	2.83	1600
$P2_b$	0.10	ND	0.16	0.01	0.15	0.01	ND	ND	ND	ND	ND	3.84	2.30	1600
$P3_b$	0.10	ND	0.18	0.01	0.24	0.01	ND	ND	ND	ND	ND	3.36	2.02	1600
$P4_b$	0.10	ND	0.16	0.01	0.19	0.01	ND	ND	ND	ND	ND	3.20	2.11	350
$P5_b$	0.10	ND	0.18	0.01	0.09	0.01	ND	ND	ND	ND	ND	3.20	1.92	350
Midstream of rivers														
$P1_m$	0.05	ND	0.16	0.01	0.23	0.01	ND	ND	ND	ND	ND	3.52	2.11	12
$P2_m$	0.05	ND	0.24	0.01	0.24	0.01	ND	ND	ND	ND	ND	NA	NA	30
$P3_m$	0.05	ND	0.18	0.01	0.18	0.01	ND	ND	ND	ND	ND	3.36	3.36	70
$P4_m$	0.10	ND	0.24	0.01	0.28	0.01	ND	ND	ND	ND	ND	NA	NA	33
$P5_m$	0.10	ND	0.15	0.01	0.26	0.01	ND	ND	ND	ND	ND	3.68	3.68	170

ND = Not detected; NA = not available.

Table 2. Reported cases of water related diseases in General Hospital Amassoma from January 2005 to December 2007.

Particular of subjects	Jan - Dec. 2005	Jan- Dec. 2006	Jan - Dec. 2007
Biodata			
Male > 15 years	4	9	8
Females > 15 years	5	11	10
Children > 5 years	1	1	2
Children < 5 years	2	3	6
Children under 1 year	1	7	19
Total	13 (14.61%)	31 (34.83%)	45 (50.56%)
Diagnosis of reported complaints			
Cholera	2	1	0
Diarrhoea	2	14	24
Dysentery	2	4	9
Typhoid fever	7	12	12
Total	13 (14.61%)	31 (34.83%)	45 (50.56%)

DISCUSSION

Surface water can pick up solid, liquid and gas either as rainwater or as it percolate through the soil layers. These added substances are broadly classified as biological, chemical (both organic and inorganic), physical, and radiological impurities. Others include industrial and commercial solvents, metals and acid salts, sediments, pesticides, herbicides, plant nutrients, radioactive materials, decaying animal and vegetable materials, living organisms such as algae, bacteria, fungi and viruses (Erah et al., 2002). The eventual emergence of this groundwater from aquifer as springs water, rivers, estuaries, quarries or pumping of this water from the aquifer as borehole water may have grave consequences on water quality. Chemical intoxication in drinking water may either be acute or chronic in nature. The acute health effect may be in form of skin irritation, skin rash, nausea, vomiting, dizziness, etc. Death may ensue if the quantity of chemical consumed is large. Most often, routine examination of water has revealed high level of inorganic chemicals and the acute effects may not easily be traced by clinicians as symptoms are treated symptomatically. Other chronic effects reported following consumption of inorganic chemicals are cancer, mutagenesis, tetratogenesis, nervousness and immune system disorders (Erah et al., 2002).

The inorganic chemical constituents obtained in this study are in normal range permissible by World Health Organisation standard. Calcium salts and calcium ions are among the most commonly occurring inorganic chemical in nature. Though the human body requires approximately 0.7 - 2.0 g of calcium per day as food element, excessive amounts can lead to the formation of kidney or gallbladder stones. Calcium toxicity is rare, but over consumption may lead to deposit of calcium phosphates in soft tissue of the body. Calcium intoxication causes depression. Calcium plays vital role in building healthy teeth and bones. It is vital to every cell in the body, for nucleus function nerve transmission, blood clothing and many other uses. When lacked, it is mobilize from bones causing osteoporosis (Chapman and Tussing, 2001). Iron exposure at high levels has been shown to result in vomiting, diarrhea, abdominal pain, seizures and possibly coma. A latent period, where the symptoms appear to improve, may occur. But it is followed by shock, low blood glucose, liver damage, convulsions and death, 12 - 48 h after toxic level of Iron are ingested. Death may occur in children if they ingest sufficient iron to exceed the body's iron-binding capacity, the metal-binding proteins that make ionic iron available (Conrad, 2004).

The concentration of heavy metals in water sample was either within the legal limit of the World Health Organization permissible level or was not detectable. This is in conformity with other studies conducted in Niger Delta region (Bariweni et al., 2000; Izonfuo and Bariweni, 2001; Ajayi and Osibanjo, 1981 and Olajire et al., 2003 and Asonye, et al., 2007).

The Biological Oxygen Demand (BOD)5 is reported (Moore and Moore, 1976) to be a fair measure of cleanliness of any water on the basis that values less than 1 - 2 mg/L are considered clean, above 2 – 3 mg/L fairly clean, 5 mg/L doubtful and 10 mg/L definitely bad and polluted. This shows that the overall quality of domestic water in the studied area of Amassoma River is fairly clean. The degree of cleanliness between the bank and the midstream is not significant. It was observed that the community builds latrines along the banks of the rivers, deposited refuse at the banks, bath, washed clothes at the banks and fetch water for drinking at the banks of the river. These activities are detrimental to health as it can lead to water pollution and water related diseases as observed in this investigation.

The chemical oxygen demand (COD) which is an indication of organic matter susceptible to oxidation by chemical oxidant is slightly above permissible level. Large value of COD shows that the water body will be in an oxidative stress. The large amount refuse and human excreta disposed into the river could be responsible for this oxidative stress. This could impact on the aquatic life causing the death of flora and fauna due to this oxidative stress as less oxygen will be available for respiration. The loss of aquatic life will definitely affect the protein supply to the community and this might lead to malnutrition. The impact on the community source of livelihood is enormous as their will be loss of employment since they are peasant fishermen. Malnutrition, unemployment, water borne diseases, loss of man hour due to hospital admission, increase expenditure of family income in treating water related diseases and deaths of infants are the various impact of consumption water from this contaminated river. The mean faecal coliforms of the water sample are above the permissible level (WHO, 1997) and the contamination of the water sample with faecal coliforms is more at the banks than the midstream of the rivers which the community utilizes as the main source of drinking water; this foretell danger in the near futures if observed trends continues. The level of contamination of the water sample is enormous and indicator of recent faecal contamination and gross pollution of the water banks.

There was a progressive increase in the number of patients with reported complaints of water related diseases. An increased from 14.61 to 50.56% for the periods of three years, 2005 - 2007, are not statistics to be ignored. The percentages of water related diseases that were consistently reported and diagnosed for the period might be higher than reported due to self medication, traditional practices and patronage of unregistered drug outlets.

The need for aggressive health education of the Amassoma community to obtain their drinking water midstream and subjecting the water to physical and chemical treatment is advocated to reduce the effects of progressive increase in water related diseases. Routine immunization of the vulnerable group of the population and inculcation of high level of personal and domestic hygiene, safe and proper disposal of refuse and human excreta and provision of portable pipe borne water supply are measures that can ameliorate the observed trends.

Conclusion

The surface water quality in Amassoma community with respect to heavy metals was in some cases inadequate and the faecal coliform count is grossly beyond the legal permissible limit for drinking water. There was consistent increase in water related diseases diagnosed in the community hospital from the case notes of subjects who patronized this health facility. These indicate that prevalence of water borne diseases may be casually related to the source of drinking water. These interrelated effects have definite impact on developmental efforts and health status of the Amassoma community.

REFERENCES

American Public Health Association, (APHA) (1998). American Water Works Association and water Pollution Control. Federation Standard Methods for the Examination of water and wastewater 20th ed. Washington DC.

Asonye CC, Okolie NP, Okenwa EE, Iwuanyanwu UG (2007). Some physico-chemical characteristics and heavy metal profiles of Nigerian rivers, streams and waterways, Afr. J. Biotechnol. 6(5): 617-624.

Ayotamuno MJ (1994). The quality of Drinking water in Rivers State, J. Environ. Educ. Info. 13(1): 56-98.

Ayotamuno MJ (1997). Survey of water facilities in an urban settlement in Port Harcourt, Nigerian. J. Environ. Educ Info. 11(40): 23-48.

Bariweni PA, Izonfuo WAL, Amadi EN (2000). An Assessment of Domestic Waste Level and their Current Management Strategies in Yenegoa metropolis. Glob. J. Pure Appl. Sci. (In press).

Chapman-Nowaskofski K, Tussing L (2001). Calcium, Univ. of Illinois co-operative Extension at http://www. McKinley.Uiuc.edu/handouts/calcium.html.

Conrad ME (2004). Toxicity of Iron available at: http://www.emedicine.com/MED/topic1189.htm.

Erah PO, Akujieze CN, Oteze GE (2002). The Quality of Groundwater in Benin City: A baseline study on inorganic chemicals and microbial contaminant of health importance in borehole and open wells, Trop. J. Pharm. Res. 1(2): 75-82.

Herschy RW (1999). Hydrometry Principles (2nd edition) John Wiley and Sons, Chichester.

United State Agency for International Development (USAID) (1990). Strategies for drinking water and sanitation program to child survival, USAID, Washington, D.C.

Ibe K, Sowa A (2002). Hydrology of part of Oramiriukwa River basin, southeast of Owerri, Imo States, Nigeria. Hydrogeol. J. 10(4): 509-521.

Imeopkaria EG, Offor N (1992). Heavy metal occurrence in Ikpoba Ogba River sediments. Paper presented at 10th Annual conference of Nigeria Association of hydro. (NAH).

Inanc B, Kinaci C, Ozturk M, (1988). Pollution Prevention and Restoration in the Golden Horn. of Istanbul. Water Sci Technol. 37(8): 129-136

Izonfuo LWA, Bariweni PA (2001). The Effect of Urban Run-off Water and Human Activities on some Physico-chemical parameters of the Epie creek of in the Niger Delta. J. Appl. Sci. Environ. Manage. 5(1): 47-55.

Martin JC, Hoggart C, Matissa A (1998). Improvement priorities for Sewage Treatment in Latvian Small and Medium Sized Towns Water Sci. Tech. 37(8): 137-144

Moore WJ, Moore EA (1976). Environmental Chemistry, Academics Press, Inc.London, pp. 360-368.

Nwidu LL (2002). Pruritus in Private Borehole Water Users in Port Harcourt city. MSc. Dissertation on Pharmacology, University of Port Harcourt, pp. 1-5.

Nwidu LL, Ebong OO, Wariso BA (2006). Report of assessment of bacteria flora of health significance in private borehole water supply in Port Harcourt city, Nigeria, J. Res. Biosci. 2(2): 13-17.

Nwidu LL, Ebong OO, Wariso BA (2006). The health implication of underground Water used for domestic consumption in oil Producing area, Port Harcourt City, Nigeria. J. Med. Pharm. Sci. 2(1): 39-45.

Ohagi SQ, Akujieze CN (1989). Iron in borehole water sources in Bendel State Nigeria, J. Niger Assoc. Hydrogeol. 1(2): 192-196.

Oladeji OS (2002). Preliminary Assessment of the Environmental impacts of land use Patterns on Ground Water Quality, AJOL Global J. Environ. Sci. Vol. 1 No. 1.

Olajire AA, Ayodele ET, Oluyemi EA (2003). Levels and speciation of Heavy metals in soil of Industrial Towns Southern Nigeria. Environ. Monit. Assess. 85(2): 135-155.

Olshanky S, Carmes B, Rogers R, Smith L (1997). Infectious diseases- New and ancient threat to world health. Popul. Bull 52(2): 2-43.

Onyeike EN, Ogbuja SI, Nwinuka NM (2002). Inorganic ion levels of soil and streams of some area of Ogoniland, Nigeria as affected by crude oil spillage. Environ. Monit. Assess. 73(2): 191-204.

Warner D (1998). Drinking water supply and environmental sanitation for health. Presented at the International conference for sustainable development, Paris.

World Health Organisation (WHO) (1997). Health and Environment in Sustainable Development, five years after the earth summit. (WHO) Geneva, (WHO/EHG/97.8), p. 245.