SECTION B: ECO-TOURISM AND FISHERIES DEVELOPMENT

PUBLIC HEALTH IMPLICATIONS OF GURARA RIVER AROUND IZOM ENVIRONS, NIGER STATE, NIGERIA.

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Abstract

Water samples were collected from River Gurara around the Gurara Falls and Izom settlement once every month for a period of twelve (12) months (June 2004 May 2005). Microbial studies were carried out on the water samples collected. There were marked variations between different samples, stations and seasons. The microbial studies showed the presence of enteric gram negative, gram positive and pyogeric groups of bacteria. Some species of indicator organisms were recorded. The results obtained showed that the activities of Izom populace has some impact on the water quality and public health status of River Gurara.

Key word: River Gurara, Public health, Izom environ, Niger State, Nigeria,

Introduction

The study of limnology is becoming more established in Nigeria due to the increasing awareness of the usefulness of water resources to man and aquatic life. The great drive toward water resources for fisheries, irrigation, animal rearing, recreation, domestic and industrial water supply, tourism attraction, public health hazard and conservation of fresh water ecosystem prompt the need for scientific information on the inland water bodies. The assessment of inland waters involves evaluating the physico-chemical parameters and microbial load of water to determine it potential productivity for future uses, and hazards to aquatic and human lives.

The quantity and quality of water are important, however it is quality that determines and support it biological composition (Kolo, 1996). The quality and biological condition of water bodies is determined by it characteristic features. The physical and chemical properties and also bacterial and fungal loads are necessary parameters to ascertain a healthy ecosystem and sustenance of human race. Water bodies are reservoir for micro-organisms, some are resident flora which are useful and harmful components of the aquatic ecosystem, while some are pathogenic in nature and their presence as indicator organisms, poses a great threat to public health and fisheries production. Contamination of water by sewage or excrement from humans or animals is the greatest danger associated with water (USEPA, 1985; Okhawere, 2003).

Water has its normal flora or a harmless group of bacteria, but some when normal flora get access to the tissue of organisms they become pathogenic. The purpose for examining water microbiologically is to help to determine the sanitary quality and its suitability for general use (Okafor,1985). Water that is considered safe for human consumption should, among others, be free from microbiological contamination; it should meet the standard for taste, odour and appearances (Okafor, 1985). Ironically, most Africans, as confirmed by Kirkwood (1998), don't have access to such water. The need for safe water is generally high in the developing countries with the various deadly water-borne diseases.

Faecal pollution of water resources is a problem of world wide concern. Okafor (1985) has reported that the organisms used as indicators of faecal contamination are:- Coliform, Streptococcus faecalis, Clostridum perfringens, *bifido Bacteria, Salmonella, Vibrio cholerae, Shigella and Versinia.* Coliform bacteria are pathogens and they are responsible for such intestinal infections as bacterial dysentery, typhoid fever and some bacterial food poisonings such as *Staphylococcus aureus, E.coli, Bacillus sp.* These diseases are exclusively transmitted by feacal contamination of water and food materials. Okhawere, (2003), reported that transmission through contaminated water supply, is by far the most serious source of infection and is responsible for the massive epidemic outbreak of the more serious enteric diseases (particularly typhoid fever and cholera).

The ratio of indicator to actual pathogens hazard is not fixed. The more pathogens an indiv carries, the more hazardous their feces. The infestation is around 5% in the U.S. and approac 100% in areas with poor hygiene and contaminated water supplies. The typical world standard coliform in drinking water is to be less than 1 per 100ml (0.5mg/m^2) and in untreated drinking wate 50 per 100ml (www.pasidesgnnet.1997-2005). Fungi are saprophytic organisms and a go number are pathogenic in nature which follow a primary bacterial or parasitic infections, physi injury or traumatic conditions. They cause disease to fish and man. The opportunistic specie include *S. prolegnis*, *Branechiomyces sanguinu, Phoma herbarium*. The objective of the study is ascertain the microbial characteristics and public health implication of the Gurara river around th Gurara water falls, and Izom environment and also to verify the human impact on River Gurara fro the upstream of the Gurara falls to the out skirt of Izom settlement.

Materials and Methods

The study area

River Gurara is located in South-Eastern part of Niger State, longitude 9°.30N and latitude 7°.00E under Gurara Local Government Area In Suleja Emirate. River Gurara is a major source o water for Bonu, Gawu/Lambatta, and Izom communities with high population density of abou 23,000 (Based on Census 1991). The communities experienced periodic out break of water-borne diseases which claimed many lives.

The study area is Bonu village few kilometers upstream before the water falls. Station 1 is about 3km upstream of the water fall around Bonu settlement. Station 2 is at the foot of water falls which is 3.5 km away from station1. Station 3 is at the confluence of Rivers Tafa and Gurara around Wagu village and Zhigbodo hamlet, which is 10 km down stream of the Gurara water fall. Station 4 is at Izom township bridge which is about 3 km from the confluence. Station 5, is at the outskirt of Izom settlement which is about 4 km from the Izom township bridge.

Water samples were taken from the five stations once every month for 12 months (June 2004 May 2005) and were taken to the Microbiology Laboratory of Federal University of Technology Minna, for bacterial and fungal load analysis. Some information in the field were acquired through observation and interview of users of the water body.

The multiple tube fermentation method which is also called the dilution method or the Most Probable Number (MPN) method was used for the microbial analyses. Samples for fungi identification were cultured on sabourad dextrose Agar, and fungi isolates were picked and examined under microscope using x 10 and x 40 objective lens, the structure of the fungi observed is then compared with standard (APHA, 1992).

Results

The bacteria isolates from the water samples were of wide range of groups. These included enteric Gram-negative and *pyogenic cocci* group. The enteric gram-negative i.e. coliform bacteria include, *Klesbiellae proteus* group, *Pseudomonas aeruginosa*, Salmonellae, *Pyogenic cocci* and gram positives which were staphylococci and *streptococci*. Their occurrence and distribution varied from station to station (Table 1). *Escherichia coli, Staphylococcus aureus* and *Pseudomonas aeruginosa*, occurred in all the months in different stations. *Klebsiella sp; Salmonellae typhi; Baccillus sp; Aeromonas sp* and *Streptococcus feacalis* were absent in some stations *Streptococcus pyogeues, Proteus vulgaris* had the least occurrence in only two months and two stations (June and November) in station 5 and 4, in November and May, station 5 and 3 respectively. The *Escherichia coli* had the highest frequency of distribution in all the stations followed by *Staphylococcus aureus* and *Pseudomonas aeruginosals* respectively. They occurred in all the months. Stations 5, 3 and 4 had the higher number of species isolates. There was higher occurrence of species during the rainy season than dry season.

Fungi species isolated from water samples were of different groups. They varied between the months and stations (Table 2). *Aspergillus niger, Aspergillus flavus* had the widest range and highest occurrence in all the stations, followed by *Rhizopus sp.* and *Fusarium sp Aspergillus fumigatus, A. parasitus, Mucor sp* and *Pencillium sp* where absent in some months.

There was low occurrence of *Aspergillus versildor and A. nidulans* in few months and stations. Chances are these species are not well adapted to the aquatic environment. *Aspergillus versicolour* and *A. glaucus* are the least recorded species. The month of May had the highest occurrence of the microbes. Wet season had high number and frequency than dry season.

Discussion

This study has been carried out to assess microbial properties of River Gurara and the effect of human activities on the environment. Microbial analysis shows the presence of indicator organisms of bacteria and fungi isolates (Tables 1 and 2). High number of species isolates from Stations 5, 3 and 4 from water samples might be due to eutrophication of water with organic and inorganic materials which provide nutrients for the bacteria to grow, as a result of several human activities carried out around these stations. The prevalence of few species such as *Streptococcus faccalis, Pseudomonas aeruginosals, Esherichia coli* and *Staphylococus aureus* in the hot dry season indicated that they are thermophilic and shows contamination of the water body by human and animal faeces. The highest occurrence of species during wet season than dry season could be due to favourable condition and unfavourable weather condition of dry cool harmattan and hot season respectively. Relatively high temperature might have inhibited the microbial growth.

The highest number of the species recorded in the month of May in all stations might be due to the early rains with high surface run-off. This agreed with the finding of Cody *et al.* (1961) who reported that the result of a mild rain greatly increase the bacteria contamination of a water body. The highest record of fungi species in the wet season in all the stations could be as a result of high water regime and surface run-off leading to eutrophication which provide suitable medium for fungal growth.

Coliforms and fecal *Streptococci* are indicator organisms commonly found in human and animal faeces. Although they are generally not harmful themselves, they indicate the possible presence of pathogenic organisms. Therefore their presence in water bodies suggests that swimming in such waters, drinking such water and eating fish from such source, might constitute health risk. Since it is difficult, time consuming and expensive to test directly for presence of a large variety of pathogens, water is usually tested for coliforms and fecal Streptococci instead. Sources of contamination include waste water treatment plant, on site septic system, domestic and wild animal manure and storm run-off. The same phenomena operate in River Gurara around Izom settlement. Swift water flow could have distributed the pathogens easily in the entire water column and length.

The source of effluent to River Gurara include irrigation, herbicides and pesticides applications, human and animal faeces, sewage, bathing, washing cloth (laundry), car washing and N.N.P.C pumping sub-station untreated effluent. These might be the sources of the organisms isolated. The pathogens isolated from the water sample (bacteria and fungi species) are known to be associated with common health hazards and possible health risk are suffered by the users of such waters. Coliforms e.g. *E.coli* and *Aeromons sp* isolated from the study are of human origin and pose great health implication; other species of bacteria could be from soil, air and vegetation. There was low occurrence of *Aspergillus versildor and A. nidulans* in a few months and stations. It is probable that these species are not well adopted to aquatic environment. Fungi species isolated are opportunistic organisms hence people with immuno-suppression such as HIV/AIDS, diabetes, etc, may be at a risk, if they drink water from this River. The monthly disease routine report (1994-2003) of Gurara Local Government Primary Health Care Unit showed that Bonu, Gawu/Lambatta and Izom settlements had high and frequent records of diseases like vomiting and diarrhea, thyphoid fever, cholera epidemic in 1996 and 2002, urinary tract infections, skin diseases, conjunctivitis and wound infections. These diseases are common to these communities and can be linked to bacteria and fungi contamination (Ernest *et al.* 1970, Itah *et al.* 1999). The isolates recorded are pathogenic in nature and could be categorically said to be responsible for those diseases suffered by these communities. Similar diseases are reported to be experienced among the Nupe's, who live in riverine areas. They claimed that the use of the herb, *Nymphea lotus* (aquatic plant) has remedy for such bacteria and fungi diseases (Yisa *et al*, 2004).

In conclusion microbal analysis revealed the presence of coliform indicator organisms. Stations 3,4 and 5 revealed high levels of total and faecal bacterial contamination above 50cfu per/100litre recommended by WHO for Third World countries. This pollution may be due to over dependence on the river during the dry season. All the evidence of faecal pollution throughout the study period agrees with the bacteriological and chemical analysis of source of portable water in Niger State reported by Okhawere (2003). The results also agreed with the findings of Ampofo (1997) in his survey of microbial pollution of rural domestic water supply in Ghana, who said that inadequate availability of water will hamper people's efforts to practice personal hygiene, and that frequent fetching, washing, and bathing in the river will expose the river to pollution and users to infections. The use of river Gurara for drinking, bathing, irrigation, swimming and fish production poses a great health risk for the people. The river water is non potable and its potentials for the fish production is low.

From the aforementioned conclusion it is recommended that basic health education for the communities be carried out on the of hazards associated with microbial pollution waters. Also provision of portable water supply (Bore hole, and tap water) be extended to the Izom communities. Boiling and filtering the water before drinking it, washing vegetables with saline water (salt) before eating and avoid swimming in the river, encouraging good practice of personal hygiene, (including to avoid bathing and defecating in the river), and proper use of latrine, will go a long way in ameliorating the scorge of water-borne diseases in these communities. N.N.P.C pump sub-station should treat its effluent before discharging it into the river. The use of water purifier (tablet or sachet) can be used to make the water safe for drinking at the individual or family level.

Tab Gr1

. Bacteria Organisms Isolated from water samples of Gurara River (JUNE 2004 – MAY 2005)

	Bacteria species	STATIONS WHERE THE ORGANISMS WERE ISOLATED DURING THE SAMPLING PERIOD.											
		JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.	March	APRIL	MAY
1	*Streptococcus faecalis* *	2, 3	—	4, 5	4	—	5	5	2	4	2, 4	5	1, 4
2	*Pseudomonas aeruginosals*	5, 4	5	3	5	2	3	3	2, 4	1	1	1	1
3	*Escherichia coli* *	2, 1, 3,	2	1, 2, 3, 5	1, 3, 5	1	4	1	1, 3	3	5	3	2, 5
4	*Salmonellae typhi* *	2	3	—	2	5	—	5	—	—	—	—	2
5	*Staphylococcus aureus*	1, 4	1	1, 3, 4	1, 4	3	2	2	1, 5	2	1	2	2, 3
6	*Klebsiella aerogenes* *	—	—	—	2	5	1	—	4	—	—	4	3
7	*Proteus vulgaris* *	—	—	—	—	—	5	—	—	—	—	—	3
8	*Bacillus subtilis*	3											

Keys

— * Indicator Organisms
Absent

Station 1. Upstream Gurara water falls
Station 2 Foot pool of water falls
Station 3 Confluence of Tafa and Gurara rivers
Station 4 Izom township bridge
Station 5 Out skirth of Izom town.

— Stations where these organisms where found respectively in the sample water

INDICATOR ORGANISMS (BACTERIA) Isolated From SAMPLE WATER OF GURARA RIVER IN 5 STATIONS BETWEEN (JUNE-MAY 2004 – 2005)

1 *Streptococcus faecalis*
2 *Escherichia coli*
3 *Salmonella typhi*
4 *Klebsiella aerogenes*
5 *Aeromonas formicans*
6 *Proteus vulgaris*

Table 2

Fungi Isolated from water samples of Gurara River (2004-2005)

	Fungal Species	STATIONS WHERE THE ORGANISMS WERE ISOLATED DURING THE SAMPLING PERIOD.											
		JUNE	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY
1	*Aspergillus fumigatus*	—	3,	2, 5	3	1, 4	4	2	5	1	2	1	
2	*Aspergillus parasitus*	2	1	4	1		2	2	3	3, 4	2, 4		
3	*Aspergillus niger*	3, 4, 5	2, 4, 5	1, 3, 4 5	1, 2	1, 2,	1, 4	3, 5	1, 4	1, 5	3		
4	*Penicillus notatum*	—	—	—	5	—	5	1	2, 5	2	3, 5		
5	*Fusarium nivale*	4	3	1	3		3, 4	3	2, 5	2	4		
6	*Rhizopus nigrica*	3, 4	4	2, 4	4	2	1, 5	4	3	3	5		
7	*Aspergillus glaucus*	—	—	—	—	—	—	—	—	—	—		
8	*Aspergillus flavus*	3, 4, 3, 5	5, 4	3	2	1, 3,	2, 5	3	4	5	1		
9	*Mucor spp*	3, 4, 5	4	4	—	3, 4, 5	—	5	2	3, 4	1	4	3
10	*Aspergillus nidulans*	—	—	—	—	—	—	—	4	—	—	—	4
11	*Aspergillus versildor*	—	—	1	—	—	3	1	—	—	—	—	4
12	*Aspergillus glaucus*	—	—	—	—	—	—	4	1	—	—	—	4
13	*Aspergillus versicolour*	—	—	—	—	—	—	—	1	—	—	—	—

Keys

— Absent

Station 1. Upstream Gurara water falls

Station 2 Foot pool of water falls

Station 3 Confluence of Tafa and Gurara rivers

Station 4 Izom township bridge

Station 5 Out skirth of Izom town.

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