Antibiotic Sensitivity Profile of Human Pathogenic Microbes from Different Water Sources in Akure Metropolis, Ondo State, Nigeria

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Abstract: The antibiotic sensitivity pattern of bacteria isolated from different water source in Akure metropolis was investigated *in vitro*. Water samples were collected aseptically from well, borehole and stream for microbiological analysis. *Escherichia coli, Aerobacter aerogenes* and *Alcaligene feacalis* were isolated from stream water while *Proteus vulgaris* and *Micrococcus luteus* were encountered from well water. Two different bacteria were also isolated from borehole water these include, *Proteus vulgaris* and *Bacillus cereus.* Oflaxacin was the most sensitive antibiotic because it showed the highest zone of inhibition against *Bacillus cereus*. In addition, all the bacteria were sensitive to it, but *Micrococcus luteus* was the least sensitive bacterium to Oflaxacin. Augmentin, Tetracycline, Amoxillin and Contrimoxazole have no effect on *Micrococcus luteus*. Stream water had the highest coliform count of 25/100 mL and a microbial load of $3.00{\times}10^4$ cfu mL^{-1}. This was followed by well water which gave coliform count of 13/100 mL and a microbial load of $1.62{\times}10^4$ cfu mL^{-1}. Borehole water gave the least coliform count of 5/100 mL and a microbial load of $0.31{\times}10^4$ cfu mL^{-1}.

Key words: Pathogenic microbes, sensitivity, water, profile of human, Nigeria

INTRODUCTION

Water is the most widespread natural resource covering more than 75% of the world's surface. It plays an important part in the structure and function of the human body; approximately 60% of health adult consists of water (Baker *et al.*, 2000). Atmospheric water results from rainfall on the earth surface and water formed by snow or hail. As the rain falls, it washes down the dusty atmospheric particles and collects with it dissolved gasses and other suspended particles. Hence, atmospheric microflora are washed down through the rain droplets. Although atmospheric water appears to be pure, it carried a large number of microorganisms (Nduka, 1985).

Groundwater can also be contaminated by microbes even in seeming well-designed and constructed water-well. Buried faeces or damaged sewers could be potential sources of contamination to the groundwater system if wells are inadvertently sited in such areas. Therefore, microorganism can gain access to well or boreholes through contaminated water for drilling and improper handling of well construction and water supply fittings. Studies have also shown that there are correlations between microbial loads of stream water and the condition of extreme rainfall and run off. Water related diseases continue to be of the major health problems globally. An estimated 4 billion cases of diarrhea annually represented 5.7% of the global disease burden in the year 2000. Acute bacterial dysentery is a global health concern particularly in developing countries. The high prevalence of diarrhea diseases among children and infants can be traced to the use of unsafe water and unhygienic practices (Admassu *et al.*, 2004). Approximately three out of 5 persons in developing countries do not have access to safe drinking water and only about one in 4 has any kind of sanitary facilities (Gary *et al.*, 2005).

The present investigation was designed to isolate and characterize human pathogenic bacteria associated with different water sources in Akure, Nigeria and determine the effect of some antibiotics on the bacterial isolates.

MATERIALS AND METHODS

Collection of sample: Water samples were collected aseptically from 3 different water sources, stream, well and borehole, in Akure metropolis between July and October, 2006. Samples were usually collected in sterile sampling bottles and analysed within 1 h.

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Isolation and characterization of bacteria: Two nutrient agar plates were inoculated with 1 mL of 10^{-2} dilution factor of each water sample using sterile pipette. Discrete colonies after 72 h of incubation at 37°C were subculture to obtain pure isolates and identified according to Cowan and Steel (1985). MacConkey broth was used for the determination of coli form counts while, the multiple tubes method was used as the presumptive test i.e. most probable number (MPN).

The presumptive positive sample was inoculated on Eosin Methylene Blue (EMB) agar to confirm the presence of a positive presumptive test. The completed test was performed to further verify the presence of *E. coli* and distinguish there presence from that of *Entorobacter aerogenes.*

Antibiotic sensitivity test: The antibiotic sensitivity pattern of bacterial isolated from different water sources was determined according to NCCL (2003). Sensitivity multidiscs were placed on the surface of the solidified Nutrient agar that had earlier been seeded with bacteria isolates from the different water sampled, using sterile forceps. The plates were incubated for 24 h after which they were examined for zones of inhibition.

RESULTS AND DISCUSSION

The Total Viable Count (TVC) obtained from stream water (3.00×10^4 cfu mL^{-1}) was the highest while the lowest TVC was obtained from bore-hole water (0.3×10^4 cfu mL^{-1}) and the TVC obtained from well water was 1.62×10^4 cfu mL^{-1}. The stream water gave the highest coli form count (25/100 mL) while borehole water had the least 5/100 mL water sample (Table 1). In all, 6 bacterial species were isolated from the water samples. These include: *Eschericia coli, Aerobacter aerogenes, Alcaligene faecalis, Proteus vulgaris, Micrococcus luteus* and *Bacillus cereus.* Table 2 shows the distribution of microbial isolates in different water sources. The antibiotic sensitivity pattern of the bacterial isolates is shown in Table 3. The most effective antibiotic against the isolates was Oflaxacin while the least was Amoxicillin. *Micrococcus luteus* showed multiple antibiotic resistance to AUG, TET, AMX and COT while *Aerobactrer aerogenes* showed multiple antibiotic resistance to NIT, GEN, AMX and COT.

The high microbial load recorded from the stream water is an indicator of the presence of high organic matter and dissolved salts on the water, which are usually a common feature for natural untreated water. The encounter of E. coli in the stream water is an indication

Table 1: The Most Probable Number (MPN) and total viable count test on water samples

Source	Most Probable Number (MPN)	Coliform count /100 mL of water	Total count cfu mL^{-1}
Well	1-4-0	13	1.62×10^4
Borehole	1-2-0	5	0.31×10^4
Stream	1-5-0	25	3.00×10^4

Table 2: Distribution of bacterial isolates in different water sources

Isolate	Well	Bore hole	Stream
Esherichia coli	-	-	+
Aerobacter aerogenes	-	-	+
Alcaligenes faecalis	-	-	+
Micrococcus luteus	+	-	-
Proteus vulgaris	+	+	-
Bacillus cereus	-	+	-

Key: - = Absent, + = present

that the stream is contaminated with faecal materials. This finding was in line with what Osei (2003) reported that the main cause of water pollution is the indiscriminate dumping of solid and liquid wastes and human waste into water bodies. Also in agreement with Chao *et al.* (2004) who stated that *E. coli*, which is the universal indicator for faecal pollution, is present in surface water.

The antibiotic sensitivity pattern of bacterial isolates from different water sources varies. The antibiotic observed to be most effective was Oflaxacin. The high incidence of multidrug reistance may presumably be due to indiscriminate use of antibiotics (Okeke *et al.*, 1999). Based on the standard of WHO (2001) for drinking water quality that sample with coli form count greater that (>) 10/100 mL is suspicious and should not be used for human, domestic or industrial purposes, hence the bore-hole water is of potable quality while the well water is just below the WHO standard and should require minor chemical treatment before consumption. The stream water gave an unacceptable coli form count and *Escherichia coli* was isolated. This implies that, faecal contamination which renders the water dangerous for human consumption or domestic application. *E. coli* are a very good indicator microorganism for faecal pollution. This has been reported to cause gastroenteritis in children (Antai, 1988; Feachem, 2001). *E. coli* has also been implicated as travelers diarrhea and infant disentary as well as urinogental tract infection in children (Kirkwood, 1998). *Bacillus* sp. is often associated with food poisoning as reported by Antai (1998). *Alcaligenes faecalis* could be involved in wound infection particularly if there has been soil or water contamination of the wound Baron and Finegold (1990). *Microccus luteus* showed multiple antibiotic resistance to AUG, TET, AMX and COT while *Aerobacter aerogenes* showed multiple antibiotic resistance to NIT, GEN, AMX and COT.

Table 3: Antibiotic sensitivity pattern of the bacterial isolated (cm)

Isolates	NIT	GEN	NAL	AUG	OFL	TET	AMX	COT
Esherichia coli	0.6	0.9	1.1	0.8	1.9	1.1	0.1	0.1
Aerobacter aerogenes	NI	NI	1.2	1.3	0.1	1.4	NI	NI
Alcaligenes faecalis	0.2	0.5	1.3	1.2	0.2	1.2	0.3	1.2
Proteus vulgaris	0.5	0.9	1.0	1.6	0.5	1.4	0.2	0.9
Micrococcus luteus	1.4	1.2	1.2	1.0	NI	NI	NI	NI
Bacillus cereus	1.6	1.4	0.6	2.2	1.4	2.0	1.3	1.3

Key: NIT = Nitrofuramton, GEN = Gentamicin, NAL = Nalidixic acid, OFL = Oflatxacin, AUG = Augmentin, TET = Tetracyclin, AMX = Amoxicilin, COT = Contrimoxazole, NI = No inhibition

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