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Screening for Bacterial Contaminants of Natural Spring Water Located at Ohaukwu Local Government Area, Ebonyi State, Nigeria.

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ABSTRACT

These studies were carried out in Ohaukwu LGA of Ebonyi state, Nigeria to screen for bacterial contaminants of natural spring water used for drinking and domestic purposes in the area. The rural communities of Amoffia, Okposhi-Eheku and Ukwagba depend largely on spring water during the dry season for domestic uses. A total of eight (8) samples were collected from the three communities and were analyzed for microbial contaminants as well as some physico-chemical parameters using standard methods. The results showed that all the water samples did not conform to the physico-chemical parameters except for pH were all the samples fall within acceptable ranges. The pH value ranged from 6.0 to 8.5. All the samples showed high percentage of colony count (10% and above) except for sample OH6 with 9.3%. The result further showed that the water samples were polluted with coliform ranging from 6.0 to 10.0cfuml as against the WHO standard which is OCfu/ml. *Escherichiacoli* were identified in samples OH3, OH4, OH7 and OH8, but were negative for samples OH1, OH2, OH5 and OH6. The Presence of other microorganisms such as *Morganella*species, were not significant except for its presence in sample OH7 same with *S.marcescens* only in sample OH8 These studies can serve as a yardstick for accessing information about the microbial and physic-chemical conditions of spring water bodies in Ohaukwu Local Government Area of Ebonyi state. It further suggested means by which these water bodies can be treated for the health benefits of the rural dwellers of Ohaukwu.

Keywords: Ohaukwu, bacterial, contaminants, natural, spring water.

INTRODUCTION

The findings that the rural communitiesin Ohaukwu local government area of Ebonyi State are largely dependent on spring water sources especially during the dry seasons of the year and the believe that spring water are free from contamination declaring it fit for drinking and other domestic uses by the rural dwellers necessitated this study [1]. Water is one of the most important elements for all forms of life. It is indispensible in

the maintenance of life on earth [2]. Water on certain occasion can constitute hazard to human health when it contains pathogenic microorganismsa wide variety of microorganisms pathogenic to human beings are transmitted through contaminated water [1]. Though spring water is considered as aesthetically acceptable for domestic use. Presence of poorly designed pit latrines, poor waste water management as well as poorinadequate spring protection may lead to contamination of water from springs with pathogenic bacteria [2]. The microbiological examination of water is used worldwide to monitor and control the quality and safety of various types ofwater including potable water, treated recreational water and untreated waters used for recreational purposes such as sea, river and lakewater [3]. The problem of water borne diseases is especially prevalent where general hygiene and environmental sanitation are poor and where there is a shortage of protected water supply [4]. Drinking water should be free from microbial as well as chemical contaminants [5]. Safe drinking water is essential to humans and other life forms even though it provides no calories or organic nutrients. Access to safe drinking water has improved over the last decades in almost every part of the world but approximately, one billion people still lack access to safe water and over 2.5 billion lack access to adequate sanitation [6]. However, some observers have estimated that by 2025, half of the world's population will be facing water based vulnerability [7].In order to ensure a safe public health, water supply for human consumption must be free from pathogens, free from chemical toxins and must be physically clear and appealing to taste [8].

Therefore the focus of this study was to determine the potability of these spring water by identifying bacterial contaminants using microbiological method of water analysis.

MATERIALS AND METHOD

The study area Ohaukwu local government area, Ebonyi State is located in South East, Nigeria, it is characterized by two distinct wet and dry seasons. The method adopted for

this study was largely sampling and laboratory analysis using membrane filtration method of water analysis at the Ebonyi State University Microbiology Laboratory.

Samples were collected duringthe dry season betweenJanuary to April 2016. Some physical test of temperature, pH determination, colour and turbidity were carried out on collection site using portable HANNA test kits [9]. Samples were collected using sterilized half litre of gallons rinsed with the water in the morning hours, Afternoon and evening and were kept cool using an icebox before subsequent transfer to the laboratory for analysis. Samples were filtered thoroughly with membrane filter of Nalgene make. 50ml each of the sample was poured into the membrane filter with a filter paper also inserted in between the upper part and the base where the filtrate is deposited. The filter paper kept hold of the residue while the filtrate passed to the base of the membrane filter. Bacteriological examination of the water samples were carried out using Nutrient Agar which is a general purpose agar for the culture of non fastidious organisms, it was Merck make with batch number 6029890. Also used was MacConkey broth which is a differential media relevant for isolation of coliform in water and other materials. It was oxoid make with batch number 303890. The isolates were examined microscopically through the process of Gram staining technique and to further distinguish them. They were subjected to different biochemical test. The samples were labeled as Abarigwe spring (OH1), Ndiaguonwe spring (OH2), Okwerike spring (OH3), Iyi Ogwugwu (OH4), Ekweburu (OH5), Mkpumagboro (OH6), Iyi Mkpuma (OH7) and Iyi Ogbomogu (OH8).

RESULTS

Table 1: This shows total bacterial count of the natural spring water from the eight (8) spring sites.

Samples	No. of samples	Total viable CFU/ml	% colony
OH1	3	$9.0x10^8$	14
OH2	3	$7.0x\ 10^8$	10.9
OH3	3	$8.0\ x10^8$	12.5
OH4	3	$10\ x10^8$	15.6
OH5	3	$9.0\ x10^8$	14
OH6	3	$6.0\ x10^8$	9.3
OH7	3	$7.0\ x10^8$	10.9
OH8	3	$8.0\ x10^8$	12.5

Key: CFU = colony forming unit

% = percentage

Table 2: The bacterial isolates showed considerable morphological characteristics and as well had different biochemical reactions on the parameters tested. The biochemical properties of the isolates are as shown in this table.

Samples	Morphological characteristics	Gram reaction	Biochemical properties								Bacteria suspected
			OX	Cata	Ind	Glu	Lac	CIT	Tcb	Emb	
OH1	Short, curve, motile, yellow, red,	-	+	+	+	-	d	-	Y	D	*Aeromonas species*
	Small curved, motile, yellow	-	+	+	+	+	+	d	Y	D	*Vibrio cholera*
	Green, large, crenated, irregular edge	-	+	-	+	-	-	d	-	P	*Pseudomonas species*
OH2	Creamy, round, raised surface, white	-	+	+	+	AG	-	d	-	R[1]	*Proteus species*
	Pale to pink colour, inking cubation, small	-	-	-	d	-	-	-	-	R	*Shigella species*
	Cocci, short chain, mucoid, raised	+	-	-	-	+	-	ND	-	Y	*Streptococcus species*
OH3	Convex, smooth, distinct, small	-	-	-	+	+	+	-	-	R	*Escherichia coli*
	Cocci, round, convex, sharp	+	-	+	-	A	+	+	-	Y	*Staphylococcus species*
OH4	Cocci, round, convex, sharp	+	-	+	-	A	+	+	-	Y	*Staphylococcus species*
	Pink, mucoid, circular, and sticky	-	-	-	-	+	+	+	-	P[2]	*Klebsiella species*
	Convex, smooth, distruct, small	-	-	-	+	+	+	-	-	R	*Escherichia coli*
OH5	Green, large, crenated, irregular edge	-	+	-	+	-	-	d	-	P	*Pseudomonas species*
	Cocci, short chain, mucoid, raised	+	-	-	-	+	-	ND	-	Y	*Streptococcus species*

OH6	Small curved, motile, yellow	-	+	+	+	+	+	d	y	D	*Vibrio cholerae*
	Creamy, round, raised surface, white	-	+	+	+	AG	-	d	-	R^1	*Proteus species*
	Pale with black centre, small	-	ND	-	+	+	-	-	-	P^1	*Salmonella species*
OH7	Short, curve, motile, yellow, red	-	+	+	+	-	d	-	y	D	*Aeromonas species*
	Convex, smooth, distinct, small	-	-	-	-	+	+	-	-	R	*Escherichia coli*
	Dirty white, mucoid, spreading colour	-	-	ND	+	A	-	-	-	ND	*Morganella species*
	Green, large, crenated, irregular edge	-	+	-	+	-	-	d	-	P	*Pseudomonas species*
OH8	Convex, short, circular surface, red	-	-	+	-	+	D	+	-	R^1	*S. marcescens*
	Convex, smooth, distinct, small	-	-	-	-	+	+	-	-	R	*Escherichia coli*
	Pink, mucoid, circular and sticky	-	-	-	-	+	+	+	-	P^2	*Klebsiella species*
	Small curved, motile, yellow	-	+	+	+	+	+	d	y	D	*Vibrio cholerae*
	Pale to pink colour, inking cubation, small	-	-	-	d	-	-	-	-	R	*Shigella species*

Key: OX = oxidase, Cata = catalase, Ind = Indole, GLu=glucose,

Lac = lactase, CIT=citrate, TCBs = thiosulphate citrate bile salt sucrose, Emb = Eosin methylene blue, d = different stain produce different result, ND = not due, A = acid production, AG = acid and gas production, y = yellow, R = red-pink, P = pink, R^1 = few strains give reactions similar to shigella, P^1 = pale-black, p^2 = purple.

Table 3: comparison of the water quality parameters of the tested springs with WHO/NIS guideline for drinking water

Parameter/sample	WHO/NIS	OH1	OH2	OH3	OH4	OH5	OH6	OH7	OH8
Ph	6.5-8.5	7.5	8.5	8.0	7.5	6.0	5.5	5.0	6.0
Temperature (^{0}C)	10-25	27.7	26	28.5	29.5	29.5	29.5	30.0	27.0
Colour (Hazen)	5-50	5.0	6.0	5.0	120	5.0	115	5.4	5.5
Turbidity (NTU)	25	10	5	7	185	5	198	5	5
Plate count	-	223	170	76	89	240	301	231	82
Total coliform	0/100ml	9.0	7.0	8.0	10.0	9.0	6.0	7.0	8.0
E. coli	0	-ve	-ve	+ve	+ve	-ve	-ve	+ve	+ve
Morganella	0	-ve	-ve	-ve	-ve	-ve	-ve	+ve	-ve
Total alkalinity (mg/l)	100	10	7.0	8.0	25.0	12.0	30.0	8.0	8.0

Key: WHO=World Health Organisation

NIS=Nigeria Industrial Standard

DISCUSSION

It is a fact that water resources are not entirely free of bacterialcontaminants; the prevalence of water related diseases in developing countries like Nigeria is determinate by the quality of their drinking water. The safety of drinking water in poor and deprived communities has remained a major issue of concern owing to the unavailability of basic amenities to those rural communities like water source. The results obtained from this research were compared with the world health organization [10] and Nigeria industrial standards to ascertain conformity with the national and international guidelines for drinking water and observation had shown that the spring sources fell short of the accepted ranged ranges except for certain parameters like PH where allthe springs were within the maximum permissibly limits. All the springs had percentage colony count of 10% and above except for samples OH6 with 9.3% (table 1) indicating high level of contamination. The biochemical test further suggested the stains of the bacteria present in the springs with each of the springshaving an average of three bacteria each (table 2).

The morphological characteristics grouped the isolates into distinct Gram positive and Gram negative organisms (table 2) with *Escherichiacoli* manifesting in samples OH3, OH4, OH7 and OH8 indicating fecal contamination of the affected sample springs. *Vibriocholerae* appeared in sample OH1, OH5 and OH8 while *pseudomonas* species was detected in samples OH1, OH5 and OH7, *Morganella* species was implicated only in sample OH7 while *S. marcesens* was present only in sample OH8.

More also, these water sources showed a considerable turbidity ranges (table 3) with the WHO bench mark except for samplesOH4 and OH6 with as high as 185 and 189 NTU. They also posses excessive colour concentration of 120 and 115 Hazen respectively. This could be as a result of fact that Amofia community the site of these two springs is made up of weathered rock with porous soil. High turbid water often serves as breeding places for disease-causing pathogens and algae growth. The total coliform bacteria count (table 3) of these samples were high as each of the spring exceeded the WHO permissible range of 0/100ml for drinking water, largely indicating pollution most likely from the activities of those villagers dwelling within the annex of the spring as rain could likely carry their waste to the site of these springs. The pressure of *E. coli* as earlier stated in some of the samples indicates fecal contamination further pointing out sources of pollution from the activities of human in the spring as all the sources tested were poorly protected giving breeding chances to bacterial contamination. Also, the samples all had temperature above the accepted range of WHO whereas Alkalinity tests were within the rages prescribed by the giant health organization. Human and environmental sources of contamination to these springs are defecation around the water sources, decomposition of the leaves that fall in and within the springs(when rain comes it washes them down to the springs), materials used in fetching the water and direct human contact all reveal sources of contamination to these springs.

CONCLUSION

It has been observed that these spring water sources are heavily contaminated and as such not fit for human consumption or for domestic uses without treatment. The high level of coliform bacteria contents is a clear indication that some level of treatment strategy should be adopted for these spring sources before use.

RECOMMENDATION

The credence amongst the people that spring water is free from contamination maybe looking at it physically should be disregarded. Lack of adequate protection to these water sources exposes them to bacterialcontamination. More resources should be allocated to the rural water/environmental monitoring team for further investigation of waters consumed in the rural settlement. This can be facilitated by the government, non-government organization and good spirited individuals all in the bid to eradicate water borne diseases especially in places like this study area where such awareness campaign is yet to gain due prominence among the population.

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