EVALUATION OF MICROBIOLOGICAL QUALITY OF BOREHOLE WATER SAMPLES AT DAMATURU, YOBE STATE

[1]Gide Suleiman, [1]Musa S. Joji, [2]Gide Anas and [3]Alegbe S. David

[1]Desert Research, Monitoring and Control Centre Yobe State University Damaturu P.M.B 1144.

[2]Nigerian Institute for Trypanasomiasis Research Kebbi State.

[3]Ahmadu Bello University Zaria.

ABSTRACT

This Research was carried out to determine the quality of boreholes water from 10 different location of Damaturu Local Government Yobe State, namely Sabon feggi, Don Etebet, Hausari, Lowcost, Jerusalem, Obasanjo, Nasarawa, Sani Daura, Gwange and Malari, were analysed from June-July 2015. The physical parameters assessed were turbidity, colour, temperature and odour most of the physical parameters were within the WHO limits for drinking water. The determination of total coliform and feacal coliform bacteria was determine using most probale number (MPN) technique. The MPN result was 4-920MPN/100ml. The pathogens isolated were Salmonella spp, Escherichia coli, Enterobacter spp, Klebsiella spp and Shigella spp. The result obtained from the 10 boreholes sample with mean volume of 920MPN/100 and the presence of pathogenic bacteria indicates that none of the water used for domestic purposes in the 10 area meet the maximum acceptable value for WHO (1986) and USEPA for drinking water.

Key: Borehole water, physical parameters, Most Probable Number,Bacteriological quality.

INTRODUCTION

The importance of the provision of a wholesome supply of drinking water has been recognized since at least the times of the Romans with major advances being made during the nineteenth century, knowledge, understanding and good practice has continued to be gained and develop over tome with consequential benefits for public health. The provision of safe drinking water is one of the most important steps that can be taken to improve the health of a community by preventing the spread of water borne disease (1).

In developing countries, millions of children under five years die every day due to drinking contaminated water (2). Thus lack of safe drinking water supply, basic sanitation and hygiene practices is associated with high morbidity and mortality from excreta related diseases.

Microbial and chemical contaminants have been detected in groundwater, the sources of contamination are numerous and include the land disposal of sewage effluent, sludges, solid waste, septic tank effluent urban run off agricultural mining and industrial practices.(3)

This microbial contaminant of water have been responsible for water borne disease including gastro enteritis, cholera, hepatitis, typhoid fever and giardiasis has infect around 250million people each year resulting in 10 to 20 million deaths worldwide. An estimated 80% of all illness in developing countries is related to water and sanitation, and 15% of all child deaths under the age of five years in developing countries result from diarrhoeal diseases (4).

Boreholes are low-cost technology option for domestic water supply in developing countries and are generally considered as "safe source of drinking water when properly constructed and maintained they provide consistent supplies of safe and whole some water with low microbial load and little need for treatment of the water before drinking.

The level of ground water in the borehole may undergo changes due to the recharge and discharge rate. The rate at which a borehole is recharged may vary due to response to withdrawal from wells through pumping, as leakage to vertically adjacent aquifers, as natural flow from an aquifer into streams and springs and also through evaporation from the shallow water taste.

The study was aim to determine the quality of water from the boreholes, as to ascertain it safety for consumption in relation to standard sets by WHO for drinking water.

Table 1: Bacteriological Standard of water quality

Class	Grade	Presumptive count/100ml	E coli count Per100ml
Excellent		0	0
• Satisfactory		1-3	0
• Suspicious		3-4	0
• Unsatisfactory		10	0, 1 or more

MATERIAL AND METHOD

The study area.

Yobe State is one of 36 state of Nigeria located in North Eastern part of the country. The State has a total of 45,502km^2 (17,568sqm) which extends between latitude 12^{o}N and longitude 11^{o}E. The state border the Nigerian state of Bauchi, Gombe and Jigawa, it alsoshare border with Diffa and Zindar region of Niger Republic to the north.(5)

Geology.

The geology of Yobe State is made up of the crystalline and sedimentary rock, which are all underlain by the crystalline basement complex. The crystalline rock are represented by older granite and are found in pockets of place in the states.

Climate

The climate of Yobe State is hot and dry for most period of the year. The mean temperature for most stations in the state is about 37^{o}C. The highest temperature (about 42^{o}C) is normally experience in April while minimum temperature about (36^{o}C) are usually recorded in December. The major rainy season extends from May to September.

Collection of Samples.

Water samples were collected using clean containers, labeled, 5 drops of aqueous Sodium Thiosulphate solution was added to the samples bottle and sterilized in hot box oven at 160^o for one hour. The taps of

each bore holes was disinfected, opened fully and the water rush for 2minutes before collection. The samples were then transported to the laboratory in a cooler (container).

Table 2 below shows the selected samples location, source and sample code.

Table 2: shows the randomly selected samples locations, source and samples identification code

Samples location	Sources of supply	Sample I.D code
Sabon Feggi	Public Borehole	SBF (sample 1)
Don etabet	Public Borehole	DEF (sample 2)
Hausari	Private Borehole	HSR (sample 3)
Lowcost	Public Borehole	LWC (sample 4)
Jerusalam	Public Borehole	JRS (sample 5)
Obasanjo	Public Borehole	OBJ (sample 6)
Nasarawa	Private Borehole	NSR (sample 7)
Sani Daura	Public Borehole	SND (sample 8)
Gwange	Private Borehole	GWG (sample 9)
Malari	Public Borehole	MLR (sample 10)

Table 3. Nature of Sampling Sites

S/N	Location Area	Sample Code	Activities within 50m of Catchment	Topography	Dept Of Bore holes
1	SBF	B1	Road site	Level ground	70m
2	DEB	B2	Beside the main road	In gentle slope toward Bore hole	65m
3	HSR	B3	Within the settlement		70m
4	LWC	B4	Within the settlement	Level ground	70m

5	JRS	B5	Road site	Level ground	70m
6	OBJ	B6	Within the settlement	Level ground	70m
7	NSR	B7	Within the settlement	Level ground	70m
8	SND	B8	Within the settlement	Level ground	65m
9	GWG	B9	Road site	Level ground	65m
10	MLR	B10	Within the settlement	Level ground	65m

DETERMINATION OF TOTAL COLI FORM AND FAECAL

Coli form

Coliform enumeration in water samples. The coliforms was determined using most probable number (MPN) techniques. With MPN procedure coliform are detailed by series of presumptive, confirmatory and completed test (6).

Presumptive test

The test was carried out using 15 sets of test tube containing sterile lauryl trypton broth with 5 test tubes containing double strength and 10 tubes containing single strength all with an Inverted Durham tubes. All the 3 set of tubes were inoculated with different volume of water samples, (10ml, 1ml and 0.1ml respectively). All tubes, were then inoculated at 37^{o}c for 24-48 hours.

Acid gas production was determined by the indicator organism changing the lauryl trepton broth medium containing Bromocresol purple to yellow, while the gas production was checked for the entrapment of gas in the Durham tube. The positive tubes were then observed and recorded and result were interpreted using most probable number (MPN) standard table.

Confirmation of coliform test

This test was done by re-inoculation of the positive tubes into tubes containing sterile brilliant green bile broth with an inverted Durham tubes, and also streak an sterile Eosin methylene blue agar plates. They were all incubated at 44^{0}c for 18-24 hours.

Completed test

The test was done by subculturing the suspected coliform into a nutrient agar plates where gram staining and biochemical test was done to complete the analyses.

Result

Physical parameter of water samples

Table 4

Samples code	Turbidty	Colour	Temperature	Odour
SBF	Clear	Colourless	Ambient	Not determine
BED	Clear	Colourless	Ambient	Not determine
HSR	Clear	Colourless	Ambient	Not determine
LWC	Clear	Colourless	Ambient	Not determine
JRS	Clear	Colourless	Ambient	Not determine
OBJ	Clear	Colourless	Ambient	Not determine
NSR	Clear	Colourless	Ambient	Not determine
SND	Clear	Colourless	Ambient	Not determine
GWG	Clear	Colourless	Ambient	Not determine
MLR	Clear	Colourless	Ambient	Not determine

Table 5: Total coliform count MPN/100ml of water samples

Sample code	MPN/100ml
SBF	14
BED	47
HSR	70
LWC	110
JRS	40
OBJ	14
NSR	920
SND	26
GWG	45
MLR	4

Table 6: Enterobacteria detected

Samples code	*Escherichia coli`*	*Enterobacter spp*	*Salmonella spp*	*Klebsiella spp*	*Shigella spp*
SBF	1	1	1	0	0
DEB	1	1	0	0	0
HSR	0	0	1	1	1
LWC	1	0	0	1	1
JRS	0	0	1	1	1
OBJ	1	0	0	1	1
NSR	1	1	0	1	1
SND	1	1	1	1	0
GWG	0	1	0	1	0
MLR	0	0	1	1	0

Result and discussion

Table 5 shows the total coliform obtained from 10 samples of boreholes water collected from SBF, DEB, HSR, LWS, HRS, OBJ, SND, GWG, and MLR respectively. Table 5, indicates samples collected from boreholes ranged between 14-4 MPN/100ml in SBF-MLR, table 5 revealed the highest coliform with mean value of 920/MPN/100ml found in NSR borehole can be traced to proximity of the boreholes to stagnant water, household waste disposal and other sanitary condition of the area.

The value of 4MPN per/100ml obtained in MLR location was compared with WHO standard (7) of drinking water and was found to be unsatisfactory.

Most of the boreholes showed evidence of pollution from biological sources. This was comfirmed with the high levels of coliform bacteria detected from 920/MPN/100ml and presence of faecal coliform bacteria in almost all the 10 samples analysed. It was also found out almost all the private boreholes analysed were sited near the neighborhoods areas with poor sanitary habit have high MPN/100ml. These arose from improper sanitation management and inadequate public education on indiscriminate waste disposal and other practices.

The result obtained from the 10 boreholes samples implies that the boreholes were not fit for drinking without treatment in accordance with WHO (1986) united state environmental protection agency (8)

Recommendations

The presence of these pathogenic indicator organism and high MPN/100ml of the samples render them unfit for human consumption but may be used for other purposes.

It is recommend that regular monitoring, management and maintenance are required in order to minimize acute problem of water related disease which are endemic to health of man.

In discriminate of waste and poor sanitary habit should be regulated.

Conclusion

Most of the boreholes showed evidence of pollution from biological sources, these was confirmed with high level of coliform bacterial from 4-920MPN/100ml and presence of pathogenic organism in all most all the 10 samples analysed.

The presence of high faecal coliform in borehole (NSR) could be due to proximity of the boreholes to stagnant water located at a distance less than 30m which is not in line with WHO.

This study concluded that water quality of boreholes at Damaturu nead more effort in limiting the number of microbial organism released into the distribution.

Also there is need to increase awareness among the people in the study area the danger associated with the used of contaminated water and construction of pit latrine and septic tank near water sources.

Water from the boreholes should be boiled before drinking to prevent diseases.

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