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PHYSICOCHEMICAL AND BACTERIOLOGICAL ANALYSIS OF DIFFERENT SOURCES OF WATER FROM DURKWA VILLAGE, BORNO STATE, NIGERIA

[1]Katuzu, M.I.,[2]Ladi, L.,[3]Kida, O. P., [4]Mustapha M., and [5]Istifanus M.
[1]Department of Basic Studies, School of General Studies, The Federal Polytechnic Damaturu. P.M.B 1006 Damaturu, Yobe State, Nigeria.
[2,3&4]Department of Science Laboratory Technology, School of Science and Technology, Federal Polytechnic Damaturu, P. M. B. 1006, Damaturu, Yobe State, Nigeria
Email: musaibrahimkatuzu@gmail.com

ABSTRACT
Study of water quality tells about present status of useable water for domestic as well as industrial use. This study was aimed to determine water quality parameters in borehole and well water Samples. The water Samples were collected, and analyzed using different types of analytical techniques. The parameters analyzed include; Electrical conductivity, Turbidity, pH, TDS, TSS, SS, calcium hardness, magnesium hardness, total hardness, Temperature and Alkalinity, and also to analyze the bacteriological quality of the sample and compare the results obtained with the stipulated guideline given by world health organization (WHO). The result obtained shows that, the bacterial load ranged from 2.1 x 10^{-4} to 4.5 x 10^{-5} where the highest mean bacteria count was observed from D1, PH1 and Do1 for well and D1, C, for borehole. While, the lowest mean bacteria count was however observed in C1, for well and PH1 for bacteria. This implies that only 8% of the samples are free from contamination while 92% are contaminated. These results pose a high level of risk to the health of people living in these communities and therefore, treatment of water before use as well as proper sanitary awareness is highly recommended for the safety of the local people.

Keywords: *Determine, Sanitary, Compare, Contamination, Bacteria, Borehole.*

INTRODUCTION
Water is indispensable and intricately connected to life, without which there is no life. This is the reason for which water must be given the necessary attention at all times good drinking water is not luxury; it is one of the most essential amenities of life itself. The supply of safe drinking

water to all has therefore engaged the attention of many individuals, groups, governmental organization and private organizations *(Adetunde et al., 2010).* Drinking water free of pathogenic organism is fundamental to breaking one of the principal transmission routes of infectious disease. This fact has stimulated worldwide investment in the construction of water system that are designed to meet stringent water quality standards *(Fry, E. J., 2006).*

Water borne pathogens, including a variety of vital bacterial, algal and protozoan agents, account for much of the estimated 4billion cases and 2.5 million deaths from endemic diarrheal disease each year *(Krantz, D. and B. Kifferstein. 2007);).* Increase in human population has exited an enormous pressure on the provision of safe drinking water, especially in developing countries *(Vorosmartyet al., 2000).* Unsafe water is a global public health threat, placing persons at risk for a host of diarrheal and other disease as well as chemical intoxication *(Horwitz and Finlayson,2012).* Unsanitary water particularly has devastating effects on young children in developing world. Each year, more than two million people, mostly children less than 5 years at age die of diarrheal disease *(Krantz, D. and B. Kifferstein. 2007).* Nearly 90% of diarrheal related deaths have been attributed to unsafe or inadequate- water supplies and sanitation condition affecting a large part of the world's population. An estimated 2.6 billion person lack access to adequate sanitation (*(WHO, 2004).).*

Water is abundant in nature and is an important part of the earthly environment, covering about (75%) of the earth surface. It occurs as surface water in lakes, streams, rivers, ponds, shallow aquifers, oceans, seas, ice caps, glaciers, etc., and as ground water (when it accumulates in the ground) which is obtained as spring water, well water, and borehole water (Chandra et al., 2012). Small amount of gases like N_2, O_2 and CO_2 in the atmosphere are contained in all-natural water. Water is made up of two element, hydrogen and oxygen and is the most popular solvent as it has the ability to dilute many chemicals. Water takes part in many reactions including those with complex organic compound like amino acids. It is vital in industrial and manufacturing activities and various agricultural aspects, especially irrigation. Water is essential natural resources as it is impossible for life to exist without water and most manufacturing industries cannot function in its absence. An essential pre-requisite for the establishment of a stable community is the presence of safe and reliable sources of water (Erah et al., 2002). Historically, (Okonkwo et al., 2009) water scarcity has led to severe conflict, migration and change in agricultural patterns. Human activities often result in water pollution making such water unfit for use. Water pollution is a change in the quality of water which renders it unstable or dangerous as regards foods, man and animal health, industry, agriculture, fishing or leisure. However, before the advent of industrialization, the degree of contamination of water by pollutant was low. New age activities like manufacturing process led to pollution of service water source. Typical example is the location of chemical industries at river banks with effluent released into the river. Sewage disposal into water bodies, leaves streams and rivers polluted (Okonkwo et al., 2009). Agricultural processes involving the use of fertilizers, herbicides and pesticides produce toxic substances that are transported as effluents into water sources and these pollute water bodies (Obi et al., 2007). Similarly, textile industries emit waste water that contains organic dyes which introduce different ions into water that can alter its composition (Olowe et al., 2005).

WATER POLLUTION

Water pollution is produced primarily by the activities of man, specifically his mismanagement of the water resources. Pollution of water occur when undesirable effluents water causes and change the quality of such the water is unsafe for human use. The pollution are chemicals, physically, biological substance that affect the natural condition of water which may either be dissolved or suspended in water *(Shelton B.T.,2007).* The incident of water pollution in general can be traced back to water which has been contaminated with domestic and industrial swage which could be a source of disease. Many infection diseases are known to be easily spread by water pollution. The greatest outbreak of cholera in West Africa in recent years may serve as example *(WHO, 1993).*

WATER AS A SOURCE OF INFECTION

The water, air and food are generally accepted as the basic necessities of life. It is not surprising that they have been exploited by parasite and other infective organisms as means of gaining access into human body. During the nineteenth centuries, the main infection source can be broadly grouped into these as mentioned earlier i.e. water, air and food. But water is the source of infection of much disease-causing parasite man is infected through drinking water or by penetration through the skin when contact with the water. The world health organization (WHO) has estimated that up to 80% of the sickness and disease are caused by the inadequate sanitation and polluted water *(Shiklomanov I.,2000).*

The aims in objective of this research work are:

- To investigate the total bacteriological count of the borehole and well water sample.
- To draw government attention toward the community about the disease which may affect human health, due to the presence of pathogenic bacteria in the water?
- To determine the extent of underground water pollution from a farmland to nearby ground water sources (wells and boreholes) based on certain physicochemical parameters of interest such as; total dissolved and suspended solid, temperature, conductivity, pH, alkalinity, total hardness, magnesium hardness and calcium hardness.

METHODS OF SAMPLES COLLECTION

Water sample for the analysis were collected in sterile containers and in this process, special care is taken in order to obtain a fair sample. for sample to be collected from well the samples bottles will be filled below the surface of the water to avoid Sedimentation, while samples from the tap were collected after allowing the tap to Run for about 2 to 3 minutes before the samples were collected. The samples were Carefully capped, placed in ice and transport it to the laboratory for microbiological Analysis and the results were compared with the standards of WHO for drinking Water. Water sample were collected from four (4) different boreholes and wells Respectively. Boreholes water sample from Durkwa, Pashi, Kirallaku, Primary boreholes water. For well water Durkwa well, Dogo, center well, and Burtali well water, respectively. The samples were subjected for physicochemical and microbiological analysis.

The method used in counting colonies was with the aid of scientific colony counter which allowed the examination of the plate by combined reflected and obliquely transmitted artificial light against a dark background.

After the incubation of the plate at 37°C they were removed from the Incubator after 24 hrs and the colonies were counted immediately.

Grams Staining Techniques

- With the aid of wire loop, a colony was taken from the growth obtained and were smeared on a clean slide.
- The smeared were fixed by passing the slide over a flame for about 2 to 3 times.
- The smeared was primary stained with crystal violet for 30 seconds.
- Excess stained was washed with tap water.
- The smeared was then covered with logos iodine for 30 seconds.
- The smear was rinsed with tap water.
- The slide was then decolorizing with 95% acid alcohol for about 5 second.
- The slide was rinsed with tap water the slide was again courter stained with neutral Red (safranin) for 1 minute, excess stained was washed with tap water, and finally were allowed to air dry and the slide was examined under microscope using x 100 objective lens

RESULTS: TABLE. I: shows the result of physicochemical analysis of well water

Sample location	pH	Magnesium (mg/l)	Calcium (mg/l)	Turbidity (NTU)	Conductivity (µS)	TDS (ppm)	Hardness (mg/l)	Arsenic (mg/l)
C	7.4	6.4	0.1	1.07	443.1	222.3	32	0.00
DH	7.4	7.5	0.1	9.85	400.9	201.6	30	0.00
D	7.2	9.8	0.1	1.20	444.0	223.2	29	0.00
PR	7.4	12.3	0.1	2.10	433.3	217.3	46	0.00
WHO	7.5-8.5	30	75	5	No limit	500	250	0.01

TABLE II: Shows the Result of Physicochemical Analysis of Borehole water

Sample location	pH	Magnesium (mg/l)	Calcium (mg/l)	Turbidity NTU	Conductivity µS	TDS (ppm)	Hardness (mg/l)	Arsenic (mg/l)
C	7.4	10	0.1	0.7	446.2	223.7	43	0.00
DH	7.2	8.0	0.1	0.77	413.8	207.8	44	0.00
D	7.4	8.9	0.1	0.01	434.7	333.2	43	0.00
PR	7.4	7.1	0.1	1.03	423.4	443.3	41	0.00
WHO	7.5-8.5	30	75	5	No limit	500	250	0.01

Table III Bacteriological Count of Well Water Sample in Durkwa

Sample location	D1	PH1	C1	Do1
Water Source	Well	Well	Well	Well
Cfu in 100µl	410	307	202	211
Cfu/1m1	$4.1x10^{-4}$	$4.0x10^{-4}$	$2.02x10^{-4}$	$2.11x10^{-4}$

Table IV Gram Staining Techniques of well water

Sample location	D1	PH1	C1	Do1
Water Source	Well	Well	Well	Well
Gram-positive	+	+	+	+
Gram-negative	-			-

Table V: Bacteriological Count of Borehole Water Sample in Durkwa

Sample location	D1	PH1	C1	Do1
Water Source	Borehole	Borehole	Borehole	Borehole
Cfu in 100µl	329	234	446	232
Cfu/1m1	$3.3x10^{-3}$	$2.3x10^{-3}$	$4.5x10^{-3}$	2.5×10^{-3}

Table VI: Gram Staining Techniques of borehole water

Sample location	D1	PH1	C1	Do1
Water Source	Borehole	Borehole	Borehole	Borehple
Gram-positive	+	+	+	+
Gram – negative			-	

DISCUSSION

The mean TDS (Total Dissolved Solid) value in all the four boreholes and wells were found to range between 207.8m g/l to 443.3mg/l which is at the range of the national and international standard for world health organization (WHO); so, the water is good for drinking. The conductivity values in this study area in all the four boreholes and wells ranged between 423.4us-1 to 44.3us-1 as the ionic concentration increases the conductance of the solution also increases. Therefore, conductivity measurement provided an indication of ion concentration. The mean pH values of all the four sampling stations ranging from 7.2 to 7.4 were found to be neutral. All the values are at within the permissible level of 6.5 to 8.5 as recommended by the World Health Organization (WHO).

From the result obtained it was found that D1 has the high total numbers of bacterial load of 4.1 cfu, then followed by PH1 which have 4.0 which is higher than C, with 2.0 and Do1 is also higher than c1 with 2.1. Therefore, C1 is having the least number of bacteria loads compared with D1, PH1 and Do1. While the results obtained from the borehole water samples shown in table 4 above it was found that c1 has the highest total of 4.5 cfu, followed by D1 with 3.3 and PH1 with 2.3 so PH1 is found to have the least number of bacterial load and therefore safer as compared with D1 and C1. While Do1 does not have borehole and so it was not analyzed. Therefore, all the results that were found in both well and borehole water samples have significant differences with the guidelines of drinking water by the (WHO) because according to the guidelines / standard the coliform count most not be detected in any 100ml per samples.

The results obtained from grams staining techniques it was found that all the well water samples have the presence of gram-positive bacteria while, Do1 and D1 found to have gram negative bacteria but PH1 and c1 were not fund with gram negative bacteria, shows that borehole water sample analysis was found to have the presence of gram-positive bacteria while c1 is containing with gram negative bacteria while D1 and PH1 were also found to have the presence of gram-positive bacteria. But Do1 is not analyzed because there is no borehole found in that location.

CONCLUSION

The importance of access to good quality water cannot be overemphasized. Effective water quality monitoring could assist in checking how our daily activities affect the quality of our water and impact of the introduction of pollutants on water quality. In general ground water quality of Durkwa village in Borno State is not harmful to human beings, since the ground water which were taken from the various location in Durkwa village were analyzed and the analysis showed that the water quality parameters like pH, Electrical Conductivity (EC), Chloride content (Cl^- ,) TDS, Ca^{2+} Mg^{2+} and Hardness lies within the maximum permissible limit prescribed by WHO. Also, the study revealed that the distribution pattern of the studied physico–chemical parameters of the borehole water were within the permissible limit set by World Health Organization. Hence this report explains that the ground water in Durkwa village is suitable for drinking and agricultural purposes. Water is essential to people and the large available source of fresh water lies under ground.

Increase in demand for ground water in the rural areas has led to contamination and the outbreaks of diseases. Experience has shown that the major risks to contaminations is not from source but between collection and use as the people of those communities have developed resistance to some extent of the chemical contamination but that does not ascertain that it is safe for everyone since we don't have the same immune system. The peculiar climate and terrain of Durkwa in hawul local government area has made ground water the major source of water supply as well as the most importance means of rural water supply. From both pysio-chemical and bacteriological analysis result shows that open or poorly covered well heads pose the commonest risk to well water quality. The presence of faecal coli form however is due to a pollution source (pit latrine and cattle ranch). These are mostly observed to be at a distance between 5 and 8 meters which makes it possible for source. Most pathogenic bacteria found in water are indigenous to the intestinal track of humans and aimed and with the presence of a pit latrine or a cattle ranch close to a well, there is a high risk of contamination.
The result obtained from this source considered are contaminated with biological and agents of human and animal origins. However, one borehole water and one well water is comparatively better than the three well and two boreholes.

RECOMMENDATIONS

In respect to the result obtained from this study however, the following recommendation were made: -

- Water from open wells should be monitors regularly by health care supervision or appropriate authorities who are responsible for safe drinking water.
- Borehole should be recommended in place of wells.
- Wells should be covered with metal or proper wooden lids to avoid contamination well users should educate and saltation on personal and hygiene.
- Pit latrines and cattle ranck should be located within a minimum distance of 20 meters away from water source.
- The ambient area of the well should be seed with concrete to make the well impervious to surface water infiltrating to ground water.
- The wells should be disintifecated and / or chlorinated regularly against bacteria.

- Political reasons must not be allowed to prevail over the needs of the people in the society hence proper funds should be made available by the government for improving ground water supply as well as proving ground water supply as well as providing pipe network within the township to provide treated and protected water from open dug wells at various locations to be supplied to the consumer with serious concern.
- The wells should be covered and the wells casing should be water tight and extend 6 inches above the ground.
- Proper sanitation should be strictly be observed around the vicinity of the boreholes.
- Proper and appropriate treatment should be done according to seasonal variation with respect to the important physico-chemical parameters.
- Further analysis should be carried out on organic pollutants like pesticides, aldehydes, phenols and other toxic element such as mercury.

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