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SEASONAL VARIATION IN COLIFORM OF WATER FROM SIX (6) HAND DUG WELLS NEAR SOAKAWAY PITS IN VANDEIKYA LOCAL GOVERNMENT AREA OF BENUE STATE

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ABSTRACT

Most rural dwellers depend on Hand dug well water as the only available water source. The qualities of this well water generally are not guaranteed and at times pose health problems to consumers who rely on them as a drinking source. The aim of this study was to assess the seasonal variation in Coliform of Water from Six (6) hand Dug Wells near Soak away Pits in Vandeikya Local Government Area of Benue State using Palintest Water Analysis Technologies (2017). Data collected were analysed using Minitab Software, version 16.0. Results of Analysis showed that Feacal coliform counts ranged from 56 to 184 CFU/ ML and 0 to 122 CFU/ML in Wet and Dry season respectively; Total coliform counts ranged from 112 to 368 CFU/ML and 6 to 208 CFU/ML in Wet and Dry season respectively. There were significant differences ($P < 0.05$) among all hand dug well samples for Mean Total Coliform counts in wet and dry season. Based on Coliform counts, none of the hand dug well water was fit for drinking water purposes without treatment. It was recommended that Water from hand dug wells in the selected Districts in this study needs to be disinfected or boiled before used for drinking purposes.

1.0 INTRODUCTION

Water plays an important role in human life. It is necessary for industry, agriculture and human existence. The healthy water ecosystem is depended on the physico-chemical and microbiological characteristics. Due to increase in industrialization, urbanization, agriculture activity and various human activities has increased the pollution of surface water and ground water. Use of ground water for human beings depends upon ambient water quality. Ground water plays important role in human life (Sohonou *et al*., 2017).

Water pollution due to chemicals and microbes is one of the serious environmental problems, which has greatly impacted human health. Recorded history of contaminated drinking water supply has witnessed various viral, bacterial and protozoan diseases globally. It is estimated that more than 250 million cases of waterborne diseases are reportedworldwide and over 25 million deaths are blamed due to waterborne diseases (Roohul-Amin *et. al*., 2012).Peoples obtain their drinking water from surface and underground sources. However, both surface and ground water sources could become contaminated by biological and chemical pollutants arising from point and non point sources (Roohul-Amin *et. al*., 2012).Worldwide, about 1.1 billion of the population lack safe water and 2.4 billion lack adequate sanitation (WHO, 2012) resulting in widespread of water and sanitation-related diseases. Sanitation generally refers to the provision of improved facilities and services for the safe collection, storage, and appropriate disposal of wastes ranging from domestic, industrial, commercial, medical, and hazardous wastes. (Oke*etal.*, 2013). An improved sanitation facility is one that hygienically separates human excreta from human contact and it generally involves physically closer facilities, less waiting time, and safer disposal of excreta (Hutton and Haller, 2004). Nearly 250 million cases of water and sanitation related diseases are reported every year, with morethan 3 million deaths annually, about 10,000 a day (WHO/UNICEF, 2012). The report by the Joint Monitoring Programme further revealed that as at2011 in Nigeria, only 31 % of the population has access to improved sanitation facilities such as flushtoilets, 24 % uses shared facilities while 22 % uses unimproved facilities and 23 % defecate in the open(WHO/UNICEF, 2012).This study aims at assessing the coliformof water from six (6) hand dug wells near soakaway pits inVandeikya Local Government Area of Benue state.

Despite the fact that water is one of the key elements of life due to its indispensable role in maintenance of life on earth human beings continue to pollute water sources resulting in provoking water related illnesses. So there is the need to identify the pollutant sources in order to manage associated risks (WHO, 2OO8).Information on the potential sources of water pollution of hand dug wells in the various communities in Vandeikya Local

Government of Benue State will provide health experts or other concerned agencies with base line values which could be helpful in the implementation of programmes that could help in ameliorating water related diseases in such communities. An adequate supply of safe and potable water would assist in preventing the spread of gastrointestinal diseases, supports domestic and personal hygiene, and improve the standard of living in Vandeikya local Government Area.In view of the importance of water in our daily life and state of sanitation of the sources of water supply, it is imperative to conduct thorough microbiological and physico-chemical examinations especially in low-income urban settlements. Moreover, this kind of study is imperative as there has not been any major record on this aspect of research in the area. The aim of this study was therefore, to assess the seasonal variation in coliform of Water from Six (6) hand Dug Wells near Soak away Pits in Vandeikya Local Government Area of Benue State.

2.0 MATERIALS AND METHODS

2.1 Study Area

Vandeikya Local Government Area was created on the 28th August, 1976.The local Government is between 8045", and 9004", East and between longitude 7003", and 6033", North. The local Government is bounded in the East by Kwande local Government in the south by Cross River, South-West by Konshisha local Government and in the North-East by Ushongo local Government. Vandeikya local Government covers an area of about 307.5 square kilometers. She has a population of 390,000 inhabitants with a population density of 198 persons per square kilometres. Its headquarters is Vandeikya. The local Government derives its name from a rock that has always been occupied by monkeys.

2.2 Source of Raw Materials

Water samples for analysis was collected from six (6) hand dug wells in Vandeikya local government Area of Benue state.

2.3 Water Collection

Water samples were collected according to standard procedures by (APHA. 2000) from six (6) different hand-dug wells; clean plastic container was tied to a synthetic rope down the well. New 75 Cl bottles were used to collect the samples for analysis.

2.4 Determination of Faecal Coliform and Total Coliform

These were determined by Palintest Water Analysis Technologies (2017). The plastic collar was taken and the filtration funnel secured in the loose but not free position, which will allow the formaldehyde gas to penetrate all areas of the filter head. About 10-15 drops of Methanol was poured into the vacuum cup. The Methanol was ignited in the vacuum cup using a lighter. The cup was placed on a flat surface which will not be damaged by heat. The methanol was allowed to burn for 5 seconds and when almost completely burned up, the filtration head was placed over the vacuum cup and the filtration head pushed over the vacuum cup and pushed firmly into place to form a good seal. The filtration apparatus was sealed for 15 minutes before it was used.

The sterile vacuum cup was removed from the filtration apparatus and later pushed the filtration apparatus firmly onto the vacuum cup.The plastic collar and filtration funnel were unscrewed in order that these may be easily sealed. The sterile tweezers were carefully used to remove a sterile membrane filter from the packet. The membrane was held only by the edge and the membrane filter was not allowed to touch anything while it was being transferred to the filtration apparatus. With one hand, the filtration funnel and plastic collar were lifted above the filtration base with the tweezers in the other hand; the membrane filter was placed on to the bronze filter support. The filter funnel and collar were replaced immediately, without allowing them to come in contact with any external object. The funnel was held between the thumb and forefinger to ensure that the collar does not slip off and that the fingers do not come in contact with the interior surface of the funnel. The plastic collar was screwed down tightly to provide a water tight seal between the filter membrane and the filter funnel. The sample cup was rinsed once with the water before taking the sample. 50 ml of sample was poured into the filtration funnel.

The filtration apparatus was tilted and carefully poured the first few millilitres of water down the inside of the filter funnel. The filtration apparatus was returned to the upright position while continue adding the sample. The plastic connector of the vacuum pump was inserted into the vacuum connection on the filtration base. The pump bulb was squeezed several times to draw a vacuum, then squeezed as required to draw all the water through the membrane filter. When all the water has passed through the filter, the pump was disconnected from the filtration apparatus, the collar unscrewed and the funnel removed with one hand. Using the sterilize tweezers in the other hand the membrane was lifted carefully from the filtration base. Holding the membrane by the edge only, the lid of the petri dish was removed and the membrane grid placed side up, onto the absorbent pad soaked in culture medium. The lid of the Petri dish was replaced and the lid marked with sample information.The inoculated plates were properly arranged in their rakes and put in a double chambered incubator and selected temperature of 37 oC and 44 oC for 18 hours for Faecal and Total Coliform respectively.

2.5 Statistical Analyses

Data collected were analysed using Minitab Software, version 16.0. Tools used included Descriptive Statistics: Mean, SE Mean, Standard Deviation, Minimum and Maximum, Graph.

3.0 RESULTS AND DISCUSSIONS

3.1 Results

3.1.1 Coliform Counts

The Coliform Counts for water from the hand dug wells shown in Table 1 and Table 2 respectively.Feacal coliform counts ranged from 56 to 184 CFU/ ML and 0 to 122CFU/ML in Wet and Dry season respectively; Total coliform counts ranged from 112 to 368 CFU/ML and 6 to 208 CFU/ML in Wet and Dry season respectively.Comparison of Coliform counts (total and faecal coliform counts) and Mean Total Coliform in Wet and Dry Season is as shown in Figure 1 and Figure 2 respectively. The figures indicate that there were significant differences in the Coliform counts in all the hand dug well water samples for the two seasons (Wet and Dry) with Wet season having higher values for both Feacal coliform and Total coliform than the dry season.

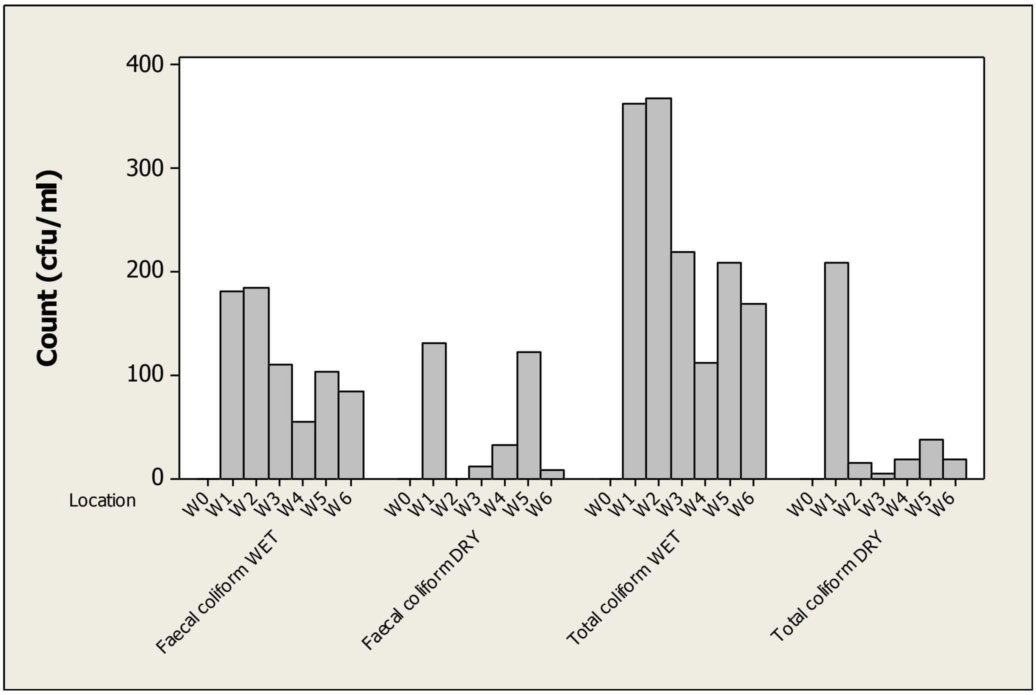
Table 1: Coliform Counts in Wet season

Sample/Parameters	Faecal Coliform(CFU/ml)	Total Coliform (CFU/ml)	MPVforFeacal Coliform	MPV for Total Coliform present	Reference WHO
WoR1	0	0	**0**	0	**NSDWQ**
WoR2	0	0		0	
Mean	0	0			
W1R1	180	360	**0**	0	**NSDWQ**
W1R2	182	364			
Mean	181	362			
W2R1	184	368	**0**	0	**NSDWQ**
W2R2	184	368			
Mean	184	368			
W3R1	110	220	**0**	0	**NSDWQ**
W3R2	110	220			
Mean	110	220			
W4R1	56	112	**0**	0	**NSDWQ**
W4R2	56	112			
Mean	56	112			
W5R1	104	208	**0**	0	**NSDWQ**
W5R2	104	208			
Mean	104	208			
W6R1	86	172	**0**	0	**NSDWQ**
W6R2	84	168			
Mean	85	170			

KEY:
MPV = Maximum Permissible Value
NSDWQ = Nigerian Standard for Drinking Water Quality

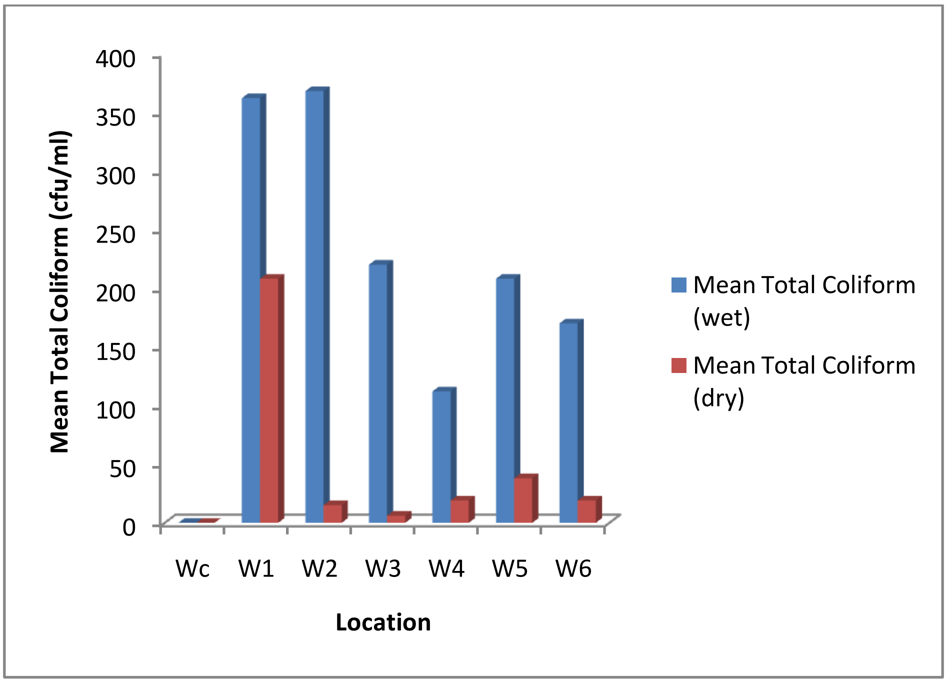
Table 2: Coliform Counts in Dry Season

Sample/ Parameter	Feacal Coliform (Cfu/Ml)	Total Coliform (Cfu/Ml)	MPV for Faecal Coliform (Cfu/Ml)	MPVfor Total Coliform (Cfu/Ml)	Reference WHO
WoR1	0	0	0	0	NSDWQ
WoR2	0	0			
Mean	0	0			
W1R1	132	208	0	0	NSDWQ
W1R2	132	208			
Mean	132	208			
W2R1	0	15	0	0	NSDWQ
W2R2	0	15			
Mean	0	15			
W3R1	12	6	0	0	NSDWQ
W3R3	12	6			
Mean	12	6			
W4R1	33	19	0	0	NSDWQ
W4R2	33	19			
Mean	33	19			
W5R1	122	38	0	0	NSDWQ
W5R2	122	38			
Mean	122	38			
W6R1	9	19	0	0	NSDWQ
W6R2	9	19			
Mean	9	19	0	0	NSDWQ



W (total coliform in wet and dry) =265.0, P=0.0047 (P<0.05)

Figure 1: Coliform Counts in Wet and Dry Season



W = 265.0, P = 0.0047 (P < 0.05)

Figure 2: Comparison of Mean Total Coliform in Wet and Dry Season

4 DISCUSSION

The Coliform counts for the hand dug wells were as shown in Table 5 and Table 6 respectively. Feacal coliform counts ranged from 56 to 184 CFU/ML and 0 to 122CFU/ML in Wet and Dry season respectively; Total coliform counts ranged from 112 to 368 CFU/ML and 6 to 208 CFU/ML in Wet and Dry season respectively. Comparison of Coliform counts and Mean Total Coliformin Wet and Dry Season is as shown in Figure 1 and Figure 2 respectively; the figures indicate that there were significant differences in the coliform counts (faecal and total coliform counts) and Mean *Total*

Coliform counts in all the hand dug wells for the two seasons (Wet and Dry), with values for wet season being higher than those for dry season.Faecal Coliform is a sub-group of Total coliform bacteria which are more typically found in the waste of warm-blooded animals, but which can be found in non-mammals and insects. Faecal coliform bacteria should not be present in your drinking water and a suitable result would be absent or < 1 colony per 100 ml (Appiah *et al*., 2010).

Total Coliform can be used as an indicator of the microbiological quality of your water. If these bacteria are not present in your water, i.e., a result of absent or < 1 colony per 100 ml, this should be interpreted to mean that it is not likely that the water contains a microbiological agent that may pose a health problem. If the bacteria are present in your water, i.e., a result of Present or 1 or more colonies per 100 ml, this should be interpreted to mean that it is more likely that the water contains a microbiological agent that may pose a health problem and that some action is needed (Brian, 2012).Based on the results of Coliform counts, the hand dug wells are unfit for drinking without treatment as both the Feacal coliform counts and Total coliform counts are above the WHO Maximum Permissible Value of 0cfu/ml and 10cfu/ml respectively for both seasons.

Epidemiological evidences have shown that total coliforms and feacal coliforms are good indicators of water quality (Wade et al. 2003; Verhille, 2013). In all the cases in this study, Total coliforms and Faecal coliforms were in concentrations far higher than the recommended limits due to possible leaching of excreta from the nearby soakaway pits. The use of unprotected nearby soakaway pits may cause severe human and ecological health impacts including diseases associated with microbiological and chemical contamination of shallow groundwater sources (Blackburn *et al*., 2004; Caincross, 2004) as well as inadequate personal hygiene (Olowe*et al*., 2005).

4.0 CONCLUSION AND RECOMMENDATIONS

4.1 Conclusion

All the Hand dug well samples from the six selected Districts of Vandeikya Local Government of Benue State had higher values ofFeacal coliform counts and Total coliform counts in the Wet season than in the Dry season.Based on the Coliform Counts results for both wet and dry season, the values exceeded the limit of 0cfu/ml of faecal Coliform and 10cfu/ml of total Coliform recommended by WHO (2008) for potable water. This implies that the water from those wells are unfit for human consumption and most domestic purposes without treatment.

4.2 Recommendations

Based on microbial quality of the hand dug well waters, chlorination appears to be more efficient way of treating high bacterial density in water.The containers used for collection of water should be kept in clean conditions to avoid introduction of contaminants.The Community needs to be educated both on activities around the hand dug wells that impair the microbial quality of ground water and on safe handling of water obtained from the hand dug wells.

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