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Bacteriological Analysis Of Hand-Dug Well Water In Demsa Local Government Area, Nigeria

Tya, T.S.K.[1], Umaru, A. B.[2] and Barmamu, B. R.[3]

1,2,3(Department of Agricultural and Environmental Engineering,
School of Engineering and Engineering Technology,
Modibbo Adama University of Technology, Yola, .Nigeria)

ABSTRACT: *Water samples were collected from four different hand-dug wells designated as W_1, W_2, W_3 and W_4 from Farai, Borrong and Dong in Demsa Local Government Area, Adamawa state. 4 samples were taken from each location making a total of 12 samples on each day. Water samples were taken at 7days interval for 42 days for bacteriological analysis. The mean range was 6-190 MPN per 100 ml for total coli forms and 3-92 MPN per 100 ml for faecal coliforms. The highest count was consistently found in Well (W_2) located in Borrong (located near stagnant water). The findings showed that the water from all the wells in the study area did not meet the World Health Organization (WHO) standard for drinking water and thus, the water should be treated before drinking.*

Key word: *Bacteriological analysis, faecal coli form, Hand –dug well, Total coli form, Water quality*

I INTRODUCTION

Water is no doubt one of the most essential resources on earth and remains man's prime need in his environment. It is also a fact that portable water supply is lacking in many communities despite being one of the most abundant resource on earth. It is therefore important that the relationship between water quality and health be fully appreciated by all concerned. According to Mustapha and Yusuf (1999), poor water quality can pose health problem enough to threaten human life if consumed. The need for water treatment before consumption cannot be over emphasized, but irregularity or acute shortage of portable water to the populace has lead to people drinking water from hand-dug wells and other sources including streams and ponds.

The pollution of ground water sources may be from industries, agricultural and domestic wastes. According to Ibe and Okplenye (2005), industrial pollution may involve seepage of used water containing chemicals such as metals and radioactive compounds, or contaminated water from damage pipelines that infiltrates into the ground water and can be in hand dug wells. Also, domestic pollution may involve seepage from septic tanks, pit latrine, cesspools and privies. In addition, agricultural pollution is also from irrigation and runoff water carrying fertilizers, pesticides, herbicides and faecal matter to the water source. Environmental pollution may be caused by sea water intrusion into coastal aquifer. However, Chukwurah (2001) said World Health Organisation (WHO, 1986) recommended that wells should be located at least 30 m away from latrines and 17 m from septic tanks.

According to (Okafor, 1985; Okpokwasili and Akujobi, 1996), the presence of faecal coliforms or *Escherichia col* is an indicator for the presence of water borne pathogens. Bacteriological examination of water is therefore a powerful tool in order to foreclose the presence of micro-organisms that might constitute health hazards (Singh and Neelam, 2011). However, World Health Organization (WHO) recommended that no faecal coliform should be present in 100 ml of drinking water. Good quality water should be odourless, colourless, tasteless and free from faecal contamination and chemicals in excess of WHO tolerable levels.

Most of the communities within the study area depend on hand-dug wells as their major source of water supply. Reports from health centre (Demsa Primary Health Care, 2012), showed rampant cases of water related diseases within the study area. Most of the hand-dug wells have low water table which made it vulnerable to contamination. This study was carried out to determine the bacteriological quality of the hand dug well waters in the area to ascertain the presence of pathogens in the area water sources.

II MATERIALS AND METHOD

The Study Area

Demas Local Government area is located at the confluence of River Benue and River Gongola which is on latitude 90^o 13'N and longitude 12^o37'E in the savannah ecological zone of Nigeria. The boundaries of the

area is defined by Yola North and Yola South Local Government areas in the East, Shelleng in the North, Numan in the West and Mayo-Belwa Local Government area in the South. The Climate of the area is divided into two main seasons which are the dry season (November to March) and wet season (April to October). Most of the inhabitants are farmers growing varieties of crops in the areas which include maize, cotton, guinea corn and millet.

Collection of Samples

ater samples were collected from hand dug wells used as water sources for domestic use by the inhabitants in Demsa Local Government area. Three areas were identied for sample collection which includes; Farai, Borrong and Dong. From each location, four sampes were collected, designated as W_1, W_2, W_3 and W_4. A total of 12 samples were collected on each day at an intervals of 7days for 42days. The water samples were collected in 2 litres containers after being sterilized with 70 % (v/v) ethanol. After collecting the samples the containers were closed to avoid escape of gases. Water samples were taken to the laboratory for bacteriological analysis.

Determination of Total Coliform and Faecal Coliform Count

(i) Presumptive test

Colifrm count was obtained using the three tube assay of the Most Probable Number (MPN) technique (Speck, 1976, Manjula et al, 2011 and WHO,2012). Presumptive coliform test was performed using MacConkey broth(Oxoid). The first set of three tubes had sterile 10 ml double strength broth and the second and the third sets had 10 ml single strength broth.All the tubes contained Durham tubes before sterilization. The three sets of tubes received 10 ml, 1 ml and 0.1 ml quantities of water samples using sterile pipettes. The tubes were incubated at 37^0C for 24-48hrs for estimation of total coliforms and at 44.5^0C for faecal coliforms for 24-48hrs and examined for acid and gas production. Acid production was determined by colour change of the broth from redish purple to yellow, while gas production was checked for by entrapment of gas in the Durham tube. The MPN was then estimated from table for three tube test.

(ii) Confirmed test

Confirm test was carried out in line with (Manjula et al., 2011 and WHO,2012) by transferring a loopful of culture from a positve tube from the presumptive test into a tube of Brilliant Green Lactose Bile (BGLB) broth (Oxoid) with Durham tubes. The tubes were incubated at 37^0C for 24-48hrs for total coliforms and 44.5^0C for 24-48hrs for faecal coliforms and observed for gas production.

(iii) Completed test

Completed test was carried out in accordance with (WHO, 2012) by streaking a loopful of broth from a positive tube onto Eosine Methylene Blue (EMB) agar plate for pure colonies . The plates were incubated at 37^0C for 24-48hrs. Colonies developed on EMB agar, were further identified as coliforms or faecal coliforms (*Escherichia coli*) using cultural characteristics, morphology and biochemical tests. For faecal coliforms, colonies with green metallic sheen were Gram stained and the IMVIC test was carried out to identify the colony as E.coli. The MPN per 100 ml water was determined using the completed test.

III RESULTS AND DISCUSSION

Table 1 shows the total coliforms obtained from 4 samples of hand dug well water collected from Farai, Borrong and Dong, respectively. Table 1 indicates that for samples collected from wells at Farai, total coliform ranged 8-9, 6-7, 15-18 and 6-8 MPN per 100 ml with mean value of 9, 6, 16 and 7 MPN per 100 ml for Well; W_1, W_2, W_3 and W_4, respectively. For Borrong location, Table 1 revealed that highest total coliform in the range of 189-191 MPN per 100 ml with mean value of 190 MPN per 100 ml as obtained from well W_2. Wells; W_1, W_3 and W_4 had total coliform in the range of 9-10, 3-5 and 6-10 MPN per 100 ml respectively. Table 1 also revealed that total coliform obtained from wells in Dong ranges between 13-16, 10-20, and 5-7 MPN per 100 ml for Well; W_1, W_2, W_3 and W_4, respectively. The relatively high value of coliform count of 190 MPN per 100 ml found in Well (W_2) located in Borrong can be traced to proximity of the well to stagnant water. Statistically, using analysis of variance, it was observed that there was no significant difference between the total coliform counts in all the wells and the locations at 5 % level of significance.

Table 1: Total Coliform Count (MPN per 100 ml)

Well Number	Farai		Borrong		Dong	
	Range	Mean	Range	Mean	Range	Mean
W_1	8-9	9	9-10	10	10-16	13
W_2	6-7	6	189-191	190	10-20	15
W_3	15-18	16	3-5	4	6-8	7
W_4	6-8	7	6-10	8	5-7	6
Mean		**9**		**53**		**10**

Table 2 shows the faecal coliform count for the area of study. The Table indicates that at Farai, faecal counts ranged from 3-5, 5-9, 3-5 and 2-4 MPN per 100 ml with mean value of 4, 7, 4 and 3 MPN per 100 ml for Wells; W_1, W_2, W_3 and W_4, respectively. From Table 2 for Borrong, the Well (W_2) had the highest faecal count between 90-94 MPN per 100 ml with mean value of 92 MPN per 100 ml. Well; W1, W3 and W4 had faecal counts in the range of 2-4, 6-8 and 3-7 MPN with mean values of 3, 7 and 5 MPN per 100 ml, respectively. Hand dug well water samples collected from Dong showed that faecal coliform counts ranged from 6-8, 3-5, 2-4 and 3-7 MPN per 100 ml with mean values of 7, 4, 3 and 5 MPN per 100 ml for Well; W_1, W_2, W_3 and W_4, respectively. The highest mean faecal coliform value of 92 MPN per 100 ml was in the range of 12.0-189.2 MPN per 100 ml recorded in earlier studies by (Adeoye et al., 2012) for evaluation of water quality standard in Ibadan. Based on analysis of variance, it was observed that there was no significant difference between the faecal coliform counts in the Wells for all the locations at 5 % level of significance.

Table 2: Faecal Coliform Count (MPN per 100 ml)

Well Number	Farai		Borrong		Dong	
	Range	Mean	Range	Mean	Range	Mean
W_1	3-5	4	2-4	3	6-8	7
W_2	5-9	7	90-94	92	3-5	4
W_3	3-5	4	6-8	7	2-4	3
W_4	2-4	3	3-7	5	3-7	5
Mean		**4**		**27**		**4**

The results revealed that Wells in Borrong had much higher faecal coliform count mean value of 27 MPN per 100 ml compared to faecal coliform count mean value of 4 MPN per 100 ml for wells in Farai and Dong, respectively. This implies that water from all the hand –dug wells are not fit for drinking without treatment in accordance with World Health Organization (WHO,1986), United State Environmental Protection Agency (USEPA,2001, 2004) and Oxfam (2005). USEPA and WHO standard for faecal coliform in drinking water is zero faecal coliform per 100 ml.

IV CONCLUSIONS

The presence of high faecal coliform in Well (W_2) in Borrong could be due to proximity of the well to stagnant water located at a distance less than 30 m which is not in line with WHO recommendations. Also, there is need to increase awareness among the people in the study area the danger associated with the use of contaminated water and construction of pit latrine and septic tank near water source. Water from all the hand dug wells should be boiled and filtered before drinking. A regular monitoring of the water quality for improvement not only prevents disease and hazards but also checks the water resources from going further polluted. The bacteriological examination of hand-dug well water is a sensitive method to assess its quality.

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