
Presence of Pathogenic Microorganisms in Deep Wells of Catbalogan City, Philippines

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ABSTRACT:

This study checked the presence of pathogenic microorganism present in Catbalogan City deep well namely Barangay 7 Poblacion , Barangay 9 Poblacion, Barangay 13, and Barangay Payao. Results showed that the coliform and E. coli formation were both >23MPN/100ml during dry and wet seasons except for Barangay Payao with <1.1 fecal coliform count and 3.6 e. coli count during wet season, probably due to public dissemination conducted by the researcher. This research confirmed that pathogenic microorganisms were present in the deep wells. The recommendations of this study are: deep wells in the entire city of Catbalogan must be check for pathogenic microbes as well as in the whole Samar province and throughout the Philippines to avoid future cases of water diseases; residents under the Barangays subject of this research must boil water from the deep well to decontaminate the pathogenic microbes present in the water.

KEYWORDS: *deep wells, deep well water, E. coli, fecal coliform, pathogenic microorganisms*

1. INTRODUCTION

1.1 Background and Rationale

Water is one of the most vital resource in the planet. All organisms depend on this precious compound for their survival. If there was no water there would be no life on earth. According to the National Water Resources Board (NWRB), there are 21, 354 deep wells in the Philippines. The national body accounted that approximately 60 percent of extraction in the Philippines groundwater is illegal, resulting in indiscriminate water withdrawal. In the locality, there is no exact number of deep wells, which makes it impossible to test the water quality if it is potable or not.

Moreover, there are dangerous health problems that can be caused by unsanitized water such as diarrhea and dysentery. In a report from GMA News Online dated September 8, 2012, World Health Organization said that over 70,000 Filipino children have died of diarrhea in span of seven years. Therefore, we can say that there is really a need to check the presence of microorganisms in Catbalogan City water surfaces, specifically deep wells as well as the sources of microorganisms in that area.

2.2 Statement of the Problem

This study determined the presence of pathogenic microorganisms in deep wells of Catbalogan City. This research sought answers to the following questions: what are the pathogenic microorganisms present in deep wells of four barangays in Catbalogan City; what

is the number of Fecal and E. coli count in the top and in the middle part of the deep wells; and what are the sources of pathogenic microorganisms present in deep wells of four barangays in Catbalogan City.

2.3 Objectives

The following are the objectives of this research: determine the pathogenic microorganisms present in deep wells of four barangays of Catbalogan City; determine the number of Fecal and E. coli count in the top and in the middle part of the deep wells; and determine the sources of pathogenic microorganisms present in deep wells of four barangays in Catbalogan City.

2.4 Related Literature

Water borne diseases are health concerns faced by any country in the planet including the Philippines. Kanellos (2015) explained that three billion people in the world do not have clean and sanitized toilets and thousands of kids die a day from water-related complications. In Britain or the US alone, according to a major new report by Seager (2012) in a post in the guardian, nearly two million children a year die for want of clean water and proper sanitation while the world's poor often pay more for their water than people.

Meanwhile, in the Philippines, the problem on dirty water is as intense as the problem being experienced in the other parts of the world. Domestic wastewater is the main contributor of bacterial contamination to the groundwater supplies. The presence of coliform bacteria in drinking water supplies can cause water-borne diseases such as diarrhea, cholera, dysentery, hepatitis A, and others. Limited data on the bacteriological content of groundwater from 129 wells indicated a high level of positive coliform bacteria in 75 wells (58 percent). Apparently, in 2011, in report of ABS-CBN, dirty water has been blamed for deaths of 20 people in Bataraza town in Palawan province. The Department of Health (DOH) study showed that the water used by villagers in Sitio Linao, Barangay Colandanum, tested positive for E. coli bacteria.

There were also less deep well monitoring stations in the country, unlike in Malaysia in 2006, a total of 1,064 water quality monitoring stations located within 146 deep well (⁶wepa-db.net). So that the deep wells in the Philippines will not be contaminated, Presidential Decree No. 856 dated December 23, 1975 was promulgated by then president, Ferdinand Marcos. This is found in section 13, paragraph b which states that no artesian, deep or shallow well shall be constructed within 25 meters from any source of pollution (⁷Lawphil Project).

This problem brought three people down by diarrhea outbreak as reported by ²GMA News Group in Northern Samar. This incident raised an alarm to the local government and declared a state of calamity in the area.

In Catbalogan City, deep wells are commonly the sources of drinking water in far- flung areas. These drinking waters are untested if they are potable or non- potable which can lead to cases of water- borne diseases, such as diarrhea. In a recent report of Investigative Docus of Philippine Center Investigative Journalism (PCIJ), according to the Catbalogan City Health Office, diarrhea ranked four in the list of ten leading health problems in the city.

Therefore, there is really a need to check the status of our deep wells to search if there are harmful microorganisms present in its water.

2. MATERIALS AND METHODS

2.1 Materials/Equipment

The materials and equipment used in this study are: D.O.S.T water quality analyzer (multiple-tube fermentation technique; water samples from four barangays; and water sample bottles.

2.2 Collection of Materials

The study utilized medicine bottles and PET Bottles, which were subjected for auto-clave: the process of sterilizing a vessel to avoid contamination, in the Samar Provincial Hospital. The water samples were gathered from deep wells of four barangays in Catbalogan City, Samar. The water samples were taken from Barangay 7 Poblacion, Barangay 9 Poblacion, Barangay 13 Diversion Road, and Barangay Payao from April to July 2014 for the dry season and August to November 2014 for the wet season. This research collected water samples from top and middle layer of the deep wells to determine the variation of pathogenic microorganisms. They were collected during dry and wet seasons.

2.3 Treatment

The water samples were brought to the Department of Science and Technology- Regional Standards and Testing Laboratory (DOST- RSTL) in Tacloban City, Philippines using Multiple-Tube Fermentation Technique to check the Most Probable Number (MPN) of bacteria in 100 ml of deep well water sample.

3. RESULTS/FINDINGS

3.1 Dry Season

Table 4.1
Fecal and E. Coli Formation in Barangay Payao Deep Well

Sample Number	Sample Information	Parameter	Method	Results
ML14-126	Water sample placed in 330 mL PET bottle labelled by costumer as: "Sample Description: DEEP WELL; Date/Time of Collection: 7-17-14, 7:48 A.M, Place of Collection: BRGY. PAYAO, CATB. CITY; Collector's Name: JEFF ANTONIO R. LIM	Fecal Coliform (MPN) Count	Multiple-Tube Fermentation Technique	>23.0 MPN/100mL
		E. coli (MPN) Count	Multiple-Tube Fermentation Technique	>23.0 MPN/100mL

As seen in table 4.1, the results showed that the Fecal Coliform Most Probable Number (MPN) of Barangay Payao Deep Well in Catbalogan City for dry season is greater than 23 MPN per 100 mL. For the E. coli count, it amounted to greater than 23.0 MPN per 100 mL. As far as the ¹National Water Resource Board (NWRB) Water Quality Monitoring is concerned, the water for human drinking should contain no amount of Fecal Coliform and E. coli. This implies that the water in Barangay Payao deep well is not potable for human drinking.

Table 4.2
Fecal and E. Coli Formation in Barangay 7 Poblacion Deep Well

Sample Number	Sample Information	Parameter	Method	Results
ML14-128	Water sample placed in 330 mL PET bottle labelled by costumer as: "Sample Description: DEEP WELL; Date/Time of Collection: 7-17-14, 8:05 A.M, Place of Collection: BRGY. 7, CATB. CITY; Collector's Name: JEFF ANTONIO R. LIM	Fecal Coliform (MPN) Count	Multiple-Tube Fermentation Technique	>23.0 MPN/100mL
		E. coli (MPN) Count	Multiple-Tube Fermentation Technique	>23.0 MPN/100mL

In Barangay 7 Poblacion, revealed by table 4.2, the results showed that the result based form the DOST Laboratory showed that the Fecal Coliform Most Probable Number (MPN) of said area for dry season is greater than 23 MPN per 100 mL. For the E. coli count, it amounted to greater than 23.0 MPN per 100 mL. As far as the ¹National Water Resource Board (NWRB) Water Quality Monitoring is concerned, the water for human drinking should contain no amount of Fecal Coliform and E. coli. This implies that the water in Barangay 7 deep well is not potable for human drinking.

Table 4.3
Fecal and E. Coli Formation in Barangay 13 Poblacion, Diversion Road Deep Well

Sample Number	Sample Information	Parameter	Method	Results
ML14-129	Water sample placed in 330 mL PET bottle labelled by costumer as: "Sample Description: DEEP WELL; Date/Time of Collection: 7-17-14, 8:11 AM, Place of Collection: BRGY. 13, CATB. CITY; Collector's Name: JEFF ANTONIO R. LIM	Fecal Coliform (MPN) Count	Multiple-Tube Fermentation Technique	>23.0 MPN/100mL
		E. coli (MPN) Count	Multiple-Tube Fermentation Technique	>23.0 MPN/100mL

The Fecal Coliform Most Probable Number (MPN), as well as the E. coli count, of Barangay 13 Poblacion, Diversion Road (Table 4.3) for dry season is greater than 23 MPN per 100 mL. As far as the ¹National Water Resource Board (NWRB) Water Quality Monitoring is concerned, the water for human drinking should contain no amount of Fecal Coliform and E. coli. This implies that the water in Barangay 13 Poblacion, Diversion Road deep well is not potable for human drinking.

Table 4.4
Fecal and E. Coli Formation in Barangay 9 Deep Well

Sample Number	Sample Information	Parameter	Method	Results
ML14-127	Water sample placed in 330 mL PET bottle labelled by costumer as: "Sample Description: DEEP WELL; Date/Time of Collection: 7-17-14, 7:30 AM, Place of Collection: BRGY. 9, CATB. CITY; Collector's Name: JEFF ANTONIO R. LIM	Fecal Coliform (MPN) Count	Multiple-Tube Fermentation Technique	>23.0 MPN/100mL
		<i>E. coli</i> (MPN) Count	Multiple-Tube Fermentation Technique	>23.0 MPN/100mL

The Fecal Coliform Most Probable Number (MPN) of Barangay 9 Poblacion (Table 4.4) is greater than 23 MPN per 100 mL. The *E. coli* count also amounted to greater than 23 MPN per 100 mL.

As far as the National Water Resource Board (NWRB) Water Quality Monitoring is concerned, the water for human drinking should contain no amount of Fecal Coliform and *E. coli*. This implies that the water in Barangay 9 deep well is not potable for human drinking since it is a must that the water for human drinking should not be infested by any number of Fecal Coliform as well as *E. coli*.

Table 4.5
Summary of Fecal and E. Coli Levels in Top and Middle Part of the Deep Wells of Four Barangays in Catbalogan City

Barangay	7		9		13		Payao		Mean	
	Top	Middle	Top	Middle	Top	Middle	Top	Middle	Top	Middle
Fecal Coliform	>23	>23	>23	>23	>23	>23	>23	>23	>23	>23
<i>E. coli</i>	>23	>23	>23	>23	>23	>23	>23	>23	>23	>23
Mean	>23	>23	>23	>23	>23	>23	>23	>23	>23	>23

As viewed in table 4.5, based from the water quality analysis, there are no variation in Fecal Coliform and *E. coli* count on the top and middle layer of the deep wells. This implies that the variability of pathogenic microorganisms on the deep wells is not present. This further implies that at any layer on the deep wells is harmful for human drinking which will falsify the old culture that on the surface or top part, the water is safe.

WET SEASON

Table 4.6
Fecal and E. Coli Formation in Barangay Payao Deep Well

Sample Number	Sample Information	Parameter	Method	Results
ML14-289	Water sample placed in 120 mL PET bottle labelled by costumer as: “Sample Description: DEEP WELL; Date/Time of Collection: NOV. 6, 2014, 6:10 AM, Place of Collection: BRGY. PAYAO, CATB. CITY; Collector’s Name: JEFF ANTONIO R. LIM	Fecal Coliform (MPN) Count	Multiple-Tube Fermentation Technique	<1.1 MPN/100mL
		<i>E. coli</i> (MPN) Count	Multiple-Tube Fermentation Technique	3.6 MPN/100mL

As far as the result of Barangay Payao Deep Well (Table 4.6) in Catbalogan City for wet season, which is greater than 1.1 MPN per 100 mL and 3.6 MPN per 100 mL for the Fecal Coliform and *E. coli* formation respectively, the presence of pathogenic microorganisms lowered compared to the result during the dry season. This is probably the good result of the information dissemination conducted by the researcher to the said barangay. However, even though they decreased in number, the water in the deep well of Barangay is still not safe for human drinking since the ¹National Water Resource Board (NWRB) Water Quality Monitoring said that the water for human drinking should contain no amount of Fecal Coliform and *E. coli*.

Table 4.7
Fecal and E. Coli Formation in Barangay 7 Poblacion Deep Well

Sample Number	Sample Information	Parameter	Method	Results
ML14-291	Water sample placed in 120 mL glass bottle labelled by costumer as: “Sample Description: DEEP WELL; Date/Time of Collection: NOV. 6, 2014, 6:22 AM, Place of Collection: BRGY. 7, CATB. CITY; Collector’s Name: JEFF ANTONIO R. LIM	Fecal Coliform (MPN) Count	Multiple-Tube Fermentation Technique	>23.0 MPN/100mL
		<i>E. coli</i> (MPN) Count	Multiple-Tube Fermentation Technique	>23.0 MPN/100mL

In Barangay 7 Poblacion (Table 4.7), the DOST Regional Standards Testing Laboratory showed that the Fecal Coliform Most Probable Number (MPN) of said area for wet season is greater than 23 MPN per 100 mL. For the *E. coli* count, it amounted to greater than 23.0 MPN per 100 mL. These results are the same with the data during the dry season.

Furthermore, according to the National Water Resource Board (NWRB) Water Quality Monitoring is concerned, the water for human drinking should contain no amount of Fecal Coliform and *E. coli*. This implies that the water in Barangay 7 deep well is still not potable for human drinking.

Table 4.8
Fecal and *E. Coli* Formation in Barangay 13 Poblacion, Diversion Road Deep Well

Sample Number	Sample Information	Parameter	Method	Results
ML14-292	Water sample placed in 120 mL PET bottle labelled by costumer as: "Sample Description: DEEP WELL; Date/Time of Collection: NOV. 6, 2014, 6:22 AM, Place of Collection: BRGY. 13, CATB. CITY; Collector's Name: JEFF ANTONIO R. LIM	Fecal Coliform (MPN) Count	Multiple-Tube Fermentation Technique	>23.0 MPN/100mL
		<i>E. coli</i> (MPN) Count	Multiple-Tube Fermentation Technique	>23.0 MPN/100mL

As highlighted in table 4.8, the Fecal Coliform Most Probable Number (MPN) of Barangay 13 Poblacion Diversion Road Deep Well for wet season is greater than 23 MPN per 100 mL. For the *E. coli* count, it amounted to greater than 23.0 MPN per 100 mL.

These results are the same with the data during the dry season. This calls for intensified information dissemination.

Furthermore, according to the National Water Resource Board (NWRB) Water Quality Monitoring is concerned, the water for human drinking should contain no amount of Fecal Coliform and *E. coli*. This implies that the water in Barangay 13 deep well is still not potable for human drinking.

Table 4.9
Fecal and *E. Coli* Formation in Barangay 9 Deep Well

Sample Number	Sample Information	Parameter	Method	Results
ML14-290	Water sample placed in 120 mL PET bottle labelled by costumer as: "Sample Description: DEEP WELL; Date/Time of Collection: NOV. 6, 2014, 6:41 AM, Place of Collection: BRGY. 9, CATB. CITY; Collector's Name: JEFF ANTONIO R. LIM	Fecal Coliform (MPN) Count	Multiple-Tube Fermentation Technique	>23.0 MPN/100mL
		<i>E. coli</i> (MPN) Count	Multiple-Tube Fermentation Technique	>23.0 MPN/100mL

In Barangay 9 (Table 4.9), the DOST- RSTL showed that the Fecal Coliform Most Probable Number (MPN) of said area for wet season is greater than 23 MPN per 100 mL. For the E. coli count, it amounted to greater than 23.0 MPN per 100 mL. These results are the same with the data during the dry season. This implies that maybe the local government unit did not respond to the information disseminated to them by the investigator, unlike in Barangay Payao. Furthermore, according to the National Water Resource Board (NWRB) Water Quality Monitoring is concerned, the water for human drinking should contain no amount of Fecal Coliform and E. coli. This implies that the water in Barangay 9 deep well is still not potable for human drinking.

Table 4.10
**Summary of Fecal and E. Coli Levels in Top and Middle Part of the Deep Wells
of Four Barangays in Catbalogan City**

Barangay	7		9		13		Payao		Mean	
Parameter	Top	Middle	Top	Middle	Top	Middle	Top	Middle	Top	Middle
Fecal Coliform	>23	>23	>23	>23	>23	>23	>1.1	>1.1	>17.5	>17.5
E. coli	>23	>23	>23	>23	>23	>23	>3.6	>3.6	>18.15	>18.15
Mean	>23	>23	>23	>23	>23	>23	>2.4	>2.4	>17.85	>17.85

As seen in table 4.10, based from the water quality analysis, there are no variation in Fecal Coliform and E. Coli count on the top and middle layer of the deep wells except for Barangay Payao in which number of Fecal Coliform and E. Coli colonies lowered to <1.1 MPN and 3.6 MPN respectively. In the same way, this implies that the variability of pathogenic microorganisms on the deep wells is not present. This further implies that at any layer on the deep wells is harmful for human drinking which will falsify the old culture that on the surface or top part, the water is safe.

Sources of Deep Well Contamination

Based from the survey conducted by the researcher, the sources of deep well contamination are animal wastes, human garbage, and sewerage systems. Animals like dogs and cats which are undomesticated can lay their waste near or in the deep well. This will eventually cause for harmful bacteria like E. coli and fecal coliform to spread in the water.

According to the interviewed local residents of each concerned barangay and to the personal inspection made by the researchers, the houses and sewerage systems were 1-2 meters away from the deep wells.

Five meters north from Barangay 13 Diversion Road deep well is a private piggery and a poultry farm. The industrial wastes from these livestock farms may directly cause the deep well contamination for Barangay 13 Diversion Road deep well.

4. CONCLUSION

Based from the findings the following conclusions were made: the deep well in the four areas cited in this study are contaminated by Fecal Coliform and E. coli; the amount of Fecal Coliform and E. Coli is >23.0 MPN/100 mL; the amount of Fecal Coliform and E. coli is not tolerable for human drinking; the Mean MPN of the four barangays was less than 23 MPN per 100 mL, this means that the water is not potable for human consumption; and finally animal waste, human waste and garbage, and sewerage system are the sources of deep well contamination in the locality.

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APPENDICES

Appendix A. Deep wells Surveyed



Figure 1. Barangay 13 Diversion Road Deep Well



Figure 2. Barangay 7 Deep Well



Figure 3. Barangay 9 Deep Well



Figure 4. Barangay Payao Deep Well