Coliform Count in Drinking Water of Various Sources Within Jimeta Metropolis

BY

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A Project Work Submitted to the College of Science and Technology, Department of Science Laboratory Technology, In Partial Fulfilment of the Requirement for the award of National Diploma (ND) in Science Laboratory Technology

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APPROVAL PAGE

This is to certify that the researcher has carried out all the research in this project. It has been read, certified and approved to meet the requirement for the award of National Diploma in Science Laboratory Technology, College of Science and Technology, Adamawa State Polytechnic, Yola.

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DEDICATION

I dedicated this project work to God Almighty and my beloved parents Mr. and Mrs. O.I Ukah, may the name of the Lord be praised.

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I wish to express my profound gratitude to the most high God from the depth of my heart who preserved me and made all the necessary provision for the successful ending of my project. I also wish to sincerely acknowledged my beloved parents Mr. and Mrs. O.I Ukah for their love, care and concern towards me (their beloved daughter). To my H.O.D Mr. Offong .A.O. my treasured supervisor Mr. Musa .H.M Belel and lecturers who took their time to assist my studies in one way or the other and to the school authority for admitting and believing in me.

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ABSTRACT

The study of coliform count in drinking water of various sources was carried out within Jimeta metropolis, Yola North Local Government Area of Adamawa state. water in its pure form is a tasteless, colourless and odourless substance that is essential to all known forms of life, it is also known as a universal solvent, without it life is impossible (WHO, 1993), coliform count is the test for water contamination in which the number of the colonies of coliform bacteria per 100ml of water is counted by Popular Environmental Pollution Control. The main purpose of the study is to know if drinking water within Jimeta metropolis have zero (0) colonies of coliform per 100ml of drinking water according to WHO standard of drinking water and the objective of the study is to know the number of coliform in the various sources of drinking water and also to get quality drinking water, due to the fact that a lot of people living in Nigeria suffer from water-borne disease such as diarrhea, dysentery, hepatitis, typhoid and cholera cause by these coliform bacteria (Noami, 2004), awareness is been created to the resident of Jimeta, Yola North Local Government Area of Adamawa State. The beneficial at the end of this project work are lecturers and students of Adamawa state polytechnic, and people living with in Jimeta metropolis. The methods used in this project work include research design, study area, sample and sampling techniques, instruments used, procedure for data analysis, method of data analysis, method of data presentation. Fifty (50) samples of water were collected from the various sources of drinking water, 15 well water, 5 river water, 15 bore hole water and 15 tape water, these water samples were

cultured, gram stained and microscopically examined for Escherichia coli in conclusion, from the findings of the result, well water has the highest percentage of coliform 67%, followed by borehole 47%, River 40% and tape 33% of Escherichia coli.

CHAPTER ONE

1.0 INTRODUCTION

1.1 BACKGROUND OF STUDY

Water in its pure form is a tasteless, colorless and odorless substance that is essential to all known forms of life. It is also known as a universal solvent, without it life is impossible, water like air and food is one of the vital resources for sustaining life, man needs the daily intake of 2 – 3 liter of good, quality drinking water, crops and plant also need water to grow.

Water quality is the ability to analyze water in terms of

i. Chemical content: hardness (calcium + magnesium) metals (iron etc). nutrients (nitrogen and phosphorous) organic compound.

ii. Physical content: turbidity, colour and odour etc

iii. Biological content: faecal coliform, total coliform virus.

Good quality drinking water is free from disease causing organism, harmful chemical and radioactive matter. The pathogenic agents involved includes, bacteria, virus and protozoa which causes disease such as diarrhea, dysentery, hepatitis, typhoid and cholera. Ideally drinking water should not contain any micro- organism known to be pathogenic or any indicative of faecal pollution. Defection of faecal indicator method of quality assessment and it is not possible to examine water for every pathogen that are present (WHO 1993).

There are many sources of drinking water which include pipe borne water, spring water, well water, rain water, bore hole water etc. water is required for domestic use, animals consumption, agriculture and industrial production, power generation, fishery, wild life management and recreational purpose (NAFDAC 2004)

Coliform bacteria are bacilli: that inhabit the large intestine of human and certain other animals. American heritage Dictionary fourth edition (2007). Coliform bacteria are commonly found in soil, on vegetation and surface water. They also live in the intestine of warm blooded animal because coliform bacteria are most commonly associated with sewage or surface water, they are used as an indicator group to determine the sanitary qualities of drinking water. One particular type of coliform organism which is called Escherichia coli is an indicator of faecal contamination, some coliform bacteria strains can survive in soil and water for a long period of time, bacteria contamination cannot be detected by taste, smell or sight. Michigan department of environmental quality (MDEQ 1998). Colifirm Count is the test for water contamination in which the number of the colonies of coliform bacteria per 100ml of water is counted popular environmental pollution control (2011).

Water from a substantial and vital component of the environment, it is regarded as an important resources for economical development (Cholery 2011). The intake of this water can not be over looked considering the facts that a lot of

people are being exposed to health dangers. Environmental protection agencies standards for water states that.

- Drinking water must have zero colonies per 100mls
- Recreational, bathing, swimming can't be over 2000 colonies/100mls
- Boating or secondary contact can't be over 5000 colonies/100ml (EPA 1997)

1.2 Statement of the Problems

A lot of people living in Jimeta metropolies are complaining of water borne diseases, the public health consequence of consumption of contaminated water from the point source can be severe in relation to both endemic and epidemic disease Pedley and Howard (1997). Many diseases causing organism are transferred from human and animals faces to water from where they can be ingested by people and infect them Gray N. and Gleeson C. (1997). Therefore, there is a need for much research to be carried out in this area so as to eradicate the incidence of water borne disease.

1.3 Objectives

- The primary objectives of this project is to know the number of coliform bacteria in the various sources of water within Jimeta metropolies
- To get quality drinking water.

1.4 Research Question

- What should be the number of coliform in the various sources of drinking water?
- What are the ways of getting quality drinking water?

1.5 Significance of the Study

This is to create awareness to the staff, student and resident of Jimeta on the dangers they are exposed to, (water borne disease) like cholorea, dysentery, typhoid, diarrhea, and advice them on proper maintenance and local treatment of water for domestic use.

1.6 Scope and Delimitation

This projects is restricted only to Jimeta, Yola north local government area of Adamawa state and also restricted to tape water, bore hole water, river water and well water.

1.7 Definition of Terms

Water: - water is a universal solvent; it is required for domestic use, animal consumption, agriculture and industrial production, power generation, fisheries, wild life management and recreational purpose.

Coliform Bacteria: - this are bacilli that inhabits the large intestine of human and certain other animals.

Culture: - this is the population of micro organisms grown in laboratory.

Eosin Methylene Blue Agar (EMB): - This Is a selective media which helps in the growth of micro organisms.

Sterilization: - this is the process of destroying microorganism / microbial life.

Inoculation: - this is the act of introducing an organism into a culture medium.

Endemic: -occurring frequently in a particular region or population applied to disease that are generally or constantly found among people in a particular area..

Epidemic: - a sudden outbreak of infectious disease that spread rapidly through the population affecting a large proportion of people.

CHAPTER TWO
LITERATURE REVIEW

2.0 INTRODUCTION

The purpose of examining water microbiologically is to help in the determination of its sanitary quality and also its suitability for general use, the sanitary of water may be defined as the relative extend of the absence of suspended matter, colour, taste, unwanted dissolve chemicals, bacteria indicative of faecal presence and other offensive object or properties as cited by Olayemi etal, (2002). But in this case colifrom count in water or faecal coliform indicative is what will be discuss in other to make drinking water safe for various use or drinking, the following will be considered.

1. Coliform bacteria in the various sources of drinking water such as well, boles holes, Tape and River Water.
2. The World Health Organization (WHO) standard of quality drinking water.
3. Also other ways of getting quality drinking water..

2.1 Coliform Count in Bole Hole Water

The level of coliform contamination of bole hole water with higher number of total viable bacteria count may be due to the location and environmental factors whereby some animals visit site to drink water, when drinking these water, they lick the mouth of the bole-hole taps and defecate around the bole-hole.

These activities could enhance bacteria spore to contaminate the water through the opening side of the bole-holes, unsafe water is a global public health threat, placing persons at risk for a host of diarrhea and other water-borne disease as well as chemical intoxication as cited by Hughes and Koplan, (2005). while Gunnison 1985 reported that during the year 1971-1980, three hundred and fifteen (315) water-borne disease out break in USA resulting in 78,000 illnesses in persons who drank bole-hole water contaminated with pathogenic microorganism and chemicals.

Water analysis for bole-hole water carried out at Gwaza Local Government Area of Borno State as reported by J. N. Noam (2004), the bacteriological quality of their water was above the WHO standard. Children also defecate around the bole-holes which can easily pollute the water with pathogenic microorganisms and these eventually can lead to the out break of disease such as typhoid, cholera, dysentery and diarrhea.

2.2 Coliform Bacteria in Well Water

Water has remains a very important natural occurring and also an abundant available fluid to all living things, since the beginning of creation. Nevertheless, water story in relation to mans health did not unfold until the classical work of the famous epidemiologist as Cited by John Snow in (1954) when sewage population of district wells gave rise to large scale out break of cholera and many deaths. He

implicated the broad street pull up in incidents as been responsible for the cholera epidemic in London, his assertion was up held and faultless since at that time there was no knowledge of the relationship between bacteria and disease nor there any general recognition of the part that water could play in the dissemination of cholera. while journal of applied science and management, (2001) state that long before the demonstration that water was a vehicle of disease, man some times suspected it, following an out break of water – borne disease in Chicago due to the fact that the wells are not covered and children use unwashed items to fetch water out of the wells which at times carry some contaminant that can easily pollute the water.

Ado-Ekiti is also one of those communities that resort to well digging as their main source of water supply, in order to review the evidence of pollution in these area, 30 wells were analyzed in which 24 wells have high bacteria counts, some have 43 colonies of coliform bacteria per 100ml of water. The heavy counts in some of these wells may be due to the sanitary habit of the people dwelling around the wells and also the well users. as cited by African Journal of Environmental studies, (2001).

2.3 Coliform Bacteria in Rivers

In a separate sewer system, sanitary wastes (from toilets, washers and sinks) flow through sanitary sewers and are treated at the water treatment plants, storm sewers

carry rain and snow melted from streets and discharge untreated water directly in to rivers as cited Doyle and Erickson, (2006). Heavy melting snow wash bird and pet waste from side walks and street and may "flush out" faecal coliform from illegal sanitary sewage connections in to the storm sewers, untreated or inadequately treated waste may be diverted in to the rivers to avoid flooding the waste water treatment plants. To avoid this problem, some cities have build retention basins. While WHO (1993) states that despite the fact that they cannot linked directly to contamination by human sewage, faecal coliform bacteria counts are often used to regulate surface waters for recreational use shell fishing and portability (ability to be safely consumed). Federal regulation stipulate maximum allowable numbers of these bacteria for various uses. If faecal coliform count are high over 200 colonies/100ml of water sample in the river, there is a greater chance that pathogenic organisms are also present. A person swimming in such water has a greater chance of getting sick from swallowing disease – causing organisms and from pathogen entering the body through cuts on skin, the mouth, nose and ears, disease and illness such as typhoid, hepatitis, gastroenteritis, dysentery and ear infection can be contacted in waters with high faecal coliform counts as cited by Fresno County, (2009) cities and suburbs sometimes contribute human waste to local rivers through their sewage systems, a

sewage system is a network of underground pipes that carry waste water as cited by Olayemi etal, (2002)

2.4 Coliform Bacteria In Tape Water

Coliform are a broad class of bacteria found in our environment including the faeces of man and other worm-blooded animals. The presence of coliform bacteria in tape water may indicate a possible harmful disease-causing organisms as cited by Agbiaka, (2009). While Kelly etal state that: tape water must be free of disease such as hepatitis, giardiasis and Dysentery to actually test water for specific harmful viruses, protozoa and bacteria is time consuming and expensive. In addition, not all water laboratories are equipped and approved to do the testing required. Therefore, testing water for microorganisms is limited to investigating specific water-born disease out break. Coliform bacteria are used as water quality indicator for two main reasons.

(i) coliform maybe associated with he source of pathogens contaminating the water.

(ii) The analysis of tape water for coliform is relatively simple, economical and efficient as cited by Edema etal, (2001).

2.5 World Health Organization Standard of Quality Drinking Water

According to World Health Organization (1984), natural and treated water vary in bacteriological quality; ideally drinking water should not contain any microorganisms known to be pathogenic. It should be free from bacteria indicative of pollution with excreter, to ensure a supply of drinking water that satisfy the WHO standard and guideline of bacteria quality, it is important that samples should be examined regularly for indicators of faecal pollution. The primary indicators recommended for this purpose is the coliform group of organism as a whole, they may be universally present in large numbers in the faeces of man and other vertebrates, thus putting their defection after considerable dilution. The detection of faecal (thermo-tolerant) coliform organisms in particular Escherichia coli provides definitive evidence of faecal pollution.

2.6 Review of other Related Work

Many infection (intestinal) disease of human are transmitted through faecal waste, pathogens (disease producing agents in faeces of infected persons) include all major categories of viruses, bacteria, protozoa and helmithes (parasitic worms). The resultants diseases are most prevalent in those area of the world where sanitary disposal of human faeces is adequately practices, the transmission may not be directly from person to person by contaminated

finger or indirectly through food and water. Some water borne disease include typhoid, cholera, amoebic dysentery, bacillary dysentery, infectious hepatitis, schistomiasis and a member of disease caused by a parasitic worms as cited by Hamman etal, (2000). According to a report carried out by African Journal of Environmental Studies, (2001) that the effect of mineral in water on the cardio-vascular system have been investigated for instance death rate for isochemic heart disease were greater in areas which have soft drinking water and increased sodium level, In water has been reported significantly with an increase in blood pressure therefore resulting to hyper tension. Industrial waste and effluents in water when consumed may result in cancer, goiter dental and congenital malfunction etc. from authoritative statistical records. (NAFDAC 2004).

- Reliable estimate have indicate that each year about 500 millions of people are affected by incapacitating Water-borne disease.
- it is also estimated that 25% of the worlds hospital beds are occupied because of unwhole some or impure water

the illness include: typhoid, cholera, infectious hepatitis, bacillary and amoebic dysentery and gastroenteritis. But according to World Health Organization WHO (1984) community water supply should be provided pure and wholesome, the society of water treatment and examination

set up by WHO defined pure water as one which after been taking from a properly protected source and submitted to an adequate system of purification is free from visible suspended matter, colour, odour and taste from all objectionable bacteria indicative of presence of disease. Popular Environmental and Pollution Control state that drinking water must be completely free from any colony of coliform, bathing and swimming pool water can have about 200 colonies and recreational (fishing and boating water about 1000 colonies as cited by EPA. (2002).

CHAPTER THREE

3.0 METHODOLOGY

3.1 INTRODUCTION

This chapter carries the following information

i. Research design
ii. Study area
iii. Sample and sampling techniques
iv. Instruments used
v. Procedure of data analysis
vi. Method of data analysis and
vii. Method of data presentation

3.2 RESEARCH DESIGN

The research design used in this project was the experimental research design.

3.3 STUDY AREA

Jimeta is the headquarter of Yola in Adamawa state, it is situated in the northern part of Adamawa and north – eastern part of Nigeria. The maximum temperature is 30°c and the minimum temperature is 19°c. The people living in Jimeta are mostly are civil servants and business men and women only a few engage in farming and livestock rearing, the population of Jimeta is about 325, 956 (census, 2006).

3.4 SAMPLE AND SAMPLING TECHNIQUES

50 samples of water was collected randomly from the various sources of drinking water, that is 15 well water, 15 bore hole water, 15 tape water and 5 river water, Within Jimeta metropolis.

3.5 INSTRUMENTS USED

The following instruments were use in the laboratory in carrying out the experiment.

1. Sample bottle (clean and sterilized bottle)
2. Incubator
3. Forcep
4. Slides
5. Small beaker
6. Petri-dishes
7. McConkey agar
8. Microscope (electrical microscope)
9. Sample (water samples)
10. Measuring cylinder
11. Wire loop
12. Bunsen burner
13. Conical flask
14. Distilled water
15. Oil Immersion

3.6 PROCEDURE

20.0g of powered McConkey Agar was weighed and dissolved in 500ml of distilled water in a clean sterilized conical flask. It was allowed to soak for 10minutes, was mixed and sterilized in an autoclave at 121°c for 20minutes. It was cooled to 17°c and was agitated gently to ensure uniform distribution of the precipitate and was poured into the petri dishes.

1. Small quantity of the various sources of drinking water was collected randomly and labeled W (well Water), R (River Water), B (borehole water) and T (tape water).

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1. Small quantity of the various sources of drinking water was collected randomly and labeled W (well Water), R (River Water), B (borehole water) and T (tape water).

2. The petri-dishes were labeled W,R,B and T for the total coliform count (TCC).
3. About 3ml of the McConkey Agar was then poured into the petri-dishes aseptically and was allowed to cool.
4. The water samples were inoculated on the Agar medium and incubated in an inverted position at 37°c for 24 hours.
5. A smear was made on the slides using distilled water and the growth on the agar medium, it was air dry and stained.
6. The slides was then viewed under the microscope for the presence of coliform bacteria and the count was taken.

3.7 METHOD OF DATA ANALYSIS

Simple percentage (%) was used for data analysis.

3.8 METHOD OF DATA PRESENTATION

The data was presented in a tabular form.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 INTRODUCTION

Escherichia Coli was viewed under the microscope and isolated as coliform bacteria, it took the colour of crystal violet when viewed under the microscope. The result of the analysis are as shown below. The full meaning of TNTC is Too Numerous To Count.

4.2 PRESENTATION OF RESULTS

TABLE 1: the following shows the result of coliform in well water.

TCC IN WELL WATER	ESCHERICHIA COLI
W1	+ 20
W2	TNTC
W3	-
W4	+ 10
W5	+50
W6	+ 15
W7	-
W8	+ 30
W9	TNTC
W10	-
W11	+ 40
W12	TNTC
W13	TNTC
W14	+ 60
W15	TNTC

Calculation of percentage.

% of coliform bacteria in well water ($W - H_2O$)

Total no of $W - H_2O$ samples collected = 5

No of $W - H_2O$ samples contaminated = 10

% of coliform in $W - H_2O = \frac{10}{15} \times 100$

$= 66.66$

$= \underline{67\%}$

TABLE 2: the following shows the result of coliform in river water.

TCC IN RIVER WATER	ESCHERICHIA COLI
R1	-
R2	TNTC
R3	-
R4	+ 50
R5	-

Percentage of coliform in river water ($R - H_2O$)

Total no of $R - H_2O$ Samples collected = 5

No of $R - H_2O$ Contaminated = 2

% of coliform in $R - H_2O = \frac{2}{5} \times 100$

$= \underline{40\%}$

TABLE 3: the following shows the result of coliform in bore hole

TCC IN BOREHOLE WATER	ESCHERICHIA COLI
B1	+ 40
B2	-
B3	TNTC
B4	-
B5	TNTC
B6	+ 50
B7	-
B8	-
B9	-
B10	TNTC
B11	-
B12	+ 50
B13	-
B14	TNTC
B15	-

% of coliform in bore hole water (B - H_2O)

Total no of B - H_2O samples collected = 15

No of B - H_2O samples contaminated = 7

% of coliform in B - H_2O $= \frac{7}{15} \times 100$

$= 46.666$

$= \underline{47\%}$

Table 4: The following shows the result coliform in tape water

TCC IN TAPE WATER	ESCHERICHIA COLI
T1	-
T2	-
T3	-
T4	-
T5	-
T6	+ 20
T7	TNTC
T8	-
T9	+ 40
T10	+ 50
T11	-
T12	+ 30
T13	-
T14	-
T15	-

% of coliform in tape water

Total no of T - H_2O Samples collected = 15

No of T - H_2O sample contaminated = 5

% of coliform in T - H_2O = $\frac{5}{15} \times 100$

= 33.33

= 33%

TABLE 5: Results of % of coliform in all the water sources

NO OF WATER SAMPLE COLLECTED		NO OF CONTAMINATED WATER SAMPLES	% OF COLIFORM IN THE WATER SAMPLE
Well water	15	10	67%
River water	5	2	40%
Bore hole water	15	7	47%
Tape water	15	5	33%

4.3 DISCUSSION

The result of the study on coliform analysis of water from the various sources of drinking water (50 samples of water) was collected randomly with in Jimeta metropolis for analysis (15 well, 15 bore hole, 5 rivers and 15 tape water) some of the water samples contained high colony of coliform. Out of the 50 samples of water collected and analyzed for coliform, the sources of drinking water containing the highest number of Escherichia coli is the well water with 67%, followed by bore hole water which has 47% river water which has 40%, and lastly tape water which has 33%.

The high coliform count in water indicates possible high microbial load other than coliform organisms. Pollution may occur deliberately or

mistakenly from children playing around the water sources, pollution is also possible from dust, buried corps in the locality may also contaminate the water through infiltration, sewage effluence may find their way into water through channel created by roots and also animals and human being defficating around the water source may lead to its contamination (carpenter, 2000). The table below show the water sample with the highest percentage of Escherichia coli.

CHAPTER FIVE

5.0 SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 INTRODUCTION

Before this chapter the experiment has already been carried out with results, the following is what the chapter contains.

i. Summary
ii. Conclusion
iii. Recommendation

5.2 SUMMARY

In summary, the research work results revealed that almost all the water samples analyzed in the laboratory contained coliform after 24 hours of incubation only a few has no trace of Escherichia coli in it.

5.3 CONCLUSION

In conclusion, base on the research findings, it was observe that well water has the highest coliform count then after that bore hole, river and tape water respectively. While according to the WHO and EPA standard of drinking water, water should contain zero (0) colony of coliform per 100ml of water.

To this event, it is necessary to find ways of improving the quality of these water since the number of microorganisms are above the standard given by world health organization and environmental protection agency.

5.4 RECOMMENDATION

From the result of this research work, the following are recommendation for both government and individual.

1. Since the provision of standard well, borehole and tape water is too expensive and not within the reach of the poor, there is a need for government to provide a way of water supply to the people.
2. Activities around water sources like washing of clothes and household utensils should be restricted to avoid contamination.
3. The water sources provided should be sited in places were they will be no contamination of any kind, also the water should be tagged quality water.
4. Grazing around the sources of drinking water should be avoided since warm blooded animals Harbour E. Coli.
5. Water sources like wells should be properly covered after usage to avoid contamination.
6. Government should encourage good sanitary habit and health education so as to educate the community on the dangers of water borne diseases.
7. Elders should stop children and live stocks from polluting the water bodies e.g. well and river water.
8. Individuals should cultivate the habit of boiling water from the various sources (well, river, borehole and tape water) before drinking.

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