Isolation and Identification of Gastrointestinal Bacteria in Drinking Water Sources in Gwallameji, Bauchi

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Abstract- The aim of this research work therefore is to examine and evaluate the common sources of water in that locality, Gwallameji, Bauchi, Bauchi state Nigeria in order to examine their qualities with a view to determine their portability. A total of ten (10) water samples collected from five (5) different vicinity in that study area were subjected to physicochemical and bacteriological analysis. From the findings, it shows a great bacteria contamination of the water from wells and tap-water, it is recommended that the water from these sources tap and well in the study area (Gwallameji) to be properly treated before human consumption and other domestic purpose.

Indexed Terms- Isolation, Microorganisms, water quality, Bauchi.

I. INTRODUCTION

A. Background of the study

Water is an invaluable commodity to man, animals and plant. It is one of the basic requirement to life and ranks second to air in order to importance [22]. Water also serves as an effective medium for the spread of most disease (water borne disease) particularly disease like gastrointestinal disease. Globally the commodity is obtained from various sources like rain, water, surface streams, ponds, lakes, wells, boreholes, springs etc. Despite various sources of water portable domestic water supply remains a major problem especially in the developing countries with a progressive increase in water related disease.

In Nigeria a majority of the population lives in rural and semi-urban areas, with wells and Boreholes represents significant sources of domestic water supply. These sources are constantly contaminated by human or animal faeces [13]. Wells less than hundred feet (100ft) are considered to be shallow because this may proffer a possible sources of contaminant.

The need for safe drinking water inadequate quantities still possesses a serious problem in developing countries like Nigeria [8]. With the ever increasing human population, safe portable water has become vital for the survival of populations making it imperative that water from pathogen free sources must be consumed [14].

B. Statement of Problems

Gwallameji community is a typical Nigeria rural community in Bauchi. In recent times cases of gastro intestinal infections has been reported in this community with food and water most implicated as a major medium of infection spread.

Water is essential to life, but many people do not have access to clean and safe drinking water and many die of water borne bacterial infections. In this review a general characterization of the most important bacterial diseases transmitted through water; cholera, typhoid fever and bacillary dysentery is presented, focusing on the biology and ecology of the causal agents and on the diseases' characteristics and their life cycles in the environment. The importance of pathogenic *Escherichia coli* strains and emerging pathogens in drinking water-transmitted diseases will be also briefly discussed.

C. Justification of the Study

Gastrointestinal bacteria caused infection gastroenteritis as a result of the consumption of food or water that they are found or their toxins. It caused an inflammation in the stomach and intestine.

In general terms, the greatest microbial risks are associated with ingestion of water that is contaminated with human or animal faeces. Water from wells, taps and streams are the major source of

feacal microorganisms, including pathogens in Gwallameji community.

This study is carried out for the purpose to have the actual occurrence of gastrointestinal bacteria in that particular area of study there by providing the control ways to get rid of them.

D. Aims and Objectives

AIM

To isolate and identify gastrointestinal bacteria in drinking water sources in Gwallameji

OBJECTIVES

- To identify the common sources of domestic water supply to people in Gwallameji.
- To analyze the water from the selected sources with the view to determine their portability.
- To examine the level of variation in the quality of the water within the proposed study area.

II. LITERATURE REVIEW

Bacteria constitute the most successful form of life in environmental habitats. The main reason for this success is phenotypic plasticity. It is the ability of a bacterial genotype to respond phenotypically to environmental stimuli, rather than the power of its genetic repertoire, that has produced the extensive development of bacteria. A general phenotypic strategy has little by little become apparent in many bacterial strains, as we have come to understand more of the lifestyle that these organisms are able to adopt in response to changing growth conditions.

Direct observation of a wide variety of natural aquatic ecosystems as drinking-water habitats has established that the cells of *Pseudomonas spp*., which are ubiquitous bacterial species, respond to favourable nutrient conditions by adhering to available organic or inorganic surfaces and by binary fission and exopolymer production to develop mature biofilms. These rod-shaped gram-negative cells grow predominantly in this matrix-enclosed sessile mode, in which they are protected from adverse environmental conditions and chemical antibacterial agents. Thus, the majority of microorganisms persist attached to a surface with a structured biofilm ecosystem and not as free-floating cells. The most striking studies with P. aeruginosa [7] have shown that the planktonic biofilm transformation is controlled by a σ factor that is similar to that which controls sporulation in gram-positive bacteria.

Biofilm bacteria could be the product of a σ factor-directed phenotypic change in a large cassette of genes. The reversal of this σ factor-directed change would generate cells with the planktonic phenotype and would lead to the detachment of these planktonic cells from the biofilm. The data suggest that the planktonic lifestyle is favoured for dissemination and for persistence in a survival form, while the biofilm sessile state is favoured for growth. The assumption of life cycles in the development of bacteria in drinking-water, including alternating shifts between planktonic and surface-attached stages, is particularly attractive for the understanding of persistence and sometimes growth of pathogenic microorganisms in drinking-water distribution [23].

Coliform bacteria, thermotolerant (faecal) coliforms and *E. coli* have, for almost a century, been used as indicators of the bacterial safety of drinking [17]. However, their use in isolation to predict the viral and protozoal safety of drinking-water has been questioned since the 1970s. The failure of these indicators in isolation has been demonstrated by recent outbreaks of waterborne cryptosporidiosis. As pattern indicator of bacterial enteric pathogens, it appears essential to assess the behaviour of these organisms in the freshwater environment and particularly in water distribution system biofilms. Most health scientists tend to believe that all strains of E. coli are incapable of significant growth in the environment. For instance, [18] reviewed the results of more than 40 field and laboratory survival experiments and did not report cases of coliform growth. In one extensive review on *E. coli*, [10] discussed various variables that affect its life span in both natural and laboratory conditions, which could range between 4 and 12 weeks in water containing a moderate microflora at a temperature of 15–18°C. Survival or growth is determined especially by the nutrients present,

temperature and chlorination. When most conditions conducive to their growth have been met, E. coli can multiply in experimental studies or in the natural aquatic environment. This question was clarified substantially by [16] in a study in which water from the North Oconee River, Georgia, USA, was used as a nutrient source for selected pathogenic and non-pathogenic enteric bacteria. At a defined dilution rate of river water in a chemostat, various strains, including *E. coli*, *Salmonella* and *Shigella spp*., grew. The generation times ranged between 3.33 and 90.0h at 30°C. At temperatures below 30°C, generation times for all organisms tested increased, and die-off occurred in most cases at 5°C. *E. coli* are not particularly fastidious in their growth requirements; therefore, presumably the potential exists, as it does with other coliforms, for regrowth in nutrient-rich waters. This potential was recorded in the wastewater body of a pulp and card board mill, leading to the isolation of a large population of *E. coli* well adapted to this ecological niche [21]. Another example of a bloom of E. coli in a raw water reservoir has been described in [3] Numerous studies [17]; [15] have documented that coliforms other than *E. coli* frequently colonize water mains and storage tanks, growing in biofilms when conditions are favourable — i.e., nutrients, water temperature, low disinfection concentrations, long residence times, etc. For *E. coli*, the question is largely debated. [11] under conditions to simulate the conditions at the far reaches of a distribution system.

In the studies of [11], both *E. coli* strains separately injected were able to grow at 20°C in the absence of residual chlorine in a distribution network system largely colonized with an autochthonous population. However, colonization of the network by *E. coli* was only partial and transient. This is in contrast to the results of the studies of [20], carried out on a large-scale pilot distribution system (1.3 km), which showed that E. coli can survive for several days in a dead-end section of the distribution system, but does not multiply within a biofilm. However, most of these studies are small scale, and, while valuable for increasing the understanding of the factors governing the growth of coliform bacteria, they cannot create all the conditions found in distribution systems or simulate the various factors of natural contamination. Therefore, it is assumed that there is no convincing published evidence that *E. coli* can grow within drinking-water systems.

Water is substance which plays a crucial role in the existence of life on earth. It forms the living mass and together with the soil and the air, represents the living environments. Also water connects the human with all the element of this environment in such a manner that any change results in a chain of consequences which spread throughout the ecological system management of water resource has long been recognized as a means of fostering economic and social progress in many communities. Man benefits from water in various way such as irrigation for production of food, hydroelectric power generation for domestic, commercial land industrial supply and use, river improvement for navigation and control of flood to protect lives and properties. It has become increasingly evident that waste discharges and impairing water quality in many parts of Africa. In certain cases, important sources of water supply have been destroyed. The causes of this deterioration of water quality in many parts of Africa. In certain cases, important sources of water supply have been destroyed. The causes of this deterioration of water quality include the acceleration growth of human population could with increased urbanization; and rapid industrialization of the few cities where considerable waste are discharged into water course [19].

A. Sources of Water Pollution

Water pollution in developing countries like Nigeria is mainly from sewage, oil and industrial wastes. It could also result from organic waste such as lead, mercury, zinc, cyanide and copper which find their way into water sources either discrete or absorbed in other materials [9]. Different sources of water supply have different routes of contamination or pollution. The contamination of wells is due to improper construction of well. Shallowness, proximity of toilets facilities sewers and refuse dumping site and various human activities around the wells [27].

Wells should therefore be dug away from possible sources contamination [[14]. Enteric pathogens may occasionally be carried into wells though

underground seepage as observed by [14]. According to [28], well should be constructed at least 30 metres from sources of contamination e.g Pit latrines, or soak away.

Pollution can also occur due to human activities like bathing and washing clothes around wells or it could be due to animal wastes and activities as observed by [15]. Contamination of pipe borne water could be due to the poor maintenance and operational procedure in the system. [30] reported that developing countries still suffer from health problems as a result of unsafe sources of water supply which comprises Tap water, shallow well water, bore-hole water, spring water and rain water.

These sources reflected different sanitary levels from a microbial stand point and shallow well water, Tap and pond water have, low sanitary level as noted in Bauchi State of Nigeria where pipe borne water consists of less than 10% of total water sources. [5] noted that crude sewage common course contamination was a source of the most important pollution of water beside supplying organic nutrients, it could contain all the agent causing enteric infection diseases in man. Monitoring the pathogens in sewage gives an indication of organism which may be acquired through water.

B. Water as Source of Food Contamination

Studies shows that water serves as good sources of food contamination. In Samaru Zaria, studies by [10] showed that water sample from preparation point of "Kunun zaki" were highly contaminated by fecal coliforms. coliforms contamination of "Samco" and "Fan" milk was also attributed to the water used in reconstitution the milk [23].

C. Transmission of Water Borne Diseases

Several enteric pathogens such as bacteria, virusès, protozoa

Cysts, helminthes eggs or larvae often discharged in enormous numbers through human feaces can be transmitted by water. Diarrhea which can lead to severe dehydration claims over 50,000 line daily worlds wide [12]. The entire pathogens are exerted in the fences of infected industrials, enter into domestic sewage and in turn may contaminate drinking water sources. Some of these water borne discases caused by bacteria include the following: Cholera: caused by gram-negative, comma shaped bacterium. *Vibrio cholera*, the disease is characterized by sudden diarrhea with, profuse watery stool, vomiting rapid dehydration, full of blood pressure and sub-normal temperature may lead to collapsing and eventually death within 48 hours if medical care is not given.

Contaminated water can also serve as a vehicle in the transmission of drancunaliasis (guinea-worn disease) in which worm larvae are discharged through the skin of the sufferer and develop in an intermediate host, the crustacean cyclops, which may be swallowed when affected water is drunk [24]. However, it has been pointed out that at each stage of the hydrological cyele, changes occur in the quality of the water, in the nature and amount of dissolved and suspended substances which it contains. [25]. The cycle also develops a complex interdependent population of bacteria. Algae, Protozoà and larger paints and animals. Water which is percolated into the ground beyond the soil layer is usually fairly free of living organism, organic matter and suspended solids but may be rich in dissolved minerals as well as containing passes of decomposition such as carbondioxide and hydrogen disulphide.Typhoid fever: In man disease occurs as an acute gastro-enteritis characterized by a continued high fever and infection of the spleen and blood. Typhoid and Para-typhoid fever are clinically similar. The causative agent is a gram-negative lactose fermenting rod. *Salmonella Spp*. In chronic carries, the bacillus is lodged in the gall-bladder from which they are excreted in to facces. Shigellosis: this is also known as bacillary dysentery. It is characterized by frequent passage of blood-stained, mucous-containing stool. The genus *shigella*, like salmonella, is in the family enterobacteriocеae. But can be easily distinguished because *shiegella* does not produce hydrogen sulphide (H2S) .

Some pathogens like the enteropathogenic Escherichia coli is normally a harmless commensal in the alimentary canal of man and other animals.

However some serotype frequently cause gastro enteritis characterized by severe diarrhea with little mucus, blood, and with dehydration but usually without fever. Children especially infant are usually

affected by increasing cases of adult diarrhea caused by *E. coli* have been recorded. The cases usually, due to contaminated drinking water [26]. The bacteria found to be associated with tap and well water includes *bacillus, michromdbacter, micro-Coccus, enterobactar, pseudomonas, proteins flavobacterium, staphylococcus, salmonella* etc. Viruses have been dictated in drinking water at an increased frequency [6].

D. Determination of Water Pollution Using Indicator Bacteria

Among the three sources of water contamination, biological contamination in which the primary concern is the absence of pathogens is the focus of the work. Test for the various water borne pathogenic bacteria like typhoid bacillus (*salmonella typhi and Salmonella paratyphi*) would obviously comprise the most direct and actual rove of a dangerous impurity but these pathogen, if present are usually so scanty that the technically of their isolation makes the test impracticable for ordinary purpose. [7], expressed that it is not in practice possible to test drinking water for the numerous pathogenic organisms including viruses, protozoan, bacteria and fungi that may be present. To do this would be different and time wasting. Indicator organisms are tested for instead.

The indicator organism used are the coliform group of organisms [28] confirmed that coliforms are members of enteric bacteria. Information reviewed by [19] and [1] showed that coliforms are non-sporing intestinal bacilli and capable of growing in the presence of oxygen on media that contain bile salts. They are members of the family enterobacteriales. They are oxidase negative, aerobic, facultative anaerobic and gram negative, aerobic, facultative anaerobic and gram negative.

They are rod shaped bacteria and ferment lactose which gas production within 48 hours at 37°C. The coliform group are suitable indicator because they are common inhabitant of the intestinal tract both of man and warm blooded animals and are generally present in the intestinal tract in large numbers as cited by [29]. Many workers have developed and improved on some of the media and methods used for coliform enumeration. Among these are [8] a comparism of the confirmatory media for coliform and *E. Coli* in water was made by [5]. Gas production by these organism from laurel tryptose lactose broth (ITLB) was compared with that from brilliant green lactose broth (BGLB), and were both compared with laurel tryptose mannitol broth with and without added tryptophan. They observed that at 37 BGILB and BGLB were both satisfactory for gas production.

Thee are various methods which exist for enumeration and recognition of bacteria present in water, and include the most member techniques, point plate method and membrane filter techniques. [7] reported that using these three methods for detection of coliforms in water, the most probable number techniques gave greater reeovery followed by pour plate method it is customary to report the result of coliform test by multiple tube fermentation techniques, standard methods [1].

E. Species of Coliforms Associated with water

Clinically, important coliforms include species of *Eacherichia, Klebsiella, Salmonella, Shigella* and *Proteus* and other ther pathogenic coliforms are found but their low level frequency make it difficult to use them as indicators of feacal pollution. According to [9] *Escherichia coli* counts can be relied upon as indicated of pollution. He organism is universally present in large numbers in the feaces of man and other warm blooded animals. Thus, permitting their detection after considerable dilution. Two forms of coliforms exists, typical and atypical coliforms. The typical forms are those of eacal origin example *Escherichia coli*, while the atypical forms are Entrobal which are tropicsent and solid and vegetations and therefore their presence in water is never indicative of feacal pollution, The existence of typical coliform bacteria in a water system is indicative of recent feacal pollution, since they do not survive long in water [13]. Bacteria pollution of water may originate either individual with clinical symptom of disease or from symptomless such as typhoid bacilli. Pathogens are difficult; to detect in water for a number of reasons, they may be present only sporadically as a result of intermittent excretion and dilution unless water is being continuously contaminated or polluted from infected sources.

Water in the distributive system may become contaminated through defective storage wells and services reservoir, damaged hydrant. Such contamination may originate from wastes, eftfluents from intestines of animals in cattle, cattle rearing units, from rodents or sewers. The isolation of pathogens necessitics the concentration of large volume of the suspected water and the use of selected media. Bacteriological tests to determine the suitability of water for drinking are designed therefore to detect the presence in-the water of organization of the normal flora of the gut.

The coliform bacilli are the most reliable indicators of recent feacal pollution while sporing anacrobes such as clostridium indicates pollution of the remote period. The detection of few *Escherichia coli* in water is sufficient to condemn water as unfit for human consumption even if no pathogen is found in. To satisfy the guideline of bacteria quality, it is important and advisable that samples should be examined regularly far indicators of feacal pollution and thus provide useful information for engineers and health authorities. At a particular test period conclusions cannot be made from a single especially if the water sample fails but from at least 3-5 repeats. One of the main tasks of water microbiology is the development of laboratory methods that can be used to detect the microbiological contaminants which might be present in drinking water. The routine examination of water includes quantitative test for all coliforms, known as the presumptive coliform bacilli, *Escherichia coli* known as different form test and the confirmed test and completed test [25].

III. MATERIALS AND METHODS

A. Study Area

Gwallameji community, in Bauchi local government of Bauchi State, located at 8km Dass road.

B. Collection of Sample

The people living in that locality were informed prior to the study for introduction and explanations on the purpose of the study and its benefits. The water supply sources were fully identified and coded respectively. The parameter used in selecting water sources, these includes human activity, location and distance apart a total of ten (10) samples were collected from the community nine (9) well sources and a (1) Tap source.

The samples were collected in sterile sample bottle (Bijouir bottle) previously sterilized at 160°c for 1 hour. The principle of aseptic processes was fully employed to eliminate external contamination. Since the water samples used were not treated water, no neutralizers was added to the bottles before sample collection.

C. Well Water-Collection Process

A sterile rope was tied on the neck of the sterile bottle which was used to collect water samples from the well. The sample bottles were lower to the depth of 30cm (1 foot) below the surface of the well. The bottle was filled and with drawn quietly and poured in the sterile laboratory sample bottle.

This method of collection of surface water which may contain a good number of decomposing vegetable matters and may alter the result of the study.

D. Tap Water- Collection Method

In the case of Tap water, the bottle was inserted (mouth downward). 30cm below the surface of the water, the bottle was then turned and the mouth directed to the water with the cover unremoved. The bottle was then opened inside the water, allowed to fill up and the cover rescrewed and finally brought out. The samples were taken to the laboratory for immediate analysis.

E. Media preparation

All media was prepared according manufacturer's standard: For 10 samples, 5.63 grams of Eosine Methylene Blue Agar (EMBA) (was supplied to a pre-weighing container) was dissolved in 150mls of sterile distilled water in a conical flask. The mixture was heated to ensure the powder is fully dissolved, The media was sterilized in an autoclaved at 121°C for 10 minutes. The media was allowed to cooled to room temperature, and 15mls was poured onto each of the petri-dishes.

F. Membrane filtration method

This method was used to estimate the number of total and faecal coliforms bacteria in 100mls of the water

sample using Eosin Methylene Blue Agar (EMBA). Firstly, 100mls of the sample stock was introduced aseptically into a sterile filtration assembly containing a sterile membrane filter (nominal pore size 0.22µm). A vacuum was applied and the sample was drawn through the membrane filter. All indicator organisms was therefore retained on the filter, this was then transferred to a selective medium in a Petri-dish. The Petri-dish was transferred to an incubator at 37o C for total coliforms and 45o C for thermotolerant coliforms count for 24 hours. Visually identifiable colonies was formed usually yellow in color and will be counted using a colony counter or with a hand held lens, the result was expressed in numbers of colony forming unit (CFU) per 100mls of original sample.

G. Counting of coliforms growth

Following incubation, the power was switch off and each petri-dish was removed from the incubator. The petri-dishes was placed on the surface of the work bench and the lids also and a count of all the shiny metallic green colonies will be done irrespective of size using colony counter or a hand lens will be used were necessary.

H. Microscopic examination of colonies

Bacterial colonies that developed on solid media are analyzed for gram staining and mortility.

I. Gram Staining

A smear of each bacterium was prepared by placing a drop of sterile distilled water in the middle of a clean slide. A loopful of the test organism was picked with a flamed inoculating loop. This was rubbed on the drop of water on the slide and emulsified into a thin smear on the slide. The smear was air dried and fixed by passing the reverse side of the slide over a naked flame 3-4 times. The slide was flooded with crystal violet solution (primary dye), left for a minute and washed under a tap. Addition of iodine solution (mordant) for a minute. This slide was gently washed with water after a minute. The smear was decolorized by washing with 95% ethanol for 10 seconds. The ethanol was rinsed with water and safranin which acts as counter stain was added and left on the slide for a second. This was drained and washed gently under a tap and blot dried. The prepared slide was then examined under the x40 and x100 (oil immersion) objective lens. Gram positive cells stained purple to blue while Gram negative cells stained red to pink. The cellular shape and arrangement were also observed [26].

J. Biochemical Tests

K. Coagulase Test

This was used to identify bacterial isolates that possessed the ability to produce coagulase. Coagulase is a protein enzyme produced by several microorganisms that enables the conversion of fibrinogen to fibrin. The slide coagulase technique was employed. This was done by emulsifying the colony in a drop of water on a slide to obtain a homogenous thick suspension. A flamed inoculating loop was dipped in human plasma and stirred gently with the homogenous thick suspension. Positive result was indicated by visible clumping within 10 seconds which confirms the presence of the enzyme coagulase [25].

L. Catalase Test

A drop of 3% hydrogen peroxide were placed at the centre of slide using a pasteur pipette and a loopful of the isolated colonies were placed into the hydrogen peroxide using a sterile wire loop. The production of gas bubbles indicates the presence of streptococci [6].

M. Indole Test

The test organism was inoculated in a test tube of 4 ml of sterile tryptone water .it was incubated at 370 for 72 hours.15 drops of kavoc's indole reagent were added gently shaken and examined within 10 minute.

N. Citrate Test

Slants of the medium were prepared in test tubes using s sterile wire loop. The slant were streaked with a suspension of the test organism and incubated at 350C for 48 hours and examined for bright –blue colour in the medium.

O. Urease Test

The test organism was inoculated by stabbing the butt first and surface of slope were sterak in a zigzag pattern.It will then incubated at 370C for 24 hours.Absence in colour change indicated Urease negative [8].

P. Kligner Iron Agar (Kia)

The test organism was inoculated by stabbing the butt first and surface of slope will be sterak in a zigzag pattern. It will then incubated at 37°C for 24 hours. This test will indicate Production of gas, hydrogen Sulphide production, glucose fermenter, lactose fermenter and motility of the organism [12].

Q. Results

R. Water Analysis

Features of water samples collected from wells and tap in Gwallameji community.

Table 4.1: Physicochemical parameters of the water

Sample code	Description of wells	Distance (m) latrine	Color	pH	Temperature
W1	UCR, LL	13.5	Transparent	6.4	27
W2	CR, LL	6.5	Grayish	6.7	21.2
W3	UCR, HL	5.5	Transparent	6.5	22
W4	UCR, HL	5.5	Transparent	6.8	27
W5	CR, HL	14.0	Transparent	6.7	27
W6	UCR, HL	6.5	Grayish	6.6	26
W7	CR, HL	13.0	Grayish	6.9	24.2
W8	UCR, LL	8.5	Transparent	6.4	26
W9	UCR, LL	13.5	Cloudy	6.8	26
Tap		18.5	Cloudy	7.4	29

Keys:
W = well
UCR = Uncovered
CR = covered
HL = High Level
LL = Lower Level

4.2 bacteriological counts of water samples in Gwallameji. The Table shows the result of total and faecal (thermotolerant) coliforms analysis in the study area using membrane filtration and the results were compared with the WHO standard.

Table 4.2: results of Bacteriological counts of water samples in Gwallameji

Location	Sample code	Total coliforms (CFU/100ml)	Thermotolerant coliforms (CFU/100ml)
Uncovered, Low Leveled well at Doka	W1	12	0
Covered, High Level well at Doka	W2	16	0
Covered, Low Level at Doka	W3	14	0
Uncovered, High Leveled well at Gidan Gona	W4	20	0
Covered, High Level well Gidan Gona	W5	11	0
Covered, High Leveled well at Anguwan Sunday	W6	16	0
Uncovered, High Leveled well at Anguwan Sunday	W7	12	0
Covered High Level level at Anguwan Sarkin Yamma	W8	18	0

Uncovered Low Level well at Anguwan Sarki Yamma	W9	13	0
Federal polytechnic	Tap	9	0
WHO Maximum Permitted limits		10 CFU/100ml	0 CFU/100ml

Table 4.3: Organisms Isolated

Sources of sample	GR	Indole	Citrate	Urease	Catalase	Coagulase	Lactose	H_2S	Glucose	Motility	Organisms isolated
W1,w2,,W5,W6, W9	- rod	+	-	-	-	-	+	-	+	+	*Escherichia coli*
W4,W5,W7	- rod	-	-	-	-	-	-	-	-	-	*Shigella species*
Tap	+ rod	-	-	-	+	-	+	-	-	-	*Enterobacter species*
W1,W3,W96	- rod	-	+	-	+	-	+	+	-	-	*Salmonella spp*
W2,W7,kW9	- rod	-	+	-	-	-	+	+	-	-	*Bacillus species*
W3,W5,W8	- rod	-	+	+	-	-	-	-	+	+	*Proteins species*
Tap, W8	+ rod	-	-	-	+	+	-	-	+	-	*Staph aureus*

IV. DISCUSSION

The result obtained form the analysis in Table 4.2 showed a great bacteria contamination of wells and Tap-water samples available in Gwallameji community village. Wells samples in Table 4.2, IX and II, VIII has the highest coliform count followed by well IV.

They have coliform count of 13, 16, 18 and 20 respectively. The reason for the high number of bacteria in this wells could be linked to the fact that there could be easy assess of running water seepage into this well. Their locations and distance to toilets also accounts and also the fact that the season (rainy season) in which this study was carried out also plays a role in the contamination of this wells.

According to Freedom (1977), wells should be dug up, the slope of the water away from possible sources of contamination. However, most of the wells in this study were constructed contrary to this and other recommended guidelines.

Tap has coliform count of 9. This is because, steam which is suspected to have the highest number of bacteria count unlike the wells flows and as are result, might have flushed of the deeply contaminated site before the samples were collected for analysis. That is why the Tap is found to be lesser contaminated than other wells irrespective of the fact that it has the high sewage seepage than the wells. Secondly, Tap has the highest radiation power than the wells owing due to the fact that Tap has a wider expanse than wells which is concentrated, so the rate at which sun light penetrated the tap is high than that of the wells. So this radiation power helps in killing of some bacteria in water.

Going by the [29] stipulated that presence of colforms in drinking water constitute possible health hazard to the consumer of such water and drinking water should not contain more than one typical coliforms per 100ml of water. This was also illustrated by Adesiyum et al (1983) while studying well water in Katsina and [8] while studying well water and tap water in Zaria.

The isolates includes, *Escherichia Coli, staphylococcus Specie, Enterobacter Specie, salmonella specie, shigella specie, Bacillus Specie, Proteus Specie, Staphylococcus Specie* etc. These results are in agreement with a similar work done by [1] conducted in Niger-Delta. He isolated similar pathogenic micro organisms such as *klebsiella, Pneumoniae, salmonella specie, Pseudomonas specie, Shigella specie* which are of public health significance. The difference with this work is that wells which are a source of drinking water sources and type of people living in a rural village like Gwallameji community is being analysed.

The identification of *E coli* using such properties as their cultural and macroscopic and' biochemical properties like showing circular,distinct metallic green sheen colonies on culture with eosine methelene blue agar, gram-negative short rods and production of indole and being a lactose fermenter with the production of acid and gas is used. The incidence of this pathogen in the drinking water sources strongly suggest that the outbreaks of gastrointestinal infections in the areas are strongly related to poor human activity around the drinking water sources. *Staphylococcus aureus* is also due to human activities such bathing, washing etc. it's clinical importance is in the out break of boil and dysentery to the public. *Salmonella specie* also results as a result of human actives too and this introduces typical colforms into the drinking water sources resulting in typhoid fever, malaria and cholera etc. This result closely agreed with [30]. When they analysed river water and discovered *staphylococcus aureus* and other microorganisms and also concluded that its occurrence could be due to human activities as can be seen from the project *Escherichia coli*. is present in wells I, II, V, VI and IX, and *Staph specie* found in tap and W8 as *Bacillus* is found in W2, W7, W9 respectively. These diseases are common among children and adults in the community. Bacillary dysentery and lice were the most prevalent occurring infection in both adults and children. Bacillary dysentery is grown to be as a result of contaminated water source, while lice are a result of poor personal hygiene. Next is malaria which is a result of the type of housing in the study areas (as in most areas of Nigeria), where the window and doors are not screened with nets and the mosquitoes which come form dirty waters around the surrounding of the house are not kept out. Poor ventilations and over crowding of person per house hold are additional factors which increase the vector. Competence of mosquitoes and other arthropods involved in disease transmission in the area. Conductivities is also a prevalent infection on both area which is a result of lack of good water even though dry season also as a factor. It can be established that to a great extent the people are right in their beliefs because lice, bacillary dysentery, diarrhea, conductivities and stomach ache jointly comprising 48.2 % of the diseases amongst adult and 51.8% amongst children are caused h contaminated water, insufficient and or poor quality of water.

Most of the *bacillus species*, according to [10] are *saprophytic* and prevalent in water, soil, air and on vegetables. Enet et al also reported that the species of *staphylococcus aureus* are indication from human activities such as bathing and washing of clothes around the wells and streams since *staphylococcus species* are normal flora of human body found on the skin cavities and mucus membranes of humans, [19] *Enterobacter specie* which has a world wide distribution as reported by [24] are found in natural habitats such as soil, water plants of all types, fish, insect and other animals. *Proteus species* are found in the feaces of higher animal, sewage soil and garden vegetables [28].

Presence of animals and plants in addition to human activities can lead to the introduction of some of these organisms into water.

4.1 Conclusion

Based on the analysis on the drinking water sources available in Gwallameji community, the coliform counts as evident from the analysis revealed gross pollution exceeding the world Health Organization standard of 10 coliforms per 100ml of water, in addition to the incidence of such organisms as *Staphylococcus aureus, Bacilleus Species, Staphylococcus species, Enterocbacter species, Escherichia coli* which can be enteric to human health in one way or the other. Especially the recovery of coliforms in the food of this community indicates feacal contamination implying that the

villagers are at high risk of exposure of being infected.

In view of the adverse effects noted, the provision of adequate portable water supply and the treatment of the available ones is an appropriate approach for minimizing health risk associated with the use of contaminated water in the community.

4.2 Recommendations

Following the findings of the study, the following recommendations are made:

1. Since these are the major sources of drinking water (wells and tap) available in this community studied and it is difficult to prevent the people from bathing and washing clothes etc around the wells and tap. It is therefore important to engage on public enlightenment campaign through health education on the need to boil drinking water before consumption.
2. It is recommended that wells should be constructed 100m away from all latrine environments.
3. The community should be abreast concerning the gastrointestinal infections prevalent in the community as brought about by contaminated water.

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