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Bacteriological Characterization Of Tap Water In Umar Suleiman College Of Education Gashua Campus, Yobe State

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ABSTRACT

Water is very important in life for proper function of the human body. The increasing demand for domestic water has led to the indiscriminate use of underground water, such as wells and tap water as a main source of water without regard to portability for human and animal consumption. Bacteria were among the first life form to appear on earth, and are present in most of its habitats such as soil and water. The study identifies and characterized bacteria from the tap water used by the community of Umar Suleiman College of education Gashua. The water samples were collected from various sources in the case study area using swabs stick and in sterile containers to the laboratory for bacteriological analysis. The water samples collected is subjected for a serial dilution technique, microscopic, culture and sensitivity (MCS) and biochemical identification test. The coliform bacteria were analyzed. The bacteriological results of four sampled points have showed presence of *E.coli, Salmonella, S. aureus* and *klebsiella* which has clearly indicated the microbiological contamination of the samples. The results revealed that, *E. coli* is presence in almost the whole sample (41.4%) followed by *salmonella* (27.6%), *S. aureus* (17.2%) and *klebsiella* (13.8%). Furthermore these results have clearly elaborated the unsuitability of the water for human consumption.

Keywords: Bacteriological, *E. coli, Salmonella, S.aureus,* Contamination, Sensitivity, Microscopic, portability.

INTRODUCTION

In many developed countries the availability of portable water becomes a problem when supply is interrupted frequently and shortages become the order of the day (Popoola*et al,* 2007). Portable and easily accessible water is essential for good health. Unfortunately, approximately 667 million people worldwide live without access to portable municipal water. Roughly half of these people dwell is sub-Sahara Africa (WHO, 2013. Defined water supply affect population, health directly and indirectly either causing of diarrhea-related diseases or resulting in diseases linked to poor personal hygiene (Hunter *et al,* 2010). Furthermore; in developing countries 17% of all deaths of children below 5 years of age are due to diarrhea (usually following ingestion, of poor quality drinking water) *(*Pruss *et al.,* 2016).

Water is very important in life for proper function of the human body; its importance is underlined by the assentation that safe drinking water is the bright light of all human kind as much as both right as clean air *(*Lenton *et al., 2015).* Water of physiology of human existence depends very much on its availability *(Lamikanra, 2011).* According to Nikoladze and Alkastal (2016) before water can be described as municipal it has to comply with certain physical chemical and microbiological standards which is designed to ensure that water is portable and safe for a purpose (Tabutt*, 2012)* municipal portable water is that which is free from diseases causing microorganism and chemical substance. Water from most sources is unfit for immediate consumption without some of treatment *(*Roymend*, 2009).* Water is an essential

requirement for the maintenance of a play a role important in the lives of plants and animals reported that 70% of the earth surface is made up of water and man uses water for domestic and industrial, and agricultural purpose *(*Horan*, 2003).*

The increasing demand for domestic water have led to the indiscriminate use of underground water, such as wells as a main sources of water without regard to portability for human and animal consumption. As a result of majority of some selected area in Dutse metropolis of these water through pipe borne water Majority of these water sources are particularly some is poorly serve without regard portability in terms of toxic chemical element present. Greater percentage of boreholes are larger constructed with materials such as iron rods. These material is long term introduces toxic chemical due to corrosion in to the water source. Contamination of some sachet water (pure water) in terms of microbes is much more evident due to human activities while chemical contamination of the soil type. Microbial contaminations of undergo water occur when septic tanks and offal's holes are poorly constructed and communities using such tanks are vulnerable to contamination *(New Zealand, 2010*).

Underground water is a good quality water in terms of microbes because it contain no coli form as a result of natural filtration but pollution occur due to indiscriminate dumping of refuse, poor sewage system and activities of man and animal, the underground soil. (*Wilcox, 2010*) explained that water being universal solvent dissolves many organic and inorganic substances that finally sink into the aquifer.

However, biological pollutant associated with drinking water includes bacteria, protozoa, virus *(New Zealand 2010*). When intestine discharge have contaminated, the underground water, a large number of coli form bacteria are certain to be present (UNEP-WHO, 2011).

This consist not only the harmless but some pathogenic organic such as fibro cholera a causative agent for cholera, salmonella a causative agent for enteric fever, shigellosis also known as bacillary dysentery is cause by gurus shield and enchiridia coli, a causative agent of urinary tract infection of gall bladder, appendicitis and so forth water common disease is common is villages where their drinking water is source is not subjected to conventional treatment. Bacteria is a type of biological cell, that constitute a large domain of prokaryotic micro-organisms. Typically few micro meters in length, bacteria have a number of shapes, ranging from spheres to rods and spirals. Bacteria were among the first life form to appear on earth, and are present in most of its habitats. Bacteria inhabit soil, water, acidic hot springs, radioactive, water (Fredrickson et al, 2004) and the damp partials of the earth crust. Bacteria also live in symbiotic and parasitic relationships with plants and animals. Most bacteria have not been characterized and only about half of the bacteria phyla have species that can grow in the laboratory (Rappe and Giovani, 2003). The study of bacteria is known as bacteriology, a branch of microbiology. There are typically 40 million bacterial cells in a gram of soil and a million bacterial cells in a milliliter of fresh water. There are approximately 5x1030 bacteria on earth (Forbes, 2008).

Underground water is a good quality water in terms of microbes because it contains no conform as a result of natural filtration but pollution occur due to indiscriminate dumping of refuse, poor sewage system and activities of man and animal, the underground soil. (*Wilcox, 2010*) explained that water being universal solvent dissolves many organic and inorganic substances that finally sink into the aquifer. The common water contaminants include organic and micro organic which at high-level possess health effect inorganic substances such as ion and other heavy metals originate from erosion of natural deposit, glass and electronic firms and so forth other inorganic substances include non-biodegradable substances such as insecticide, packing material and detergent exposure to this substances above the limit concentration value can cause health effect such as cancer of the liver, lungs and kidney damage to the central nervous system, skin damage, fluorosis, gastrointestinal distress, Methaemoglosinemia, high blood pressure and so forth. The ground absorbs water and retains it in soil and the pores of rocks. Water that has been absorbed into the ground is known as groundwater and it can be accessed via wells and boreholes (UNEP-WHO 2012). It is often relatively clean and very rich in minerals, which makes it ideal if you need water for irrigation or watering your garden. It can also be filtered and used for outdoor cleaning. However, groundwater is rarely found near the surface, it tends to be located deep underground. If you want to use groundwater for any purpose, you'll need a way to extract it quickly and reliably. A powerful pump can

be inserted into a well or borehole and used to collect as much groundwater as you need. If you're interested in us providing this service find my information here (Tabutt, 2012).

MATERIAL AND METHODS

Sample collection

Purposive sampling was done in collecting six (6) swabbed samples from water valves surface in the campus of Umar Suleiman College of Education Gashua at the end of the daily activities to maximize the chance of isolation bacteria that might be present thereon. The swab sticks were moistened with 5 mL of normal saline that was added to the swab sticks case and excess were removed by pressing the swab against tube of the slide (Adeleye *et al*., 2022). Individual moistened sterile cotton swab was used to swab the tap water valveb. This was accomplished in a tri directional manner up/down, left/right and diagonally, recapped and properly labelled. The swabbing sticks were immediately transported to microbiology laboratory for onward bacteriology analysis.

Swab Collection

The swabbing stick was used to swab the tap water valve (two tap water valve from each hostel) were aseptically collected in duplicates. Each sterilize swabbed stick was dipped into aseptically. After collection, the swab sticks were placed back to its crew container and conveyed to the laboratory for analysis.

Preparation of Culture Media

All culture media used were prepared according to the manufacturer's instructions. They were sterilized by autoclaving at 121°C for 15 minutes.

Isolation of Bacteria

Each swab stick was aseptically rinsed into freshly prepared Nutrient Broth in test tubes (5 mL per test tube and plugged). The test tubes were incubated at 37 °C for 24 hours for growth which was detected through turbidity. After incubation, a loop full of each broth was streaked progressively to obtain discrete colonies on different culture media (Nutrient Agar, Blood Agar, MacConkey Agar, Mannitol Salt Agar and Salmonella-Shigella Agar). The plates were incubated at 37 °C for 24 hours and then observed at the end of the incubation time for the kind of growth present on each agar.

Gram staining

A gram stain was performed to confirm and identify the pathogen and bacteria were searches in pus cells in urine (Eckburg *et al.,* 2015). While, the Gram-negative rods were identified by gram staining, and such type of culture was then inoculated by streaking to MacConkey agar for subculturing. MacConkey agar is used to isolate and differentiate the Gram-negative enteric bacilli (Schwan *et al*., 2018). The gram staining procedure are described below;

i. An oval shape smear was made using a sterile loop in a center of grease free glass slide.
ii. The smear was heat fixed and later flood with primary dye (crystal violet) for 30 second and washed with distilled water.
iii. Again its later flood with mordent (Lugol's iodine) for 15 second to fixed the primary dye and wash with distilled water.
iv. The fixed smear was decolorized with 90% acetone and wash with distilled water
v. The smear was then counter stained with safranin for 30 second, wash and allowed to air dried.
vi. It was then examined using oil immersion objective lens (100).

Biochemical Characterization Tests for the Identification of Bacterial Isolates

Biochemical characterization tests ranging from indole, catalase, methyl red, Vogesproskauer, citrate, and triple sugar ion were further conducted according to the procedure reported by Cheesebrough (2006); Ochei and Kolhatkar (2008); Hemraj*et al.* (2013); Aryal (2018) to confirm the identity of the bacterial isolates. The test includes; Catalase, Oxidase, Urease, Indole, Methyl red, Coagulase, and Mortality test was done to identified the organisms as biochemical test.

RESULTS

The results of the plates sampling points designated as FHA, FHB, FHC, FHD, MHA, MHB, MHC and MHD are isolated in Table 1. However, the results for identification of the possible bacteria detected in tap water valves samples are depicted in Table 1.

Table 1: Morphological and Gram Staining Reaction of Bacteria Isolated from the Tap Water Valves

Sample	Morphology	Gram reaction
FHA	Bacillus shape	-ve
FHB	Rod shape	-ve
FHC	Non spore rod shape	-ve
FHD	Cocci in shape	+ve
MHA	Rod shape	-ve
MHB	Cocci in shape	+ve
MHC	Bacillus shape	-ve
MHD	Rod shape	-ve

Keys: FH: Female hostel, MH: Male hostel +ve: gram positive -ve; gram negative

Table 2: Biochemical Characterisation Tests of the Bacterial Isolates

Sample	G-reaction	Biochemical test				Isolates
		Citrate	Catalase	Indole	Methyl-red	
FHA	-ve	+	+	-	+	*S. typhi*
FHB	-ve	-	+	+	+	*E. coli*
FHC	-ve	-	+	-	+	*Shigiella spp.*
FHD	+ve	+	+	+	-	*S. aureus*
MHA	-ve B	-	+	+	+	*E. coli*
MHB	+ve	+	+	+	+	*S. aureus*
MHC	-ve	+	-	-	+	*S. typhi*
MHD	-ve	-	-	+	+	*E. coli*

Key: + = positive; - = negative; -ve= Gram negative G-reaction: Gram reaction

Table 3 Percentage Occurrence of the Isolated Bacteria

Organism	***Number (%) prevalence***
S. typhi	8 (27.6%)
E. coli	12 (41.4%)
Shigiella spp.	4 (13.8%)
S. aureus	5 (17.2%)
Total	**29 (100%)**

DISCUSSION

Results obtained from the Table 1 show that isolates from the tap water valves sampled from FHA, FHB, FHC, FHC, FHD, MHA, MHB, MHC and MHD had five gram negative bacterial isolates and three gram positive bacterial isolates as previously reported by Bamigboye and Amina (2018); Adeleye *et al.* (2020); Amoo *et al*. (2021) in their respective examination of drinking water quality.

In respect to the biochemical characterization of the isolates, the results have clearly suggested that all the water samples harbored *Entrobacteriacae* which includes *E. coli, Salmonella, Shigiella,* and *Staphylococcus* during the conduct of this study. And this is in line with agreement of the finding of Ochei and Kolhatkar (2008) as reported on his study conducted in Gambia.

As recorded in this current study, *E. coli* was present in almost the whole sample (41.4%) followed by *Salmonella* spp. (27.6%), *S. aureus* (17.2%) and lastly *Shigiella* spp. (13.8%) These bacteria have been

equally reported by Okareh *et al.* (2018); Adeleye *et al.* (2020); Amoo *et al.* (2021); Sitotaw *et al.* (2021); Raji *et al.* (2021); Falnyi *et al.* (2022); Adeleye *et al*. (2022) as being synonymous with water. *E coli* is one of the pathogens linked with the tap water valves (Slavik *et al*., 2020).

RECOMMENDATION

Owing to the results obtained in this study, it is recommended that the water tap valve must not be freely touched apart from on/off. Again, routine monitoring and assessment of the source of water being pumped into the tanks are highly recommended. The need to increase the frequency of sampling and quality assessment of the water in the tanks is also desirable with a view to effectively monitoring its portability. Finally, early detection of possible groundwater pollution can enhance faster employment of remedial measures to avert public health crises.

CONCLUSION

The results obtained in this study have revealed that the water tap present in the students' campus recorded the presence of *E. coli* that was found to be beyond the percentage limits with 47.4% as it all recorded the presence of total and fecal coliforms. This strongly implies that the water obtainable from all the taps during sampling was not fit for human consumption. Consequently, water stored in storage tanks may not always be of primeval quality as it ought to be.

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