THE MICROBIOLOGICAL ANALYSIS OF SELECTED TAP WATER IN MINNA, NIGER STATE, NIGERIA

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ABSTRACT

This study was to analyse the microbiological quality of selected tap in Minna, Niger State. The analysis of the physicochemical properties revealed the temperature ranged from 27.5 and 29.0C, the pH range for the water samples was between 7.67- 8.77. The total hardness ranged from 60.8-133.5 and the free residual chlorine ranged from 15.6-20.1mg/l. The the total bacteria counts ranged from 1.2×10^3 cfu/ml – 2.8×10^3 cfu/ml. The result for the Most Probable Number (MPN) ranged from 30-125 per 100ml and the bacteria isolates include *E.coli*, Pseudomonas, Staphylococcus etc The isolation of *E.coli* indicates fecal contamination of the water samples. A total of 5 water samples were collected from 5 different taps located in Minna.

1. INTRODUCTION

Access to adequate safe drinking water is an important necessity for every community but many developing regions of the world still lack a steady supply of potable water. Poverty, illiteracy and inadequate sanitary hygiene have also led to an increase in water borne diseases and environmental pollution (Gil *et al.,* 2014; WHO, 2014,). In developing countries, children are the most vulnerable to water borne diseases causing more than 20 million deaths (Thani *et al.,* 2016). It is speculated that accessible potable water will increase to by only ten per cent in the next thirty years while the earth's population is projected to rise by one third (WHO, 2011). Water of good drinking quality is of basic importance to human physiology as well as indispensable to man's continued existence (Lamikana, 1999). Its role as a medium of water borne disease which constitutes a significant percentage of the diseases that affect human and animals cannot be underestimated (Idowu *et al.,* 2011). In the olden days no settlements could be made in the absence of good and regular source of water (in most cases, rivers, streams, lakes, and springs supplemented with harvested rain water). These are adequately protected against contamination either by man or animals. In towns and cities, wells, boreholes and pipe-borne water are the major sources of potable water. The microbiological quality of drinking water is assessed by testing for non-pathogenic bacteria of faecal origin. Microorganisms used as indicators of water quality are coliforms, faecal Streptococci, *Clostridium perfringes* and *Pseudomonas aeruginosa* (Knappett *et al.*, 2013). Coliforms especially *E. coli* is a recommended indicator. The most dangerous water pollutants are pathogenic microorganisms including Salmonella sp, Shigella sp, *Vibro cholerae* and *E. coli*. Naturally occurring opportunistic pathogens commonly found in water include *Pseudomonas aeruginosa*, Klebsiella sp, Aeromonas sp and might cause diseases in human mostly the debilitated and immunocompromised (Cunningham, 2005; Adamu *et al.,* 2016). The need for safe and better health cannot be compromised with increasing urbanization and population growth. Therefore, there is need for continuous evaluation of public water supply to avoid outbreaks of epidemics. This study was aimed at evaluating the quality of public water supply at selected locations in Minna.

Sample collection

Sterilized sampling bottles were used to collect the sample for the collection of water from various taps located in Minna, the tap was disinfected using 70% alcohol and the tap was allowed to run for a while before collection into sampling bottles.

Determination of the physicochemical properties

Determination of temperature

The temperature reading of the samples were taken immediately after sample collection, a thermometer was dipped into the samples and allowed to stay for 3-5 minutes, the reading was taken after the mercury had become stable and thereafter recorded.

Determination of pH

The pH reading was taken immediately the samples were brought to the laboratory. It was done using a glass electrode pH meter, the pH reading was carried out by dipping the glass electrode pH meter into the water samples, the readings were then recorded.

Determination of Free Residual Chlorine (FRC)

The free residual chlorine was determined for the treated water by titration as described below:

100ml of the water sample was poured into a 250ml conical flask and 2ml of 5% potassium chromate (KCr) was added, it serve as the indicator. The water sample was then titrated against 0.1n silver nitrate (AgNO3) solution with continuous shaking until a pink colour appeared. The titre value of AgNO3, in the burrette was then recorded. The concentration of the FRC is calculated using the formula: mML^{-1} of chlorine(Cr) = Titre value x Factor of AgNO, Concentration of FRC = mML⁻¹x molar mass

(mg/l)   1000

Determination of Total Hardness

100ml of the water sample was measured and poured into a 250ml conical flask. Five (5) drops of Ammonium hydroxide (NH4OH) was added, Three (3) drops of the indicator erichrome black was added and it was titrated against 0.1N EDTA. The titre was recorded. Hard water gives a pink coloration after titration while a soft water gives a green coloration.

Preparation of Culture Media

MacConkey agar was used for the enumeration of total coliform and Eosin Methylene Blue (EMB) which is a differential medium for the isolation of *E. coli*. MacConkey broth was used for the enumeration of coliforms in the water sample. Each of the medium was prepared according to manufacturer's instruction.

Enumeration of total bacterial count

The standard pour plate method of Fawole and Oso (2007). was used for the enumeration of the total bacterial count, a general purpose media was used for the culture of the bacteria. Serial dilutions of the samples were made- the dilution factor for the treated water and raw water samples was 10^{-3}. After serial dilution the petri dishes was swirled to allow its content mix properly and also to allow even distribution of the microbial colonies. The plates were left to stand so that the agar can solidify, after solidification the plates were inverted and kept in the incubator at 37°C for 48hours. After 24 hours the plates were examined for colony formation and after 48 hours the colonies on each plate was counted and recorded in CFU/ml.

Test for Coliform

Most Probable Number

The process involves pipetting 0.lml and 1ml of MacConkey broth into sterile MacCartney bottles containing inverted durham tubes, this is for the single strength broth, for the double strength broth 1Oml of MacConkey broth was pippeted into MacCartneybottles containng inverted durham tubes. 10ml each of the water samples were then pipetted into respective MacCartney bottles.

The durham tubes were inserted carefully so as to prevent trapped air bubbles which may give a false test result. The bottles were then incubated at 37°C for 48hrs. After which, the results were read. A positive result is indicated by a change in color of the broth from pink to orange and also the presence of gas bubbles in the durham tube. The number of positive results was recorded and the most probable number (MPN) per 100ml for the water samples was obtained by comparison with the MPN table (WHO, 1997).

Isolation of indicator organism

Freshly prepared EMB agar was poured aseptically into Petri dishes and allowed to solidify. After which, 1ml each of the water samples were pipetted on to the agar surface and it was then streaked. It was then incubated at 37'C for 48hrs. Afler 48hrs. the plates were then observed; the indicator organism (*E.coli*) presence is characterized by the presence of greenish-metallic sheen on the agar surface (Prescott et al., 2007).

Characterization and identification of bacterial isolates

The growth of distinct bacterial colonies was counted and the morphology of the various colonies recorded. Pure cultures obtained were transferred to agar slants. These were used for various biochemical tests to determine the identities of the various isolates. The organisms were identified using bergys manual.

2. RESULTS

The water samples were collected from selected taps in Minna.

Physicochemical analysis

As shown in Table 2, the temperature ranged from 27.5 and 29.0C, the pH range for the water samples was between 7.67- 8.77. The total hardness ranged from 60.8-133.5 and the free residual chlorine ranged from 15.6-20.1mg/l.

Table 1: Physicochemical properties of the tap water sample

Bottled Water Samples	pH	Temperature(^{0}C)	Residual Chlorine (mg/l)	Total Hardness (mg/l)
M	8.28	28.7	15.6	118
N	7.67	29.0	16.2	60.7

O	8.68	28.9	20.1	120.1
P	8.57	27.5	18.8	133.5
Q	8.77	28.4	17.4	85.5

Microbiological analysis

Table 1 below show the average total bacterial count; the total bacteria counts ranged from 1.2 x 103 cfu/ml – 2.8 x 103 cfu/ml. The result for the Most Probable Number (MPN) ranged from 30-125 per 100ml and the bacteria isolates include *E.coli*, Pseudomonas, Staphylococcus, Bacillus etc.

Table 2: Total bacteria count, MPN and bacteria isolates

Bottled Water Samples	Heterotrophic Bacteria Count (cfu/ml)	Total Coliform (MPN/100ml)	Bacterial Isolates
M	2.8 x 103	120	Bacillus sp, Klebsiellia sp, Psuedomans, Enterobacter aerogenes
N	2.2 x 103	109	Enterobacter aerogenes, E.coli, Staphylococcus aureus, Bacillus sp.
O	1.2 x 103	30	Acinetobacter sp., Enterobacter aerogenes, Pseudomonas aeroginosa
P	2.0 x 103	125	Enterobacter aerogenes, Pseudomonas aeruginosa, Staphylococcus aureus
Q	1.8 x 103	55	Klebsiellia, Psuedomans sp, Enterobacter aerogenes

3. DISCUSSION

The temperature ranged from 27.5 and 29.0C as shown in table 1 and the pH range for the water samples was between 7.67- 8.77. The total hardness ranged from 60.8-133.5, the pH range was similar to that reported by (Bala *et al*.,2019; Paul, 2001) and the free residual chlorine ranged from 15.6-20.1mg/l. The average total bacterial count; the total bacteria counts ranged from 1.2 x 103 cfu/ml – 2.8 x 103 cfu/ml. The result for the Most Probable Number (MPN) ranged from 30-125 simialr to that reported by (Bala *et al.,* 2019) and the bacteria isolates include *E.coli*, Pseudomonas, Staphylococcus, Bacillus, this is similar to that reported by APHA (1998) etc. The isolation of the indicator organism in a tap water sample (N) indicates contamination of the water from a fecal source. The highest bacteria count was observed in sample O, and the presence of indicator organism was also observed. The lowest bacteria count was recorded in sample Q, the remaining samples (M, O, P and Q) had no presence of indicator organism.

4. CONCLUSION

The presence of indicator organism in a water sample indicates fecal contamination, Therefore, to avert the spread of water borne diseases, it is necessary to treat well before release into the public for consumption. We recommend proper disinfection of drinking water, periodic bacteriological appraisal of drinking water and construction and distribution of properly piped water.

5. REFERENCES

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