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Bacteriological Analysis of Sachet Water Sold in Obi Local Government Area, Benue State, Nigeria

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Abstract: The study was geared toward isolating, characterizing and identifying bacterial pathogen in sachet water in addition to determines the bacterial count of the sachet water sold in Obi Local Government Area. Twelve sachet water samples from different companies were analyzed using standard microbiological methods. The microorganism found are Escherichia Coli, Staphylococcus aures, Salmonella spp, with Staphlococuss aureus showing the highest incidence (50%), observed by Escherichia coli (29.17%) and Salmonella spp with the lowest occurrence (20.8%). The presence of these microbes in drinking water possesses a threat to life. The findings consequently suggest that some of the sachet water sold in obi L.G. A are not healthy for human intake and are risky to health. Hence there's need for strict concern and routine monitoring by regulatory agencies to make sure that appropriate treatment is applied inside the manufacturing of exceptional and safe sachet drinking water. This study is aimed to analyze the bacteriological quality of some selected sachet water in Obi Local Government Area of Benue State, Nigeria.

Keywords: Analysis; bacterial, pathogens,bacteriology; human health

INTRODUCTION

Water is an inorganic, transparent, tasteless, odorless and almost colorless chemical substance that's the principle parts of the earth's hydrosphere and the fluid of maximum living organisms. Its chemical system is H2O. Water is the name of liquid kingdom of H2O at popular ambient temperature and strain. A water molecule incorporates one molecule of oxygen and molecules of hydrogen bonded collectively by using hydrogen bond. It is one of the most critical and considerable commodities of man occupying approximately 70% of the earth's surface. An extra percentage of the world's populace maximum specifically in growing countries live without availability of safe water (Hazen and Tortora, 2009), that is because a whole lot of the water to be had isn't sparkling and transportable. The safety of consuming water is a global challenge. The World Health Organization (WHO) estimated that 1.1 billion of the world's population has no access to safe water. In addition, 80% of diseases and one third of death in developing countries are due to consumption of contaminated water (WHO, 2011). In Nigeria, it is reported that the incidence of acute diarhoea is approximately 4.9 episodes per year and there are approximately 200,000 diarhoea related deaths of children aged below five years with an average of 300 deaths per day (United nation, 2012). Great concern must therefore, be given to the quality of drinking water which is very critical in maintaining good health and for the overall socio-economic development of any society. Water for drinking should be free from disease-causing microorganisms, harmful chemicals, objectionable taste and odour, excessive level of colour and suspended materials. Ideally, the characteristic of water should not impair its aesthetic values (Abulude *et al*, 2007). Bacteria growth in drinking water depends on concentration of assimilated organic carbon, limiting nutrients, disinfectants concentration, type of pipe material, packaging nylons and a number of other factors such as pH, temperature, hardness, redox potential that controls the growth of microorganisms on pipe surfaces (Lehtola *et al*., 2002; Ollos *et al ,2003*). Many of the bacteria isolated in water distribution systems are opportunistic pathogens.

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The presence of high number of opportunistic pathogens in drinking water is of concern because these microorganisms can lead to infection of certain segments of the population (new born babies, the sick and the elderly) (Biffin, 2005).

Due to the shortage of safe drinking water in Nigeria, communities gain their transportable water in form of sachet water, popularly referred to as 'pure water'. It is the most common supply of consuming water in Nigeria, given that it's distinctly reasonably-priced, on hand and typically seemed to be of higher first-class (Stoler, 2012). Although it is less difficult and cheaper to get, human beings nonetheless worry about the purity of the sachet water. There have also been hunches that it's far on occasion poorly handled. Concerns of vertical transmission of sickness pathogens with the aid of companies have additionally been raised. Although documented proof is uncommon, there are claims of past out leak of water borne illness that resulted from consumption of polluted sachet water maximum of which can be of unknown beginning (Dada, 2009). Therefore, the objective of this study is to analyze the bacteriological quality of some selected sachet water in Obi Local Government Area of Benue State, Nigeria.

METHODOLOGY

Study area: the study was carried out in obi Local Government area; Obi LGA is located at south central apart of Benue State. It has an undulating flat land with River Obi traversing the period and breadth of the Local Government Area. Though water is with availability is not a problem, most of the populations lack adequate and secure consuming water.

Sterilization of Materials: All glass wares used were well washed and sterilized in an autoclave at 121^0C for 15 minutes. The work bench becomes disinfected to ensure an aseptic paintings environment.

Sample Collection: Four different brands of sachet water were gotten from suppliers in Obi Local Government Area via random purchase. The accrued samples were then taken to microbiology laboratory of the federal college of Agriculture Makurdi, for further analysis.

Tests for Odor and Color: Twenty milliliter (20ml) of every sachet water were poured right into a clean beaker. The beaker was then shaken vigorously and determined underneath vibrant light for the presence of any particulate matter and then delivered close to the nostril to test for any odour gift.

Test for Taste: A small quantity of every sample was tasted with the tongue and then immediately rinsed with flavor loose distilled water. The results had been recorded hence.

Test for pH: Forty milliliter (40ml) of every sample was poured into a beaker, the beaker put on a pH meter. The pH meter rod was inserted into the beaker and the device was turned on and the readings had been taken accordingly.

Preparation of Growth Media: The media used was organized in line with producer's instructions and sterilized in an autoclave for 15 minute at 1210C.

Isolation of Microorganisms: One milliliter (1ml) of every pattern was serially diluted and 1ml of an appropriate dilution become inoculated on sterile nutrient agar, Eosine methylene blue agar and manitol salt agar and Shigella-Salmonella agar using pour plate method. The plates were incubated at 370C for 24 hours. After 24 hours, a sterile cord loop turned into used to select every isolate singly and inoculated onto Nutrient agar and incubated at 370C for twenty-four hours to reap natural cultures of the isolates which were in addition inoculated into a clean nutrient agar slant and incubated at 370C for 24 hours. The slants have been then preserved.

Colony Count: Colony count number changed into performed on nutrient agar after bacteria boom regarded. Discrete wide variety of colonies performing on the plate after 24hours of incubation had been counted and recorded. The total micro organism matter become acquired via counting discrete colonies. The number of colonies counted had been improved by using the reciprocal of the dilution aspect and divided by means of the quantity of the inoculums used to reap the colony forming unit per milliliter (cfu/ml).

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Preliminary and Confirmatory Identification of the Isolates: A initial identity of the isolates become performed on the idea of the cultural traits and Gram reactions. While confirmatory identity changed into based totally at the biochemical reactions exhibited by using the microorganisms.

Gram Stain: A drop of everyday saline become positioned on a easy, dry and grease free slide and a sterile wire loop become used to transfer every colony from every pure subculture onto the slide to make a smear. The smear became air dried and warmth fixed by using passing over a Bunsen burner flame. The smear turned into then flooded with crystal violet for 1 minute and washed off with distilled water; they were then flooded with iodine and washed off with smooth water after 1 minute. The smear was then decolorized with acetone for 10 seconds and washed off with distilled water and then safranine changed into used to counter stain the smear and rinsed off after 1 minute with distilled water. The slide turned into air dried and considered under the microscope using the oil immersion goal lens after the software of the immersion oil.

Biochemical Test: Biochemical exams had been used to decide the biochemical reactions or traits of the isolates from the samples.

Indole Test: A sterile wire loop turned into used to inoculate bacteria isolate right into a check tube containing 5ml of prepared peptone water and incubated for forty eight hours at 370C. After incubation, zero.5ml of Kovac's reagent became delivered into the tube and allowed to stand for 15 mins. Red colour inside the alcohol layer of the tube suggests a fine result.

Catalase Test: A few drops of hydrogen peroxide have been delivered to the thick smear of every bacteria isolates, effervescence suggests advantageous end result and no effervescence shows bad end result.

Coagulase Test :A thick emulsion of the organism became placed on a smooth glass slide. Drop of blood serum become brought and changed into located for formation of clumps which suggests a wonderful end result and no clumping imply a terrible resul

Citrate Test: Each colony from the natural lifestyle become inoculated unto prepared citrate agar slants for 24hours. Blue colouration of the medium shows a fine result and no colouration indicates a negative result.

Oxidase Test: This take a look at is especially beneficial for differentiating Pseudomonas from other enteric or Gram terrible micro organism. On a nutrient agar plate containing 24 hours culture, few drops of the oxidase reagent have been positioned on the streaked strains of the way of life. Oxidase fantastic colonies will increase a red colour on the way to steadily end up red within 30 seconds, whilst oxidase negative colonies will not produce this purple colouration (Cheesbrough, 2006).

Urease Test: The urea agar (oxoid) slant in tubes become inoculated with the pure cultures from the nutrient agar and incubated at 370C for 24 hours. A exchange in the shade of the urea agar shape yellow to red shows a fantastic urease hobby (Cheesbrough, 2006).

Statistical Analysis: Statistical evaluation of facts become executed the usage of SPSS (20). Comparisons of means were assessed statistically by subjecting data to at least one manner analysis of variance (ANOVA). A opportunity fee (P-price) of less than zero.05 was considered as widespread.

From the study carried out, all of the samples analysed have been infected with micro organism isolates identified as Escherichia coli, Salmonella spp and Staphylococcus aureus. These bacteria were implicated in water related illnesses. All these organisms identified are heterotrophic micro organism that may be located naturally in surface water, skin, soil or vegetable and their presence indicates troubles with the processing of water which may be due to useless treatment or no remedy at all, as some unscrupulous producers simply bag and seal properly or pipe borne water without any shape of well-known treatment (Mcfeter *et al 2014)* such as chronic infections and vomiting in humans (Jay *et al*., 2006). *Staphylococcus aureus* generally occurs in water that contains organic pollutants that is, mineral ions and organic matter (Tortora *et al*., 2007)A total of three bacteria isolates were obtained from the sachet water samples analyzed. From the analysis carried out, the physiochemical indicators showed the absence of dissolved particles and the samples had a pH range of 7.1 – 7.5 which is within the standard pH range of 6.5 to 8.5, as stipulated by World Health Organization as criteria for drinking water. This also conforms to the pH range reported by other authors (Okon *et al*., 2008).

Table 1. Indicates the Total Colony Counts of micro organism in specific sachet water products in Obi L.G.A J. Emman Sachet Water had the best bacterial total colony be counted (1.23 x 102 CFU/mL) and Aqua Rapha Sachet Water had the lowest Bacterial Total Colony Count (3.Sixty seven x one hundred and one CFU/mL). Benue State. However, there was no huge difference inside the general colony counts of bacteria within the product kind (P = 0.05; zero.29).

Table 2. shows the percentage occurrence of bacterial isolates in specific sachet water in Obi L.G.A, Benue State. Staphylococcus aureus had the very best prevalence (50%) and Salmonella spp had the lowest prevalence (20.Eight%). J. Emman Sachet Water had the highest incidence of the isolates (37.50%) while Aqua Rapha Sachet Water had the least occurrence of the isolates (12.50%)

Table 1. Total Colony Counts of Bacterial in Different Sachet Water Products in Obi L.G.A.

Product Name	Colony Counts	Total colony counts (CFU/mL)
Minister Sachet Water	8.33 ± 1.53	8.33×10^1
Eboic Sachet water	4.67 ± 4.51	4.67×10^1
Aqua Rapha Sachet Water	6.67 ± 3.51	3.67×10^1
J. Emman Sachet Water	1.23×10^1 ± 2.08	1.23×10^2

Data are expressed as Mean ± Standard Deviation. (P = 0.05) , Df = 3, P= 0.29.

Table 2. Percentage Prevalence of Bacterial Isolates in Different Sachet Water Products in Obi L.G.A, Benue State.

Products Name	*Escherichia coli* Number(%)	*Staphylococcus aureus* Number (%)	*Salmonella* spp Number(%)	Total (%)
Minister Sachet Water	2 (8.33)	4(16.67)	1 (4.17)	7(29.17)
Eboic Sachet water	0 (0.00)	3(12.50)	2 (8.33)	5 (20.83)
Aqua Rapha Sachet Water	1 (4.17)	2(8.33)	0 (0.00)	3 (12.50)
J. Emman Sachet Water	4(16.67)	3(12.50)	2(8.33)	9(37.50)
Total (%)	7(29.17)	12 (50)	5 (20.83)	24(100)

Conclusions

The bacteriological analysis of sachet water sold in Obi Local Government Area revealed the presence of *Escherichia coli*, *Salmonella spp* and *Staphylococcus aureus*. Waterborne diseases pose very serious threats to the society. Most of the analysed sachet water samples studied did not meet WHO standard for drinking water, hence routine monitoring of producers of sachet water should be enforced to ensure adherence to drinking water standards. Considering the high patronage of sachet water in the area of study, it is recommended that all manufacturing industries must adhere to guidelines by relevant agencies such as NAFDAC and all the existing laws should be enforced. Furthermore, to safeguard the health of the people, there is need for regular monitoring of the quality of the water and the environment they are produced by NAFDAC.

References

Abulude, F. O., Obidiran, G. O and Orungbemi, S (2007). Determination of Physicochemical parameters and trace metal contents of drinking water samples in Akure, Nigeria. *Electronic Journal of Environment, Agriculture and Food Chemical* 6(8): 2297-2303

Bitton, G (2005). Waste Water Microbiology (3rd edition) Wiley Series in Ecological and Applied Microbiology. ISBN 047165071(2).4.pdf

Cheesbrough, M (2004). Medical Laboratory Manual for Tropical Countries: (4th Edition); Cambridge University Press: Uk. pp 78 -90

Craun, G. F and McCbe, J (1993). Review of the Causes of Water-Borne Desease Outbreaks. *Journal of American Water Works Association*, 65:74-84.

Dada, A. C (2009). Sachet water production in Nigertia: Assesment of potential Health Impact. *Journal of Applied microbial resource.* 3:15-21

Hazen, T. C., Tortora, G. A (2009). Tropical source water in Mcfeters G. A (eds) drinking water Microbiology. Springer, New York. pp 35-52

Jay, M.J., Loessna, M.J., Golden D.A (2006). Modern food Microbiology, New York, Spring Science Business Media Inc. 22(2):30-39

Lehtola, M.J., Micttinen, I.T. and Martinalnen, P.J (2002). Changes in Content of Microbially available Phosphorus, assimilable Organic Carbon and Microbial Growth Potential during Drinking water treatment processes. *Water Research:* 3681-3690

Mcfeters, G.A., kippin, J.S., Le Chevallier, M.W (2014). Injured Coliforms in Drinking Water. *Journal of Applied Microbiology:* 51:1-5.

Okonkwo, I.O., Adejoye, O.D., Ogunusi, T.A., Fajobi, E.A., shitta, O.B (2008). Microbiological and Physiochemical analysis of different Water Samples used for Domestic Purposes in Abeokuta and Ojota, Lagos State, Nigeria. *African Journal of Biotechnology.* 7(3):617-621

Ollos, P.J., Huck, P.M and Slawson, RM (2003). Factors Affecting biofilm accumulation Model Distribution Systems, *Journal of American Water Works Association.* 95:87-97

Parks, K (2005). Preventive and Social Medicine, Environment and Health, (18th edition) Jabalpur Banarsidas Bhanot pp. 520-544

Stoler, J (2012). Spatial Patterns of Water Insecurity in a Developing City: lessons from Accra, Ghana PhD Dissertation, Sam Diego State University and University of California. Santa Barbara

Tortora, J. G., Funke, R. B., Case, L. C (2007). Microbiology, an introduction.,, Media update of 7th Edition including bibliography and index publisher Daryl Fox: Pub. P 258-260

United Nation (2012): the Millennium Development Goals Report 2012 – We can end Poverty 2015 United Nations new York

World Health Organization (2010). Regional office for South-East Asia (WHOSEARO).Drinking water quality In the South-East Asia Region. Mahatma Gandhi Marga, New Delhi, India. Pp.1-178