**BACTERIOLOGICAL QUALITY ASSESSEMENT OF SATCHET WATER BRANDS SOLD WITHIN OKO, ANAMBRA STATE**

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**Abstract**

*The inadequate supply of portable drinking water in Oko and its environs has proliferated the production of package water. This study was undertaken to determine the bacteriological quality of satchet water sold in Oko Anambra state. Three (3) samples each of five different brands of satchet water giving a total of 15 samples were purchased from different points within Oko and taken to the laboratory for analysis. The bacteriological analysis was done using presumptive, confirmatory and completed test with further subculturing into some selective media. All the samples showed the presence of faecal coliforms. The total bacteria count range from 1.5 x 102 cfu/ml to too numerous to count (TNC)while the total coliform count ranges from 1.2 x 106 cfu/ml.to 2.3 x 106 cfu/ml. The samples showed the presence of faecal coliforms and Salmonella spp. All the water samples were contaminated with Escherichia coli count beyond the permissible limit by National Agency for Food Drug Administration and Control (NAFDAC) and World health Organisation (WHO) for drinking water and hence not fit for consumption. There is need for continuous monitoring of satchet water factories by NAFDAC, trainings on good manufacturing process and educating satchet water sellers on good hygeine practices.*

*Keywords: Satchet water, Oko, Faecal, Coliform, Bacteriological quality.*

**Introduction**

Water is the most essential commodity for the survival of all lives. It is abundant in nature and occupies about 70% of earth’s crust. It is also the biological medium on earth and the only common substance that exist in nature in three physical state of matter solid, liquid and gas. It is the most universally used solvent and common route for transmission of diseases (Muller*,* A. J., Manifred,M. G., Zakharia, Y. and Prendergast, G. S., 2019). The demand for safe drinking water in Nigeria cannot be overemphasized considering the inability of the government to provide adequate pipe borne water to the populace. Well packaged water in bottles or food grade polythene satchets designed for food processing stands is a ready alternative for the growing population of over 140,000,000 people. However, safe drinking water is very scarce. The ever increasing demand of readily available water has led to the concept of satchet water. It is a general perception that packaged water is safe for consumption (Abdou, M. H., Akel. M. A., El-Shal. W. I. and El- Naggar, A. S., 2005).

Satchet water in Nigeria is known popularly as “pure water”, normally sold a cheap rate. It is believed that any package water has been processed sealed and released into the market under sealed food grade material or other appropriate containers for human consumption. In view of the above, this feasibility relates to the production and packaging of purified water to World Health Organization (WHO) and National Agency for Food and Drug Administration (NAFDAC) standard requirement for human consumption.

The increase in demand for package water in Nigeria is of public health significance. Most of the satchet water brands fall below WHO drinking water standards and are therefore of doubtful quality. Efforts need to be intensified in the monitoring of activities in this rapidly expanding industry with a view of raising standards (Barbard, L. B., Keefe, S. H., LeBlanc, D. R., Bradley, P. M and Chapella. F. H., 2009).

Satchet water like any other food product must be processed and packaged under aseptic conditions free from every possible source of contamination. The potability of water is found uncertain being collected from almost every available water source ranging from rain water to tank most of which are rusty and unwashed (Dibua, U. E., Esimone, C. O. and Ndianefo, P. C., 2007). Adherence to production and analytical standard are doubtful as most of the factories are observed to lack the appropriate technology for achieving these standards. The standard for hygiene in the various stages of production of satchet water vary among various manufacturers. While some employ sophisticated techniques such as ozonization and reverse osmosis most use ordinary boiling of well water sources and exclusion of particles by use of unsterilized filtration materials. However contaminants may get introduced during packaging and/or consumer handling (Obire, O., Tamuno, D.C and Wemendo, S.A., 2004).

Oko the most populated town in Orumba North Local Government Area has a high demand for portable water. The public water supplies are not enough to serve the teaming populace. This situation has led to the proliferation of private water supplies and construction of boreholes with the sale of water from them to the public under unhygienic conditions. The determination of the bacteriological quality of this product is of essence to guide against a public health disaster.

**Materials and Method**

**Sample Collection**

Five (5) brands of satchet water was tested by collecting three samples for each brand making a total of 15 samples from shops in Oko and taken to the laboratory for analysis within 24 hours.

**Bacteriological analysis**

Presumptive test was carried out on all the samples by transfering 10ml, 1ml and 0.1ml into test tubes containing MacConkey broth with inverted Durham tubes and incubated at 37oC for 24hours. These were examined for acid and gas production. The positives tubes were subjected to a confirmatory test by inoculating into Eosin methylene blue agar and incubating at 37oC for 24hours. The plates were examined for a metallic sheen colony which was isolated and inoculated into a single strength MacConkey agar and then streaked on nutrient agar slant for gram staining and viewed under the microscope (x100) oil immersion lens.

Ten – fold serial dilution of the water samples was done and 0.1ml was collected from 10-2 and 10-8 and inoculated into Nutrient agar, MacConkey agar, Eosin Methylene blue agar and Salmonella Shigella agar plates in triplicates using spread plate technique. The plates were incubated at 37oC for 24hours after which the colonies formed were counted taking an average using the colony counter.

**Identification of isolate**

Cultural characteristics of the colonies on media was observed, gram stained and further biochemical test such as Catalase test, Coagulase test, Oxidase test, Urease test, Citrate test, Indole test, Motility test and Sugar utilization test to identify the isolate.

**Result**

The Five (5) brands of satchet water examined in this study were all positive for the presumptive, confirmatory and complete test. The water samples were contaminated with *Staphylococcus aureus, Salmonella* sppand *Escherichia coli* as shown on table 1*.*

**Table 1: Bacteria Isolate from satchet Water Samples**

|  |  |
| --- | --- |
| **Sample** | **Bacteria Isolated** |
| I | *Staphylococcus aureus*, *Escherichia coli* |
| II | *Staphylococcus aureus*, *Escherichia coli* and *Salmonella* spp |
| III | *Staphylococcus aureus*, *Escherichia coli* and *Salmonella* spp |
| IV | *Staphylococcus aureus*, *Escherichia coli* and *Salmonella* spp |
| V | *Staphylococcus aureus*, *Escherichia coli* and *Salmonella* spp |

Sample 1 had a heavy growth of *Staphylococcus aurous* and *E. coli* which was 2.8x105cfu/ml

Samples 2 had *Staphylococcus aureus* (TNC) *Salmonella* spp (4. x106cfu/ml)

and *Escherichia coli* (3.6x103cfu/ml)

Sample 3 showed the presence of *Staphylococcus aureus* (TNC), *Escherichia coli* (TNC) and

*Salmonella* spp (3.4 x108cfu/ml)

Sample 4 showed the presence of *Staphylococcus aureus* (TNC), *Escherichia coli* (6.8 x103cfu/ml) and *Salmonella* spp (3.6x103cfu/ml)

Sample 5 showed the presence of *Staphylococcus aureus* (TNC), *Escherichia coli* (2.3x103cfu/ml) and *Salmonella* spp (1.6x104cfu/ml). These result are shown on table 2.

**Table 2: Bacteria Count**

|  |  |  |
| --- | --- | --- |
| **Sample** | **Total Bacteria count (cfu/ml)** | **Total coliform count (cfu/ml)** |
| I | 2.8 x 1015 | 2.8 x 105 |
| II | 3.6 x 1013 | 1.2 x 106 |
| III | Too numerus to count (TNC) | 1.5 x 105 |
| IV | Too numerous to count (TNC) | 1.6 x 107 |
| V | 6.8 x 106 | 2.3 x 106 |

**Discussion**

The presence of high viable count observed in all the satchet water samples are not consistent with the specifications of World Health organization (WHO) for the quality of satchet water (Gleick, 2006; Abdou, 2005). The result shows the presence of coliform bacteria in all the samples which shows a deficiency in the water treatment process or no treatment at all. This result is similar to a work by Edema M. O., Atayese, A. O. and Bankole, M. O., (2011) who isolated *Salmonella* spp and *Escherichia coli*, *Pseudomonas* spp, *Aeromonas* spp, *Flavobacterium* spp, *Micrococcus* spp and *Bacillus* spp from all the satchet water sample studied. The large presence of pathogenic organisms in the packaged water is an indication that the water sample are potentially unsafe for human consumption. The presence of faecal coliform is an indication of contamination from human or animal waste. This can contribute to the high incidence of typhoid fever among students in the community.

In a previous study by Dibua *et al*., (2007) on satchet water sold at Nsukka campus of University of Nigeria, the water samples were found to be unfit for consumption, Amongst the microoganisms found were; *Staphylococcus aureus*, *Streptococcus* spp, *Micrococcus* spp, *Bacillus* spp, *Escherichia coli*, *Klebsciella*, *Pseudomonas aeruginosa*, *Actinomycetes* and *Yeast.*

Pathogenic bacteria associated with water borne diseases include *Salmonella* spp and *Escherichia coli*, *Shigella*, *Vibrio cholerae*, *Campylobacter jejuni*, *Yersinia enterocolitica*, *Aeromonas hydrophilia*

In the last decade NAFDAC has been doing a lot to combat the challenge of poor drinking water quality by factory inspection and staff trainings but invariably more work is needed to combat this menance through continuous monitoring and evaluation.

Coliform bacteria were present in all the water samples and so does not meet the WHO standard of 100cfu/ml or Zero feacal coliform per 100ml of water. (WHO, 2006).

**Conclusion**

Packaged satchet water are a source of public health hazard. Their production and distribution should be closely monitored and continuously inspected by the regulatory agencies.

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