Original Research Article

Assessment of water quality of some table water companies in Kano metropolis, Nigeria

Abubakar A. [1], Babagana M. [2], Gashua MM[3]
[1]Department of Basic Sciences, Yobe State College Of Agriculture Gujba, P.M.B 1104, Damaturu, Nigeria
[2]Department of Animal Health and Production, Yobe State College Of Agriculture Gujba, P.M.B 1104, Damaturu, Nigeria
[3]Department of Veterinary Public Health and Preventive Medicine University of Maiduguri, Borno State, Nigeria

*Corresponding author
Abubakar Adamu
Email: ismimoh@gmail.com

Abstract: This paper examines the source, production process and water quality of some table water producing companies in metropolitan Kano. Samples were taken from each of the pure water production plants (3 each) from the six (6) local government areas of Kano metropolitan namely; Dala, Fagge, Gwale, Kano Municipal, Nassarawa and Tarauni, according to the methods of FAO. Three samples were collected from each of the sample site – source and at the end user point. The result of the microbiological analysis showed that all the samples had high aerobic mesophilic bacterial counts at the source. While, some samples had lower counts at the production sites than at the selling points, Results of the conform analysis clearly indicated the presence of high coliform counts in some of the water samples from source and of course at the selling points. The paper concludes that some companies do not comply with some of the FAO and NAFDAC standards. Based on the findings of this study recommendations were drawn.
Keywords: Table Water, Production, Coliform, Kano.

INTRODUCTION

The supply of potable water is very vital to good health. This is because organisms that cause dysentery, cholera, and typhoid fever are just some of the pathogens that can be spread in contaminated water [1]. One of the major critical problems in most developing countries today is the provision of an adequate and safe drinking water to its populace [2]. It is as a result of this problem that in a country like Nigeria there are a lot of packaged table water producing companies. Packaged water is raw water purified to remove physical, chemical and microbial contaminants and packaged into labeled containers [3, 4]. The production and sell of sachet/package water or pure water is one of the common businesses in Kano Nigeria. Idakwo and Abu [5] reported that a wide variety of microorganisms pathogenic to human beings are transmitted through contaminated water. Also according to [6] in [4], 300,000 people die every day from water related diseases like typhoid fevers, cholera, bacillary dysentery and gastroenteritis. Drinking water that is safe and aesthetically acceptable is a matter of high priority to National Agency for Food and Drug Administration and Control (NAFDAC). The quality of water can be evaluated using senses of sight, smell and taste (organoleptic attributes) to identify the appearance, colour, odour, taste and sensation to determine the aesthetic value. The physical characteristics of drinking water by themselves could sometimes be indicators of the chemical and microbiological quality of the water [7]. This study put; is therefore set up with the following aim.

MATERIAL AND METHODS

There are thousands of producers of table water in Kano and millions of urban dwellers consume them daily. There seem to be no standardization and quality control in both processing and product delivery by some of the producers. This apparent lack of quality control predisposes the consumers to serious health risk. In a country like Nigeria, where the health care system is not fully in order, coupled with wide spread poverty the public health implication of the packaged water is enormous. Sometimes attempts are not even made to trace the origin of infections some of which resulted from drinking of contaminated water which is thought to be pure but actually it is not.

Study area / Sampling sites

The sampling sites are six pure water production plants, each situated in one of the six Local Government areas of Kano metropolitan namely: Kano Municipal, Fagge, Dala, Nassarawa, Gwale and Tarauni.

Sample Collection

Samples were collected according to the method of FAO [8]. From each of the sample site, three samples were collected. One sample from the source, one sample from site and another sample at the end users point. The source samples collected in brown bottles which are sterilized by heating in autoclave at 12l°C for 15minutes. While the sachet samples were immediately transported to the laboratory in their sachets in ice contained in cooler and analysed.

Determination of physical characteristics

The parameters determined include pH, taste, color, odor and visible suspended solids (which are called Yan Kwallo or sojoji in Hausa). All these are determined using appropriate instruments obtained from microbiology laboratory of Bayero University Kano, using appropriate sense organs as the case may be.

Microbiological Analysis
1. Standard Plate Count
Sample Preparation and Serial Dilution

A quantity (10ml) of the sample was diluted with 90ml of sterile distilled water. This was labeled as 10^{-1} dilution. Form this dilution one milliliter was transferred in to a test Lube containing 9ml of the diluents and this tube is 10^{-2} dilution. The procedure was repeated until 10^{-5} was reached.

Culturing of Sample

From each of the serially diluted Lubes, one ml was transferred in to appropriately label duplicate petridishes. This was followed by pouring aseptically molten nutrient agar. The plates were allowed to solidify and incubated at 37 ^{0}C for 24 hours [8].

Coliform counts

This was carried out according to the method of WHO [6]. Water sample (50ml) was transferred in to a bottle containing 50ml of double strength lactose broth. Then 10ml of sample was transferred to each of five lubes containing 10ml of single strength lactose broth with Durham's tube. Then, 1.0ml of sample into each of five tubes containing 5ml single strength lactose broth. The lubes were incubated for 24 hours at 35 ^{0}C and for other 24 hours in the absence of gas. Following 24hrs incubation, the tubes were observed for gas production and the number of gas positive tubes was compared with the Most Probable Number table (MPN), to get the MPN of coliforms per milliliter of sample.

Detection of Escherichia coli

From the gas positive tubes, a loop-fill of inoculums was streaked onto plates of Eosins methylene blue agar (EMB). Following 24hrs incubation at 35 ^{0}C the plates were observed for the presence of bluish black colonies with green metallic sheen which are suspected of E coli.

RESULTS

The determination of the physical parameters showed that; the water sample at all production sites was all colorless, odorless, tasteless and neutral. The results of the Aerobic Mesospheric Bacterial counts showed that some of the samples had high counts while there was no significant bacterial growth in some of the samples as presented in table 1.

In table 2 the result of the coliforms count was presented. In some of the samples the E. coli form MPN is high while low in others. The result of E. coli counts in table 3 showed that no E. coli was detected in any of the production site, but one sample yielded at the sell point.

Table 1: Aerobic plate count of the wafer samples from source, production and sell point.

S/no.	Sample	Aerobic Plate Count (Cfu/ml) Source		
		Production	Endpoint	
1	Fagge	1.40×10^5	1.80×10^3	1.70×105
2	Dala	1.16×10^5	6.80×10^1	5.80×10^2
3	Municipal	6.80×10^4	NSG	NSG
4	Tarauni	6.80×10^4	NSG	NSG
5	Gwale	1.00×10^1	NSG	NSG
6	Nassarawa	9.00×10^4	2.04×10^2	1.00×10^3

NSG: No significant Growth Cfu/ml: Colony Forming Unit per milliliter

Table 2: Coliform count of the water samples from source, production and sell point

S/no.	Sample	Source	Coliform Counts (MPN/ml)	
			Production	End point
1	Fagge	92	10	2
2	Dala	3	8	8
3	Municipal	13	1	2
4	Tarauni	5	1	2
5	Gwale	1	1	1
6	Nassarawa	8	2	13

MPN: Most Probable Number

Table 3: E. coli detection in the water samples from source, production and sell point

S/no.	Sample	E. coli Detection		
		Source	Production	Endpoint
1	Fagge	+ve	Nil	Nil
2	Dala	Nil	Nil	Nil
3	Municipal	Nil	Nil	+ve
4	Tarauni	Nil	Nil	Nil
5	Gwale	Nil	Nil	Nil
6	Nassarawa	Nil	Nil	Nil

Source: laboratory analysis

DISCUSSION

The result of the microbiological analysis showed that all the samples had high aerobic mesophilic bacterial counts at the source. Expectedly the counts dropped down in some of the samples after treatment by the pure water plants. The counts however were still high at production. The counts were also high in some of the samples at selling points. These high counts are great points of concern because according to FAO, [8] high viable counts in food indicate: unsatisfactory sanitation, contaminated raw materials and unsuitable temperature and time for spoilage. Also Information obtained from NAFDAC also indicated that the aerobic plate count of drinking water should be zero as obtained from municipal, Tarauni and Gwale. It can also be seen that some samples had lower counts at the production sites than at the selling points. This might be as a result of the contamination of the water and the water bags by the hawkers many of whom were found to be looking untidy and unhygienic. Results of the conform analysis clearly indicated the presence of high coliform counts in some of the water samples from source and of course at the selling points. Presence of coliforms in water - samples is a serious hazard because coliforms are a group of indicator organisms. Their presence in water suggests that the water might have processed in a questionable manner. Because of the fact that coliforms belong to the family Enterobacteriaceae, (natural habitat is gastrointestinal tract of humans and animals) their presence suggests contamination that may be traced back to faecal origin. One very important issue of concern is that E. coli was isolated in some of the samples at the selling point. This is a clear indication that, the hawkers contribute a lot in the spread of pathogenic and spoilage organisms in the water samples. This is because; the water at the production plant does not contain E. coli but it does at the selling point. This signifies that the organisms might have introduced by the hawker on to the surface of the water bag which ultimately gained access to the water during analysis. The same thing can happen during drinking. The company might produce clean water, but the same may be contaminated by the hawkers and a consumer may get infected. According to [6] and [8], E. coli should not be recovered from a water sample that is meant for human consumption.

Conclusion and Recommendation

Conclusively, some of the companies do not comply with the standards of NAFDAC. Apparently, there was however high microbial loads in some of the water samples, while some of the samples were found to be of good microbiological quality. It is therefore recommended that:

- Table water production companies should improve in the quality of their operation with a view to improve on their hygienic standards and should comply with NAFDAC guides.
- After production, the water should be kept in well sanitized storage facilities.
- Water hawkers should exercise personal hygiene.
- The hawkers should be educated and enlightened on the implication of untidiness on public health.

REFERENCES
1. Robert W; Microbiology. Benjamin Cummings Publishers 2004; 432.

2. Kulshershtha SN; A global outlook for Water Resources Management (WRM) 1998; 12(3): 167-184.

3. Mendie U; Theories and practices of clean water production for domestic and industrial use. Lacto-Mendal, Lagos, Nig. 2005; 59.

4. Alhassan AJ, Imam AA, Yakasai HM; Quality assessment of sachet water packaged around Kano metropolis Nigeria, Bayero Journal of Pure and Applied Sciences, 2008; 1(1): 83-87.

5. Idakwo PY, Abu GO; Distribution and statistical analysis of bacteria in Lake Alau in the arid Northern Nigeria. Nigeria Journal of Microbiology 2004; 19 (1-2):535–542.

6. WHO, the world Health Organization Guidelines for drinking water quality. 1982; EPF82:39.

7. Denloye SA: Quality parameters for packaged water NAFDAC Laboratory Experience, IPAN News. 2004

8. Food and Agriculture Organization of the United Nations (FAO) Manuals of food quality control 4. Microbiological analysis, 1979; D1-D37.