PALGO JOURNAL OF MEDICINE AND MEDICAL SCIENCE
ISSN 2476-8340
Volume 4 Issue 1, February 2017.Page 152-155
http://www.palgojournals.org/PJMMS/Index.htm
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AN ASSESSMENT OF THE QUALITY OF SACHET WATER PRODUCED AND SOLD IN OBANLIKWU, OBUDU AND BEKWARA LOCAL GOVERNMENT AREAS OF CROSS RIVER STATE.

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Accepted 17 January, 2017

This paper investigated the microbiological quality of the sachet water produced and sold in Obudu, Bekwarra and Obanlikwu Local Government Areas of Cross River State, Nigeria. One hundred and twenty sachets from forty brands of sachet waters were collected daily for fourteen days and evaluated for microbial content. In all the Local Areas investigated, the total coliform count, faecal coliform count, and E. coli were well above regulated limits of the World Health Organization, with the highest of these values being 39 ± 9.54, 21 ± 6.23, 7 ± 2.59 respectively.

KEYWORDS: E. coli, coliform, faecal count, sachet water.

INTRODUCTION

In many countries of the world, the production, sales and consumption of sachet water has become a major activity. Indeed, Sachet water is one of the most essential commodities in these countries. UNICEF (2004) believes that sachet water helps to provide people with healthy life to be able to carry out economic and developmental activities. In many Nigerian markets and streets, sachet water is the most patronized bagged water for consumption. It has been reported that the emergence of sachet water is due largely to the quest for cheap and readily available source of potable water (Anyamene and Ojiagu, 2014). Since it is widely produced, it is commonly available in towns and cities and often transported to even villages where access to potable water is difficult. This widespread sale and consumption of sachet water has significantly affected public health since the outbreak of water-borne diseases in any country is a function of the quality of water that the citizens consume (Ezeugwunne et al., 2009). Cases of typhoid, diarrhea and other water related diseases arising from the consumption of sachet water has been reported by Ogamba (2004).These water borne diseases are reported to account for 80% of illnesses in developing countries, leading to the death of one child in every 8 seconds (Hughes and Koplan, 2005).Cabral (2010) reports that deaths due to water associated diseases and symptoms is now in excess of 5 million people per year. In the words of KoffiAnnan,*"We shall not finally defeat AIDS, tuberculosis, malaria, or any of the other infectious diseases that plague the developing world until we have also won the battle for safe drinking water, sanitation and basic health care."* (United Nations, 2005).

As far as research on water quality sold in major Nigerian cities is concerned, the literature is very rich. Some of these results are satisfying while others are frightening. According to Yusuf et al (2015) for example, out of the 21 brands of sachet water within Zaria metropolis that were analyzed and compared with the standard of the World Health Organization (WHO) and the Nigerian Industrial Standard (NIS) threshold limits,none of the coliform count of the brands were within the WHO threshold limits. It is therefore surprising that the authors concluded that the sachet water produced in Zaria "was relatively of good quality for human consumption" simply because the physicochemical properties conformed to WHO and NIS permissible limits. The research of Mberekpe and Eze (2014) was even more frightening. Although the aim of the research was to look at the effect of preservation on the quality of sachet water consumed by households in Nsukka Zone, it was established that all brands of sachet water produced in the zone had E. coli at day one, which is an indication of faecal contamination. The study recommended that the storage duration of sachet water should not exceed 14 days of production at all conditions of storage for the purpose of consumer safety.This recommendation was also given by Akinde et al (2011). This is contrary to the safety period of two months that is usually claimed by manufacturers of sachet water. The study of Mberekpe and Eze (2014) corroborated that of

Onweluzo and Akuagbazie(2010) who, also in Nsukka, assessed the physical, chemical and microbiological qualities of 17 brands of sachet and bottled water. Although the physical and chemical qualities met the WHO and NAFDAC standards, 88% of the brands were microbiologically unwholesome .In Bauchi Metropolis, Ibrahim et al., (2015) carried out a qualitative assessment of sachet and bottled water marketed in the area. 73.3% of the sampled sachet water was not fit for human consumption. The physicochemical properties of the analyzed sachet water did not "wholly" meet recommended standards as there were indications of bacterial and fungal presence in the 15 sachet water samples. The story in Kano metropolis is however, a little heartwarming. Of the fifty brands of sachet water produced from bore holes and tap water, the physicochemical properties tested by Sheshe and Magashi (2014), were within drinking water regulation limits. The authors concluded that the sachet water sold in Kano metropolis is fit for human consumption. The research did not however include the test for E. coli. If they did, the conclusion may not have been different. This is because, Auwal and Taura (2013) analyzed a total of 212 water samples for the prevalence of molds in households' drinking water in Kano metropolis. These samples were drawn from boreholes, taps and wells. They concluded that it is unlikely that the concentration of molds found in the samples could cause any disease in healthy individuals.

Aroh et al., (2012) sampled 80 sachet water products from 10 different brands in Aba and Port Harcourt for quality. Coliform levels in all samples were seen to increase appreciably after the third week in Aba and Port Harcourt. By the fourth week, the coliform levels had exceeded permissible limits .The water samples were suitable for consumption at day 1.The Prevalence of fungi in sachet and borehole drinking water in Calabar was investigated by Okpako et al (2009). These, according to the report, are the major sources of drinking water in that city. Unfortunately, 75% of the sachet water tested positive to fungal presence.Like in many towns and cities in Nigeria, the major source of drinking water in Obudu, Obanlikwu and Bekwarra local Government Areas of Cross River State. The number of sachet water in circulation in these towns increase by the day. The purpose of this research is to assess the microbial content of these sachet waters viz-a-viz their suitability for human consumption .Coliform organisms are suitably used as microbial indicators of drinking water quality largely because they are easy to detect and enumerate in water (WHO, 1993). Coliform bacteria have classically been translated into specific chemical reactions or the appearance of characteristic colonies on commonly used media (US EPA, 2013). For the purpose of this study, total and faecal coliform qualities of sachet water were determined.

METHODOLOGY

Forty (40) different brands of sachet water were collected on a daily basis for two weeks (14 days) from the point of production. Thirty (20) of these samples were collected from Obudu, twenty (10) from Bekwara, and twenty (10) from Obanlikwu. In all, three samples were obtained for each brand; making a total of one hundred and twenty (120) sachets.Each of the samples had "NAFDAC NUMBER". Collected samples were transported in a cold box lined with ice blocks. Collection of samples was done in September, 2016. Samples were analyzed for faecal coliforms, *E. coli*, and total coliform bacteria by the membrane filtration technique AWWA and APHA (1998) using Millipore HA, 0.45 mm pore-size membrane filters (Millipore Corp., Bedford, MA).This technique is used in most water testing laboratories. A series of tests were conducted on the pure isolates of the Gram positive and Gram negative isolates, in order to identify the exact species of organisms (Gram negative isolates total and faecal coliforms). All samples were analyzed within twelve hours of collection.

RESULTS AND DISCUSSION

The mean of the total colonies counted for faecal coliforms, E. coli and total coliforms were obtained for each brand. The majority of microbes were highest in total coliforms and least in E. coli. This is shown in tables 1 and 2. Although not significant at 5% significance level, variations existed in the parameters investigated among the brands.

Table 1: Highest values of Bacteriological Property of Water samples Collected

Parameter (cfu/100ml)	Samples			WHO Limits
	Obudu	Bekwarra	Obanlikwu	
Total Coliform	27 ± 8.17	34 ± 9.24	39 ± 9.54	0.00
Faecal Coliform	12 ± 5.21	18 ± 5.78	21 ± 6.23	0.00
E. coli	4 ± 2.11	5 ± 2.23	7 ± 2.59	0.00

Table 2: Least values of Bacteriological Property of Water samples Collected

Parameter (cfu/100ml)	Samples			WHO Limits
	Obudu	Bekwarra	Obanlikwu	
Total Coliform	21 ± 7.22	29 ± 7.79	32 ± 8.13	0.00
Faecal Coliform	9 ± 4.31	14 ± 5.11	16 ± 6.12	0.00
E. coli	2 ± 1.74	4 ± 2.03	5 ± 2.21	0.00

Throughout the fourteen day period of investigation, microbes were found to be present in each sample analyzed in the three areas. The amount of microbes were higher in some days than other days, with the highest values presented in table 1, and least values in table 2. The average values of the investigated parameters are presented in table 3.

Table 3: values of investigated parameters in the three areas.

Parameter (cfu/100ml)	Samples		
	Obudu	Bekwarra	Obanlikwu
Total Coliform	26 ± 8.22	33 ± 9.11	38 ± 8.78
Faecal Coliform	11 ± 5.28	17 ± 5.71	20 ± 6.19
E. coli	3 ± 2.68	5 ± 2.11	6 ± 2.53

In all days, E. coli were least and total coliform count was highest. This was true for all local areas.The data shows that the counts for all the parameters for the different sample areas were not significantly different ($p < 0.05$).

None of the water produced during the period of investigation was found suitable for consumption. The variation in the amount of microbes found in the samples with respect to days could be due to the different levels of hygiene observed at any given point in time. Poor hygiene practices during production is the major source of cause of contamination. Okorafor et al (2014) tested the Quality of Some Products of Sachet Water in Ogoja, Cross River State. A total coliform count of as high as 100 was obtained in one of the samples. This, according to them, is an indication that the water in Ogoja is produced in an unhealthy environment. They concluded that none of the sachet water produced and consumed in Ogoja was safe for drinking. Ogoja is within the neighborhood of the three areas sampled in this research. Indeed, there are many activities of man that negatively affect the physico-chemical and bacteriological quality of sachet water. Some of these may include picking with hands or packaging with contaminated pathogenic organisms, trace of metals, human produced and toxic chemicals; the introduction of non-native species; the changes in acidity, temperature, and salinity (Felisa, 2014). Research has shown that bags of sachet water are generally filled by women and children with suspected sanitary practices Obiri-Danso et al (2003).

CONCLUSION

The microbial property of sachet water produced in Obudu, Bekwarra and Obanlikwu were evaluated in triplicates and compared with WHO limits. For water to be considered potable and suitable for consumption, its physical, chemical and microbiological qualities must conform to specified standards (Stoler, 2013). The aim of this study was to investigate the microbiological quality of sachet water from three areas of Cross River State and compare with WHO standard. Based on the study, the sachet waters produced and sold in Obudu, Bekwarra and Obanlikwu are not suitable for consumption.

REFERENCES

Akinde, S. B., Nwachukwu, M. I. andOgamba, A.S. (2011). Storage Effects on the Quality of Sachet Water Produced within Port Harcourt Metropolis, Nigeria. *Jordan Journal of Biological Sciences* 4, 157 - 164.

Anyamene N. C. and Ojiagu D. K. (2014). Bacteriological Analysis of sachet water sold in Awka Metropolis, Nigeria. *International Journal of Agriculture and Biosciences* 3: 120-122.

Aroh K. N., Eze E. M., Ukaji D., Wachuku C. K, Gobo A. E., Abbe S. D., Teme S. C.1 and Igoni A. H. (2013); Health and environmental components of sachet water consumption and trade in Aba and Port Harcourt, Nigeria; Journal of Chemical Engineering and Materials Science, 4(2), 13-22

Auwal H. and Taura D.W. (2013); Prevalence of Moulds in Households Drinking Water of Some Local Government Areas of Kano, Nigeria; Greener Journal of Biological Sciences, 3(5), 179-186.

AWWA and APHA (1998). Standard methods for the examination of water and wastewater. *Washington, DC Standard Methods for the Examination of Water and Wastewater.*

Cabral J. P. S. (2010). Water Microbiology: Bacterial pathogens and water. *International Journal of environmental Research and*

Public Health 7: 3657- 3703.
Ezeugwunne IP, Agbakoba NR, Nnamah NK, Anhalu IC (2009). The Prevalence bacteria in packaged sachet water sold in Nnewi, South East, Nigeria. World J. Dairy, Food Sci. 4(10):19-21.
Felisa, B. A. (2014). Effects of Anthropogenic Activities on Water Quality of Streams: A Case Study of the Onyasia Stream in the Greater Accra Region. Pp-13.
Hughes JM and Koplan JP (2005). Saving lives through global safe water. *Journal of Infectious Diseases* 11: 1636-1637.
Ibrahim M. D., Musa U. and Akindele A. (2015); Qualitative Assessment of Sachet and Bottled Water Marketed in Bauchi Metropolis, Nigeria; Chemical and Process Engineering Research, vol 37.
Obiri-Danso, K., Okore-Hanson, A. & Jones, K. (2003). The microbiological quality of drinking water sold on the streets in Kumasi, Ghana. *Letters in Applied Microbiology* 37, 334-339.
Ogamba, A.S. (2004); Packed Drinking Water, How Safe? Professionalism, IPAN news (4):70-76.
Okorafor K. A., Eleng I. E., and Ogah J. O. (2014); Tests of Quality of Some Products of Sachet Water in Ogoja, Cross River State, Nigeria; ARPN Journal of Science and Technology, 4(11).
Okpako E, C., Osuagwu A. N., Duke A. E. and Ntui, V. O. (2009); Prevalence and significance of fungi in sachet and borehole drinking water in Calabar, Nigeria; African Journal of Microbiology Research, 3(2), 56-61.
Onweluzo, J. C. and Akuagbazie, C. A. (2010); Assessment of the Quality of Bottled and Sachet Water Sold In Nsukka Town; Journal of Tropical Agriculture, Food, Environment and Extension, 9(2), 104-110
Priscilla Mberekpe and NgoziEze (2014); Effect of Preservation on the Quality of Sachet Water consumed by Households in Nsukka Zone; Civil and Environmental research, 6(7).
Sheshe, M.U. and Magashi A.M. (2014); Assessment of Physicochemical Quality of Sachet Water Produced In Selected Local Government Areas Of Kano Metropolis, Kano State – Nigeria; Bayero Journal of Pure and Applied Sciences, 7(2), 31-35
Stoler, J. (2013); The Sachet Water Phenomenon in Accra: Socioeconomic, Environmental, and Public Health Implications for Water Security. In *Spatial Inequalities*. Pp. 181-190 U.R. Weeks, A.G. Hill and J. Stoler, editors: Springer Netherlands.
UNICEF (Geneva, 2004). Meeting the Drinking Water and Sanitation Targets: A Mid-Term assessment of progress. Pp 31.
US EPA (2013).`Microbiological Methods/Online Publications.
WHO (1993). *Guideline for Drinking Water Quality.* ISBN 92 4 154460. Water and sanitation journal.
Yusuf, Y.O., Jimoh, A.I., Onaolapo, E.O. and Dabo, Y. (2015); An assessment of sachet water quality in Zaria Area of Kaduna State, Nigeria; Journal of Geography and Regional Planning, 8(7), 174-180.