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OJHAS Vol. 9, Issue 4: (Oct-Dec, 2010)

Short Report

Contamination of Sachet Water in Nigeria: Assessment and Health Impact

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URL
http://www.ojhas.org/issue36/2010-4-15.htm

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Abstract:

Adequate supply of fresh and clean drinking water is a basic need for all human beings. Water consumers are frequently unaware of the potential health risks associated with exposure to water borne contaminants which have often led to diseases like diarrhoea, cholera, dysentery, typhoid fever, legionnaire's disease and parasitic diseases. The inadequacy of pipe borne water-supply in Nigeria is a growing problem; as a result people resort to buying water from vendors, and sachet or bottled water became a major source of drinking water. Although, portable and affordable, the problems of its purity and other health concerns have begun to manifest. Sachet water have been reported to contain bacteria such as *Bacillus sp., Pseudomonas sp., Klebsiella sp., Streptococcus sp.,* and oocysts of *Cryptosporidia sp.* Apart from environmental contaminants, improper storage and handling by vendors also poses a serious threat to the health of the ignorant consumers. This paper tends to review the quality of these 'pure water'; its physical examination, microbial assessments, its impacts on health, and the various strategies adopted by the concerned authorities to regulate this thriving industry.

Key Words: Pipe borne water; Vendors; Contaminants; Pure water

Introduction

Good quality water is odourless, colourless, tasteless, and free from faecal pollution.[1] A reliable supply of clean wholesome water is highly essential in a bid to promoting healthy living among the inhabitants of a defined geographical region.[2] Safe and potable water supplies in urban centers in Nigeria are still inadequate in spite of four decades of independence and several efforts from various governments.[3] The standard industrialized world model for delivering of safe drinking water and sanitation technology is, however, not affordable in most of the developing world.[4] Consequently, given the renewed global commitments towards the Millennium Development Goals (MDG) marked for 2015, the importance and contribution of locally sourced low-cost alternative drinking water schemes to sustainable access in rural and urban settings of developing nations cannot be overemphasized.[5] One of such local intervention in Nigeria where public drinking water supply is unreliable is drinking water sold in polythene sachets. Water in sachets is readily available and affordable, but there are concerns about its purity. The integrity of the hygienic environment and conditions where the majority of the water in sachets are produced has been questioned.[6] Apart from environmental contaminants, contamination from improper vendor handling also poses threats to the health of the ignorant consumers who drink often times without any proper cleaning of the sachets. Previous studies have identified handling as the source of infection in food and water-borne diseases in several countries.[4] Water related diseases continued to be one the major health problems globally.[7]

The National Agency for Food and Drug Administration and Control (NAFDAC) is mandated to enforce compliance with internationally defined drinking water guidelines, but regulation of the packaged water industry aimed at good quality assurance has remained a challenge to the agency.[6] To control this menace of contaminated water in sachets, NAFDAC declared a possible 'gradual' nationwide ban on sachet water to allow manufacturers of sachet water to start winding down or change to bottle packaging.[6]

Successful implementation of this ban has remained far from reality as the sachet water market is witnessing tremendous growth, especially among the poor and middle social classes. Few studies conducted in recent years on the quality of packaged water in Nigeria focused primarily on the end-product, leaving out the processes that determine the fate of the packaged water, and the people (various stakeholders involved) in whose hands lie the will and power to effect the desired change. Consequently, practicable recommendations aimed at changing the status quo have not yet emerged. This paper tends to review the quality, physical examination and microbial assessments of these 'pure water, also its impacts on health, and the various strategies adopted by the concerned authorities to regulate this thriving industry.

Physical Examination

Previous studies on sachet water phenomenon in Nigeria have shown that factors responsible for its contamination range from sharp practices, poor hygiene of vendors, polluted environment, and non-adherence to WHO/NAFDAC regulations. This examination involves external features such as label which include product information, specific odour, appearance which includes colour, turbidity, and presence of floating particles or extraneous materials. Dada[4] in his study on sachet water contamination physically examined samples of 'pure water' from the Nigerian market and recorded that none of the identified brands met the compliance levels set by the regulatory authorities in terms of label requirements such as registration number and batch numbers, manufacturing and expiry dates, nutritional information, net volumes and sometimes producers names and contact addresses (Table 1).

Table 1: Physical examination for labeling compliance sachet water in North Central Nigeria						
NAFDAC Number	Best Before Date	Manufacturing Date	Nutritional Information	Batch No.	Net Volume (cl)	Producer' Name and Contact
+	-	-	-	-	50	+
+	-	-	-	-	50	+
+	-	-	-	-	50	+
+	-	-	-	-	50	+
+	-	-	-	-	50	+
+	-	-	-	-	50	+
+	-	-	-	-	50	+
+	-	-	-	-	50	+
+	-	-	-	-	50	+
+	-	-	-		50	+
+: displayed on sample label; -: not displayed on sample label (Source: Dada, 2009)						

Using an atomic absorption spectrometer, Orisakwe et al[8] assessed sachet water samples sold in Eastern Nigeria. They the analyzed level of lead,

cadmium, copper, and nickel and other parameters like Salinity, sulphates, and pH. Their result revealed that some of the sachet waters contained heavy metals, and consumers might be exposed to hazards.[8]

Microbial Assessment

Oladipo *et al*[7] worked on the microbial analysis of some vended sachet water in Ogbomoso, Nigeria. The isolates characterized were identified as *Bacillus subtilis, bacillus alvei, Pseudomonas putida, Pseudomonas fluorecens, Bacillus cereus, Enterobacter aerogens and Proteus mirabilis.* The antibiotic susceptibility profile of the seven isolates was determined and it was discovered that 59.30% was found sensitive to commercial antibiotic disc used while 40.70% were resistant.

The bacterial quality of sachet water was investigated at point–of sale in South-Western Nigeria using standard microbial procedures. The results showed that 87% of the packaged water samples were untreated or produced under unhygienic conditions. The study also showed that about 65% of the polythene sachets used was not food-grade quality. High aerobic colony counts on the order 10^6 were recorded from 93% of sample examined. The findings revealed that about 90% of packed 'pure water' sold in the country are not fit for human consumption and are hazardous to health. Total viable counts were in the order 10^5 and 10^6 colony forming units per ml of samples, while counts of *Salmonella* species were between 20 and 23 per 100ml of sample. Mean colony counts per ml of sample ranged from 1.51 x 10^2 to 1.54 x 10^2 while feacal coliform represented by *E. coli* were between 98 and 106 cfu/100ml.[9] Assessment of quality of packaged water sold in Ibadan, Nigeria showed that 5% of 78 samples (Type A), and 28% of 30 samples (Type B) tested positive for coliform counts. The dominant bacteria were *Klebsella* species, *Streptococcus faecalis* and *Pseudomonas aeroginosa*. (Figure 1)[3]
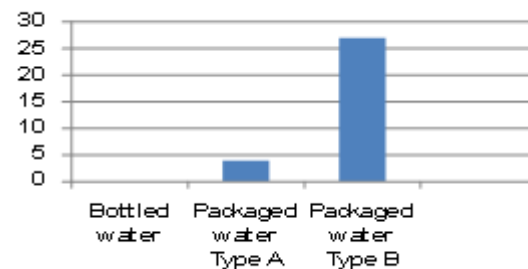

Fig. 1: Coliform counts in water samples examined. (Source: Ajayi *et al.,* 2008)

Dada[4] studied the bacterial quality of sachet water sold in Lagos, Nigeria. He also identified the contributory factors that determine the fate of the packaged water product as it moves from catchment to consumers. He observed that microbial quality deteriorated considerably as products moved

farther down the distribution chain. As low as 6.6% showed contamination after production, 40% of the samples obtained from the distributors shed were contaminated, while the highest level of contamination (45%) was observed from samples obtained from the extreme part of the distribution chain.

In Anambra, Nigeria Ezeugwunne *et al*[1] isolated bacteria *Esch. Coli* (36%), *Streptococcus faecalis* (19.4%), *Klebsiella pneumonia* (19.4%) and *Staphylococcus aureus* (25%) in sachet water samples analysed.

The health risks associated with methods of hawking of sachet water in the streets of Lagos was also investigated. The investigators sampled 8 bands of sachet water from different receptacles; open packs from factory, buckets and wheel barrow containing ice-blocks and refrigerators. Bacterial cultures were set up for the sample-water contained in sachet, surface of the sachet, swabs from compartments of the refrigerators and waste water of defrosted ice in the bucket and wheel barrow. This study revealed that enteric pathogens and *E. coli* were not isolated from any samples and brand of sachet water, but significant part of the isolates on the samples were collected from cooling receptacles.[10] Vendors and their patrons have mostly contributed to the overall contamination of hawked sachet water.[4] (Plate I)

Plate I: Improper storage condition of water in sachet. (Source: Dada 2009)

Health Impact

High prevalence of diarrhoea amongst children and infants can be traced to the use of unsafe water and unhygienic practices. It is estimated that 150 000 to 200 000 children are lost to diarrhea related death each year in Nigeria.[11] Cholera, typhoid, paratyphoid, guinea worm, and schistosomiasis are all too common. Mortality and morbidity rates are high due to the

absence of clean and adequate sanitation, and where potable water is available; the potential gains are frequently negated by contamination of the water delivery due to poor sanitation.

Water borne diseases account for one third of intestinal infections globally.[12] Another study reported that the poor hygiene were responsible for 40% of all death and 5.7% of total disease burden occurring worldwide.[11] Some of the microbial contaminants like *E. coli, Klebsiella spp*, and *Enterobacter spp* produce extended spectrum beta lactamase (ESBL), an enzyme which renders antibiotics in-effective when used to treat infection caused by ESBL bacteria thus making therapy difficult for clinicians.[13]

Prevention and Control

It is a well-known fact that clean water is absolutely essential for healthy living. Hence, the following measures should be undertaken:

- Assessment of water quality at some important stages of production; pre production, production and post production stages at the factories is therefore suggested in order to ensure their quality and safety.
- NAFDAC and the Ministry of Health need to get the producers of 'packaged water' to comply with the national drinking water guidelines. All water that fails NAFDAC and WHO regulations should be withdrawn from the market.
- Standard Organisation of Nigeria (SON) should be actively involved in the regulation of the quality of packages used in packaging water.
- Communities on their own part should be educated and enlightened on the effects of patronizing fake vendors.
- Regular monitoring and inspection will be required to enforce the existing regulations and if need be promulgate new ones to ensure that the health of the populace is guaranteed.
- Sachet water manufacturers should adequately make necessary investigation to identify the point of entry of contaminants and get it rectified.

Conclusion

After assessing sachet water phenomenon in Nigeria, more attention to intervention rather than suppressing packaged water in a bid to protect public health is advocated as residents may revert to poorer sources which could lead to more grievous conditions.

There is a need for a switch from the traditional end-product focused regulatory approach currently employed by the national regulator to one that involves the people who play active roles as manufacturers, distributors, vendors, consumers and handlers in the packaged water industry. Regulatory activities that promote core hygiene values such as hand washing, general cleanliness of storage environment and vendor

containers and proper handling culture will produce the end product monitoring.

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