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Original Paper

Parasites Associated with Sachet Drinking Water (*Pure Water*) in Awka, South-Eastern, Nigeria

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ABSTRACT

A study to ascertain the parasites associated with sachet drinking water, (popularly called "Pure Water" in Nigeria), in Awka, capital of Anambra State, southeast Nigeria was conducted. This was in order to determine the safety and suitability of such water for human consumption. Sachet water is a major source of drinking water for low and middle class Nigerians. The increase in demand of this water has led to the proliferation of industries in this sector, because of the economic benefits derivable from the sale. Samples of differently packaged sachet drinking water were purchased from producers, distributors, marketers and hawkers. Samples were observed macroscopically and pH tested. Using a sterile syringe, 10mls of water was taken from each sample and centrifuged at 2,500rpm per minute. Sediments observed were placed on a glass slide and observed microscopically using x10 and x40 objective lens for a possible parasite ova or cyst. The surface of each sachet of the packaged drinking water was also washed thoroughly and the resulting water was centrifuged and observed microscopically. All the tested water samples met the W.H.O. recommended standard, of being colorless, tasteless, odourless with average pH of 6.93. No parasites were found in the water in the sachets but some parasites were found on the surfaces of the sachets. The surface of the sachets of the packaged water purchased from hawkers had the highest number of parasites {15 (41.7%)}. Identified parasites include cysts of *Ascaris lumbricoides (5.6%), Entamoeba histolytica* (4.6%), hookworm (2.8), *Trichuris trichuria* (2.8%) and *Giardia lamblia cysts* (1.9%). Hawkers possibly play a very significant role (χ^2 = 20.21, df =2, $p<0.05$) in the transmission of parasitic infection from the outside of the sachets through improper handling. It is advocated among others that cleaning and washing of sachets of packaged drinking water before use will aid in breaking the transmission circle.

Key words: Nigeria, Parasites, Public health, Sachet drinking water

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INTRODUCTION

Sachet drinking water popularly called 'pure water' in Nigeria is presently a lucrative business, with many people involved in the production and marketing of the product. Sachet food drinks and ready-to-eat food have become very much part of our food culture. They are highly patronized by all due to their cheapness and ubiquity. In Nigeria, they come in varieties, which include *kunu* (prepared with fermented millet) drinks, *zobo* (*Hibiscus sabdariffa* water extract), ice cream, yoghourt, ice water, milk, sachet drinking water, table water, soft drinks and so on. Sachet water is presently a major source of drinking water for both poor and rich. It is easily available and affordable. As a result it is very common to see children and adults hawking sachet water on the streets of Anambra State and elsewhere in Nigeria.

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These sachet drinking water and food - drinks though beautifully packaged, well labelled and advertised are not necessarily free of contaminants, to which they are exposed (Caroli *et al*., 1985). Food - drinks contamination in Nigeria are well documented (Omenu *et al*., 2005; Taura *et al*., 2005). Food - drinks and water occasionally get contaminated either during processing, while transporting them or by hawkers and handlers. Apart from the health implications, drinking contaminated water also have serious socio - economic and political implications (Mukhtar and Oyeye, 2005).

The relative risk of infection through the use of ordinary tap water is very low because of the purification processes it must undergo before it is approved as the municipal water supply from the State Government (Caroli *et al*., 1985). Such water is tapped from sources (surface or underground water) treated and distributed for general public use. In Anambra State, however, the municipal water supply from the State Water Cooperation is currently non-functional. This has led to the proliferation of packaged drinking water business in the state and indeed Nigeria. This work is therefore aimed at investigating the types of parasites associated with packaged drinking water in Awka, Anambra State, South Eastern, Nigeria.

MATERIALS AND METHODS

Study Area

The study was carried out in Awka South Local Government Area of Anambra State, Nigeria. It lies between latitude 6^0 $07^/$ - 6^0 $26^/$N and longitude 6^0 $57^/$ - 7^0 $10^/$ E. It is 150m high above the sea level with the relative humidity between 70-90% and temperature range of 21 to 36^{o}C. Awka is an urban area with so many activities. There are many public and private establishments in the area like Nnamdi Azikiwe University, St Paul's University College, banks and markets with many commercial activities. Awka is also the seat of government of Anambra State as well as of Awka South Local Government Area.

Study Sample/Technique

Three bags of sachet drinking water each (each containing 20 packets) were purchased from eleven (11) different producers in the town. Another three bags each were purchased from thirteen (13) different wholesale dealers in different parts of the town. Three sachets each of the water were also purchased from twelve (12) hawkers respectively from different parts of the town. The marketing name of the purchased sachet drinking water include: *Earnikem, Unizik, Rancco, Beajin, Mayce, Hazeal, Crescent, Ben lovers, Be-Joy, Lekmor, Archer, Rock tama* and *Frana*. Three sachets drinking water each were randomly selected from each bag for the study. On the whole a total of 108 packaged water and sachets were analyzed.

Wearing sterilized gloves, each sachet was shaken, opened with a sharp scissors and emptied into individual sedimentation flask, covered and left overnight. This was observed macroscopically immediately after it settled. The colour, odour, taste, pH were noted using the WHO range (colourless, odorless, tasteless, pH 6.5-8.5). For each left overnight, the supernatant was decanted. The sediment was shaken and 10mls of each sample was centrifuged at 2,500rpm for a minute. The sediment from each tube was checked for parasite by concentration method described by WHO (1991). This method enables detection of small numbers of parasitic eggs and larvae through concentration by sedimentation. About one gram of the sediment and 10ml of formalin were mixed together and strained with the aid of sieve directly into a centrifuge tube. Then 3ml of mixture was thoroughly mixed using glass rod and centrifuged at 250rpm for 1 minute. The supernatant of debris and formalin-ether was poured away by quickly inverting the tube. The sediments were agitated to form suspension with the remaining fluid on the sides of the tube. A drop of the suspension was transferred onto a clean slide for microscopic examination under a cover slip using the x10 and x40 objectives. This was repeated until the sediment in each centrifuge tube was exhausted. The surface of the sachets of water was also washed off and the resulting water centrifuged and observed microscopically. The method of centrifuging used in this study was to ensure the concentration of impurity in the water samples. This method is acceptable because parasite eggs/cysts are rarely seen in volumes of liquids except when they are concentrated.

RESULTS

The macroscopic and microscopic examination results of the 108 analyzed packaged drinking water from producers, marketers and hawkers in Awka is shown in Table 1.

None of the packaged drinking water harbored any parasite. All the tested packaged drinking water also met the standard pH of 6.5-8.5 recommended by W.H.O. The packaged drinking water was odourless, colourless and tasteless. Some particles, though low, were seen in most of the packaged drinking water, but few had moderately high particles. These particles were like crystals and fibers in varying degrees.

Table 1: Analysis of all Sampled Packaged Water Purchased in Awka, South-East, Nigeria

Trade Name of Sample	pH	Odour	Colour	Taste	Parasite Cyst/Ova	Particles
Earnikem	6.93	odourless	Colourless	Tasteless	nil	very low
Frana	6.95	odourless	Colourless	Tasteless	nil	very low
Rancco	6.95	odourless	Colourless	Tasteless	nil	very low
Beajin	6.75	odourless	colourless	Tasteless	nil	low
Mayce	6.95	odourless	colourless	Tasteless	nil	high
Hazeal	6.93	odourless	colourless	Tasteless	nil	high
Crescent	6,75	odourless	colourless	Tasteless	nil	high
Ben lovers	6.93	odourless	colourless	Tasteless	nil	low
Be-joy	6.93	odourless	colourless	Tasteless	nil	low
Lekmor	6.93	odourless	colourless	Tasteless	nil	very low
Archer	6.93	odourless	colourless	Tasteless	nil	high
Unizik	6.93	odourless	colourless	Tasteless	nil	very low
Rock tama	6.70	odourless	colourless	Tasteless	nil	low

After washing, the surfaces of the sachets of the packaged drinking water harbored some parasites (Table 2). The highest number 15 (41.7%) was from hawkers, followed by marketers 3(7.7%) and the least of contaminated sachets 1(2.8%) was recorded from those purchased directly from manufacturers. This difference in contamination rate of sachets was significant (χ^2 =20.21, df=2, p< 0.05). The most frequent encountered parasite was *Ascaris lumbricoides* (5.6%) followed by *E. histolytica* (4.8%). On the whole 19(17.6%) sachets were contaminated with parasites.

DISCUSSION

Findings show that drinking water sachets, distributed and hawked in Awka urban may not pose any health threat for now as no parasitic organisms were found in them. This is in line with the findings of Egwari *et al*. (2005) in Lagos southwest Nigeria who in their bacteriology study of sachet water found no enteric pathogens and *Entamoeba coli*. The non - occurrence of parasites in these products could be as a result of use of uncontaminated water sources and improved methods of water treatment.

Table 2: Ova or Cyst of Parasites haboured on the Sachets of the Purchased Packaged Drinking Water in Awka, South-East, Nigeria

Source	No of sachets	*A. lumbricoides*	*E. histolytica*	*T. trichuira*	*G. lamblia*	Hook worm	Total (%)
Hawkers	36	5	3	3	2	2	15(41.7)
Manufacturers	33	-	1	-	-		2(2.8)
Marketers	39	1	1	-	-	1	3(7.7)
Total/%	108	6(5.6%)	5(4.6)	3(2.8%)	2(1.9%)	3(2.8%)	19(17.7)

For instance, industries like Earnikem use ultra violet radiation to treat deep borehole water. The use of ultra violet treatment or other improved treatment methods will kill any parasite or other organisms that would have entered the water (Caroli *et al.*, 1985). All sachet drinking water industries visited, used automated packaging machines as opposed to electric manually operated impulse sealers. Such hand held sealers could bring human hand in close contact with packaged water during various stages of production and this could lead to infection (Adam and Moss, 1999). However the non occurrence of parasites in the sampled sachet water in south-east, Nigeria is in contrast with Kwakye-Nuako *et al.* (2007) study in Ghana, where some protozoan parasites were detected in sachet drinking water.

Also Addo *et al.* (2009) in the study of bacteriological quality of sachet water produced and sold in Teshie-Nungua suburbs of Accra, Ghana detected faecal coliforms and *Escherichia coli* which were attributed to poor treatment and handling methods in some sachet water producing industries. The moderately high particles found on some sachet water could be as a result of poor filtration techniques that make the passage of these particles easy. These particles could be dead parasites that must have been killed by water treatment methods used, but passed through the filters employed by the industries and may or may not have health consequences.

The bulk of parasitic infection that may result from sachet drinking water would from hawkers, who sell sachet water along the streets. The outside cellophane sachets of water may be contaminated if the water was loaded in contaminated containers or if the hand of the loader was contaminated. Egwari *et al*. (2007) in Lagos, Nigeria also noted that *Entaemoeba coli* and other enteric pathogens formed a significant part of the isolates on the outside sachet surfaces of samples collected from cooling receptacles (pail, basin, wheel barrow, and refrigerator). It was therefore not surprising that some packets analysed in this present study had hook worm eggs on them. The hawkers who were mostly children probably picked up the parasites while playing with feacal contaminated soil. They also handled dirty currency notes.

Reports on contamination of currency notes have been documented (Jolaoso, 1991; Ameh and Balogun, 1997; Awodi *et al*., 2001). Hawkers may also immediately after visiting the toilet rush out to hawk the water without washing their hands, thus contaminating the sachets of drinking packaged water. Omemu *et al*. (2005) noted that *E. coli* infection persists as a result of feacal contamination resulting from improper handling. In an effort to select the desired type of water through “pick and drop” process and to choose the cooler or warmer sachet drinking water, buyers may also contaminate the packets, consequently predisposing the consumer to infection. It is thus clear that sachet drinking water from industries and wholesale dealers in Awka does not pose any health risk in terms of parasitological analysis for now. However, there is a serious need for bacteriological and fungal analysis and their health implications. Further analysis of the particles seen in the sachet water is necessary. The attitude of the hawkers is a serious source of concern as they seem responsible for actually contaminating the cellophane packaging material of the water during packing and hand out the water.

It is therefore recommended that the consumers who buy sachet drinking water from the hawkers should properly clean the cellophane packet, especially the area to be cut open before drinking. Patronizing hawkers who are generally dirty and with unsanitary commercial habits should be avoided. Finally, government agencies regulating the sachet water industry should increase and sustain the tempo of monitoring in order to ensure highest standards in the areas of water source, treatment and filtration techniques employed by industries. It is suggested that similar research be carried out in other parts of Nigeria, to amass a critical body of information needed to regulate and sanitize the sachet drinking water industry. This is highly desirable since sachet drinking water “Pure Water” is universal in Nigeria. Such research is also desirable in developing countries of Africa where drinking water is sold as sachet water.

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