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ASSESSMENT OF PARASITIC CONTAMINATION OF SACHET DRINKING WATER IN SAGAMU LOCAL GOVERNMENT AREA OF OGUN STATE

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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 contaminants which have often led to number of water borne diseases. The affordability and availability of sachet water had increased its consumption and increase in participants in the water business, therefore, there are reports of compromise in the safety of the water due to contamination by parasites. This study investigated the prevalence of contamination of sachet drinking water by parasites in Sagamu Local government area of Ogun State. One hundred and twenty sachets of water were obtained from ten producers' factories and from retailers in the study area. The samples were examined macroscopically for taste, odour impurities and pH. 10mls of each sample was centrifuged at 2,500rpm for a minute. The sediment from each tube was checked for protozoan parasite by observation under microscope using the x10 and x40 objectives. The result showed high degree of contamination in the area especially on the samples obtained from retailers. *Entamoeba histolytica* and *Necator americanus* were found to be the most and least prevalent parasite contaminants respectively in the area. Although, all the sachet water brands examined have NAFDAC approval number on them which means that they are certified as safe for consumption, particles were discovered in some of them. The level of contamination in the study area was found to be significant at $p < 0.05$. The general attitudes of hawkers (retailers) were attributed to the contamination of sachet water through improper handling and storage, as well as poor sanitary habit which eventually poses a serious threat to the health of the unsuspecting and vulnerable consumers. While consumers should properly clean the cellophane packet, especially the area to be cut open before drinking and desist from patronizing hawkers who are generally dirty and with unsanitary commercial habits, NAFDAC as regulatory body should also intensify efforts in the routine monitoring of activities in the packaged drinking water industry.

Keywords: Prevalence, Parasites, Contamination, Sedimentation, Consumption

INTRODUCTION

Water is an indispensable resource for the continued existence of all living things including man; hence adequate supply of fresh and clean drinking water is a basic need

for all human beings (Odikanmoro *et al*. 2016). Nigeria is located in coastal West Africa where water is abundant, yet most of the population lacks adequate and safe drinking water. As a result, individuals who can afford water now sink boreholes and sell water, some without any major form of treatment to the ever growing population (Omalu *et al*, 2010).

In Nigeria, water is produced into many products such as sachet water popularly known as "pure water". Sachet water is commercially treated water, manufactured, packaged and distributed for sale in sealed polythene containers for human consumption (Omalu *et al*, 2010). The production of sachet water in Nigeria started in the late 90s and today the advancement in scientific technology has made sachet water production one of the fastest growing industries in the country (Egwari *et al*, 2005). Many individuals and corporate bodies in Nigeria now engage in packaging water in polythene sachets of about 50-60cl which they sell to the public. Thus, drinking water is commercially available in sachets. The production, marketing and consumption of sachet water have increased tremendously (Egwari *et al*, 2005). There are now several brands of this sachet water marketed in Nigeria. The majority of consumers tend to be more concerned with the appearance and taste of water than the invisible loads of potentially harmful micro-organisms as well as other contaminants that may be present in the water (Mgbakor *et al*, 2011)

The continuous increase in the sale and indiscriminate consumption of sachet water in Nigeria is of public health significance, as the prevalence of water related diseases in developing countries is determined by the quality of their drinking water (Ezeuguwunne *et al*, 2009). Sachet water is seen to be a good supplement to other types of packaged water and can be bought at cheaper price. It is a source of drinking water for low and medium class Nigerians (Biswas, 2005).

Parasites are organisms that live in or on another and take their nourishment from those other organisms. They are capable of contaminating varieties of things (Charles, 2021). When water becomes contaminated by parasites, it can cause varieties of illness, pain, disability and even death. Globally, millions of people suffer from intestinal parasitic diseases such as Ascariasis (55 million), Trichuriasis (34 million), Hookworm (38 million), Amoebiasis (10 million) and Giardiasis (1.5 million) which can be water borne. These are neglected tropical diseases of which Nigeria has the greatest number of victims in Africa (Hotez *et al*, 2012).

In recent years, lots of research has been carried out in various parts of the country to determine the purity of sachet water, and most of the results point towards the same conclusion; that the "pure water" may not be completely safe for drinking (Umez, 2007). The results of the studies on sachet water to determine purity and safety have almost always churned up evidence of microbial and in some cases chemical contaminants (Umez,

2007). Another study by Ekwunife *et al*. (2010), to ascertain the parasites associated with sachet drinking water in Awka, Anambra State, and South-east Nigeria indicated that all the tested water samples met World Health Organization (WHO) recommended standard, of being colorless, tasteless and odorless with average pH of 6.93, however, some parasites were found on the surface of the sachets. Identified parasites included cysts of *Ascaris lumbricodes* (5.6%), *Entamoeba histolytica* (4.6%), Hookworm (2.8%), *Trichuris trichuria* (2.8%) and *Giardia lamblia* cysts (1.9%). Most other studies have reported a compromise of water quality in one way or the other (Dada, 2008, Ekwunife *et al*, 2010, Abua *et al*, 2012).

Water must have some sufficient qualities to serve the purpose of drinking. A portable water supply is one which is drinkable. Potable water is also treated water that meets the quality standard for human consumption and other uses (Agha, 2008).

Lack of information on pathogenic organisms associated with drinking water in our community creates some uncertainties in our understanding of overall quality of drinking water (Kwaye, 2007). However, the high dependence of people on sachet water due to its low price and instant availability to quench appetite and its low cost of production on the side of the manufacturers brought about increase of different brands of sachet water produced and marketed in Nigeria Coker, 2004). In order to clarify the quality of packaged drinking water, there is an urgent need for determination of parasites associated with drinking water in this sachet water.

The introduction of sachet water to consumers was to provide safe, hygienic and affordable instant drinking water to the public. Although this is a laudable idea however, current trends seem to suggest that sachet drinking water could be a route of transmission of enteric pathogens. The knowledge of the transmission foci through these cheap routes can help guide control efforts (Balogun *et al*. 2014). The assessment of the level of contamination of sachet water in our markets with parasite is needed in formulating intervention strategies suitable for the general populace in each area. Therefore, the aim of this work is to investigate the types of parasites associated with contamination of sachet drinking water in Sagamu Local Government area of Ogun State.

MATERIALS AND METHODS

Study area

The study was carried out among the sachet water packaging factories situated in Sagamu Local Government Area, Ogun State. Sagamu Local Government was under former political administrator network of Remo division of the defunct western region of Nigeria. The local government includes the territory of the older divisions of Offin, Makun and Ode Lemo local councils. The local government by virtue of its geographical location lies within the tropics. Sagamu Local government is bounded in the east by Ikenne Local Government, in the North by Remo North Local Government, in

the west and south by Obafemi Owode Local Government in Ogun state. The local government is peopled by all tribes in Nigeria though Remo dialect of Yoruba language is the main local language. The main occupation of the people is farming while few engage in industrialization and civil service. Sagamu Local Government area in its geographical and administrative extensions spans a total area of 614 km^2. The climatic pattern of local government is a subset of the humid tropical region characterized by high diurnal temperatures, apparent absence of cold session, lower pressure and high relative humidity. As at 2006 population census, Sagamu Local Government Area has a total population figure of about 255, 885 people (126,855 males and 129,030 females) (NPC, 2006).

Water sampling

Ten brands of sachet water were randomly selected in the study area. Six sachets of each brand were obtained from the producer while six sachets of each brand were also purchased from the retailers (hawkers) in the markets across Sagamu local government area. In all, sixty sachets were obtained from the producers while sixty sachets were purchased from retailers for the study.

Examination of sachet water

While sterilized gloves were worn, each sachet was shaken, opened with a sharp scissors and emptied into separate 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 protozoan parasite by concentration method described by WHO (2002). 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 3 ml of filtrate was thoroughly mixed using glass rod and centrifuged at 250 rpm 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.

Statistical analysis

The percentage of sachet water having no impurities and no parasites, only parasites, parasites and impurities and only impurities was calculated and analyzed using chi-square.

RESULTS

One hundred and twenty sachets of water were obtained from ten producers' factories and from retailers. The brands of sachet water obtained were coded as Sachet Water Brand (SWB 1 – 10). All the sachet water brands

were registered with the National Agency of Foods and Drugs Administration and Control (NAFDAC). Table 1 showed the observed physical qualities of the brands of sachet water examined. All the tested packaged drinking water also met the standard pH of 6.5-8.5 recommended by the World Health Organization (WHO). The packaged drinking water samples were odourless, colourless and tasteless. An average pH of 7.45 was observed. Meanwhile, some of the brands contained few particles observable in them after sedimentation.

Table 1: Physical qualities of sachet water observed in Sagamu local government area

Trade name of samples	pH	Odour	Colour	Taste	Particles
SWB1	7.62	-	-	-	-
SWB2	7.01	-	-	-	+
SWB3	8.24	-	-	-	+
SWB4	6.91	-	-	-	+
SWB5	7.67	-	-	-	-
SWB6	7.11	-	-	-	+
SWB7	6.96	-	-	-	+
SWB8	7.60	-	-	-	+
SWB9	7.20	-	-	-	-
SWB10	8.18	-	-	-	+

Key: (+) = Present, (-) = Absent

Physical examination on labeling of sachet water brands collected in the study area (Table 2) showed that all the brands have NAFDAC registration number apart from the brand names and factory addresses. Only two of the brands have batch number printed on the label but cannot be ascertained if the batch number is repeated permanently in all batches. Unfortunately, none of the labels on any of the brands carry information on manufacturing date, expiry date and nutritional information.

Table 2: Physical examination on labeling of samples

Brands	Brand Name	Factory Address	NAFDAC REG. NO.	Batch No.	Manufacturing Date	Expiry Date	Nutritional information	Vol. (Cl)
SW1	+	+	+	-	-	-	-	50
SW2	+	+	+	-	-	-	-	50
SW3	+	+	+	+	-	-	-	50
SW4	+	+	+	-	-	-	-	50
SW5	+	+	+	+	-	-	-	50
SW6	+	+	+	-	-	-	-	50
SW7	+	+	+	-	-	-	-	50
SW8	+	+	+	-	-	-	-	50
SW9	+	+	+	-	-	-	-	50
SW10	+	+	+	-	-	-	-	50

Table 3 showed the distribution of parasites in the samples collected. Samples obtained from retailers had higher prevalent rate (14.2%) compared to those obtained directly from the producers (3.3%). *Giardia lamblia and Entamoeba histolytica* were observed with the highest prevalence (4.2%) among the sachets obtained from retailers. Only *Ascaris lubricoides, Crystosporidium parvum* and *E. histolytica* were observed in the sachets of water obtained directly from the producers. In general, there was 17.5% prevalence of parasites contamination of sachet water in Sagamu local government area.

Table 3: Distribution of parasite contamination of sachet water in Sagamu local government area

Sources of water	Parasites	Occurrences	Percentage
Producers	*A. lumbricoides*	1	4.8
	N. americanus	-	0
	C. Parvum	1	4.8
	E. histolityca	2	9.5
	G. lamblia	-	0
Retailers	*A. lumbricoides*	3	14.3
	N. americanus	2	9.5
	C. Parvum	2	9.5
	E. histolityca	5	23.8
	G. lamblia	5	23.8
Total		21	100

DISCUSSIONS

Continuous increase in the sale and indiscrim inate consumption of packaged drinking wat ers in Nigeria is of public health significance (Oyedeji *et al*., 2010). The sale and consump tion of packaged water continues to grow rap idly in most countries of the world. In Nigeri a particularly, there is an astronomical increa se in the consumption of packaged waters es pecially bottled and sachet drinking water (O yedeji *et al*., 2010). One of the major and cri tical problems in most developing countries t oday is the provision of an adequate and safe drinking water to its populace. Access to saf e drinking water is a vital agent for living of humans.

This study was carried out to evaluate the parasites contamination of some sachets water consumed in Sagamu local government area of Ogun state, Nigeria. All the samples in this study met up with the WHO (2016) standards of been colourless, odourless and tasteless with average pH of 7.45. This is contrary to the report of the study of Okechukwu *et al.* (2015) conducted on sachet drinking water in a campus in Imo State, Nigeria which revealed that five of the brands of sachet drinking water examined had their

pH values lower than the permissible limit, ranging from 5.21 to 5.93, only one (hephzzy) sachet water brand had pH value within the permissible limit. Despite the fact that all the brands have NAFDAC approval number on them which should mean that they are certified safe for consumption, some particles were observed in some of the samples examined in this study. The study of Ekwunife *et al.* (2010) carried out in Awka also revealed the presence of particles in the sachet water consumed in the study area.

This research revealed that *A. lumbricoides, N. americanus, C. parvum, E. histolytica* and *G. lamblia* are the most prevalent parasite contamination in the study area. The studies of Alli *et al.* (2011) also identified *Entamoeba spp, N. americanus* and *C. parvum* as parasites that contaminate sachet water in Southwestern Nigeria.

The study also revealed high prevalence of parasite contamination of sachet water obtained from retailer compared to those from producers. This agrees with the finding of Ekwunife *et al*. (2010) who also observed high prevalence of parasite contamination among sachet water obtained from hawkers in Awka, Anambra State and also a report from Dada (2009) on the micro-bacteriological quality of sachet water in Lagos State showing the highest contamination rate in sachet water obtained from hawkers. The study carried out in Ebonyi state, Nigeria by Chollom *et al*. (2013) to evaluate the parasitic contamination of local sources of drinking water, recorded high parasitic contamination.

The attitudes of hawkers (retailers) are responsible for the contamination of water in markets. Majority of the contaminations outside the sachet water might be due to improper handling and storage by hawkers. Dada (2008) observed that most of the times, these hawkers act as the major vehicle of transmission of parasites as they use their dirty, sweaty hands to pick up the sachet water and sell to consumers. Hawkers have the tendency to immediately after visiting the toilet rush out to hawk the water without properly washing their hands, thus contaminating the sachets of drinking packaged water. The report of Dada (2009) also identified improper storage as one of the factors that led to the contamination of sachet water. Improper storage and handling by vendors also poses a serious threat to the health of the unsuspecting and vulnerable consumers.

Generally, the high significance of the rate of contamination of Sachet water in the study area showed that most sachet water in the area are not safe for consumption, especially those obtained from retailers. Cotte *et al.* (1999) observed that several factors potentially accounted for this observation, notable among these are; improper processing and purification procedures, unhygienic handling after production, small size of the pathogen which enable them to escape filtration and resistance of these pathogens to physical water treatment agents or disinfectants. Abua *et al.* (2012) posited that drinking water that is fit for human consumption is expected to meet the WHO standard and be free from physical and chemical substances and as well as

microorganisms in an amount that can be hazardous to health.

CONCLUSION

Conclusively, our findings indicated that some sachet water contain few impurities and parasites like *A. lumbricoides, N. americanus, E. histolytica, G. lamblia* and *C. parvum* were found in the samples most especially those obtained from retailers.

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.

NAFDAC should make it mandatory for all companies to include this vital information on their sachet water bags. NAFDAC should also intensify efforts in the routine monitoring of activities in the packaged drinking water industry. The safety of sachet drinking water should be ensured through comprehensive regulatory programs at various levels.

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