

Prevalence of Protozoan Parasites in Sachet and Bottled Water from Various Water Companies in Wukari Metropolis Taraba State Nigeria.

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ABSTRACT

Water is one of the indispensable resources for the continued existence of all living things including man. This study aimed at to determine the prevalence of protozoan parasites in sachet and bottled water from various water companies in Wukari Metropolis Taraba State Nigeria. 200 sachet water was obtained from ten companies and 200 bottled water was obtained from two companies and it was examined microscopically for presence of protozoan parasites using x10 and x40 objectives lenses. Out of the 200 sachet water examined 12(6.00%) were infected with protozoan parasites inside the sachet water with 4(20.00%) sachet water from E infected with (8) *Giardia lamblia* and 8(40.00%) sachet water from C infected with (8) *Entamoeba histolytica*. For the outside sachet water 16(8.00%) were infected with 4(20.00%) sachet water from C infected with (8) *Entamoeba histolytica*, 8(40.00%) sachet water from H infected with (12) *Giardia lamblia*, 2(10,00%) sachet water from I infected with (8) *Giardia lamblia* and 2(10,00%) sachet water from J infected with (8) *Giardia lamblia*. 200 samples of bottled water examined there was no infection inside the bottled water, but for the outside bottled water 9(4.50%) were infected with protozoan parasites with 5(5.00%) K bottled water infected with (8) *Giardia lamblia* and (4) *Entamoeba histolytica*, 4(4.00%) L bottled water infected with (3) *Giardia lamblia* and (3) *Entamoeba histolytica*. Based on the results obtained it shows that some sachet and bottled water were contaminated with protozoan parasites which require correct treatment to purify the water for human consumption.

Keywords: Prevalence, Protozoan Parasites, Sachet Water, Bottled Water, Various Companies

INTRODUCTION

Water is one of the indispensable resources for the continued existence of all living things including man and adequate supply of fresh and clean drinking water is a basic need for all human beings (Edema *et al.* 2011). Water is defined as a liquid substance that is colourless, odourless, clear and capable of existing in a liquid, solid or gaseous phase. It is second to air, because it serves as a source of nourishment to man, animals, micro organism and even plants (Odikamnoru *et al.*, 2016). According to Edet *et al.*, (2012) quality water is one that is free from disease causing microorganisms and chemicals substances harmful to human health. In nature, all water contains impurities

which could be harmless or harmful, that is why a lot of water companies are in business to provide quality drinking water (Ogamba, 2004). Drinking water that is safe and aesthetically acceptable is a major of high priority to Standard Organization of Nigeria (SON), National Agency for Foods and Drugs Administration and Control (NAFDAC) and other regulatory agencies in Nigeria and is expected to meet the Nigerian Industrial Standard (NIS). Furthermore, drinking water that is fit for human consumption is expect to meet the World Health Organization standard (WHO) and be free from physical and chemical substances as well as micro-organism in an amount that can be hazardous to health (Denloye, 2004). Table waters that come from well water are obtained by sinking holes into the ground to reach the water table. Much treatment is required before it would be suitable for consumption because it is more prone to contamination with pathogens. Untreated or inadequately treated water from well can contain sufficient numbers of disease causing organisms (Agha, 2008). Nevertheless, bottled water from underground sources (springs, or wells) is less likely to be contaminated with cryptosporidium oocyst than bottled municipal water derived from rivers or lakes.

Sachet and bottled water are any commercially treated water, manufactured, packed, and distributed for sale in sealed food grade containers and is intended for human consumption. The introduction of sachet and bottled water in Nigeria was to provide safe, hygienic and affordable instant drinking water to the public and reduce the magnitude of water related infection in the country. The different between the two types of water is the materials used to package them. It is also believed that bottled water is purer than sachet water; this does not necessarily mean that bottled water is 100% free from any pathogen. The production of sachet water in Nigeria started in the late 90s and today the advancement in scientific technology have made sachet water production one of the fastest growing industries in the country. Investigation conducted on safety drinking water has showed that sachet water especially from hawkers is not of good microbiological quality (Dada 2009).

This observation was based on studies carried out on water samples to ascertain the bacteriological quality of the water in sachet, to identify contributory factors that determine the fate of package water product as it moves from catchments to consumers. In other to clarify the quality of packaged drinking water, there is an urgent need for determination of parasites associated with drinking water in these sachet and bottled water, there are growing number of reported public illnesses such as typhoid, diarrhea and other water borne disease arising from the consumption of sachets and bottles water. Consumption of sachets water in Nigeria is on the increase irrespective of whether they have NAFDAC certification or not. However, despite the strong effort by NAFDAC in the regulation and quality assessment of sachet water and other food and drugs in Nigeria, most manufacturer have not complied with the agency's regulation (Airaodion *et al.*, 2019). It is a known fact that no single method of purification can eliminate 100% contaminants from drinking water. One of the highest types of contaminants found in water companies are protozoan parasites which have often led to diseases like diarrhea, dysentery and other parasitic diseases. Research shows that treatment by disinfection (Chlorination) alone offers not 100% protection against the cyst of *Giardia lamblia* and *Entomeoba histolytica* (Agha, 2022).

The prevalence of intestinal parasites infections was 58.5% in 1000 children recorded in Benue State (Guerrent *et al.*, 2013). In developed countries, prevalence is peaks at the

age of 1 to 4 years (Flannagan, 2013) and also in the age group 20 – 40 years , partly through caring for young children and as a result of traveling and drinking contaminated water. *Giardia lamblia* infections are very common in children; the prevalence is 2 to 5% in developed countries and 20 to 30% in developing countries (Farthing, 2010). The epidemiology of amoebiasis has been well studied in several developing countries. In the urban population of Lagos, Nigeria, the overall prevalence of *Entamoeba histolytica* was reported in one study to be 11.2%. The prevalence increased rapidly among school age children and was especially high in some ethnic groups and families (Agha, 2022). Distribution of amoebiasis is related to inadequate sanitation and contaminated food and drinking water than climate (Cheesebrough, 2009).

The presence of these organisms in sources of drinking water is partly due to four reasons: Firstly, these organisms are indigenous pathogens found in most domestic animals; secondly, the degree of environmental contamination with their infective stages; thirdly, their resistance to water purification processes and finally unhygienic handling of drinking water (Ekwunife, *et al.*, 2010). *Giardia lamblia*, is a well-known cause of diarrhea and infection is acquired via person to person contact and waterborne sources. The ingestion of as few as 10 cysts is enough to cause infection in humans. *Entamoeba histolytica* is one of the major causes of morbidity and mortality worldwide and contaminated water is a prime source of infection in many areas (Kwakye-Nuako *et al.*, 2021). Water consumers are frequently unaware of the potential health rate associated to water borne contaminants which have often led to diseases like diarrhea, cholera, dysentery, typhoid fever and other parasitic diseases. Cysts from humans are infective for a wide variety of domestic and wild animals and are widely distributed in the environment.

Some water borne outbreaks have been attributed to the contamination of drinking water some times by cysts of non-human origin. The cysts are highly resistant to disinfection (Meisel *et al.*, 2005; Obiukwu *et al.*, 2008). However, water can be and should be made safe for consumption within acceptable limits.

MATERIALS AND METHODS

Study Area

This study was carried out in various sachet and bottled water companies in Wukari Metropolis Taraba State Nigeria. Wukari Local Government area is situated in Taraba State, Northeast Geopolitical Zone of Nigeria. The headquarters of the LG.A is in the town of Wukari and it shares boundaries with parts of Nasarawa and Benue State. Wukari Local Government Area Taraba State Nigeria is located on the latitude 8.89213° North and longitude 11.3672° East, it situated at elevation of 198.14 meters above sea level. The climate is classified as tropical; there is less rainfall in winter than in summer. According to Köppen and Geiger, this climate is classified as Aw (tropical wet-dry climate). The average annual temperature is 28.2°C (82.7°F). Precipitation is about 986mm (38.8inch) per year which is lowest in January, with an average of 1mm (0.0inch), precipitation falls in August, with an average of 209mm (8.2 inch).

Water Sampling

Ten (10) sachet water companies were selected at random which were labeled A to J, a total of 200 sachet water were obtained, 20 from each company. And 2 bottled water companies were also selected at random which were labeled K and L, a total of 200 bottled water were obtained, 100 from each company in to clean sterilized robber buckets using hand gloves. It was convey to the department of Biological Sciences Laboratory Federal University Wukari for parasitological examinations

Materials and Reagents

Materials used were Robber buckets, Slides, Cover slips, Applicator sticks, Sterile bottle, Hand glove, Light microscope, Centrifuge tubes, Centrifuge machine, 5% of lugols iodine, Dropping pipette, distilled water and Oil immersion

Parasitological Examination of the Sachet and Bottled Water

The back of each sachet and bottled water was washed with clean boiled/distilled water in to clean sterilized conical flask. The inner water of both the sachet and the bottled water was also poured into clean sterilized conical flask. 10 ml of each sample was dispense into 15ml sterilize centrifuge tubes. The test tube and it content was centrifuge at 2500 rpm (revolution per minute) for 5 minutes. The resultant sediment was stirred with a clean applicator stick and a drop was placed on a clean grease free slide (using a dropping pipette) and was mixed with a drop of lugol's iodine solution. The mixture was covered with a cover slip, to avoiding air bubbles. It was viewed under a light microscope using x40 and x100 objectives lenses with immersion oil (Chessbrough, 2009).

Data Analysis

The data obtained was analyzed using percentage (100%)

RESULTS AND DISCUSSION

Table 1: Prevalence of protozoan parasites inside sachet water

Company	No %	No Examined	No Infected	Parasites Infected	
				<i>Giardia lamblia</i>	<i>Entamoeba histolitica</i>
A	20	-	-	-	-
B	20	4	8	-	20
C	20	8	-	8	40
D	20	-	-	-	-
E	20	-	-	-	-

F	20	-	-	-	-
G	20	-	-	-	-
H	20	-	-	-	-
I	20	-	-	-	-
J	20	-	-	-	-
Total	200	12	8	8	6.0

Table 2: Prevalence of protozoan parasites outside sachet water

Company	No	No	Parasites Infected		
			Examined	Infected	Infected
%			<i>Giardia lamblia</i>	<i>Entamoeba histolitica</i>	
A	20	-	-	-	-
B	20	-	-	-	-
C	20	4	-	8	20.00
D	20	-	-	-	-
E	20	-	-	-	-
F	20	-	-	-	-
G	20	-	-	-	-
H	20	8	12	-	40.00
I	20	2	8	-	10.00
J	20	2	8	-	10.00
Total	200	16	28	8	8.00

Table 3: Prevalence of protozoan parasites inside bottled water

Company	No %	No Examined	No Infected	Parasites Infected	
				<i>Giardia lamblia</i>	<i>Entamoeba histolitica</i>
K	100			-	-
L	100			-	-
Total	200			-	-

Table 4: Prevalence of protozoan parasites outside bottled water

Company	No %	No Examined	No Infected	Parasites Infected	
				<i>Giardia lamblia</i>	<i>Entamoeba histolitica</i>
K	100		5	8	4
L	100		4	3	3
Total	200		9	11	7

DISCUSSION

The prevalence of water related diseases in developing countries is determined by the quality of their drinking water. The safety of drinking water in poor and deprived communities has in the last decade been in jeopardy as a result of wanton introduction of refuse and sewage into sources of water supply. The introduction of the sachet and bottled drinking water in the market was a laudable idea but studies suggest that this innovative idea is not risk free. This study was carried out to determine the prevalence of protozoan parasites in sachet and bottled water from various water companies in Wukari Metropolis Taraba State Nigeria. This research shows that protozoan parasites such as *Giardia lamblia* and *Entamoeba histolytica* are found in some sachet water brand both in and out with (6.00%) and (8.00%) respectively, which is lower as compared with the findings of Kwakye-Nuakon *et al.*, 2021, that recorded (27.00%) and (14.00%) in Anambra State Nigeria.

The research also shows that water borne protozoan is found outside bottled water with (4.50%), which is lower as compared with the findings of Ekwunife *et al.*, 2010 in Awka South eastern Nigeria, the percentage of outside bottled water found contaminated were (7.59%), while no parasites were found inside the bottled water, this shows that some sachet and bottled water are not really pure. In recent years' lots of research has been

carried out in various part of the country to determine the purity of sachet and bottled water and most of the results point towards the same direction, that our so called pure water may not be completely safe for drinking (Edet *et al.*, 2022). Majority of contamination outside the sachet and bottled water might be due to improper handling and storage by hawkers, improper treatment and packaging by the manufacturer. Unfortunately, contamination of water can be due to many reasons such as fecal contamination, poor sewage disposal and poor personal hygiene, lack of basic sanitation, bad storage facilities and poor treatment of water.

CONCLUSION

The study indicated the presence of contaminants of fecal origin in some of the sachet and bottled water examined. This has grim public health implications as the organisms identified i.e. *Gardia lamblia* and *Entamoeba histolytica* can cause water related diseases which have serious complications in children and adults particularly immunocompromised individuals. Therefore we can conclude that some sachet and bottled water within Wukari Metropolis are not safe for drinking and should be constantly monitored for the presence of protozoan parasites.

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CONFLICTS OF INTEREST

The Authors has no competing interest to declare.

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