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Protozoan Parasites Associated With Different Water Sources In Lokoja Metropolis

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ABSTRACT
This study was conducted to examine and identify the protozoan parasites associated with different water sources in Lokoja metropolis. A total of 600 water samples were collected, from Tap, Borehole, well and River waters for six month between February, 2018 and July, 2018 these samples were collected from five different locations namely; Lokongoma, Meme Bridge, Adankolo, kpata and Old Market in Lokoja, Kogi state, Nigeria. Lugol's iodine was used to stain the parasites, using colouration to show parasitic features, 9 protozoan parasites were recovered from Well and River water source while no parasite was recorded for Tap and Borehole water sources.Entamoebahistolytica was observed to be the most prevalent protozoan parasite (49.8%) followed by Cocccidia species (21.3%) Opalina species (11.6%), Balantidium coli (10.7%), Chilomastixmesnili and Giardia species (2.2%), Neigleriaspecies (1.3%) while Amphileptusspecies andChillodonella species had the least occurrence of (0.4%). Out of the 225 different stages recovered, 80 of them were cysts, 50 were Oocyst while trophozoites were 95. Most of the protozoan parasites were recovered from River Niger water source in Old Market site (41.8%), followed by Lokongoma (18.2%), Meme Bridge (14.7%), Kpata (12.9%) and Adankolo had (12.4%). The month of July had the highest number of protozoan occurrence (31.6%) followed by the month of June with (18.7%) then April (16.9%), May (13.3) and March (11.6%) while the month of February had the least number of occurrence (8.0%) the result of this study shows that, water-bodies especially rivers used by inhabitants for drinking, cooking, house chores, fishing, recreation are heavily parasitizedand government intervention is required to reduce the rate of contamination, since Well water had low level of contamination, simple water treatment such as filtration, Chlorination and other disinfectants will be of great help and measures should be put in place for the provision of pipe borne-water in communities where they are lacking.

KEY WORDS: *Protozoan, Parasites, Water Sources, LokojaMetropolis__*

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I. INTRODUCTION

Parasitic diseases are among the most important causes of morbidity and mortality in developing countries (Aazadi*et al.,* 2014).Water related diseases are responsible for 80% of all illness or death in the developing countries and kill more than 5 million people every year (UNESCO, 2007).Parasitic diseases transmitted through water by protozoa causes epidemic and endemic diseases in both developed and developing countries. There are about 15,000 species of protozoa (Cox, 2002). Parasitic protozoa that are transmitted through water and those that cause human infections include*Toxoplasma gondii*, *Entamoebahistolytica, Cyclosporacayetanensis, Isospora belli*, *Blastocystishominis, Balantidium coli, Acanthamoeba spp., Sarcocystis spp*. and *Naegleria spp*. (Lane and Lloyd, 2002). These enteric protozoan parasites are important causes of diarrheal disease and these pathogens cause human disorders worldwide (Fontanet*et al.,* 2000; Apichai*et al.,* 2005). Many of the intestinal oocyst producing protozoan parasites inhabits the gastrointestinal tracts of humans (Baqui*et al.,* 1992).Sources of water are polluted by indiscriminate disposal of sewage, industrial waste and human activities, however,the rate of contamination vary widely depending on the location and environmental factors.

In a survey carried out on the parasitic contamination of drinking water sources inEzza North Local Government Area ofEbonyi State, South East Nigeria. 63 water samples were investigated from five major water sources within the study area. Pond water was found to have the highest occurrence of parasites (35.9%)followed by stream (28.1%) well (21.9%) borehole (9.4%) while rainwater had the least percentage (4.7%). Three parasites *Gardialamblia*, *Entamoebahistolytica*and *Cryptosporidium parvum* were observed in their cystic and oocystic forms. Among these parasites, *Entamoebahistolystica* had the highest prevalence of 29(45.3%) followed byGardialamblia 22(34.4%) and *Cryptosporidium parvum* 13(20.3%) (Ani and Itiba, 2015).In Heipang, BarkinLadi Local Government Area of Plateau State, Nigeria,Chollom*et al*., (2012) reported

that between October to December, 59 out of 100 water sources were parasitized. Ponds had the highest degree of parasitic contamination (78.3%), streams followed closely with 50%, while wells and bore holes had 35% and 0% in that order. Protozoan cysts of *Balanditium coli* and *Entamoebahistolytica*accounted for 18.6% of parasites each as reported by Chollom*et al*., (2012). In Okura, Kogi State, Iyaji*et al.,* (2015) examined a total of 300 water samples collected from two sources (Borehole and River water) in three communities (Anyigba, Egume and Ochaja) between the months of November 2014 and January 2015. They reported that River samples had total prevalence of 229 (83.58) while borehole had 45 (16.42%) with overall prevalence of 274 (91.33).

Lokoja metropolis hasstandard treated pipe borne water supply system popularly called 'Ibro water' but not all locations benefit from the supply. As such, majority of the population depend on wells, boreholes constructed in many households, river and rainwater. These water sources are to a large extent exposed to contaminants hence, the purpose of this research is to study the degree/level of protozoan infestationin different water sources.

II. MATERIALS AND METHODS

Study Area

Lokoja is the capital of Kogi State, Nigeria. It lies at the confluence of the Niger and Benue rivers and is the capital of Kogi State. It is about 165 km Southwest of Abuja as the crow flies, and 390 km Northeast of Lagos by same measure.

Collection of Water Samples

A total of 600 water samples were collected from Tap, Borehole, well and River for six month, 120 water samples were collected each from Lokongoma, Meme Bridge, Adankolo, kpata and Old Market in Lokoja metropolis. The water samples were collected in labeled sterilized bottles and were transported to Federal University Lokoja Laboratory for parasitological examination

Parasitological Examination

Water samples were filtered using a sieve of 0.5µm mesh size, seven ml of the filtrate was dispensed into four sterile centrifuge tubes and three ml of Normal saline was added. The tubes and its content were centrifuged at 1000 rpm for 2 minutes. The supernatant was discarded while the resultant sediment was stirred with a clean applicator stick and a drop was placed on a clean grease free slide, a drop of lugol's iodine solution was added. The mixture was covered with a cover slip and examined under Tension microscope using magnification of x10 and x40 oil immersion objective lens. The parasites were identified using parasite identification guides and colouration of parasitic features as described by Garcia and Bruckner (1988), Forbes *et al.,* (1998) and Murray *et al.,* (1999)

III. RESULTS

Out of the 600 water samples that were collected from tap, borehole, well and river for six month, between February, 2018 and July, 2018 for protozoan examination, only nine protozoan parasites were recovered as follows:*Entamoebahistolytica, Opalina species, Balantidium coli, Cocccidia species,Chilomastixmesnili, Giardia species, Amphileptus species, Chllillodonella species,* and *Neigleriaspecies.*The occurrence of Protozoan parasites and percentage parasitic infestation in the four different water sources in Lokoja metropolis are shown in Table1.Out of the nine different Protozoan parasites recovered, *Entamoebahistolytica* was found to be the most prevalent protozoan parasite (49.8%) contaminating the water bodies in Lokoja metropolis. Also, of the four water sources analyzed, River water had the highest number of parasites followed by well water. There were no parasites recorded for Tap and Borehole water.

Three different stages of protozoan parasites such as cysts, oocysts and trophozoite were recovered during the study, out of the 225 different stages recovered, 80 of them were cyst, 50 were Oocyst and trophozoites were 95. The cyst of *Entamoebahistolytica*occurred most, followed by *Balantidium coli,* in river water.*Coccdia*oocyst occurred mostly found in River water and *Entamoebahistolytica*Trophozoite occurred most followed by Opalina*ranarum*and were all found in River water sources. (Table 2)

Out of 120 water samples collected from each No protozoan parasites were recorded for Tap and Borehole water sources in all five location, Protozoan parasites were found in 33 Well water samples distributed as follows; Lokongoma (13), Meme Bridge (2) Adankolo (3), kpata (6) and Old Market (9) while 192 River water samples were found with protozoan Parasites and were distributed as follows Lokongoma (41), Meme Bridge (33) Adankolo (28), kpata (29) and Old Market (85) (Table 3)

The monthly distribution of protozoan parasites in water samples shows that, out of 600 water samples examined for protozoan parasite from February to July, a total of 225 water samples were parasitized. The month of July had the highest number of occurrence 71(31.6%) followed by the month of June with 42(18.7%) while the month of February had the least number of occurrence with 18(8.0%) (Table 4)

The distributions and percentage occurrence of protozoan parasites found in water samples are shown in (table 5). Out of the 225 protozoan parasites found in the water samples, River water source had the highest occurrence (85.3%) followed by Well water (14.7%) while Tap and Borehole water sources had no parasite.

IV. DISCUSSION

*Entamoebahistolytica*was observed to be the most prevalent parasite contaminating the water sources (49.8%). The high occurrence of *Entamoebahistolytica* agrees with the reports of Emile *et al.,* (2013). In Kigali, Rwanda who recorded 54.5% prevalence of *Entamoebahistolytica*. Okonko*et al.,* (2009) reported a far higher prevalence of 51.7% for *Entamoebahistolytica*in south eastern Nigeria. The high occurrence of *Entamoebahistolytica* is however in contrast with the report In Benue State, where Jombo*et al.,* (2007) reported low prevalence of *Entamoebahistolytica*and higher prevalence for *Entamoeba coli*.

The absence of *Entamoeba coli* in this research agrees with the studies conducted by Egwari*et al.,* (2005) who worked on sachet water in Lagos southwest Nigeria and found no cyst of *Entamoeba coli. Opalina*species had the occurrence of (11.6%) and were mostly found in River Niger water source in Old Market site. The sporadic occurrence could have arisen from factors such as seasonal weather patterns, impacts of sewage and animal waste discharged into River Niger. *Balantidium coli* had *10.7*% occurrence and were observed in Well and in River water samples across the five locations although the water sources were not heavily parasitized.

The occurrence of*Cocccidia species (*6.7%) only in River Niger water source in old market could be due to the anthropogenic activities in the old market where large number of birds and cattles are kept for sale and their faeces are washed into the river.

Amphileptus species and *Chilodonella species* were found near the point of effluent discharge where the waters were a bit stagnant; this might be as a result of accumulation of organic sediments by domestic sewage and urban effluents which promotes aquatic pollution, thereby increasing the incidence of parasites. There is little or no report on these parasites in water sources.

Of the four sources of water examined, no parasite was recorded from Tap and Borehole water while Well and River water harbored both Protozoan parasites. The observation that no parasite was recorded for tap and Borehole water source is in contrast with the result of Ani*et al.,* (2015) where 9.4% parasite were recorded for borehole water sample and Iyaji*et al,* (2015) who reported that 45 (16.4%) parasites were observed in borehole water. However this result agrees with the report of the findings of Thulasi*et al,* (2014) in Malaysia and Thailand where there was no parasite contamination of drinking or household water sources and a selected swimming pool in Malaysia was also found to be free of parasites. However, other untreated environmental water in both countries and effluent water in Thailand were contaminated with waterborne parasites. Solomon *et al,* (2012) also observed that Water samples from boreholes in Plateau state were found to be free from parasites they inferred that the result was largely attributed to borehole make-up, unlike other sources that are open to external contamination; boreholes operate a water system that is closed.

The negative results (0%)obtained from tap water sample in Lokoja metropolis might be attributed to the effective management and maintenance of the water boardand effective water treatment process which include Filteration, that is capable of parasite removal, chlorination for destroying bacteria and parasites, and ammonation capable of stabilizing chlorine from evapouration while it runs through the pipe; The use of pipe borne water began between 2010/2011 with proper plumbing hence the pipes are assumed to be intact and have no leakages or pitting as they have not attain the stage of corrosion which could lead to parasitic contamination of water. No parasites recorded in Borehole water samples might be due to the presence of water filters with filter pores between 0.1-0.4um capable of effective removal of bacteria and parasites in water. It has been previously explained that human parasites do not directly use water bodies for life cycle development Instead, their vectors inhabit water bodies thereby associating their transmission to water bodies and certain water foods Chollom*et al*., (2012) Thus these negative result obtained are proofs that properly maintained water sources that are devoid of parasite vectors might be free from parasitic contamination. The wells in old Market water source had the highest number of parasites while River Niger water source at old market appeared to be the most parasitized water source. Mosquitos' larvas were also observed in Well water source especially from uncovered Wells found in Lokongoma, Kpata and Old Market.The Well water source in Old Market site were more contaminated probably because The wells are old and lined with poorly sealed brick and having unsealed covers which allow water to seep into the well from holes or cracks and are potential avenues for surface contamination also lack of maintenance and the poorly installed well cap, allows fecal matter from sewage or animal droppings and insects enter the Well. The high prevalence of parasite infection in river Niger could be due to higher turbidity of river Niger (Eyo and Iyaji, 2014). Feacal contamination, poor sewage and untreatment effluent discharged into the water body. These result agrees with the reports of Iyaji*et al.,* (2015) where 300 water samples were collected from two sources (Borehole and River water) and was observed that river had 229 (83.58) while borehole had 45 (16.42%) parasites.

The monthly distribution of protozoan parasites in water samples shows that, the month of July had the highest number of occurrence 71(31.6%) with *Opalina*species occurring in all water samples collected from River Niger at Old market site. The month of April had 38(16.9%) occurrence and was heavily parasitized with *Entamoebahistolytica* cyst. while the month of February had the least number of occurrences with 18(8.0%) and was also contaminated with different algae which were all found in River water samples.

It can be concluded that this research was conducted to evaluate the Protozoan parasite infestation in different water sources in Lokoja metropolis, using, filtration method and application of Lugol's iodine to show parasitic features, nine parasites were recovered. The result showed that River water especially from River Niger Old Market site in Lokoja metropolis had the highest prevalence (85.3%) followed by Well water also, in Old Market site (11.7%) there were mostly infested by *Entamoebahistolytica*. Tap and Borehole waters had no parasites (0%). Human and animal activities noticed on a daily basis in the study areas could be the likely factor for the high level of contamination in Old market site. Monthly occurrence of parasites indicated that July had the highest prevalence while the least prevalence was in February.

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Table 1: Occurrence and Percentage Infestation of Protozoan Parasites in Different Water Sources in Lokoja Metropolis

Parasites	Number of Water Samples With Protozoan Parasites					%Parasitic Infestation
	Tap Water	Borehole Water	Well Water	River	Total Number of Water Sample	
Amphileptus	0	0	0	1	1	0.4
Balantidium coli	0	0	2	22	24	10.7
Chillodonella	0	0	0	1	1	0.4
Chilomastixmesnili	0	0	0	5	5	2.2
Coccidia	0	0	3	45	48	21.3

Entamoebahistolytica	0	0	28	84	112	49.8
Giardia lamblia	0	0	0	5	5	2.2
Neigleria species	0	0	0	3	3	1.3
Opalina	0	0	0	26	26	11.6
Total	0	0	33	192	225	100.0

Table 2: Stages Of Protozoan Parasites Found In All Water Samples In Lokoja Metropolis

Protozoan Parasites	Cyst	Oocyst	Trophozites
Amphileptus	0	0	1
Balantidium coli	11	0	13
Chilodonella	0	0	1
Chilomastixmesnili	0	0	5
Coccidia	0	46	0
Entamoebahistolytica	69	0	45
Giardia lamblia	0	2	3
Neigleria species	0	2	1
Opalina	0	0	26
Total	80	50	95

Table 3: Occurrence of the Protozoan Parasites And Percentage Infestation in Different Water Sources at Different Locations in Lokoja Metropolis

Locations	Number of Water Sample With Protozoan Parasites					Number of Water Samples Examined	% Parasitic Infestation
	Tap Water Sample	Borehole Water Sample	Well Water Sample	River Water Sample	Total Number Of Water Sample		
Lokongoma	0	0	13	28	41	120	18.2
Meme Bridge	0	0	2	31	33	120	14.7
Adankolo	0	0	3	25	28	120	12.4
Kpata	0	0	6	23	29	120	12.9
Old Market	0	0	9	85	94	120	41.8
Total	0	0	33	192	225	600	100.0

Table 4: Monthly Distributions of Protozoan Parasites and Percentage Infestation in Different Water Sources in Lokoja Metropolis

Month	Number Of Water Samples Examined	Number Of Water Samples With Parasites	% Parasitic Infestation
February	72	18	8.0
March	82	26	11.6
April	82	38	16.9
May	120	30	13.3
June	120	42	18.7
July	124	71	31.6
Total	600	225	100.0

Table 5: Distributions of Protozoan Parasites and Percentage Parasitic Occurrence in Different Water Sources in Lokoja Metropolis

Water Sources	Number of Water Samples Examined	Number of Water Samples With Parasites	% Occurrence
Tap	96	0	0.0
Borehole	120	0	0.0
Well	120	33	14.7
River	264	192	85.3
Total	600	225	100.0

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