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ASSESEMENT OF PARASITIC CONTAMINATION OF WATER FROM DIFFERENT SOURCES IN DUTSIN-MA LOCAL GOVERNMENT AREA, KATSINA STATE

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Abstract
Parasitic water borne diseases have become a source of concern to the people due to continued contamination of water from different sources as a result of human activities. This study was carried out to assess the parasitic contamination of water sources in Dutsin-ma Local Government Area, Katsina State Nigeria. A cross sectional study was conducted using 204 water samples collected from various water sources and processed by centrifugation, Calcium carbonate floatation and modified Ziehl Nelson techniques before microscopy. Among the samples examined, pond water had the highest contamination (100%), followed by Dam (63.3%), well (22.9%), tap (10%) and boreholes (0%). The major parasitic protozoans detected from the samples in their cystic form are *E. histolytica* and *G. lamblia* with mean prevalence of 13.7% and 7.8% respectively. The prevalence of of *E. histolytica* and *G. lambia* in the dry season was 8.8% and 6.9% respectively. While that of the wet season was 18.6% and 8.8% respectively. The results of this study indicate the need for continuous monitoring and protection of water sources against waterborne parasites and people should be encouraged to inculcate the habit of consuming treated water to reduce the chances of contracting the diseases.
Keywords: Water-borne,protozoans, parasites, Contamination, Drinking water.

INTRODUCTION:

Water-borne diseases are usually acquired by the consumption of polluted water containing human and animal faecal matter from patients or healthy carriers (Chigor *et al.*, 2012). Parasitic infections of water borne origin cause various physiological disturbances in the host body and the infection of man and animal with these parasites is either by oral route or by active penetration of unbroken skin, and this constitutes one of the public health hazards in tropical Africa and the world in general (UNICEF, 2008). Faecal oral route is important in the transmission of parasitic infections to humans via poor personal hygiene, environmental conditions like contamination of soil and water sources with human faeces (Okojokwu and Inabo, 2012). Quality water should be free from chemical and biological contamination and must be acceptable in terms of colour, taste, odour, organic and inorganic matter in accordance with the W.H.O guidelines on the quality of drinking water (Chollom *et al.*, 2013).

Local sources of water such as wells bore holes, ponds and streams need a great deal of protection from pollution and contamination by potential parasites, and harmful chemical substances (Chollom *et al.*, 2013). An estimated 1.1 billion people lack access to an improved water source, also over three million people, mostly children, die annually from water-related diseases (UNICEF, 2008). According to World Health Organization reports more than 80 infectious diseases can be transmitted via water (WHO, 2010). *Giardia lamblia* and *Cryptosporidium parvum* are ubiquitous protozoan parasites that affect humans, domestic animals and wildlife throughout the world and have been highlighted as significant waterborne parasitic pathogens (Branco *et al.*, 2012).

According to Franco *et al.* (2012) it has been estimated that food- and water-borne infectious diseases currently infect 3.5 billion people in developing countries and cause about 160,000 deaths per year and 80% of these occur in children less than 5 years of age. Excreta-related communicable diseases have become a major problem in areas where untreated human faeces are used as manure (Alli *et al.*, 2011). Moreover, the human faecal wastes that are deposited in the environment are regularly washed into the communities' water bodies, pollutes the water as well as fresh vegetables which is a threat to public health (Assafa *et al.*, 2004).

Due to the unchanging behavior of people of defecating anywhere, the persistence of outbreaks of parasitic diseases associated with drinking water as well as insufficient information on pathogenic and parasitic protozoans in our drinking water creates some uncertainties in our understanding of the overall quality of drinking water in Dutsin-ma Local government Area. To bridge this information gap, there is an urgent need for the assessment of parasitic contamination of different water sources used in Dutsin-ma Local Government area of Katsina State.

MATERIALS AND METHODS

Study Area

Dutsin-ma is one of the oldest L.G.A's of Katsina State. Its headquarters is located in the town of Dutsin Ma. The L.G.A has an area of 527 km² and a population of 169,671 at the 2006 census (Nona.net, 2017). Their main occupation is farming and animal rearing. The main sources of drinking water in Dutsin-ma L.G.A are boreholes, Dam, wells, rain water, pond and tap water. The area extends between latitudes 12 ^{0} 29′ 0 ″ and 12 ^{0} 12 ′ 30 North of the equator and longitude 07 ^{0} 22 ′0 and 07 ^{0} 33′ 0′ East of the Greenwich meridian and the vegetation of the region is predominantly of savannah type having only about three months of rainfall annually (Ministry of Land and survey, Katsina, 2018). Moreover, the climate of the area is semi arid classified as tropical wet and dry climate (AW) in the W. Koppens' scheme with maximum day temperature of up to 38 o C in the months of March, April and May and with minimum temperature of about 22 o C in December and January. There is few household engaged in traditional fishing from the Zobe Dam.

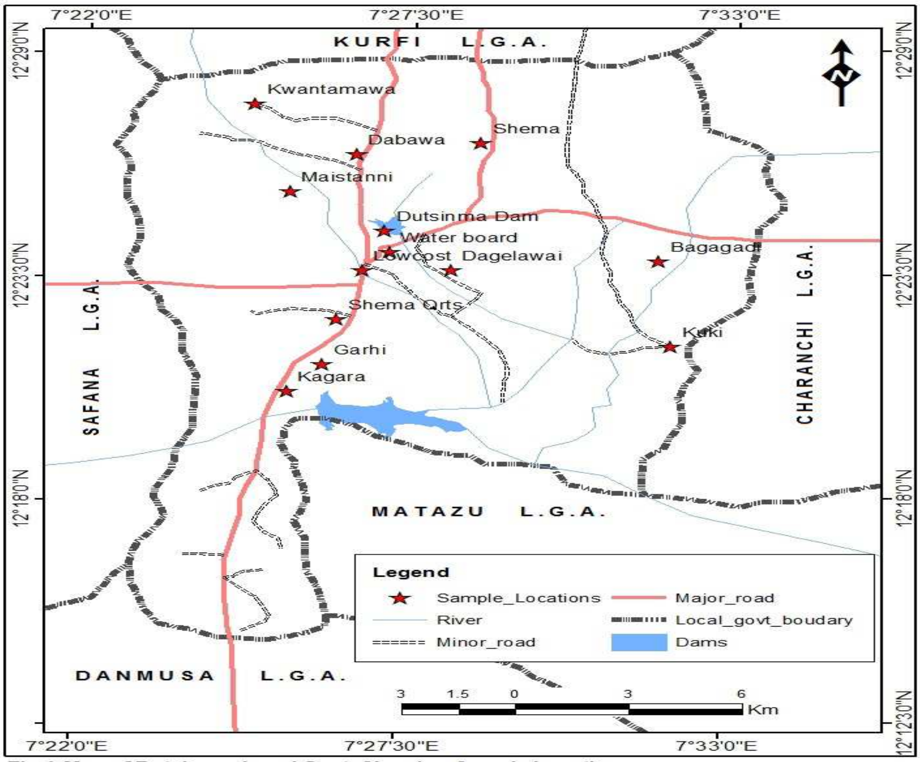

Fig.1:Map of Dutsin-ma Local Govt. Showing Sample Locations
Sourece:- Ministry of Lands & Surveys Katsin.

Sample collection:
Water samples were collected in triplicates directly from the various sources of drinking water viz., protected well, unprotected well, dam, pond, borehole and tap water within the sampling sites that were selected randomly of Garhi, Kagara, Kontamawa , Dabawa , Kuki, Bagagadi, Shema, Maitsani, Dagelawai, Dangaje, Dutsin-ma dam, Dutsin-ma borehole and Dutsin-ma tap into 750mLs wide mouth screw-capped cleaned plastic polyethylene bottles and were taken to the laboratory in an icebox jar to avoid unusual change in water quality. Prior to the sampling all the bottles were washed and rinsed thoroughly with distilled water. The collection was done from April – June for the dry season and July - November 2017 for the rainy season.

Parasitological analysis:
Collected samples were examined macroscopically and microscopically. The microscopy followed concentration by centrifugation, calcium carbonate floatation method and modified Ziehl Neilson technique as described by (Cheesbrough, 2005).

The Concentration by centrifugation was by using a gauze filter into a funnel and each of the replicate samples was shaken and passed through the filter into a testubes to reach the 10ml mark. The filter was then removed and materials present discarded. The tubes were then transferred to the centrifuge tubes and centrifuged for 5 minutes at a speed of 100 × g (300rpm). The supernatant was discarded by gently inverting the tubes leaving the deposits in the tube. A drop of deposits was placed on a slide for examination (Cheesbrough, 2005).

In the calcium carbonate floatation method each 200mL water sample was treated with 1mL of calcium chloride solution and 1mls of sodium bicarbonate solution. One millilitres of sodium hydroxide solution was also added to the samples. The solutions were mixed and allowed to settle for two hours at room temperature. The calcium carbonate formed, absorbed and pushed the particulates in the water to the bottom of the beakers. Supernatant fluid was discarded; sediments dissolved in 2mls of 10%w/v sulphuric acid and were centrifuged at 3000 rpm for 15 minutes. After which a smear was made on two glass slides out of the sediments obtained; one was stained with lugol's iodine while the other was stained with acid fast stain using Ziehl-Nelson technique (Cheesbrough, 2005). In the modified Ziehl Nelsen technique a drop of each sediment was placed on a labelled slide and spread in a thin uniform smear using a Pasteur pipette over an area of 2cm ×1cm and allows the smear to dry before it was fixed in methanol for two minutes. The slides were stain with cold carbol fuschin for fifteen minutes and wash off with water. Slides were decolorized with 1% acid alcohol, rinsed with water and counterstained with methylene blue for 5mins. The sides were finally rinsed with water and examined using high power objective lens (x100) as described by Cheesbrough (2005).

Parasites were identified by the morphological structures of their cysts, and ova when focused under the microscope.

Statistical analysis: Differences were tested using Analysis of Variance and DMRT-at 95% level of significance (2-way ANOVA) in SPSS 20 Statistical Package.

RESULTS

The contamination of the water sources in the dry and wet seasons was presented in Table1. Among the water sources studied pond was the most contaminated with parasitic contamination100%, followed by Dam water 63.3%, wells 20.8%, tap 10% and boreholes 0%. Moreover, two different parasites found in this study were *Entamoeba histolytica* in its cystic form 13.7% and the cyst of *Giardia lambia* 7.8% (Table 2) for the entire study period. The most widely distributed was *E.histolytica* having occurred 28 times in the water samples from various sources. ANOVA indicates that the prevalence of *E. histolytica* and *G. lamblia* in dry seasons was not significantly higher than in the rainy season [ANOVA's F (1, 26) = 0.808, p = 0.377 and 0.578].

Table 1: The contamination of water sources in dry and wet seasons.

Water source	Number of samples collected	Number contaminated (Dry season April-June)	*E. histolytica*	*G. lambia*	Number contaminated (wet season July-Nov)	*E. histolytica*	*G. lambia*
Dam	15	7(46.7%)	4 (26.7%)	3 (20%)	12(80%)	8(53.3%)	4(26.7%)
Tap	15	2(13.3%)	1 (6.7%)	1 (6.7%)	1(6.7%)	1(6.7%)	0(0%)
Well	24	3(12.5%)	2 (8.3%)	1 (4.2%)	7(29.2%)	5(20.8%)	2(8.3%)
Pond	6	4(66.7%)	2(33.3%)`	2(33.3%)	8(13.3%)	5(83.3%)	3(50%)
Borehole	42	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)
Total	102	16	9	7	28	19	9
% Prevalence		15.7	8.80%	6.90%	27.5	18.60%	8.80%

Table 2: The contamination of sources for the entire study period

Water source	Number of samples collected	Number contaminated	%	*E.histolytica*	*G. lambia*
Dam	30	19	63.3	12(40%)	7(23.3%)
Tap	30	3	10	2(6.7%)	1(3.3%)
Well	48	10	20.8	7(14.6%)	3(6.3)
Pond	12	12	100	7(58.3)	5(41.7%)
Borehole	84	0	0	0(0%)	0(0%)
Total	204	44		28	16
% Prevalence		21.6		13.70%	7.80%

DISCUSSION

The research recorded parasitic contamination of the different water sources in Dutsin-ma Local Government Area, Katsina State, Nigeria. The contamination varies between the different sources of water (Dam, pond, wells, tap and boreholes). Several researchers have also recorded different ranges of rates of contamination of water with parasites at different parts of the country (Christiana and Levi, 2015). The implication of this finding is that the pathogenic parasites may pose serious hazard to the health of people of that area especially those that consume the water directly without any purification. Among these water sources, pond water recorded the highest prevalence of parasites (100%). This could be due to its exposure to possible contaminants as it collects water from many routes especially during wet season. It therefore stands a greater risk of contamination with parasites which is similar to the findings of Christiana and Levi (2015) who recorded the highest occurrence of parasites in pond water. Moreover, this could be as a result of feacal and sewage contamination of the water source as observed in the site during collection of water samples. Water samples from boreholes had no infestation (0%).This is because boreholes operate a closed system unlike other sources that are open to external contamination. This agrees with the findings of Chollom *et al.* (2013) in which no parasite was detected in borehole water . The parasitic infestation in well water could be due to contamination by a point source of pollution such as places where refuse is dumped that is near the source of water. This is similar to the findings of Amenu and Gobena (2015) with high contamination of water from unprotected wells. The contamination of water from tap is a serious concern, finding the source of contamination is needed for the safety of tap water is not guaranteed. This is in line with the findings of Silva *et al.* (2015) in Brazil concerning household water. Two water-borne protozoan parasites, *Entamoeba histolytica* and *Giardia lambia* were identified in their cystic form in this study. The identification of these parasites in various drinking water sources agreed with the studies carried out by Vivian *et al.* (2016) and Rafie *et al.* (2014) as these parasites were the most occurred in their study. Some water sources contained coloured particles, thus, making the water aesthetically unaccepted by the people for drinking. The poor sanitary attitude of the people near the water sources in addition to erosion and influx of surface water into the water sources could also account for their contamination. *Entamoeba histolytica* was the most prevalent of the parasites having occurred times in a total of 204 water samples examined. Hence, there is the tendency of high rate of amoebiasis infection within the study area. The high occurrence of *E. histolytica* is in line with the report of Mohammad (2016) who recorded high prevalence of *E. histolytica* in his study.

Giardia lamblia gained low prevalence in these water sources. This could be associated with its abundance in the area. This contradicts with the findings of Nagwa *et al.* (2013) which found the occurrence of *Giardia* in about 25% of the samples collected while *C.parvum* was in 16% of the samples tested, Branco *et al.* (2012) in which the prevalence of *Giardia* was higher than that of *E. histolytica* and Amenu and Gobena (2015) found that the mean value of *Giardia* in unporotected well was higher than that of tap water 0- 5.6 and 0 respectively. The presence of these two parasites is closely linked with unsanitary attitude of people who defecate near the water bodies and activities of farm animals which harbour the parasites. This could result to the outbreak of amoebiasis and giardiasis in the area.

A review of 28 studies carried out by the World Bank as cited by Franco *et al.*, (2012) gives the evidence that incidence of certain water borne, water washed, water-based and water sanitation associated diseases are related to the quality and quantity of water and sanitation available to users. Waterborne diseases accounts for 80% of illnesses in developing world, killing a child every 8 seconds. It is also believed that hospital beds are occupied by people suffering from water borne diseases due to polluted drinking water (Isirimah, 2003).

CONCLUSION

Entamoeba histolytica and Giardia lambia were detected in the water sources used in Dutsin-ma. The occurrence of *E. histolytica* was more frequent than that of *Giardia* cysts in the drinking water. The possible source of contamination of the treated drinking (Tap) and sources untreated water can be human activities such as agricultural and waste dumping around the water sources. Since the consumption of water is necessary for life, then it is of utmost importance to evaluate the quality of water through continuous monitoring of these drinking water sources and people should cultivate the habit of boiling or treating water meant for consumption to reduce the chances of disease transmission and the outbreak of water-borne diseases due to parasitic infestation of water sources.

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