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Evaluation of Parasitic Contamination of Drinking Water Sources in the Rural Areas of Dekina Local Government Area, Kogi State, Nigeria

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Abstract **Background**: Waterborne and sanitation-related infections are one of the major contributors to diseases burden and mortality in the world with children and poor individuals in rural areas being the most affected. Different parasitic diseases such as giardiasis, toxoplasmodiasis, amoebiasis, cryptosporidiosis have been associated with contaminated drinking water. In this study, a survey on the parasitic contamination of drinking water sources was carried out in Anyigba and Iyale of Dekina Local Government Area of Kogi State, Nigeria, to evaluate the level of contamination of water sources and their public health implications. **Materials and Methods**: Water samples were collected from five sample streams in the selected communities. The water samples were examined for parasites using formal saline concentration method. A drop of sediment obtained after centrifugation at 4000 rpm for 6 minutes was placed on a clean glass slide and viewed under the microscope at x10 and x40 objectives. The parasites were identified using the standard keys of Cheesbrough (2006). **Results**: A total of twelve waterborne parasites were observed in the water samples collected from the five streams with an overall prevalence of 15.6%. The individual prevalence of these parasites were 4.4% (*Entamoeba* species), 4.0% (*Schistosoma haematobium*), 2.6% (*Giardia duodenale*), 1.6% (*Diphyllobothrium latum*), 1.6% (*Strongyloides stercoralis*), 1.6% (*Gastrodiscoides hominis*), 1.2% (*Trichuris trichiura*), 1.2% (*Taenia* species), 0.8% (*Ascaris lumbricoides*), 0.8% (Hook worm), 0.8% (*Isospora rivolta*) and 0.4% *(Hymenolepis diminuta*). The prevalence of the parasites in the streams were 24.0% (Abujalake), 16.0% (Ajidam and Oganaji), 12.0% (Ajieko) and 10.0% (Ajietito).

Keywords: *drinking water, rural areas, protozoans, helminths, Dekina LGA, Kogi, Nigeria*

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1. Introduction

Water is essential for life. It is used for many purposes such as drinking, bathing, agricultural and industrial activities. Water has been considered as environment for many pathogenic organisms (helminths and protozoan parasites) to grow and develop. Drinking water could be gotten from sources such as borehole/tap water, rivers, streams, lakes and rain water. Every communities of humans, animals or plant have one or more of these as their source of water. It is important for the health and survival of man in all his habitation. Unfortunately, water users are usually not aware of the potential health risk associated with exposure to waterborne contaminants [1]. These contaminants occur mainly because of improper management of water supplied, reuse of waters, poor sanitation and poor hygienic behavior among human population [1,2,3]. Water is consumed untreated and this represents a risk factor for acquiring waterborne infections that may cause diarrhea.

In developing countries, water-borne protozoan pathogens are frequently associated with morbidity [4]. The protozoan parasites are the most common causes of infections worldwide [5]. Among protozoan diseases, amoebiasis is gaining prevalence in the world. Other important classes of water-borne diseases are caused by metazoan parasites. The helminths are very large group of multicellular parasitic worms. Some infect humans, others plants and animals. There are three major groups of helminths containing members that have man as their host, these are, flukes (Trematoda), tapeworm (Cestoda) and roundworms (Nematoda). Helminths infection are spread through ingestion or inhalation of their ova, some of which can survive outside the host for a long period of time or via larvae or cercariae penetrating skins exposed to infected soil or water. Helminths ova once inside the body are passed out via the faeces to the environment [6]. This research work evaluates the level of parasites contamination of some drinking water sources in rural areas of Dekina Local Government Area of Kogi State.

2. Materials and Methods

2.1. Study Area

The study was carried out in rural villages of Dekina Local Government Area of Kogi State, Nigeria. The mean minimum and maximum temperature range from 20°C to 30°C. It has an estimated population of 260,311 km^2 (950 sqmi) [7]. The vegetation is characteristic of guinea savannah belt and consists essentially of shrubs and trees. The major occupation of the inhabitants are farming and petty trading. Sources of water for drinking and domestic use in the area include, streams, lakes and rainwater.

2.2. Sample Collection

Water samples were collected directly from the various sources of drinking water within the area into plastic containers. Five sample sites which included Oganaji stream, Abuja Lake, Aji-dam, Aji-eko, Aji-etito streams were selected for investigation among the communities in the area. Samples were collected from each sample site and analyzed within 48 hours of collection. A total of 250 water samples were collected on 5 trips.

2.3. Experimental Procedure

Water samples were filtered through a filter sieve of 0.5 mesh size. The residue was soaked and rinsed thoroughly in a beaker containing 20ml of 5% formal saline (5% formalin in 0.85% of NaCl). The filtrate was poured into centrifuge tube and centrifuged at 4000 rpm for 6minutes at room temperature and allowed to rest in test tube rack for 3minutes. The supernatant was discarded leaving small amount of suspended sediment. A drop of suspended sediment was placed on a clean glass slide and iodine solution was added using Pasteur pipette. It was then covered with cover slip and examined under a microscope using x10 and x40 objectives.

3. Results

A total of twelve waterborne parasites were encountered in this study with an overall prevalence of 15.6%. These include; *Entamoeba* species, *Isospora rivolta, Giardia duodenalis, Schistosoma haematobium, Trichuris trichiura, Ascaris lumbricoides, Diphyllobothrium latum, Strongyloides stercoralis, Hymenolepis diminuta, Gastrodiscoides hominis, Taenia* species, and Hook worm. The parasites were detected in their various stages (cysts, oocysts, trophozoites, larvae and egg/ova).

In the various drinking water sources investigated, the highest prevalence of 24.0% (12) was recorded in Abuja-lake, followed by Oganaji with a prevalence of 16.0% (8). The least is Ajietito with a prevalence of 10.0% (5) (Table 1).

Table 2 shows the frequency of protozoan and helminthe parasites in the different water sources. *Entamoeba* spp had the highest frequency of 11, followed by *S.haematobium* with a frequency of 10. The least was *H. diminuta* with a frequency of 1.The percentage frequency of protozoan and helminth parasites shows that *Entamoeba* spp had the highest prevalence of 4.4%, followed by *S.haematobium* with a prevalence of 4.0%. The least was *H. diminuta* with a prevalence of 0.2%.

Table 1. Summary of the Results of the Various Drinking Water Sources Examined and the Number of Samples Contaminated with Parasites

Streams	Total Examined	Status	
		Positive(%)	Negative (%)
Ajieko	50	6(12.0)	45(90.0)
Ajietito	50	5(10.0)	44(88.0)
Ajidam	50	8(16.0)	42(84.0)
Abuja-Lake	50	12(24.0)	38(76.0)
Oganaji	50	8(16.0)	42(84.0)
Total	250	39(15.6)	211(84.0)

Table 2. Frequency of Protozoan and Helminth Parasites of the Different water sources in the area

Parasites	Streams					Total (%)
	Ajieko	Ajietito	Ajidam	Abuja-lake	Oganaji	
Schistosoma haematobium	2	0	3	3	2	10 (4.0)
Trichuris trichiura	0	0	1	1	1	3 (1.2)
Ascaris lumbricoides	0	1	0	1	0	2 (0.8)
Diphyllobotrium latum	0	0	0	2	2	4 (1.6)
Strongyloides stercoralis	1	0	1	2	0	4 (1.6)
Giardia hominis	1	1	0	2	0	4 (1.6)
Hymenolepis diminuta	0	1	0	0	0	1 (0.4)
Taenia spp.	0	1	1	1	0	3 (1.2)
Hookworm	1	1	0	0	0	2 (0.8)
Entamoeba spp	2	1	4	4	3	11 (4.4)
Ispospora rivolta	0	0	2	2	0	2 (0.8)
G. duodenalis	1	0	2	2	1	6 (2.6)

4. Discussion

The study area recorded at least two different parasites contaminating the various drinking water sources. The rate of contamination varied between the different sites, Abuja-lake, Ajieko, Aji-dam Ajietito, and Oganaji. Studies carried out by several researchers have also recorded the rate of contamination of water with parasites in different parts of the country [5,8]. The findings may result to public health complications by these pathogenic parasites which may pose a serious hazard to the health of rural dwellers, due to poor sanitation habits [9].

Among the water sources, Abuja-lake recorded the highest sample contamination with a prevalence of 24.0% (12). This could be because the lake is a slow moving water body, and during the rains, it collects run-off water from different routes. It therefore stands a great risk of contamination with parasites. The entire sample sites investigated were contaminated with parasites. This could be as a result of faecal and sewage contamination of the streams, especially during rainy season. Twelve water borne parasites: 3 protozoan *(Entamoeba* spp, *Giardia duodenalis*, and *Isospora rivolta*) and 9 helminthes (*Schistosoma haematobium, Trichuris trichiura, Gastrodiscoides hominis, Taenia* spp, *Hymenolepis diminuta, Strongyloides stercoralis, Ascaris lumbricoides, Diphillobothrium latum* and Hookworm) were identified in their cystic, oocystic, trophozoites, eggs/ova and larval forms.. The identification of these parasites in the various drinking water sources agreed with the studies carried out by Odikamnoro, *et al*. [5], Omowaye, *et al*. [8] and Alli *et al*. [10] in different parts of Nigeria and Kassim *et al*. [11] on the drinking water sources in Hilla city, Iraq. Apart from the presence of these parasites, it was observed that most of the water samples contained dirt and debris, while some others contained coloured particles which could also contribute to contamination of water.

Entamoeba spp was the most frequently occurring parasite of the twelve parasites identified, with a prevalence of 4.4%. This showed a low rate of contamination when compared to the high prevalence of 31.8%, reported by Alli *et al*. [10]. *Entamoeba* spp and *Giardia duodenalis* are protozoan parasites that cause major human infections through water borne transmission. The contermination by these parasites could result from the unsanitary attitude of the people who defecate near the water bodies and activities of farm animals which harbour the parasites, resulting to the outbreak of water borne diseases, usually characterized by diarrhea. *Schistosoma haematobium*, with a prevalence of 4.0%, ranked second most frequently occurring parasite in this study and this could be associated with the contamination of the water with urine and faecal matter as the residents of the study area urinate and defecate indiscriminately in their environment.

5. Conclusion

This study revealed that the drinking water sources in Dekina Local Government Area are contaminated with protozoan and helminthes parasites, which are the cause of waterborne diseases characterized mostly by diarrhea. The pathogenic microorganisms, usually occur as a result of not treating the water contaminated by waste, natural disasters like flood and the activities of farm animals and man harbouring the different stages of the parasites.

6. Recommendation

Hygiene education like washing hands with soap and water, washing of vegetables, brushing of teeth and avoiding drinking unsafe water should be properly taught. Drinking water from these sources should be boiled and allowed to cool before use. Provision of portable water by both government and non- governmental organizations to the residents of the rural villages and communities is also recommended as this will reduce the rate at which the spread of water borne parasitic diseases occur.

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