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Cercarial shedding and trematodes infestation in freshwater snail species from selected freshwater bodies in Zuru Emirate, Kebbi State, Nigeria

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ABSTRACT: Cercariae shedding and trematode**s** infestation in freshwater snails were studied in 503 snail species collected from reservoirs, dams, ponds, and streams in four Local Government Areas of Zuru Emirate, Kebbi State, Nigeria from January to May 2019. Of this number, three (3) freshwater snail species namely; *Bulinus globosus*, *Lymnaea natalensis*, and *Melanoides tuberculata* were collected in twelve (12) sites of four local government areas (Danko/Wasagu, Fakai, Sakaba and Zuru) of the study area. The snails were then exposed under direct between 9.00am to 1.00pm sunlight for cercarial shedding, and a percentage prevalence of trematode infestation (8%) was recorded in the study area. Distribution of cercariae among the snail species screened showed that *Bulinus globosus*, and *Lymnaea natalensis*, shedded 8.59% and 8.53% of the *Schistosoma haematobium* and *Fasciola* species cercariae respectively, while *Melanoides tuberculata* shedded 4.22% of *Paragonimus* species cercariae. The intensity of infection rate among the examined snails varied significantly ($P<0.05$) based on Local Government Areas of sampled. The highest cercarial infection (8.63%) was recorded in Fakai, followed by Danko/Wasagu (8.59%), Sakaba (7.96%), and the least infection (6.50%) was recorded in Zuru in conclusion, related studies to establish the incidence of diseases vectored by snails on the water quality parameters to certain the factors that could influence freshwater snail distribution in the study area is highly recommended.

Key Words: Cercariae, Trematodes, Snail Species, Freshwater bodies, Zuru Emirate.

Introduction

Many freshwater snail species are involved in the transmission of parasitic disease in both humans and animals. These snail species serve as intermediate hosts of pathogenic trematodes of the genus *Schistosoma, Fasciola, Clonorchis, Echinostoma* e.t.c, which remains the most important cause of global health problems to man and his livestock (Kanta, 2009; WHO, 2016). Trematodes have a heterogeneous life cycle with freshwater snail as their first intermediate host. The adult forms of the parasites are found in different vertebrate definitive hosts including amphibians, reptiles, fishes, birds, and mammals (Bunza and

Abdullahi, 2013). The disease characteristics of trematode infections vary with the parasite species and the site or organ of infection (Strong and Ellen, 2008). The different parasitic diseases they cause are urinary and intestinal Schistosomiasis, Fasciolosis, Paragonimiasis, and Paramphistomiasis in tropics (Okaiyeto *et al*., 2011).

Intestinal schistosomiasis caused by *S. mansoni* and *S. japonicum* result in eosinophilia, hepatomegaly, splenomegaly, and hematemesis while urinary schistosomiasis caused by *S. haematobim* results in dysuria, hematuria, and uremia. Diseases caused by *Fasciola hepatica, Clonorchis sinensis, Opisthorchis viverrini* infection, causes fever, hepatomegaly, abdominal pain, and jaundice. Infections with *Paragonimus westermani* result in cough, hemoptysis, chest pain, and epilepsy. *Fasciolopsis buski* causes abdominal pain, diarrhea, and edema (Otubanjo, 2013). Developing countries in Africa, Asia and Latin America have the highest incidence of these diseases, while some endemic parasites have developed in to worldwide epidemics through the global spread of snails (Xiao-Ting Lu, 2018).

These parasitic diseases are prevalent in areas where the snail intermediate hosts breeds in water contaminated by faeces or urine of infected persons or animals. People acquire the disease through repeated contact with the contaminated freshwater during fishing, farming, swimming, washing, bathing and recreational activities (WHO, 2015). Water development schemes in certain areas, particularly irrigation schemes can contribute to the introduction and spread of the diseases (WHO, 2014).

Distribution of freshwater snails accounts for the occurrence of different Trematode taxa in a particular region. As the parasites are mostly host specific, higher heterogeneous of the host promotes higher heterogeneous of the parasites (Hechinger and Lafferty, 2005). Similarly, higher snail diversity leads to higher Trematode diversity. Apart from that, conditions influencing the proliferation of snail population will inevitable enhance the existence of trematode parasites in their intermediate host (Hechinger and Lafferty, 2005). Consequently, this research would provide a current status of freshwater snails and different trematode taxa in the study area thereby providing a guide for planning control strategies of the diseases transmitted by freshwater snails in the study area. The study was designed to determine the cercarial shedding and trematodes infection in freshwater snails collected from selected water bodies in the study area.

Materials and Methods

Study Area

The research was conducted in Zuru emirate council of Kebbi State North-western Nigeria. The Emirate comprises of four Local Government Areas namely; Danko/Wasagu, Fakai, Sakaba and Zuru (Figure 1). Danko/Wasagu covers an area of 4,016 km^2, with a population of about 265,203. Fakai has an approximate area of 2,247 km^2 and a population of 121,212. Sakaba covers an area of about 1,260 km^2, with a population of 89,937, while Zuru covers an area of 653km^2 with a population of about 165,547 (Kebbi State Diary, 2003).

The Emirate is located in the extreme southeastern part of the State, situated within latitudes 11º and 12º North and longitude 4º and 5º East of the equator (Kebbi State Diary, 2003). Occupation of the people in the four Local Government areas are agriculture, animal rearing and trading, in which pastoralists and smallholder farming sector plays an important role in food production. Pastoralist communities practice transhumant or nomadic livestock husbandry and can have large herds of animal of which provide a means of livelihood and household assets (MAFF, 1997; Lange, 2009).

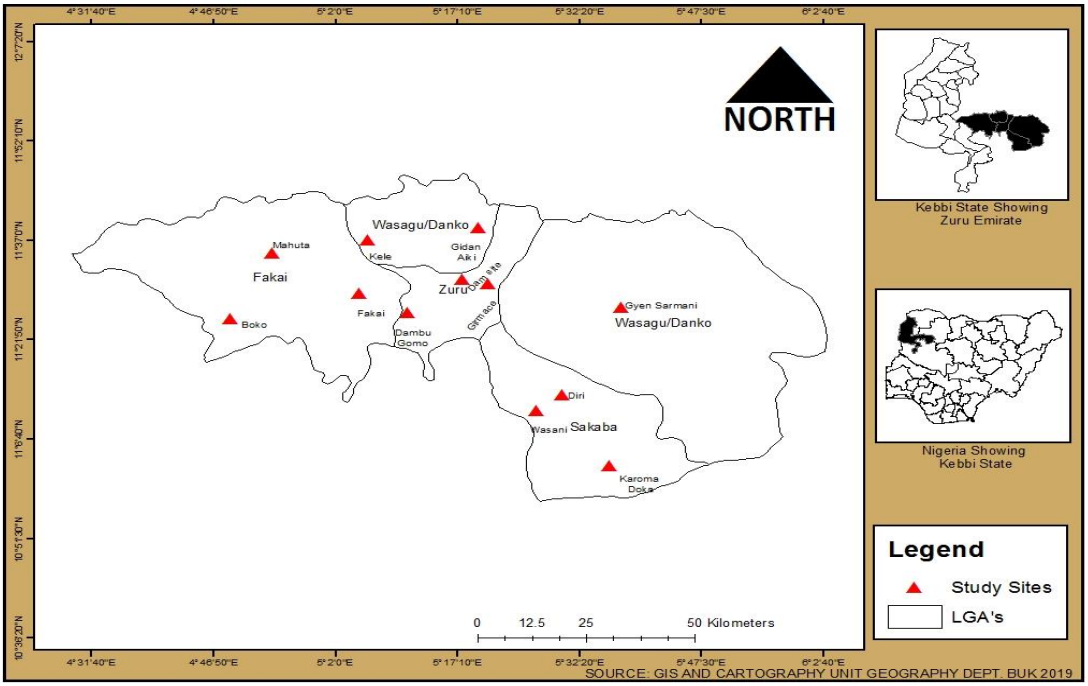

Fig 1: Map of Zuru Emirate Showing Study Sites.

Site Selection

The selection of site was based on easy access to the stream, reservoir, ponds, dams, presence of livestock grazing areas or where birds and other wild life visit for water and food. Freshwater snails were collected with the aid of scoop nets made from wire mesh attached to a long metal handle from reservoirs, dams, ponds or stream bottom. The time for collection was between 8.30 a.m. to 11.00 a.m., at each of the selected freshwater bodies (Opisa *et al.*, 2011). Each site was sampled two (2) times during the study period.

Collection of Snail samples

The study was a field and laboratory based research. Freshwater snails were collected between January and May 2019, during the dry and early raining season. During the course of study, the snail samples were collected in in twelve (3) sites of each Local Government Areas. The collected snails from each site were placed in sterile plastic containers with water from the same habitat to avoid overheating and were transport to the Biology Laboratory in the Department of Animal and Environmental Biology of the Kebbi State University of Science and Technology, Aliero, Nigeria. The nails were washed to remove dirt and sort out according to their morphologies (Vander and Loker, 1990) and then identified according to the method of Brown who provided keys for identification of medically important African freshwater snails (Brown, 1994).

Cercarial Shedding

The freshwater snails collected from each sampling sites were placed separately in a small clean labeled plastic rubber container containing clean water. The snails were then exposed under direct sunlight between 09:00 a.m. to 01:00pm to induce shedding of the cercariae. The emergent method of cercarial release was adopted as described by Sharif *et al*. (2010) for the confirmation of the presence or absence of cercarial shedding. After these hours, the water in each specimen container was poured into a petri dish and examined for the presence of cercariae under X40 microscope for several times as described by Uthpala *et al*. (2010).

Identification of Cercariae

The cercariae released by each separated freshwater snails were transferred in a glass slide and stained with neutral red (0.1%). A cover slip was carefully place on the stained slide and then observed under the X40 objective of the light microscope. The morphological details of the observed cercariae were recorded and identified using the identification key provided by Frandsen and Christensen. (1984).

Data Analysis

The results obtained were calculated and expressed in percentages and subjected to *Chi*-square analysis for the test of significant difference using statistical package for social sciences (SPSS version 26, 2019). $P<0.05$ was considered significant at 95% confidence limit.

Results

A total of 503 freshwater snails belonging to three freshwater snail species were collected and shedded cercariae namely; *Bulinus globosus, Lymnaea natalensis,* and *Melanoides tuberculata*. Of the 503 freshwater snail species, 7.95% released one or more types of cercariae species. The highest cercarial sheds (8.63%) was recorded in Fakai, followed by Danko/Wasagu (8.59%), Sakaba (7.96%), and the least cercarial sheds (6.50%) was recorded in Zuru (Table 1).

Table 1: Distribution of Cercariae in Freshwater Snails from each Local Government Area of the study Area

L.G.A	No. of Snail species Collected	No. with Cercariae Sheds	(%) Infestation	P-value
D/W	128	11	8.593	0.916
Fakai	139	12	8.633	
Sakaba	113	9	7.964	
Zuru	123	8	6.504	
Total	**503**	**40**	**7.952**	

$X^2 = 0.512$, df = 3, P = 0.916

The overall prevalence of trematodes infestation according to freshwater snails collected in the study area was 21.36%. *Bulinus globosus*, *Lymnaea natalensis,* and *Melanoides tuberculata* were found to harbor cercariae of different trematode species. *Bulinus globosus* had the highest prevalence of trematodes infestation (8.60%), followed by *Lymnaea natalensis* (8.53%), while *Melanoides tuberculata* had the lowest prevalence (4.23%) of trematode infestation (Table 2).

Table 2: Prevalence of Cercarial Sheds According to Snail Species in the Study Area

Snail Species	No. of Snail Examined	No. of Snail Infected	% Prevalence Infestation	P-value
B. globosus	221	19	8.597	0.456
L. natalensis	211	18	8.531	
M. turberculata	71	3	4.225	
Total	**503**	**40**	**8.0**	

$X^2 = 1.569$, df = 2, P = 0.456

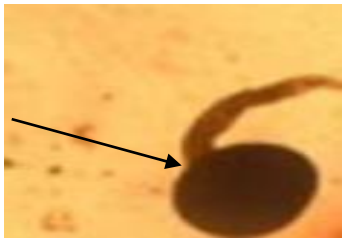

Fig 2: Gymnocephalous Cercariae

Fig 3: Furcocercous Cercariae

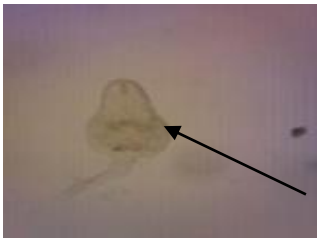

Fig 4: Xiphidio Cercaria

Discussion

This study recorded a total of 503 freshwater snail species collected from reservoirs, ponds, dams, and streams in the study area. Three freshwater snail species collected are; *Bulinus globosus, Lymnaea natalensis,* and *Melanoides tuberculata*, and the total prevalence of trematode infestation is 8.0%. The overall prevalence of trematodes infestation rate recorded in the current study differed from the results obtained in similar studies from other part of the world. For example, 10.55% prevalence rate was reported by Fatima *et al*. (2018) who sampled eight genera of snails from six freshwater bodies in Kaduna State and 0.9% prevalence rate was also reported by Joshua and Albert, (2015) among snails from some selected freshwater bodies in Borno State, Nigeria. Kigadye and Nkwengulila, (2001) reported an overall prevalence of 1.3% among snails sampled in parts of Tanzania. Prevalence rate of 16% was reported by Uthpala *et al.* (2010) who sampled four genera of snails from irrigation canals in three climatic zones of Sri-Lanka and 7.33% was reported by Tigga *et al*. (2014) among freshwater snails from canal, tanks, ditches, ponds, and crop fields inRanchi.

However, results of this study is similar to the results conducted in Jos Plateau State Nigeria by Okpala *et al*. (2010) who recorded 8.13% prevalence. This discrepancies in prevalence rate in different regions may be attributed the low prevalence of cercarial shedding among natural snails population to direct consequence of parasites induced host mortality. The season of sampling may also have contributed to the fluctuating prevalence of cercarial shedding (Anderson and May, 1979; Chandiwana *et al*. 1987.

Base on the previous results reported, freshwater snails sheds more cercariae during dry seasons. In most areas, seasonal changes in rainfall, water level and temperature cause marked fluctuations in snail population densities and transmission rates. Additionally, increased volume of freshwater bodies in canals due to rainfall and the effect of temperature are other factors known to affect freshwater snail population and their cercarial shedding which is dependent on direct sun or artificial light and temperature. The low infestation rate in the freshwater snails is viewed as a characteristic of parasites in short lived host (Esch

and Femande, 1994). Increased in water velocity was reported to dislodge snails from their natural habitats, thereby reducing their production and infection potentials (Born *et al*. 2014).

Conclusion and recommendation

Freshwater snails are involved in the transmission of many trematode parasites of medical and veterinary importance. Although the percentage prevalence of trematode infestation in is low, the presence of snail intermediate hosts in the study area can be a potential risk to humans and livestock. The presence of cercariae in freshwater bodies in the study area also implied that there could be a widespread of *trematodiasis* in the study area. Therefore, provision of current control strategy is needed to prevent the infection of human and animal populations in the area.

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