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Research Article

Survey of Freshwater Snails on Three Parts of Jakara Dam, Kano State, Nigeria

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Abstract

Background: The survey of fresh water snails in Jakara dam was carried out to investigate the different types of freshwater snails in three parts of the dam. **Methodology:** Snails were searched for and collected in Fako, Kwata and Yadakunya between August 2015 and September 2016 using steel net and hand picking. Chi-square test was used to compare the difference in snail abundance between the different parts. **Results:** Thirteen snail species from 4 families were encountered. *Bulinus* species collected are *Bulinus globosus morelet*, *B. reticulatus*, *B. truncatus rohlfsi*, *B. truncatus truncatus* Egypt, *B. jouseammei*, *B. nyassanus*, *B. africanus ovoidus*, *B. liratus*, *Bulinus succinoides* and *B. camerunensis*. Except for *B. africanus ovoidus*, *B. liratus* and *B. succinoides* all the species of *Bulinus* encountered are known intermediate hosts of urinary schistosomiasis. *Bulinus globosus* is the only *Bulinus* species that was previously encountered in this water body. **Conclusion:** The presence of these new species of *Bulinus* suggests their combined roles with *B. globosus* in the transmission of urinary schistosomiasis in the endemic rural communities of Wasai, Ungoggo and Gezawa. There is need for a snail control strategy to prevent schistosomiasis transmission.

Key words: Freshwater snails, urinary schistosomiasis, intermediate hosts, Jakara dam

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Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Freshwater snails are gastropod molluscs which live in fresh water. They are found throughout the world in various habitats, ranging from rain fed pools to dams and lakes. In the Northern state of Kano, North west Nigeria, there is widespread development of earth dams. Many of such water bodies have been found to contain potential snail intermediate hosts^{1,2}. Freshwater molluscs have been known to play significant roles in public and veterinary health and thus need to be scientifically explored more extensively³. *Schistosoma haematobium* the causative agent of urinary schistosomiasis is transmitted through snails of the genus *Bulinus* which contains around 37 species within 4 species group. *Bulinus* species are extensively distributed throughout much of Africa, Madagascar, parts of the Middle East and Mediterranean⁴. Schistosomiasis is one of the neglected tropical diseases in Nigeria especially in irrigation areas. In its various forms it often leads to various physical, social and economic disability and together with other major parasitic diseases can weaken the development capacity of developing countries⁵. Adult male and female schistosomes pair and live together in human blood vessels. The females release eggs, some of which are passed out in the urine (in *S. haematobium* infection) or stools (*S. mansoni*, *S. japonicum*) but some eggs are trapped in body tissues⁶. Transmission occurs in fresh water when the intermediate snail hosts release infective forms of the parasite. People are infected when they come in contact with water where infected snails live. Larval forms of the parasites (known as cercariae), released by the snails, penetrate the skin of people in the water. The snails themselves become infected by another larval stage of the parasite, known as a miracidium, which develops from eggs passed out in the urine or faeces of infected people^{6,7}. In urinary schistosomiasis (due to *S. haematobium*) damage to the urinary tract is revealed by blood in the urine. Urination becomes painful and is accompanied by progressive damage to the bladder, ureters and then the kidneys. Cancer of the bladder is common in advance cases⁸. In intestinal schistosomiasis (infection with *S. mansoni*, *S. japonicum*, *S. mekongi*), disease is slower to develop. There is progressive enlargement of the liver and spleen and intestinal damage, due to fibrotic lesions around eggs lodged in these tissues^{8,9}. Freshwater snails have been reported in different parts of Nigeria. In Kano state Betterton *et al.*¹, Duwa and Oyeyi² and Rabi¹⁰ reported the presence of freshwater and snail intermediate hosts in Wasai part of Jakara dam. *Bulinus globosus*, *Bythynia tentaculata*, *Lymnea natalensis* were reported by Duwa and Oyeyi² and Rabi¹⁰ in Jakara dam. Studies carried out on freshwater snails in Jakara dam have

always focused on the Wasai part of Jakara dam which is in Minjibir local government area and not on the other parts which are in two other local government areas. The aim of this study is to investigate the different parts of Jakara dam and determine if they all harbor the same types of snail intermediate hosts.

MATERIALS AND METHODS

Study area: This study was conducted in three locations on Jakara dam namely Wasai (Fako and Kwata) and Yadakunya, Minjibir and part of Ungoggo and Gezawa local government areas of Kano state between August 2015 and September 2016. Both Fako and Kwata are in Wasai. The Gezawa and Ungoggo part met at Yadakunya. Jakara dam was constructed in 1976 and is situated in Wasai, Minjibir Local Government Area (LGA) in the North Eastern part of Kano metropolis about 41.5 km from the city centre. The area in terms of geology falls within the tip end of the basement complex adjoining chad formation, which is characterized by disappearing type of streams. Jakara dam is one of the most grossly polluted dam in West Africa, because during the dry season all the streams that feed it dry up with the exception of the major Jakara stream which sustain it. The water bodies contain muddy substrata and gentle flowing, low turbidity water with rich growth of algae and macrophytes.

Methodology: Three locations on Jakara dam were investigated for the presence of freshwater snails and potential snail intermediate hosts. Snails were searched for using long handled steel net, examination of submerged and emergent plants as well as polythene bags. Snails found were placed in wide mouth screw capped containers and brought alive to the laboratory for identification. Identification was done based on Brown⁴ and Mandahl-Barth¹¹. They were fed with lettuce during this study. Cercarial shedding was determined from snails and species of snails were also identified based on shell morphology.

RESULTS

This survey revealed the presence of 13 different snail species on three parts of Jakara dam (Fig. 1), sample site 1,2,3; Kwata, Fako and Yadakunya, respectively. A total of 2836 snails were collected. Out of the 2836 snails collected *Bulinus jousamei*, *Bulinus truncatus rohlfsi*, *Bulinus reticulatus*, *Bulinus nyassanu*, *Bulinus camerunensis*, *Bulinus liratus*, *Bulinus succinoides*, *Bulinus africanus ovoidis* were reported for the first time in Jakara dam. *Melanooides tuberculata*, *Bythynia tentaculata* were found in all the



Fig. 1: Map of Jakara dam Kano state, Nigeria



Fig. 2: Snail species collected in Fako, from left: *Bithynia tentaculata*, *Bulinus globosus*, *Lymnea natalensis*, *Melanoides tuberculata*, *Lymnea natalensis*

3 parts. Generally snail abundance varied significantly across the different parts of the water body ($p < 0.0001$). The most abundant snail species in this present study was *Melanoid tuberculata* (35.26%) followed by *Bythynia tentaculata* (31.73%) (Table 1). *Bulinus africanus ovoidus* was the least with only two. *Lymnea natalensis* was only encountered in Fako (Table 1).

All the *Bulinus* species except *Bulinus globosus* were found in the Yadakunya part of the dam. Fako has the highest number of snails (1230) followed by Yadakunya (911) and Kwata (695) has the least but Yadakunya has all the snail species except *Lymnea natalensis* (Table 1). None of the snail species examined was found to shed schistosome cercariae.

The number of snails collected during the months of August-December 2015 are more in Fako followed by Kwata and then Yadakunya. Between January and May the number

Table 1: Abundance of freshwater snail species in the 3 parts of Jakara dam Dam sites

Snail species	Yadakunya	Kwata	Fako	Total	Abundance (%)
<i>Lymnea natalensis</i>	0	0	30	30	1.05
<i>Bithynia tentaculata</i>	100	500	300	900	31.734
<i>Melanoides tuberculata</i>	200	200	600	1000	35.26
<i>Bulinus reticulatus</i>	50	0	0	50	1.76
<i>Bulinus globosus</i>	100	211	300	611	21.54
<i>B. jousseaumei</i>	91	0	0	91	3.2
<i>B. camerunensis</i>	21	0	0	21	0.7404
<i>B. nyasanus</i>	10	0	0	10	0.3526
<i>B. liratus</i>	04	0	0	04	0.14
<i>B. truncatus rohlfsi</i>	87	0	0	87	3.06
<i>B. truncatus truncatus</i> Egypt	20	0	0	20	0.7
<i>B. succinoides</i>	10	0	0	10	0.3526
<i>B. africanus ovoidus</i>	02	0	0	2	0.07
Total	695	911	1230	2836	100

Table 2: Snails collected by month

Site	No. of snails	August-December (2015)	January-May (2016)	June-September (2016)
Kwata	911	713	128	70
Fako	1230	900	188	142
Yadakunya	695	300	201	194
Total	2836	1913	517	406

of snails collected in Yadakunya are more than the other parts (Table 2). During the months of November, December and January the rain has completely receded and there is more access to the dam for collection of snails, new species have also emerged. Some of the snails were more during the rainy season while some are completely absent (Table 3). The snail species collected in Fako are shown in Fig. 2, *Bulinus globosus*, the only species of the genus *Bulinus* collected Kwata is shown in Fig. 3. The abapertural view

of the snails collected in Yadakunya is shown in Fig. 4, while Fig. 5 shows the apertural view. *Lymnea natalensis* was only encountered in Fako. The *Bulinus* species *B. reticulatus*, *B. camerunensis* and *B. truncatus truncatus* Egypt. *Bulinus nyassanus*, *B. succinoides*, *B. truncatus rohlfsi*, *B. jouseaumei* Gambia, *B. ovoidus*, *B. globosus* (Y),

B. africanus ovoidus, *B. globosus*, *B. liratus* collected in Yadakunya are shown in Fig. 6.

Table 3: Snails collected by month

Months (2015-2016)	No. of snails
August	214
September	245
October	307
November	514
December	633
January	163
February	96
March	82
April	88
May	88
June	122
July	126
August	88
Sept	70
Total	2836



Fig. 3: *Bulinus globosus* Kwata in Wasai



Fig. 4: Abapertural views of freshwater snails collected from Yadakunya part of Jakara dam

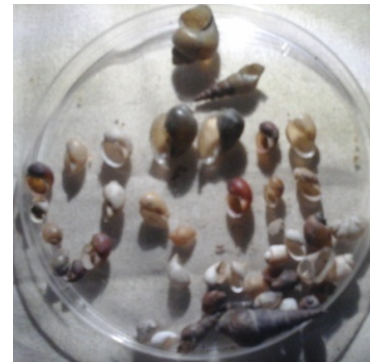


Fig. 5: Apertural views of freshwater snails collected from Yadakunya part of Jakara dam

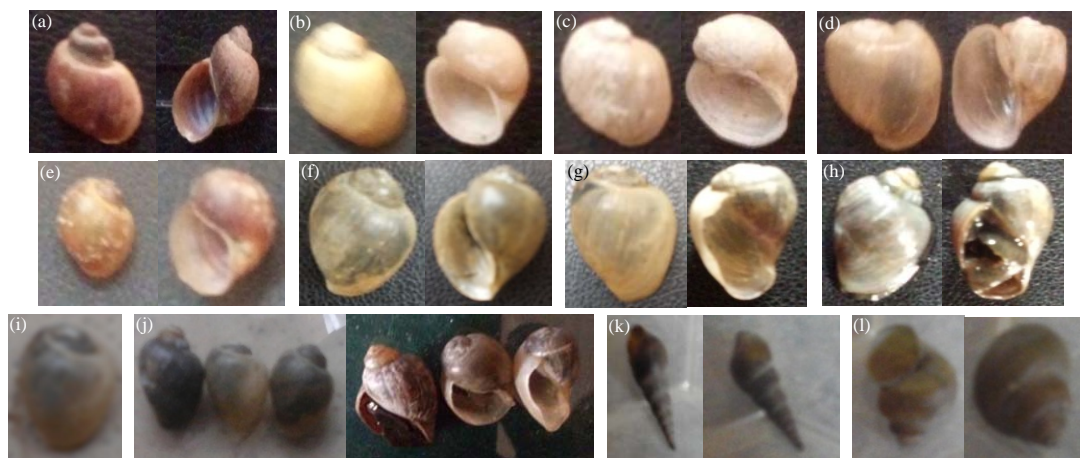


Fig. 6(a-l): Snail species collected in Yadakunya, (a) *Bulinus reticulates*, (b) *Bulinus camerunensis*, (c) *B. truncatus truncates* Egypt. (Mamdahl-Barth), (d) *Bulinus nyassanus*, (e) *Bulinus succinoides*, (f) *Bulinus truncatus rohlfsi*, (g) *Bulinus jouseaumei* Gambia, (h) *Bulinus ovoidus*, (i) *Bulinus globosus*(Y), (j) *Bulinus africanus ovoidus*, *Bulinus globosus* and *Bulinus liratus*, (k) *Melanooides tuberculata* and (l) *Bithynia tentaculata*

DISCUSSION

The snails collected in this study shows that different snail species are found in the different parts of Jakara dam. Previous studies have only restricted the search for snails to only two parts of Jakara dam located in Wasai (Fako and Kwata). Duwa and Oyeyi² and Rabi¹⁰ reported the presence of *Bulinus globosus*, *Bithynia tentaculata* and *Lymnea natalensis* in these two parts. This is the first time more than one species of *Bulinus* is reported in Jakara dam. Salawu and Odaibo¹² and Salawu and Odaibo¹³ reported the presence of *Bulinus jousseaumei* in Ogun state South Western Nigeria. *Bulinus camerunensis* was also reported by Salawu and Odaibo¹². None of the snails was found to be shedding any schistosome cercariae but cyclops were observed in abundance during the cercarial shedding process. A monostome cercariae was also encountered. Various studies have shown that the community in which this dam was situated is highly endemic with over 60% prevalence of urinary schistosomiasis among adults and children^{2,14}, it is not certain whether cyclops can consume schistosome cercariae, Johnson *et al.*¹⁵ reported that cercariae are often consumed by cyclops that could be the reason why schistosome cercariae was not observed during the cercarial shedding process. *Bulinus globosus* and *Lymnea natalensis* are established intermediate hosts of urinary schistosomiasis and fascioliasis, respectively¹³. *Bulinus reticulatus*, *B. truncatus truncatus*, *B. truncatus rohlfsi*, *B. jousseaumei*, *B. nyassanus*, *B. camerunensis* have been reported to be intermediate hosts of urinary schistosomiasis¹¹. It is not known whether *Bulinus succinoides*, *B. africanus ovoidus* and *B. liratus* are intermediate hosts of schistosomiasis. Although these new *Bulinus* species may not be transmitting the disease now, their presence in this water body can be of epidemiological significance in the near future if there is no quick intervention. *Bulinus globosus* obtained from Wasai is different from that of Yadakunya. The same species of *Bulinus globosus* obtained from a previous study² found shedding schistosome cercariae is still the same type obtained in Wasai in this present study. Wright¹⁶ regards *B. jousseaumei* as a subspecies of *B. globosus* but the occurrence of true *B. globosus* of typical form and normal size contradicts this supposition¹⁷ in this study only *B. globosus* collected in Yadakunya resembles *B. jousseaumei* and its much bigger than the size of *B. jousseaumei*. Less snail species were available for collection at the peak of the rainy season during the months of August and September. The only species found during the rainy season (July-September)

were *Bithynia tentaculata* and *Melanoid tuberculata*. During the wet season, rain-fall affects water movement and temperature, thereby, affecting the distribution and density of the aquatic snails^{18,19}. Kenneth²⁰ also reported that during the rainy season most of the snail species and their eggs were carried away by high water current thereby resulting into less snail species caught during this period. Snail intermediate hosts of *Schistosoma* are intolerant of strong currents and breeding colonies are not found in swift flowing streams or water bodies, they are usually found in areas where the velocity off low is below²¹ 40 cm sec⁻¹. This may be the reason why *Bithynia tentaculata* and *Melanoides tuberculata* are the only snail species available during the rainy season. One form of water contact activity or the other such as farming, fishing or swimming is always taking place at one time or the other at the 3 different parts of the dam. Girl child hawkers were also found there selling food to the farmers and fishermen. Children as young as 10 years old were found fishing or swimming at the dam sites, some were also helping their parents in farming (irrigation).

CONCLUSION

This study showed that there are new species of *Bulinus* in Yadakunya and that transmission of urinary schistosomiasis can take place at any time of the year if a quick intervention by snail control is not carried out.

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