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The freshwater snail fauna of the Dadinkowa man-made reservoir, Gombe State, Nigeria

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Abstract
Fresh water snails are important to mankind because they serve as intermediate hosts to various parasites of public health importance. Both natural and man-made water bodies provide conducive habitats for these snails. Thus, it is imperative to examine for the occurrence of freshwater snails in the Dadinkowa man-made reservoir where such information is currently lacking. Consequently, this study was carried out between July to December 2015. Snails were searched for in the main reservoir as well as the main irrigation canals. Seven different prosobranch species namely *Lanistes libycus*, *Lanistes varices*, *Pila werneri*, *Melanoides tuberculata*, *Gabbiella humerosa, Belamya unicolor* and *Cleopatra colbeaui* and three pulmonates species namely *Bulinus forskalii*, *Biomphalaria pfeifferi* and *Lymnaea natalensis* were encountered. Snails were examined for natural infections and only *Lymnaea natalensis* shed gymnocephalus cercariae typical of *Fasciola* species. The findings of the present study have provided information on the diversity of fresh water snail fauna of the Dadinkowa reservoir, this information would subsequently be of utmost importance in controlling snail-borne diseases in the Dadinkowa reservoir as well as its adjoining irrigation canals Gombe State. Nigeria.

Keywords: Freshwater, Snails, Dadinkowa reservoir, Gombe State, Nigeria

1. Introduction
The construction of dams to create man made reservoirs for irrigation and other purposes in Nigeria had the consequence of creating safe heavens for species of freshwater snails to establish flourishing colonies. Some of these snails have been known to play significant roles in public and veterinary health spheres because they serve as intermediate hosts for platyhelminth parasites that cause diseases such as the dreaded schistosomiasis which is second only to malaria in terms of morbidity. Other equally important parasitic diseases transmitted by snails include fascioliasis, paragonimiasis and angiostrongylosis among others. The transmission of these infections takes place only in places where fresh water snail intermediate hosts are present and where there is contact between the population and infested water. Disease transmission is therefore facilitated by availability of surface water throughout the year and this is provided by dams.

In Nigeria, several studies have indicated an increased prevalence of schistosomiasis associated with dam construction. These include those of [1] at the Bacita Sugar Plantation (Kwara State); [2] at Malumfashi, Katsina State; [3] for the South Chad Irrigation Project Area in Borno state and [4] for the Kano River irrigation Project area (Phase1) in Kano State. Subsequent similar studies in Kano [5-8] have all re-emphasized the increase in prevalence of schistosomiasis in association with dam construction and irrigation works. Other studies by [9] at the Savannah Sugar Plantation staff village in Adamawa State; [10] at irrigation schemes in Sokoto, Katsina and Kebbi States; [11] at Piro village near Gubi Dam, Bauchi; [12] in mining ponds in Jos, [13] around the Goronyo Dam, Sokoto, [14] at the Alau Dam, Borno State; [15] in mining ponds in Jos South; [16] in the Rima valley, Sokoto; Benue State [17] and around the Kiri Dam, Adamawa State (Kaleson pers comm.) have either observed an increased trend in transmission of snail –borne parasitic infections or occurrence of freshwater snail intermediate hosts of parasites of public health importance in places where they hadn't been earlier observed.

Elsewhere on the African continent, [18] while working in Senegal and Mali, reported that the construction of dams in Diama and Manantali (in Mali), which helped to boost agriculture led to the introduction of intestinal shistosomiasis in areas where the disease was hitherto absent.

It is therefore pertinent to understand the distribution, diversity and disease transmission status of fresh water snails in man-made water bodies. This will go a long way in curtailing the menace that may arise as a result of the diseases caused by these snails. It is on this basis that we report here the freshwater snail fauna of Dadinkowa reservoir in Gombe State Nigeria as well as their public health significance.

2. Material and Methods

2.1 Description of Study Area

Dadin Kowa Dam is located 5km North of Dadin Kowa town (about 37km from Gombe town, along Gombe-Biu road) in Yamaltu Deba local Government Area of Gombe State. The dam area lies within longitude 11^0 30' E and 11^0 32' E, and Latitude 10^o 17' and 10^o 18' N of the equator [19]. The Dam is part of River Gongola; its drainage basin is situated in North-Eastern Nigeria, with water capacity of 800million cubic litres and surface area of 300kilometer square.

Fig 1: Map of Nigeria showing Gombe State

2.2 Snail sampling and identification

Different microhabitats in the dam and main canal were extensively searched for snails between 7am-12pm using a long handled scoop net and pair of forceps monthly as described by [20]. Snails along the irrigation channels and farm fields were also extensively sampled by use of scoop net and handpicking. Snails collected from each habitat were kept in labelled specimen bottles and transported to the laboratory of the Abubakar Tafawa Balewa University Bauchi for further examination. The snails captured were then identified based on their morphological characteristics with reference to the standard keys of [21].

2.3 Snail infection rates

All snail recovered were examined for natural infections in the laboratory on the same day of collection. After group screening, batches that were positive were then individually placed in a beaker containing clean tap water and induced to shed cercaria using a 60 watts bench lamp for 30 minutes. Cercariae that emerged were examined under a dissecting microscope and identified using reference to the keys of [22].

3. Results

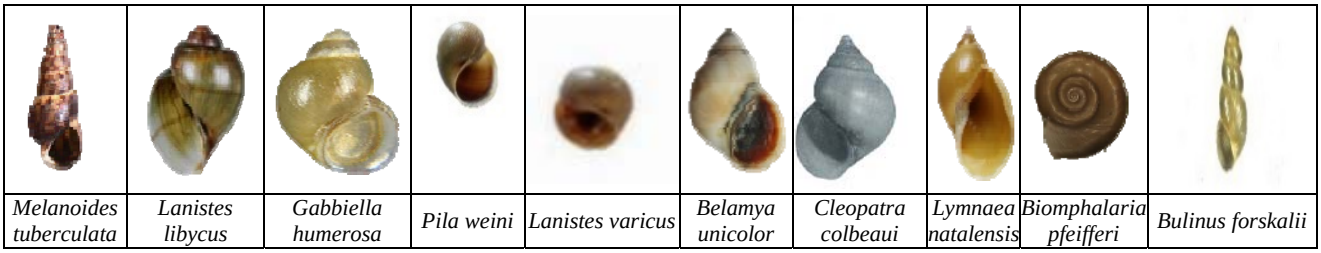
3.1 Fresh Water Snail Species encountered in the Dadin Kowa Reservoir

Ten (10) different fresh water snail species were encountered during the study as shown in Table 1. These include seven different prosobranch species and three pulmonates (Fig. 1). The Prosobranchs showed clear preference to the main reservoir except *Melanoides* which was found to be equally distributed in the main reservoir as well as the canals. The Pulmonates on the other hand were more predominantly found along the adjoining canals.

Table 1: Occurrence of Fresh Water Snails encountered in the Study Area

Snails species	Main Reservoir	Canal A	Canal B
Prosobranchs			
Lanistes lybicus	+++	+	+
Lanistes varices	+++	-	++
Melanoides tuberculata	+++	+++	+++
Pila werneri	+++	+	+
Belamya unicolor	+	+	+
Gabbiella humerosa	+	++	++
Cleopatra colbeaui	-	-	+
Pulmonates			
Biomphalaria pfefferi	+	+++	+++
Bulinus forskalii	-	+	-
Lymnaea natalensis	+	+++	+

+ = uncommon, ++= common, +++ = very common, - = not found.
Canal A = Near Mabbon Hydroelectric Power Plant
Canal B = Minor canal Adjacent to Power Plant



Melanoides tuberculata	*Lanistes libycus*	*Gabbiella humerosa*	*Pila weini*	*Lanistes varicus*	*Belamya unicolor*	*Cleopatra colbeaui*	*Lymnaea natalensis*	*Biomphalaria pfeifferi*	*Bulinus forskalii*

Fig 2: Snail species collected in Dadinkowa reservoir

3.2 Occurrence of Infected Snails

Among the ten (10) snail species encountered in this study, only *Lymnaea natalensis* shed cercariae identified as gymnocephalus cercariae. This is as shown in Table 2. Out of the 150 *Lymnaea natalensis* examined for cercariae, 57(38.6%) were positive for cercaria. The other nine snail species did not carry any natural trematode infections.

Table 2: Cercarial shedding of snails encountered during the study

Snail species	No. examined	No. infected (%)	% Infected
Lanistes varices	25	0	0
Lanistes libycus	20	0	0
Pila werneri	40	0	0
Melanoides tuberculata	45	0	0
Bellamya unicolor	10	0	0
Gabbiella humerosa	25	0	0
Cleopatra colbeaui	04	0	0
Biomphalaria pfeifferi	100	0	0
Bulinus forskalii	08	0	0
Lymnaea natalensis	150	57	38

4. Discussion

All the snail species encountered in the present study have been reported from various parts of Nigeria [23-28]. Thus, no unusual species of snails were recorded. This further underscores the fact that all of the snails are part of the most common freshwater gastropod fauna in Nigeria. The ubiquity of these snails may be related to the phenomenon of the linking of the water systems during the Pleistocene as expressed by Beadle [29]. It may also be associated with the activity of aquatic birds migrating from one region across the country to another thereby spreading the eggs of these snails which subsequently hatch and establish flourishing colonies.

Prosobranchs and Pulmonates snails show preference to certain locations in a lotic water habitat, with the former being more predominantly found in the headwater and the latter showing preference to the rather shallow and more temporary part of the water body [30]. This has been attributed to the evolutionary biology of these snails [31-33]. It is believed that Pulmonates have secondarily reinvaded fresh waters and range from amphibious to fully aquatic life style as seen in their ability to utilize aerial respiration. Prosobranchs on the other hand invaded lotic water system from estuaries [32].

[34] and [35] reported that predation also plays an important role in the distribution of fresh water molluscs. Large species with thick strong shells have an obvious advantage over small, thin-shelled species [36-37]. It is true that the presence of an operculum in the prosobranchs can also serve as a protective cover especially against shell-invading predators. From the foregoing, it is expected that the importance of predation in the habitat preference of snail species will increase in a direct proportion with water body size and permanence. The major predators of snails in small temporary water bodies such as ponds, and irrigation canals are shell-invading invertebrates, e.g. Sciomizid fly larvae [38], Beetles [35] and leeches [39]. These invertebrates most probably have low predation rates relative to those of large, shell crushing crustaceans and fish predators that abode the larger and more permanent part of a water body [40]. It is therefore, likely that this factor played a role in the preference of Prosobranchs to the main reservoir and Pulmonates along the canals in this study.

The occurrence of *Melanoides tuberculata* in both the main reservoir as well as the irrigation canals is interesting. This may be attributed to its short generation time, size and the fact that it is a competitor snail that can outcompete a number of Pulmonates. Furthermore, [41] reported that this snail was associated with lotic environments with low aquatic vegetation and variable degrees of domestic sewage input. This may account for the presence of the snail in places where there was slight pollution by domestic sewage during the study.

Cleopatra colbeaui is probably reported for the first time in the study area. An earlier study by [42] on the taxonomy of mollucs in some water bodies in Northern Nigeria including the Dadin Kowa reservoir did not encounter any snail of the Genus *Cleopatra*. Therefore, the snail could have been recently introduced into the area. Although it has not shed any cercariae and has not been reported as an intermediate host to any trematode parasite yet, further studies on this species and indeed all the fresh water snails in the area is warranted in order to determine their disease transmission status in view of changing environmental conditions and the effect of globalization.

The occurrence of naturally infected *Lymnaea natalensis* in Dadinkowa reservoir strongly suggests that there may be an on-going transmission of *Fasciola gigantica* in the area. As observed during the study, cattle were dropping feacal matter along as they grazed along the irrigation canals. This is an important epidemiological factor in enhancing the transmission of fascioliasis. Consequently, there is need to clarify whether active transmission of fascioliasis is on-going in the area and to elucidate on the transmission pattern.

Although, *Biomphalaria pfeifferi* recorded in the study area was not found to be carrying any natural infections, its occurrence is of great concern as well. This is because of its potential in the transmission of intestinal shistosomiasis. Further studies in this regard will similarly be of immense importance since the intestinal form of the infection is more virulent.

5. Conclusion

The present study reveals that Dadinkowa reservoir harbours a number of freshwater snails. Some of which are known intermediate hosts of trematode parasites. Therefore, further studies to determine their precise role in disease transmission as well as the transmission pattern is desirable. The study has also shown that other freshwater snail species are being introduced into the area. Thus, snail surveys should regularly be undertaken so as to keep track of species diversity in the area towards possible control.

6. References

1. Thompson FG. The land and freshwater snails of Campeche University of Florida, 1967.
2. Pike EG. Engineering against schistosomiasis/bilharzia: guidelines towards control of the disease MacMillan Publishers, 1987.
3. Betterton C. Ecological studies of the snail intermediate hosts of schistosomiasis in the South Chad Irrigation Project Area, Borno State, Northern Nigeria. Journal of Arid Environ. 1984; 7:43-57.
4. Betterton C, Ndifon GT, Bassey SE, Tan RM, Oyeyi T. Schistosomiasis in Kano State, Nigeria: I Human infections near dam sites and the distribution and habitat preferences of potential snail intermediate hosts. Annals of Tropical Medicine and Parasitology. 1988; 82(6):561-570.
5. Abdullahi MK, Bassey SE, Oyeyi TI. A omprehensive Mapping of Urinary schistosomiasis using Geographic Information System (GIS) in Kano State, Nigeria Bayero. Journal of Pure and Applied Sciences. 2009; 2(1):41-46.

6. Duwa MR, Oyeyi TI. Role of Jakara dam in the transmission of schistomiasis. Bayero Journal of Pure and Applied Sciences. 2009; 2(1):58-62.
7. Duwa MR, Oyeyi JI, Bassey SE. Prevalence and intensity of urinary schistosomiasis among primary school pupils in Minjibir Local Government Area of Kano State. Bayero Journal of Pure and Applied Science. 2009; 2(1):75-78.
8. Sarkin Fada F, Oyebanji AA, Abubakar IS, Iliyasu Z. Urinary schistosomiasis in the Danjarima community in Kano, Nigeria. The Journal of Infection in Developing countries. 2009; 3(6):452-457.
9. Akogun OB, Okin BN. The ecology of fresh water snails in an agro-industiral estate in Yola. Nigeria Nigerian Journal of Parasitology. 1993; 14:75-80.
10. Ofoeze IE, Bolton P, Imevboire AMA, Christensen NO. Schistosomiasis and other helminth infections in irrigation schemes in Sokoto, Katsina and Kebbi States of Nigeria. Nigerian Journal of Parasitology. 1996; 17:31-37.
11. Adamu US, Panda SM, Okafor A. Studies on human water contact pattern and other schistosomiasis predisposing factors in Gubi Dam. The Science Forum: Journal of Pure and Applied Sciences. 2004; 7(2):197-202.
12. Agi PI, Okwuosa VN. Aspects of water quality of freshwater systems harbouring snail vectors of schistosome parasites in Jos. Nigeria Journal of Aquatic Sciences. 2001; 16(1):13-17.
13. Bello YM, Adams T, Abubakar U, Mohammed AA. Urinary schistosomiasis in some villages around the Goronyo dam, Sokoto state, Nigeria. Nigerian Journal of Parasitology. 2003; 24:109-114.
14. Inuwa A, Istifanus WA, Kela SL. The diversity, distribution and health implications of the snail fauna of Alau Dam, Borno State, Nigeria. The Nigerian Academic Forum. 2003; 5(2):126-131
15. Okpala HO, Ajayi JA, James-Rugu NN, Emelike OF. Survey of snail intermediate hosts of trematodes in Jos South Local Government Area, Plateau State. Nigeria International Journal of Natural and Applied Science. 2010; 6(2):151-154.
16. Taofik S, Bunza MDA, Majeed Q, Abubakar MB, Ladan MU. Studies on snail vectors of Helminth Disease Agents along Rima Valley, Wamakko Local Government Area, Sokoto state, Nigeria. SM Tropical Medicine Journal. 2017; 2(1):1011-1015.
17. Tersoo AR, Terngu IS, Akogwu AE. Survey and identification of macroinvertebrates found in some ponds in Makurdi. International Journal of Ecotoxicology and Ecobiology. 2017; 2(1):26-32.
18. Ernould JC, Ba K, Sellin B. The impact of local water development programme on the abundance of the intermediate host of schistosomiasis in three villages of the Senegal River. Annals of Tropical Medicine and Parasitology. 1998; 93(2):135-145
19. Upper Benue river Basin Development Authority (UBRDA) Dadin-kowa Resettlement Project Draft final report 2, 1980.
20. Panda SM, Istifanus WA, Suleiman MM. Observations on some morphological variations among different Bulinus globosus populations in North Eastern Nigeria. International Journal of Advancement in Biological Science. 2014; 6(2):65-75.
21. Brown DS. Fresh Water Snails of Africa and their Medical Importance 2nded Taylor and Francis Publishers London, 1994, 609
22. Frandsen F, Christensen NO. Introductory guide to the identification of cercariae from African freshwater snails with special reference to cercariae of trematode species of medical and veterinary importance Taxonomic key Acta tropica, 1984.
23. Ntonifor HN, Ajayi JA. Studies on the ecology and distribution of some medically important freshwater snail species in Bauchi State. Nigeria International Journal of Biological and Chemical Sciences. 2007; 1(2):121-127.
24. Ngele K, Kalu E, Ukwey M, Onyeukwu C. A survey of freshwater snails; the intermediate hosts of schistosomiasis in Bende Local Government Area, Abia State. Nigeria International Journal of Science and Nature. 2012; 3(4):879-882.
25. Omonijo AO, Asaolu SO, Ofoezie IE. Ecology of Schistosoma Snail Vectors in Ado-Ekiti Local Government Area, Ekiti State, Nigeria. International Journal of Pure and Applied Zoology. 2016; 4(1)
26. Okeke OC, Ubachukwu PO. Urinary Schistosomiasis in Urban and Semi-Urban Communities in South-Eastern Nigeria. Iranian Journal of Parasitology. 2013; 8(3):467.
27. Salawu OT, Odaibo AB. Urogenital schistosomiasis and urological assessment of hematuria in preschool-aged children in rural communities of Nigeria. Journal of Pediatric Urology. 2014; 10(1):88-93.
28. Awosolu OB. Epidemiology of urinary schistosomiasis and knowledge of health personnel in rural communities of South-Western. Nigeria Journal of Parasitology and Vector Biology. 2016; 8(10):99-106.
29. Beadle LC. The inland waters of tropical Africa. An introduction to tropical limnology Longman Group Ltd, Publishers, 74 Grosvenor Street, London W, 1974.
30. Brown KM, Alexander JE, Thorp JH. Differences in the ecology and distribution of lotic pulmonate and prosobranch gastropods. American Malacological Bulletin. 1998; 14(2):91-101.
31. Russell-Hunter WD. Ecology of freshwater pulmonates Pulmonates (ed V Fretter and J Peake), 1978, 334-383.
32. McMahon RF. Respiratory response to periodic emergence in intertidal molluscs. American Zoologist. 1988; 28(1):97-114.
33. Brown DS, Shaw KM, Rollinson D. Freshwater snails of the Bulinus truncatus/tropicus complex (Basommatophora: Planorbidae) in Kenya: diploid populations. Journal of Molluscan Studies. 1991; 57(2):143-166.
34. Eisenberg RM. The regulation of density in a natural population of the pond snail. Lymnaea elodes Ecology. 1966; 47(6):889-906.
35. Gillespie DM. Population studies of four species of molluscs in the Madison River, Yellowstone National Park. Limnology and Oceanography. 1969; 14(1):101-114
36. Brown KM, DeVries DR. Predation and the distribution and abundance of a pulmonate pond snail. Oecologia. 1985; 66(1):93-99.
37. Stein JL, Cary SC, Hessler RR, Vetter RD, Felbeck H, Ohta S, Childress JJ. Chemoautotrophic symbiosis in a hydrothermal vent gastropod. The Biological Bulletin.

1988; 174(3):373-378.
38. Eckblad J. Biomass and energy transfer by a specialized predator of aquatic snails. Freshwater Biology. 1976; 6(1):19-21.
39. Lodge DM, Brown KM, Klosiewski SP, Stein RA, Covich AP, Leathers BK *et al*, Distribution of freshwater snails: spatial scale and the relative importance of physicochemical and biotic factors American Malacological. Bulletin. 1987; 5(1):73-84.
40. Giovanelli A, Da Silva CLPAC, Leal GBE, Baptista DF. Habitat preferences of freshwater snails in relation to environmental factors and the presence of the competitor snail Melanoides tuberculatus (Muller, 1774). Memórias do Instituto Oswaldo Cruz, Rio de Janeiro. 2005; 100(2):169-176.
41. Gadzama I, Katsallah M. Distribution and taxonomy of molluscs (mollusca) in some parts of northern Nigeria (Doctoral dissertation), 2012.