



## Survey of Fresh Water Snails in Vandeikya Local Government Area, Benue State Nigeria

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### **Authors' contributions**

This work was carried out in collaboration among all authors. Authors TSA and JIC designed the study and carried out the field work. Author JIC wrote the manuscript. Authors TSA and VUO carried out literature search and managed the statistical analysis of the study. All authors read and approved the final manuscript.

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### **ABSTRACT**

A survey was carried out in Vandeikya Local Government Area of Benue State, Nigeria from April-July 2017 to determine availability of freshwater snails of and their preferred habitats. A total of 289 fresh water snails of four different genera were collected across 27 streams in the 7 districts in Vandeikya LGA. Water pH, water temperature and water velocity were also measured. *Lenistislibycus* was found to be the most abundant freshwater snail species accounting for 40.83% of the total freshwater snails. *Melanoidestherculata* was the second most abundant accounting for 29.411% of the total snails population sampled, *Biomphalaria pfeifferi* accounted for 17.99% while *Bulinus globosus* was significantly lower in abundance than the other snails, accounting for only 11.77%. By location, Mbaduku district had highest abundance of snails 84 (29.1%). The effect of the nature of the substratum on the availability of freshwater snails revealed that habitats with rocky substratum favoured the presence of snails accounting for 181(62.7%) freshwater snail collected. Our understanding of factors affecting the availability and abundance of freshwater snails in nature can prove useful in snail control which is integral for the control of the diseases for which they serve as intermediate host.

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## 1. INTRODUCTION

Some freshwater snails serve as intermediate host to parasites which cause public health problems to humans. Diseases such as fascioliasis, schistosomiasis, paragonimiasis require fresh water snail hosts for their life cycle. These diseases are prevalent in the tropics and are termed neglected tropical diseases because their economic and disease burden affects poorer people [1]. 93% of the current schistosomiasis burden resides in Sub Saharan Africa [2]. *Bulinus* species serves as intermediate snail host for *Schistosoma haematobium* which causes urinary schistosomiasis and *Biomphalaria* species serves as intermediate snail host for *S. mansoni* responsible for intestinal schistosomiasis. Both *Bulinus* species and *Biomphalaria* species are present in Nigeria.

The prevalence and distribution of schistosomiasis is dependent on the presence and distribution of the intermediate snail host in natural freshwater bodies [3]. *Bulinus globosus*, *B. pfeifferi* and *Lymnaea natalensis* are present in South-Western Nigeria and of the three snail species, *B. globosus* had significantly higher distribution [4]. A survey carried out in Kaduna State, Nigeria on the presence of freshwater snails and physico-chemical parameters affecting their abundance, revealed the presence of seven (7) species of fresh water snail intermediate hosts including *B. globosus* and *B. pfeifferi* and *Melanoides tuberculata* [5]. An investigation on the distribution of fresh water snail hosts in Makurdi, Benue State, revealed the presence of *B. globosus*, *B. truncatus*, *M. tuberculata* and *Indoplanorbis exustus* in the water bodies in the area [6].

Successful schistosomiasis control programs of the past century relied on an integrated approach which included reducing the freshwater snail host [7]. In places without high reinfection rates, mass drug administration with praziquantel has led to a significant reduction in prevalence and infection rates but maintenance of low transmission and a complete elimination of the disease would require an integrated approach which includes control of the snail intermediate hosts [8]. Data from snail studies can complement prevalence data in humans for broader appreciation of disease epidemiology in an area. Local streams and rivers particularly serve as important

transmission sites; this is because residents of communities where streams are situated frequent these water bodies for water for domestic and agricultural purposes. Farming is a major occupation of the people of Benue State, Benue State is known as the food basket of the nation. There is paucity of information on presence of freshwater snails in local water bodies in Benue State and to the best of our knowledge, there has been no study on the presence and distribution of freshwater snails which serve as intermediate hosts for trematode parasites in Vandeikya LGA, Benue State. The presence, distribution and habitat preferences of freshwater snail species which potentially serve as hosts for diseases of public health significance could have consequences for disease epidemiology in the area and could prove useful in the integrated control of the diseases.

## 2. MATERIALS AND METHODS

### 2.1 Study Area

The study was carried out in Vandeikya Local Government Area. Vandeikya is situated in the South Eastern part of Benue State. Twenty seven streams (27) were sampled across seven (7) districts.

### 2.2 Snail Collection

Snail collection was carried out from April-July, 2017. Each sampling site was visited two times a month for snail collection using a scoop net and hand picking as described by Ikpeze and Obikwelu, 2016. Snails were identified with a morphological key (WHO, 1978). The nature of the substratum, weather rocky or sandy was also recorded as well as physico-chemical parameters: pH, water current and temperature of the streams visited. Water pH of streams was taken with the aid of a pH meter, water temperature was read using a thermometer and water velocity of streams was taken using a flow meter.

### 2.3 Statistical Analysis

Students T-test was used to determine significant difference between nature of substratum and number of snails sampled in a location.



**Table 1. Nature of substratum and number of fresh water snails collected in Vandeikya LGA, Benue State**

S/N	Streams	Nearest settlement	Nature of substratum	Total no of freshwater snails
1	Be	Betse	Rocky	76
2	Afengi	Dagab	Rocky	8
3	Mnya	Mbaatende	Rocky	1
4	Utyavereshi	Ageva	Rocky	-
5	Atitim	Mbadargh	Rocky	-
6	Ugbeede	Gumbe	Rocky	-
7	Akanyi	Mbajime	Rocky	4
8	Apirmyi	Mbakambe	Rocky	6
9	Used	Mbaadonko	Rocky	-
10	Ukenge	Kaamen	Rocky	4
11	Gigigbe	Adangbe	Rocky	-
12	Uwyaka	Chi	Sandy	1
13	Arum	Agirgba	Sandy	8
14	Dure	Koti-yough	Sandy	20
15	Utyem	Mbagban	Sandy	-
16	Nyamshe	Tseagbo	Rocky	-
17	Ugyo	Kongbade	Rocky	2
18	Aya	Mbakijime	Rocky	39
19	Aforkper	Mbaagbaor	Rocky	1
20	Ukyargu	Mbalim	Rocky	-
21	Uvasar	Ihugh	Sandy	-
22	Twe	Gbagbogom	Sandy	-
23	Wagh-shu	Mede	Sandy	2
24	Asuu	Mbaakune	Sandy	1
25	Akangy	Mbaadeke	Sandy	61
26	Sambe	Kiishi	Sandy	50
27	Ityuma	Tsa-daaug	Sandy	2

*P*<0.05**Table 2. Physico-chemical properties of streams in Vandeikya LGA, Benue State**

S/N streams	Total no of freshwater snails	Temp(°C)	pH	Water current (M/S <sup>2</sup> )
1 Be	76	25	8.7	2.91
2 Afengi	8	24	8.5	1.91
3 Mnya	1	24	9.1	1.90
4 Utyavereshi	-	24	9.5	1.52
5 Atitim	-	24	9.3	1.31
6 Ugbeede	-	24	9.4	3.31
7 Akanyi	4	26	9.3	2.80
8 Apirmyi	6	25	9.6	2.00
9 Used	-	23	9.5	2.81
10 Ukenge	4	23	9.6	3.01
11 Gigigbe	-	23	9.2	1.31
12 Uwyaka	1	24	9.1	1.81
13 Arum	8	22	8.1	3.50
14 Dure	20	25	9.3	3.50
15 Utyem	-	25	8.9	1.31
16 Nyamshe	-	23	9.5	1.31
17 Ugyo	2	25	9.5	1.71
18 Aya	39	25	8.9	2.91
19 Aforkper	1	24	9.8	3.50
20 Ukyargu	-	25	9.6	1.31
21 Uvasar	-	23	9.8	1.31

S/N streams	Total no of freshwater snails	Temp(°C)	pH	Water current (M/S <sup>2</sup> )
22 Twe	-	25	9.8	1.31
23 Wagh-shu	2	24	9.0	2.00
24 Asuu	-	24	8.0	2.70
25 Akangy	61	24	9.0	3.41
26 Sambe	50	25	8.8	2.97
27 Ityuma	2	24	8.0	2.99

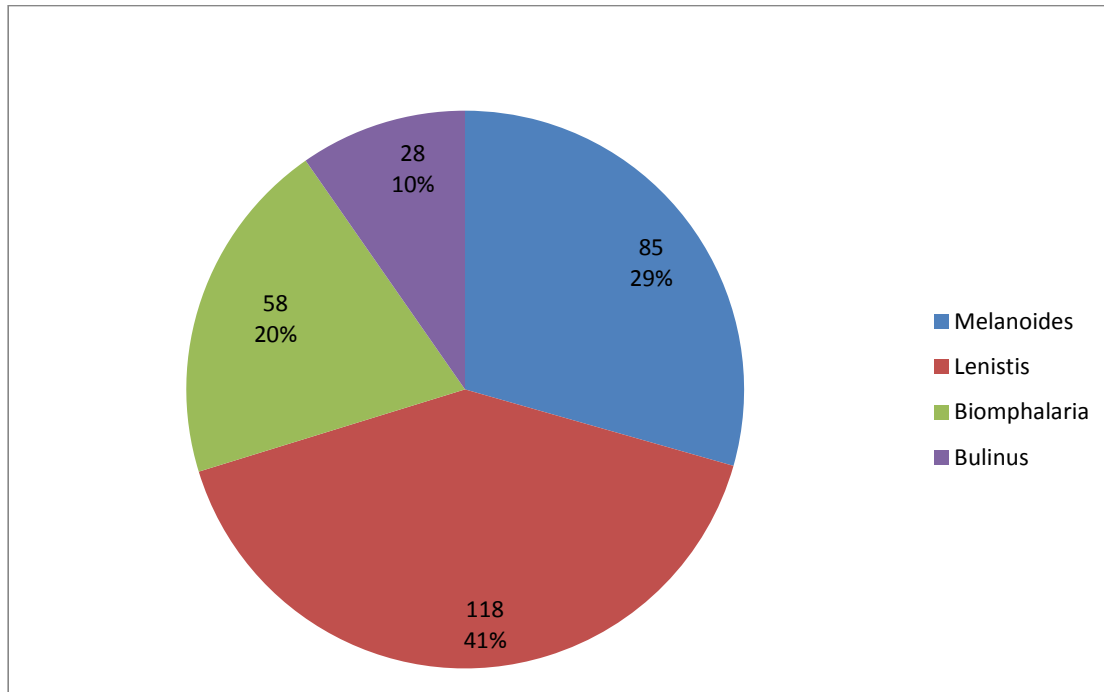
P<0.05

**Table 3. Number of snails collected and their relative abundance in the 7 districts in Vandeikya LGA**

S/N	Districts	No of snail	Nature of substratum
1	Mbaduku	84 (29.1)	Rocky
2	Mbayongo	56 (19.4)	Rocky
3	Mbagbera	18 (6.2)	Sandy
4	Ninger	8 (2.7)	Sandy
5	Ute	20 (6.9)	Sandy
6	Mbaka-Ange	41 (14.2)	Rocky
7	Mbera	62 (21.5)	Sandy

P<0.05

Key:Zones in Vandeikya Name of 27 local streams visited in the zone Mbaduku Be, Afengi; Mbayongo Mnya, Utyavereshi, Atitim, Ugbeede, Akanyi, Apirnyi, Used, Ukenge, Gigigbe Mbagbera Uwyaka Ninger Arum Ute Dure, Utyem Mbaka-Ange Nyamshe, Ugyo, Aya, Aforkper, Ukyargu Mbera Uvasar, Twe, Wagh-Shu, Asuu, Akangy, Sambe, Ityuma



**Fig. 2. Relative abundance of freshwater snails in Vandeikya LGA, Benue State**

abundant snail species in our study. *Melanoidestuberculata* snails serve as intermediate hosts of the liver fluke *Paragonimus westermani* however this disease has not yet been reported in the area. Similarly, high abundance of *Melanoidestuberculata* was reported in 3 different parts of Jakara dam in Kano State, Nigeria [11].

**Table 4. Snail species collected, and their abundance in 27 streams in Vandeikya LGA, Benue State**

S/N	Stream	<i>Lenistislibycus</i>	<i>Melanoidetuberculata</i>	<i>Bulinus globosus</i>	<i>Biomphalaria pfeifferi</i>
1	Be	30	24	17	7
2	Afengi	3	1	2	2
3	Mnya	-	-	1	-
4	Utyavereshi	-	-	-	-
5	Atitim	-	-	-	-
6	Ugbeede	-	-	-	-
7	Akanyi	1	2	-	1
8	Apirmyi	2	-	-	4
9	Used	-	-	-	-
10	Ukenge	-	3	1	-
11	Gigigbe	-	-	-	-
12	Uwaka	-	1	-	-
13	Arum	2	3	1	2
14	Dure	11	6	2	1
15	Utyem	-	-	-	-
16	Nyamshe	-	-	-	-
17	Ugyo	-	-	-	2
18	Aya	17	13	8	1
19	Aforkper	-	-	-	1
20	Ukyargu	-	-	-	-
21	Uvasar	-	-	-	-
22	Twe	-	-	-	-
23	Wagh-shu	-	1	1	-
24	Asuu	-	-	-	-
25	Akangy	21	18	17	5
26	Sambe	30	9	7	4
27	Ityuma	1	4	-	-
Total		118	85	58	28

$P < 0.05$

*Bulinus globosus* and *Biomphalaria pfeifferi* are responsible for urinary schistosomiasis and intestinal schistosomiasis respectively. Fig. 2, showed that both *Bulinus globosus* and *Biomphalaria pfeifferi* accounted for 86 of the 289 (29.97%) freshwater snails collected in the course of this study. No matter how few, these snails could cause significant public health problems because within each snail host, *Schistosoma* parasite undergoes asexual reproduction. Typically just 1 snail could potentially serve as host to 1000's of cercariae because, within the snail, sporocysts give rise to daughter sporocysts, until thousands of new forms cercariae (singular cercaria) break out of the snails into the water body in active search of a human host [12].

Table 4 revealed that *Bulinus globosus* was significantly more abundant than *Biomphalaria pfeifferi* in Vandeikya LGA. In Nigeria as a whole, urinary schistosomiasis is more prevalent than

intestinal schistosomiasis [13]. Table 4 also showed that both *Bulinus* species and *Biomphalaria* species can be found in the same streams. This shows that the habitat's ecology in streams in Vandeikya supports the thriving of both snail species which serve as intermediate hosts for urinary and intestinal schistosomiasis respectively both diseases could therefore be of potential public health importance in Vandeikya lga. Our results were in agreement with both of whom found both *Bulinus globosus* and *Biomphalaria pfeifferi* in the in the same location in Kaduna, Nigeria and Nasarawa, Nigeria respectively (1, 5). In contrast, *Biomphalaria* species were reported among the freshwater intermediate snail hosts along the shorelines of Agulu lake in Anambra State, Nigeria [14].

#### 4.3 Public Health Implications

The presence of these fresh water snails in streams close to human settlements has public

health implication. If these snails are infected with the parasites, these streams could serve as transmission hot spots where people get infected when they visit streams to fetch water for household use and to carry out agricultural activities like vegetable garden irrigation. Agulu lake has been implicated as a possible schistosomiasis transmission hot spot since residents of surrounding communities frequent the lake for agricultural and religious activities [12].

#### 4.4 Physico-chemical Parameters

Table 2 showed that all 27 streams in Vandeikya LGA are alkaline. From Table 2, for streams Be, Dure, Aya and Sambe had temperatures of 25°C and high snail population of 76, 20, 39 and 50. Temperature of 25°C seemed to favour the thriving of snail population in Vandeikya. Akangi had a temperature of 24°C and abundance of snail fauna this could mean that temperature is not the only factor affecting snail abundance in the area. We recorded water currents ranging from (1.31-3.5 M/S<sup>2</sup>) in all streams visited. Water currents of 1.91M/S<sup>2</sup> and below however did not favour thriving of snails. Snails tend to be washed off by very high water currents [1]. Also, a flowing stream tends to be more aerated and nutrient rich than stagnant waters and as such may better favour the thriving of snail population.

#### 5. CONCLUSION

*Melanoides tuberculata*, *Lenistislibycus*, *Bulinus globosus*, and *Biomphalaria pfeifferi* are four (4) species of freshwater snail in Vandeikya. *Biomphalaria Pfeifferi* and *Bulinus globosus* serve as hosts for schistosomiasis. More research should be carried out on disease transmission in streams in the area, and on the presence, prevalence and distribution of schistosomiasis in communities in Vandeikya LGA, Benue State. As this would provide comprehensive epidemiological data useful for effective control of the diseases to which they serve as intermediate snail host.

#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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