



Evaluating the Ecology and Distribution of Snail Hosts of *Schistosoma* at the Water Bodies in Ihitte-Uboma Area of Imo State

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Authors' contributions

This work was carried out in collaboration among all authors. Authors MON and AAU designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors JNA and PCO managed the analyses of the study. Author MII managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Intermediate snail host of *Schistosoma* species are known to exist and constitute public health problems in Imo state. Effects on this study were devoted to evaluate the ecology and distribution of the snail hosts of *Schistosoma* species at the water bodies of Ihitte Uboma local Government area and this was researched during the months of June and September, 2015. A total of 600 pulmonate or lunged snails were collected using scoop net technique from different water bodies in five villages, out of these, 345 (57.5%) were dissected and screened for cercariae of human Schistosomes 67 (19.4%) tested positive. The snail infected were *Bulinus* species 55 (82.1%) and *Biomphalaria Pfeifferi* (17.9%), out of the *Bulinus* species, *Bulinus globosus* recorded the widest

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ecological range, highest distribution and infection rate of 44.8% followed by *Bulinus truncatus* (22.4%). The other two genera *Lymnaea* spp and *Melanoides* spp encountered in the study did not test positive for cercariae. Environmental modifications such as water resources development schemes in the area are some of the ecological and epidemiological risk factor promoting the spread of the snails. Statistically, presence of urinary and intestinal Schistosomiasis becomes indicated in Ihitte Uboma L.G.A. Regular and timing mollusciciding, malacological and public health education are therefore recommended and imperative.

Keywords: Ecology; snail hosts; *Schistosoma*; water bodies; Ihitte-Uboma.

1. INTRODUCTION

All species of *Schistosoma* inhabit fresh water snails as intermediate host that are essential to the completion of their life cycles [1]. The ecology and distribution of the snail hosts or relation to the *Schistosoma* species include tropical lotic and lentic water environment as well as the behaviour of people and their domestic animals that live near these aquatic environments [2]. The recent single in construction of large impoundment throughout many parts of the tropics has dramatically affected the ecology and distributions of the snail hosts of *Schistosoma* and has increased the health risk associated with acquiring *Schistosomiasis* [3].

Many species of fresh water snails belong to the classes of highly infective flukes of medical and veterinary importance [4]. Eggs are shed from the human hosts in faeces or urine. Under optimal conditions in the environment, the eggs hatch and release miracidiae, which swim and penetrate specific snail. The stages in the snail include two generations of *sporocysts* and the production of *cercariae*, swim and penetrate the skin of human host, where maturation of the worms continues, the following fresh water snails are the intermediate hosts of *Schistosoma* species: *Oncomelania* species for *Schistosoma Japonica*, *nestricula* species, for *S. Mekongi* *Biomphalaria* species *S. haematobium* and *S. intercalatum*. These four species of schistomes belongs to the phylum platyhelminths [5]. The snails themselves become infected by another larval stage of the parasite known as miracidium which develops from eggs passed out in urine or faeces of infected people [6,7]. Adult male and female schistosomes pairs and live together in human blood vessels (Gynaecophoric canal). Some of the eggs passed out in the urine (*S. haematobium* infection or stools (*S. mansoni*, *S. japonicum*), and some eggs are trapped in body tissues [8]. Urinary *Schistosomiasis* (*Schistosoma haematobium*) damages the urinary tract as revealed by hematuria and

painful urination accompanied by progressive damage to the bladder, ureter and then the kidneys. Cancer of the bladder is common in advanced cases [9].

Intestinal *Schistosomiasis* with *S. mansoni*, *S. japonicum*, and *S. mekongi*, disease develops slow. Progressive enlargement of the liver, spleen and intestinal damage, due to fibrotic lesions around eggs [10,11]. Disease symptoms associated with schistosomiasis are related to previous host exposure, worm burden and host responses. Symptoms include cercarial dermatitis, acute Schistosomiasis or katayama filer and related tissue changes, resulting from egg deposition [12].

Intermediate hosts of *schistosoma* species are known to exist in some rivers and streams in Ihitte Uboma areas of Imo state. These areas have high human to water contact activities such as vegetable farming, swimming, fishing and other domestic purposes, helps to encourage the spread of infection and increase the number of snail intermediate hosts by contaminating the water bodies with their infected urine and stools. Hence Shistosomiasis becomes endemic. This work was undertaken to evaluate the ecology and distribution of snail hosts of *Schistosoma* species at the water bodies of Ihitte-Uboma area of Imo State.

2. MATERIALS AND METHODS

2.1 Study Areas

The study area was carried out in five villages of Ihitte Uboma Local Government area of Imo state (latitude: 5°62'N and longitude: 7°37'E). There were two distinct seasons, rainy and non rainy seasons with the - rainy lasting from march to October with peak - rainfall in July and September and slightly drier in August popularly known as "August break". Annual rainfall up to 2,500mm the mean temperature was 27°C while relative humidity is about 70-80 [13] and developmental schemes to aid drainage and water supply to the village.

2.2 Occupations

The main occupation of the populace was agriculture, civil and public servant as well as fisher men and traders. The inhabitants of the area usually engage in water contact activities such as fishing, farming irrigation, swimming, washing, bathing and recreational activities.

2.3 Study Sample

Different species of water snails breeding in the local water bodies in the area were collected and used as study samples.

2.4 Methods

2.4.1 Questionnaire and administration

Representative members of each village were administered with a simple health semi structured questionnaire to source information on occupation, water contact activities, prevailing disease conditions in the area, perception and knowledge of the symptoms, presence of blood in their urine, health implications *schistosomiasis* from them. The information gathered helped in locating the water snails and arriving at authenticated conclusion about the ecology and distribution of the potential snail host of *schistosomiasis* in the area.

2.4.2 Snail collection, sampling techniques and malacological survey

This involves the use of scooping net on catching the water snails after malacological mapping of the contact sites such as the rivers, burrow pits, stream, gutters and ponds in the selected villages. This was done between the month of

June to September 2015. Protective measures were adopted by wearing knee length rubber boots and elbow length hand gloves. A 10 minutes sampling period per habitat was adopted. The sampling sites were first cleared of weed and debris. Snails were searched using long handle rectangular scoop net. The net was lowered with water and then a scoop was taken towards the bank of the water body collecting emergent vegetation for snail search. The snails gotten were put in specimen bottles bearing labels showing the locations of collections, reference number and date of collection (Plates 1, 2, and 3). Snails of all sizes were collected. Four collections were made each for the month of June, July, August and September, 2015. After the sampling all the snails collected were taken to the laboratory for preparation, snail identification and parasitological analysis.

2.4.3 Sample preparation and identification

In the lab, the snails were thoroughly washed with clean water, sorted out, identified and classified using shell morphology [14,15].

2.4.4 Parastiological analysis

After identification the snails were dissected and microscopically examined for infective stage (cercaria). The causative agent of *schistosomiasis*.

2.5 Data Analysis

The data collected was subjected to statistical analysis of variance (ANOVA), which was cross-checked by student t-test for the establishment of significance [16].



Plate 1. *Bulinus species*



Plate 2. *Biomphalaria pfeifferi*



Plate 3. *Malanoides tuberculata*

3. RESULTS AND DISCUSSION

3.1 Species of Sampled Fresh Water Snails

An evaluation of the ecology and distribution of the snail host *Schistosoma* species at the water bodies of Ihitte Uboma area of Imo state was carried between June and September 2015. A total of 600 snails were examined and identified. The results of the study were presented (Table 1).

3.2 Prevalence and Distribution of Different Species of Fresh Water Snails

A total of 600 species of 4 genera were samples from Ihitte Uboma L.G.A. The snail species sample include *Bulinus*, *lymnaea*, *Biomphalaria* and *melanoides*.

Ukwumaeto had the highest number (200) of snail species with percentage distribution of (33.3), while the least number o snail

species (100) was from Umueze at 16.7 of occurrence.

3.3 Distribution of Snail Host in Fresh Water Bodies

Table 3 shows that over all distribution and percentage of snail host in fresh water bodies of Ihitte Uboma L.G.A It is shown above that more snails were distributed in the

stagnant habitats (ponds, burrow pits and lakes) than the flowing habitats (streams and rivers).

3.4 Number of the Snail Species Dissected

Table 4 shows that a total number of 345 snail species form of different genera were dissected. *Bulinus* by *Biomphalaria* (3.5).

Table 1. Shows the different species of sampled fresh water snails in Ihitte Uboma L.G.A and their sites of collection

Villages sampled	Water bodies	No of snail species collected (%)	Snail spp. identified
Umueze	Burrow pit	100 (16.7)	<i>Bulinus</i> spp
Umunumo	Pond River	105 (17.5)	<i>Bulinus</i> spp
		45 (7.5)	<i>Lymnaea</i> spp
Ukwumaeto	Abadaba lake	120 (20.0)	<i>Bulinus</i> spp
	Abadaba lake	80 (13.3)	<i>Biomphalaria</i> spp
Lowa	Stream	110 (18.3)	<i>Bulinus</i> spp
	Burrow pits	40 (6.7)	<i>Melanoides</i> spp

Table 2. Shows the percentage, prevalence/distribution of different species of fresh water snails from Ihitte Uboma L.G.A

Name of village	Number of snail species	%
Umueze	100	16.7%
Umunumo	150	25.0%
Ukwumaeto	200	33.3%
Lowa	150	25.0%
Total	600	100%

Table 3.

Water bodies	Number of snail collected	Number of snails infected	Percentage infection
River bank	20	0	0
Stream bank	50	3	6
Lake	250	40	16
Pond	180	16	8.9
Burrow pit	100	8	8
Total	600	67	11.1

Table 4. Total number of snail species dissected (examined and their percentage infection)

Snail species	Total no sampled	No of species dissected	No positive with cercariae	Percentage infection
<i>Bulinus</i> spp	435	250	55	15.9
<i>Biomphalaria</i> spp	80	42	12	3.5
<i>lymnea</i> spp	45	28	0	0
<i>Melanoides</i> spp	40	25	0	0
Total	600	345	67	19.4

Table 5.

Snail species	Habitat	No infected with cercariae	Percentage infection
<i>Bulinus globosus</i>	Lake and pond	30	44.8
<i>B. truncatus</i>	Pond and slow stream banks	15	22.4
<i>B. forskalii</i>	Pond and slow stream	6	10.4
<i>B. senegalensis</i>	Burrow pit and ponds	3	4.5
<i>Biomphalaria Pfeifferi</i>	Lank and river banks	12	17.9
Total	600	67	11.1

3.5 Snail Species Infected

Table 5 shows the species of the infected snails at Ihitte Uboma L.G.A. Out of the total snail samples only 67 (11.1%) are infected with *Schistosoma* species in Ihitte Uboma L.G.A.

4. DISCUSSION

Malacological and parasitological findings indicate that snail intermediate host of *Schistosoma* species do exist in various water bodies in the rural village at Ihitte Uboma Local Government area. This fairly agrees with the earlier work of [17] with the observance of urinary *Schistosomiasis* in the study area. The absence of some pulmonate planorbis snail hosts in this study was due to the fact that the present collections were limited in both time and space.

However the snail intermediate host found during the study was *Bulinus* spp, the vector of *Schistosoma haematobium* and *Schistosoma intercalatum* [18]. Other snail host found were *Biomphalaria* spp, which transmits *Schistosoma mansoni* (Akogun and Obadiah, 1996) as well as *lymnaea natalensis* and *melanoides tuberculata* [19]. Out of these only *B. globosus* and *B. pfeifferi* were found with furcocercous cercariae believed to be human *Schistosomes*. The species of snails caught were commonly found in areas that have high human contacts and activities such as swimming, vegetable farming, washing and bathing [20,21]. The indigenes were equally seen using the water for domestic purposes. All these help to encourage the spread and increase in the number of snail intermediate host because the infected individuals were found contaminating the water bodies with their infected urine or stools [22,21]. It was equally observed and confirmed from the questionnaire that most of the indigenes had no knowledge of the symptoms, risk factors and mode of transmission of the disease and this further compounded the problems of *Schistosomiasis* in the area.

Bulinus spp occurred in higher numbers and in almost all the villages sampled. This suggests a high potential for intensification of transmission of urinary *Schistosomiasis* in the area, in the near future [23]. It was observed that the snail hosts usually prefer living in stagnant or slow flowing water bodies such as (pond, lake and burrow pit). Negligible numbers of the snails were retrieved from fast flowing habitats (streams and rivers).

Throughout the study the highest number (200) of snail hosts were recorded in Ukwumaeto and this amounts to 33.3% of snail distribution in the area. Out of the 600 snails samples studied, 250 (41.7%) were collected from Abadaba lake found in Elugwu Umuchienta autonomous community Ihitte Ubomma and out of the 250, 40 (16%) of the snails tested positive for the cercariae of human *Schistosomes*. In all the villages, *Bulinus* species has the highest occurrence with a total percentage distribution of 15.9, this is followed by *Biomphalaria* spp. (3.5%).

Again out of the total snails sampled in the study, only 67 (11.1%) are infected with *Schistosoma* species in Ihitte Uboma L.G.A. Imo state. The recent upsurge in population size of the snail hosts of *Schistosoma* species in Ihitte Uboma might be due to water resource development schemes in the community, ignorance and indiscriminate man to water contact activities in the area.

5. CONCLUSION

With the occurrence of *Bulinus* spp and *Biomphalaria* spp of water snails in the Ihitte Uboma area, urinary and intestinal *Schistosomiasis* is incriminated. The relative abundance of the snails in the area could be attributed to better acceptability of *Bulinus* species to local ecological factors in the stagnant and slow flowing water body. Findings as reported in the work indicates that water contact activities in the study area is an epidemiologically risk factor.

6. RECOMMENDATIONS

- Stagnant water bodies are recommended and government should install pipe borne water in this area.
- The populace of Ihitte Uboma should be treated for *schistosomiasis* regularly.
- Molluscicide should be timely used in controlling the snail species.
- Snail experts (malacologists) should be recreated to educate the general public on the public health importance of snails.
- The villagers should be advised not to urinate or defecate into the water body to avoid the spread of the infection.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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