



## INVESTIGATION OF *SCHISTOSOMA* SPECIES IN POND WATER SNAILS ACROSS EBONYI STATE, SOUTH-EASTERN NIGERIA

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### ABSTRACT

Schistosomiasis is a parasitic disease caused by the trematode worm *Schistosoma haematobium*; and its transmission usually takes place only in places where fresh water snail vector is present and where there is contact between the population and infected water. The disease is commonly observed in most tropical countries; and it is a serious public health problem that needs concerted efforts to contain its spread or occurrence in any given community. A total of 240 freshwater snail specimens were collected from three different sampling sites (ponds near schools, market and farmland areas). Twenty freshwater snails were collected from each of the given locality within the four selected local government area of Ebonyi State. The specimens were analyzed using biological and Microbiological Standard techniques. Out of the 240 freshwater snails collected, 200(83.33%) were identified morphologically to be *Bulinus* species while 40(16.67%) was *Biomphalaria* species. The prevalence of 15(7.5%) was recorded against *Bulinus* snail species that is an intermediate host of *S. haematobium* while *Biomphalaria* snail species gave prevalence of 6(15%) which is an intermediate host of *S. mansoni*. The overall prevalence of 21(8.75%) was recorded in this study. The freshwater snails collected from Ezza South local government area (LGA) yielded 8(13.13%) and Ikwo gave 7(11.67%) while least occurrence 4(6.6%) and 2(3.8%) were recorded against pond water snails collected from Izzi and Afikpo North LGAs respectively. This study advocates for public awareness and regular treatment of the pond waters in these areas to eliminate the intermediate host responsible for the transmission of schistosomiasis in the environment studied.

**KEYWORDS:** Schistosomiasis, Freshwater Snail, *Schistosoma haematobium*, Parasites, Nigeria.

### INTRODUCTION

Schistosomiasis in general is a parasitic disease caused by the trematode worm *Schistosoma haematobium*. It is a very serious environmental health problem in many tropical countries; and about 200-300 million people may be suffering from the disease worldwide.<sup>[1]</sup> The disease is endemic in Nigeria and it is one of the most common parasitic infections in the world. *S. haematobium* is responsible for urinary schistosomiasis and it is endemic in several countries of the world.<sup>[2,3,4]</sup> From the previous work carried out in school children in Ebonyi State, it has been reported that *S. haematobium* is highly infectious.<sup>[5]</sup> *Bulinus* snails are intermediate host for *S. haematobium*. The transmission of schistosomiasis takes place only in places where fresh water snail vector is present and where there is contact between the population and infected water. Schistosomal infections plague more than 240 million people worldwide. The most prevalent anthrophilic schistosome species

globally, *Schistosoma haematobium*, accounts for nearly half of that number, primarily in sub-Saharan Africa and the Middle East.<sup>[6]</sup> *S. haematobium* infects humans through direct skin penetration by aquatic cercariae that emerge from *Bulinus truncatus*, the intermediate snail host. After entering the human host, the parasite rapidly migrates into the circulation as a schistosomulae, matures and subsequently lodges in the venous plexus of the bladder where male-female worm pairs mate and produce eggs for years to decades. While in rare cases ectopic *S. haematobium* oviposition causes pathology outside of the urogenital tract, the vast majority of infections result in urogenital schistosomiasis. Although the symptoms are varied, the bulk of the morbidity and mortality of urogenital schistosomiasis can be ultimately attributed to the host immune response against *Schistosoma* eggs deposited within the walls of the urinary tract. This inflammation leads to compromise of urothelial integrity thereby promoting urinary tract

infections<sup>[5,7]</sup>, hematuria and protein-wasting<sup>[8,9]</sup> urothelial changes leading to carcinogenesis<sup>[10]</sup>, urinary tract fibrosis causing bladder dysfunction, obstruction, infection, and renal failure.<sup>[11,12]</sup> In fact, the annual death toll of 150,000 due to urogenital schistosomiasis-induced obstructive renal failure makes *S. haematobium* one of the most lethal worms worldwide.<sup>[13]</sup> Various socio-epidemiological factors are responsible for transmission of the disease and level of infection. Such factors are inadequate sanitation and water supplies, poverty, ignorance, poor living condition and urine and fecal contamination of water source.<sup>[14]</sup> The detection of viable eggs of the parasite indicates an active infection requiring drug treatment. The presence of urinary schistosomiasis in Ebonyi State has been well documented; but no studies about the snails implicated with *Schistosoma* species have been carried out; hence the present study was designed to investigate the presence of freshwater snail infested with *Schistosoma* species in Ebonyi State.

## MATERIALS AND METHODS

### The Study Area

This study was carried out in Ebonyi State specifically in Ikwo, Izzi, Ezza South and Afikpo South L.G.As. The climate in these areas is tropical and the vegetation characterized predominantly by the rain forest with an average atmospheric temperature of 30° C. These four Local Government Areas have dry and wet/raining seasons. Wet seasons last from April to October and is characterized by heavy rain, while dry seasons occurs from November to March.

### Sample Size

A total of 240 freshwater snails (60 from each LGAs) were collected from 20 pond water and investigated for the presence of cercariae that causes schistosomiasis in humans. Basically, ponds located near the markets, schools and farm lands were considered for this study because of human activities such as collection of drinking water, washing clothes, bathing/swimming usually young children and farming activities.

### Sampling Technique

Freshwater snail sampling was conducted from Jan-Aug, 2012. The sampling was divided into dry (January-April) and rainy (May-August) seasons. Sampling was carried out by using standard snail scoops or occasionally, by hand picking. From each pond, snails were collected, packed into plastic containers properly perforated and labeled with dates, time and area of collection. The samples were transported to Applied Microbiology Laboratory Complex for analysis.

### Freshwater Snails Identification

The freshwater snail species were collected and identified morphologically based on shell structural configuration according to biological standard. Each snail was dissected thus: on a grease free slide, the snail tail end was cut off using forceps. The shells were

carefully removed and the fluid allowed to drop on the slide. A drop of normal saline was added and covered with cover slip. The preparation was focused using 10X and examined with 40X objectives to identify the parasite.<sup>[15]</sup>

## RESULT

A total of 240 freshwater snail specimens were collected from three different sampling sites, 20 each were collected from a given locality within the four selected local Government Areas of Ebonyi State. On the basis of shell morphology, 200(83.33%) of the snails collected were putatively identified as *Bulinus* species and 40(16.67%) as *Biomphalaria* species respectively. Both freshwater snail species were found to be present in these locations namely pond water near schools, markets and market areas but *Bulinus* species were found to be more in number. Out of 240 pond water snails investigated for the presence of *Cecarial* 21 (8.75%) were positive. Pond water snails collected from Ezza South L.G.A yielded 8 (13.33%) and Ikwo gave 7 (11.67%) while the least occurrence 4(6.6%) and 2(3.8%) were recorded against pond water snails collected from Izzi and Afikpo South LGAs respectively (Table 1).

**Table 1. Rate of Occurrence Rate of *Cecarial* Infected Pond Water Snails among the Four Selected LGAs of Ebonyi State.**

LGAs	Number of pond water snails examined	Number of pond water snails positive	Percentage occurrence (%)
EZZA SOUTH	60	8	13.33
IKWO	60	7	11.67
IZZI	60	4	6.67
AFIKPO SOUTH	60	2	3.34
<b>TOTAL</b>	<b>240</b>	<b>21</b>	<b>8.75</b>

LGAs= Local Government Areas.

A close look at the occurrence of *Cecarial* infected snails among the four selected LGAs in Ebonyi State with respect to the pond water location showed that pond waters nearer to the schools (Ikwo, 20%; Izza, 15%) and market (Ikwo, 10%; Izzi, 10% and Izza, 25%) places had highest occurrence while least occurrence were observed among pond water snails collected near farm lands demonstrating prevalence of 5% for Ikwo and Izzi LGAs (Table 2,).

**Table 2. Occurrence Rate of *Cecariae* Infected Pond Water Snails in Pond Waters in the Four LGA.**

LOCATION	QUANTITY OF SAMPLES EXAMINED	EZZA SOUTH n(%)	IKWO LGA n(%)	IZZI LGA n(%)	AFIKPO SOUTH LGA n(%)
SCHOOLS	20	3(15)	4(20)	1(5)	1(5)
MARKETS	20	5(25)	2(10)	2(10)	1(5)
FARM LANDS	20	-	1(5)	1(5)	-
<b>TOTAL</b>	<b>60</b>	<b>8(13.3)</b>	<b>7(11.67)</b>	<b>4(6.7)</b>	<b>2(3.33)</b>

LGAs= Local Government Areas.

During dry season, which ranged from November to March, 120 pond water snails were collected and analyzed, out of it only 5(4.2%) water snails were positive for the parasite (Table 3). The remaining 120 water snails were equally collected and analyzed during rainy season between April to October, 16(13.33%) pond water snails were found to be positive for the parasite. The highest occurrence of 6(15%) was observed among water snails collected from Ezza South LGA followed by Ikwo with 5(12.50%) while least 2(5%) and 3(7.5%) were recorded among pond water snails collected from Afikpo South and Izzi LGAs respectively (Table 3).

**Table 3. Occurrence Rate of *Cecarial* Infected Pond Water Snails in the Four Selected LGAs with Respect Seasonal Variation.**

LGAs	Number of pond water snails examined	Dryn (%)	Rainign (%)
IKWO	40	2(5)	5(12.5)
IZZI	40	1(2.5)	3(7.5)
EZZA SOUTH	40	2(5)	6(15)
AFIKPO SOUTH	40	-	2(5)
<b>TOTAL</b>	<b>120</b>	<b>5(4.2)</b>	<b>16(13.33)</b>

LGAs= Local Government Areas.

The distribution of freshwater snail that serves as an intermediate host were collected and identified morphologically based on shell structure configuration. Out of the 240 snails collected 200(83.33%) were observed to be *Bulinus* species while *Biomphalaria* species identified was 40(16.67%), (Table 4).

Table 5 showed that Ezza South and Ikwo LGAs recorded high prevalence of 5(8.33%) each infected *Bulinus* species that is the intermediate host of *S. haematobium* while least of this species infested were found in Izzi and Afikpo South with prevalence of 3(5%) and 2(3.33%) respectively. Ezza South and Ikwo LGAs also recorded high abundance of *Biomphalaria* snail species that is an intermediate host of *S. mansoni* with prevalence of 3(5%) and 2(3.33%) infected ones respectively while Izzi had 1(1.67%) and zero prevalence was found in Afikpo LGA for the same species.

**Table 4. Spatial Distribution of Freshwater Snail Species in the Investigated Areas.**

Freshwater Snail species identified	Percentage number of snail collected (%)
<i>Bulinus</i> species	200(83.33)
<i>Biomphalaria</i> species	40 (16.67)
<b>Total</b>	<b>240</b>

**Table 5. The Distribution of Snail Species among Different Freshwater Snail Species Collected from the Four Selected LGAs of Ebonyi State.**

Selected LGAs	Number of specimen collected	Snail species <i>Bulinus</i> speciesn (%)	<i>Biomphalaria</i> speciesn (%)
Ezza South	60	5(8.33)	3(5)
Ikwo	60	5(8.33)	2(3.3)
Izzi	60	3(5)	1(1.7)
Afikpo South	60	2(3.33)	-
<b>TOTAL</b>	<b>240</b>	<b>21(8.75)</b>	<b>6(15)</b>

LGAs= Local Government Areas.

## DISCUSSION

The presence of urinary schistosomiasis in Ebonyi State has been well documented but no studies about the snails implicated with *Schistosoma* species have been carried out.<sup>[5]</sup> The present study was aimed at investigating the presence of freshwater snail infested with *Schistosoma* species in Ebonyi State. A total of 240 freshwater snails were collected from four LGAs of Ebonyi State and were screened for the presence of cercariae shedding *Schistosoma* species. The overall prevalence of 21(8.75%) was recorded in this study regardless of the snail species. The above finding is in consonance with work done within the informal settlement areas of Kisumu City of Kenya in April-May, 2011 where they recorded total prevalence of 19(1.8%).<sup>[1]</sup> The snails collected from Ezza South and Ikwo LGAs yielded high prevalence 8(13.33%) and 7(11.67%) respectively. The low prevalence of 4(6.67%) and 2(3.34%) were also recorded against snails collected from Izzi and Afikpo LGAs respectively. The above findings could be suggested to be related to the chemical, physical and biological factors determining snail species density and diversity to be found in a particular locality of pond water at a given period. The ecological factors necessary for schistosomiasis transmission in favorable snail habitat can vary considerably from site to site or from one locality to another. Our results showed that among the four selected local government areas with respect to the pond water locations showed that freshwater snails collected from pond waters nearer to the schools and market places had high prevalence of 15%, 25% in Ezza South; 5%, 10% in Izzi LGA; 5%, 5%, in Afikpo South LGA and 20%, 10%, in Ikwo LGA respectively. The least prevalence was found among pond water located near farmland areas; zero percentage prevalence for pond water in Ezza and Afikpo LGAs but 5% prevalence was recorded against Ikwo and Izzi LGAs each. The reason of these variations may be due to difference in abundance of vegetation and suitable conditions in different areas that promote the growth factors of snails.

Such factor which is significantly associated with snail density was the presence of horizontal vegetation. Most snails were found while resting on the underside of the leaves, areas probably rich in oxygen due to photosynthesis. The water grass also provides egg-laying surfaces, shelter from the sun and food for snails. Another contributing factor includes human activities such as swimming, defecating inside and within the area. Our finding establishes that *Bulinus* is the most prevalent species of *Schistosoma* in our locality which was in disagreement with the findings of Al-Khafaji, 1997 and Al-Khafaji, 2006 in which he reported that *B. truncatus* was the most common snail intermediate host observed in Rummana Sub-district and that it was the only evident intermediate host for *S. haematohium* in the study area.<sup>[15,16]</sup> On the seasonal variation as it affects the freshwater snail abundance. Our result gave high prevalence of 16(13.33%) during rainy season and 5(4.17%) out of 120 freshwater snails investigated during dry season. More so, snails collected from pond water at Ezza South gave a prevalence of 2(5%) while those collected from Afikpo South LGA recorded none prevalence during same period. The high percentage abundance of freshwater snails infested was 6(15%) among the snails collected from Ezza South LGA followed by Ikwo LGA with 5(12.5%) while least prevalence of 3(7.5%) and 2(5%) against snails collected from Izzi and Afikpo LGAs respectively during rainy season. The above findings could be suggested to be an attribute of rain and availability of food etc. The decrease in the number of infested freshwater snails during dry season could be as a result of decreased water contact activities associated with swimming or domestic activities. Our observation on seasonal variation is also in agreement with the previous research along Kisumu beach observed that cercarial shedding was lowest during the months of February-April.<sup>[16]</sup>

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