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Fresh Water Snails of Public Health Importance in Canals in Okigwe Imo State Nigeria: Their Infectivity and Implications for Control

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Abstract

Studies have linked freshwater snails with human flukes as a result of repeated contacts with contaminated water. This study is aimed to determine the distribution of freshwater snails and their infectivity rates along human dwellings in Okigwe Imo state using Physico-Chemical parameters. Freshwater snails were collected by using long plastic spoons and with hand-picking method. The Physico-Chemical parameters were determined with appropriate instrument and freshwater snails harvested from the site were morphologically identified. One thousand four hundred and nine (1409) freshwater snails belonging to the species Lymneae and Bulinus were collected once a week throughout the period of study with the relative percentage of 43.9%; 29.9% ;26.2% respectively. The infectivity rate was highest in snails that were collected in the month of May compared to those collected in June and July, the rate was 69.2%, 50.1% and 33.6% in the months of May, June and July respectively. Dissolved oxygen (DO), Biological oxygen demand (BOD) and P^H were found to significantly influence snail distribution in the site ($p<0.05$). The finding showed that 54.2% of all the snails collected were infected. The snail distribution observed may give an insight into some aspects of the epidemiology of trematodes infection in Okigwe the site for the study and their potential risks to infect human beings and animals.

Background

Many species of freshwater snails have been reported as intermediate hosts of highly infective fluke (trematode) larvae of the genus Schistosoma which cause schistosomiasis also known as bilharziasis. Some ecological factors like water quality, temperature, microphytes, human settlements contribute significantly to the distribution of these intermediate hosts of Schistosoma. Freshwater snails are considered to be intermediate hosts because the sexual stages of the parasites are found in man while the snails harbour the asexual stage [1-4]. Humans

serve as vectors by contaminating the environment. Transfer of the infection requires no direct contact between snails and humans, but rather, the disease is acquired by repeated contacts with freshwater snails [5-7]. Therefore, researchers have shown that the prevalence and distribution of schistosomiasis are dependent on the presence and distribution of the intermediate snail host in natural freshwater bodies [8-11].

Urinary schistosomiasis, caused by *Schistosoma haematobium* which has a suitable snail host species of aquatic freshwater *Bulinus* snails, is one of the neglected tropical diseases very common in Nigeria, with some States having very high prevalence especially in the southeastern part of the country [12,13]. Urinary schistosomiasis constitutes a major infection of public health importance in Nigeria and affects mainly the rural poor and some disadvantaged urban populations [14-16]. It is characterized by haematuria, dysuria, bladder wall pathology, hydronephrosis (swelling of kidney due to build-up of urine) , It can also present with squamous cell carcinoma [17-19]. In adults, the infection can result to genital ulcers and other types of lesions that can cause poor reproductive health with sexual dysfunction and infertility. These pathological effects occur mostly among school-age children, adolescent and young adults [20-25].

Apart from reports on the prevalence of schistosomiasis , there is scarcity of research on the risk factors associated with this infection especially in the South East region of the country including Imo State [29-32]. This lack of information on risk factors have been shown to constitute limitations in providing intervention and control programmes. This is because availability of such information is crucial in identifying and implementing effective control measures [33-35]. However, studies have observed that the complex schistosome life cycle and the intricate interactions that are encountered with the host immune system make it difficult for neither drugs nor vaccines to adequately control schistosomiasis without first identifying the parasite load. Studies have shown that in Nigeria, the main disease control measures are the provision of potable water, population-based chemotherapy and health education , but that most of these control measures are affected by lack of baseline data on the distribution of the host and its infectivity [36-40]. This study therefore, examined the distribution of snail species and their infectivity rates along freshwater canals in the rural poor areas of Imo State Nigeria.

This study is of interest because most individuals including school children living close to the study area use water from the canals for several domestic activities including swimming. Also, the snails from these canals serve as the main source of protein as well as means of raising money for sustenance. It is as a result of the activities of people living close to these canals that the researchers deemed it necessary to identify the snail species and their infectivity rates so as to protect the individuals resident in this rural area from likely infection that could result to disease conditions. This study is unique because it helped to reconcile the public health objective of eradicating deadly pathogens so as to protect their environmental biodiversity.

This study also aimed to contribute a quota in helping to achieve the World Health Assembly (WHA) endorsed resolution which has the vision of having a world free from schistosomiasis so as to eliminate schistosomiasis as a public health problem by the year 2025. If this goal is realized, millions will be spared from future sufferings from the pathological effects of this disease condition.

Materials and Method

Study Area

The study area is Okigwe. It is the zonal capital of Okigwe district in Imo State of Nigeria. The district is made up of six Local Government Areas namely: Isiala Mbano, Ihitte Uboma, Ehime Mbano, Onuimo, Obowo and Okigwe. The study area lies between latitude 5°30-5°57N and longitude 7°04-7°26 E (covering a land area of about 1,824 km^2. (www.maplandia.com).

The main occupation here is peasant farming and

petty trading, The major source of protein for most individuals is snail consumption. Some individuals also trade on snails as sources of income for sustenance. Freshwater canals are common sources of water for several domestic activities , while the source of drinking water is from bore holes which are strategically located for commercial purposes. The residents travel few kilometers to purchase the drinking water.

Snail Collection and Identification

Snail collection was carried out from May-July 2021. The study site was visited weekly for snail collection using a long plastic spoon and hand picking wearing a hand glove. The sites where the snails were collected were mainly in places where there are obvious constant human activities like school compounds. The freshwater snails collected were transferred to a labeled plastic container that was covered with a net for ventilation and air passage.

The collected snails were taken to the Department of Animal and Environmental Biology laboratory, Abia State University where the snails were sorted and identified by specie level using morphological characteristics standard key as described by Gillei (1986). The identified snails were counted and recorded.

Snail Infectivity

The collected snails were put in petri dishes with a little quantity of water in the dishes and thereafter, placed under the sun. The petri dishes were monitored for cercariae shedding at the intervals of 30 minutes using a dissecting microscope and hand lens. The number of snails that shed was recorded and those unable to shed also recorded. Water quality index was determined using the methods described by Association of Official Analytical Chemistry (AOAC, 2005).

Findings

A total of one thousand four hundred and nine (1,409) snails was collected from drainage systems around the residential areas close to the Iyiechu Stream Okigwe. The snails so collected were identified as Lymneae and Bulinus genera.

Table 1. Shows the monthly distribution and the relative percentage of the freshwater snail species collected from Iyiechu Stream Okigwe, the area of study. From this table, there is a marked variation in the number of snails collected. In the first month of snail collection, (May), 619 snails were collected, in June 421 snails were collected while in July, 369 were collected. In May, the snails collected consisted of 318 (53.1%) Lymnaea, and 301(48.63%) Bulinus. This is the largest collection made during the period of study. For the second month, June, the snails collected were made up of 309 (73.4%) Lymnaea, 112(26.6%) Bulinus, while in July, being the third month, the snails collected were 249(67.5%) Lymnaea, and 120(32.5%). For all the collections made during the period of study, 876(62.2%) were of the Lymnaea and 533(37.8%) Bulinus genera respectively.

Table 2 contains the proportion of fresh water snails that shed cercariea showing that they were infected. From the table, out of 619 fresh water snails collected in May, 428 of them representing 69.2% were infected. In June, out of 421 snails collected, 211(50.1%) shed cercariea, while in July, out of 369 snails collected 124 (33.6%) were also infected giving a total of 764(54.2%) that were infected.

Table 3 contains physico-chemical parameters of the analysis of the water canals from Iyiechu Stream where the snails studied were collected. From the physico -chemical analysis on this table, dissolved oxygen (DO), Biological oxygen demand (BOD) and P^H significantly influenced snail distribution in the area studied ($p<0.05$).

Discussion

The fact that the snails collected were more in May and June when the rains are not yet heavy than the ones collected in July when rainfalls are heavy, shows that snails breed less during heavy rains than other periods. The result obtained from the study showed the abundance and diversity of freshwater snail intermediate hosts in the water canals studied. This abundance and diversity of freshwater snail hosts are of public health importance because of the risks to human infections. This finding corroborates with that of [1,18] that the presence

Table 1. Monthly distribution of Freshwater snails.

Snail Genera	May (%)	June (%)	July (%)	Total
LYMNAEA	318 (53.1)	309 (73.4)	249(67.5)	876(62.2)
BULINUS	301(48.63)	112(26.6)	120(32.5)	533(37.8)
TOTAL	619 (43.9)	421(29.9)	369(26.2)	1,409

p<0.01

Table 2. Infectivity rate of Freshwater snails collected from Iyiechu Stream, Okigwe of imo State, Nigeria.

Months	Total number	Infected	%Infected
May	619	428	69.2
June	421	211	50.1
July	369	124	33.6
Total	1409	764	54.2

p<0.01

Table 3. Physico chemical analysis of water canal from Iyiechu Stream

Parameters	**Result**	**Mean**	**0035limit**
pH	7.0	7.0	5 - 9 (Domestic water), 6 -9(fresh water), 6.5 - 8.5 (marine). FEPA: 6-9
Temperature	26.5	26.5	FEPA:<40°C in 15ml of out fall
BOD	1.2	1.2	FEPA:50mg/l
DO	4.6	4.6	100ug/l, marine

p<0.01

of freshwater snails is of public health importance because of the indication for parasitic transmission.

The high proportion of cercariae shed in both Lymneae and Bulinus genera reflect the extent to which consumers of these snail species and those with regular contacts with the freshwater canals including school children are exposed to infections. The findings that individuals living in this vicinity use water from the canals for domestic activities means that they are likely to have regular contacts with the freshwater from the canals and therefore, human and animal excreta may be common in the freshwater where the snails grow. This finding agrees with those of [19, 20,33] in which they observed that freshwater body is usually polluted with human and animal excreta and that snails that grow in freshwater body polluted with human and animal excreta produce some organic matters that increase the concentration of detritus and the proliferation of algae which form the diets for planorbid and prosobranch snails.

The fact that some of the infected freshwater snails studied were of *Bullins* specie which serves as intermediate host to highly infective larval trematode of the genus Schistosoma shows that Schistosomiasis infection may be common in the study area especially among school children who were seen swimming in the canals near their school premises as well as picking snails for food. This regular human contacts with the canals presupposes the extent to which the surface water must have been contaminated by excreta and others.

The finding that majority of the freshwater snails that were infected were of the Lymmeae specie which according to studies by [2,8] is the chief intermediate host of Fasciola which predisposes human and animals to liver disease (fascioliasis), shows that some individuals resident in this area may be infected with fascioliasis.

Realizing the fact that snail is the main source of protein and avenue for generating revenue for sustenance among some residents in the area of study, presupposes that a significant proportion of the residents may have continuous contacts with the definitive host which would influence the occurrence of disease conditions like fascioliasis, schistosomiasis and others. Other human activities near the canal such as farming, bathing, swimming, washing of clothes, cassava and vehicles that were observed during the study, may be what contributed to the poor environmental conditions noted around the freshwater canals. These numerous human activities suggest constant contacts with parasites which occur on aquatic plants that serve as foods and shelter to freshwater snails thereby, increase their number and diversity. Also the fact that there is increase in the number and diversity of the freshwater snails make them available even on semidried soils where they are easily picked by individuals. One striking observation in the study is that a good number of individuals picking these snails move barefooted, thereby add to the predisposing factors to schistosoma and Fasciola infections as also pointed out in the researches done by [6, 10].

The finding that dissolved oxygen (DO), Biological oxygen demand (BOD) and P^H significantly influenced snail distribution in the area shows that the presence of snails increased the biomass of filamentous green algae and decrease the biomass of periphyton thereby reducing the DO of the water which is needed by aquatic organisms for existence. This finding agrees with that of [11, 25].

This shows that the more the presence of snails, the more the biomass of periphyton is reduced.

Conclusion

Freshwater snail intermediate hosts of trematodes were common in the freshwater canal studied. Inhabitants in the area depended largely on water from the canal for several domestic activities probably because water from most of the bore holes were sold and as a result, it may not be easy considering the economic status of most individuals in the rural areas, to have the resources to buy water for drinking as well as for other domestic activities. As a result, a good number of those who cannot afford the money, resort to using water from the canals. It is evident that the numerous activities that occurred near the canals contributed to the poor environmental sanitation which could facilitate infection

of snails and the continuation of their life cycles.

Since most people in this area consume some of these snails as a source of protein as well as market them for sustenance, and realizing that the infective larvae (cercariae) develop within freshwater snails which when released penetrate the skin of a human/mammalian body in contact with the water, it may be right to conclude that a good number of the individuals who have contacts with the freshwater canal and the snails that grow here may be infected with schistomiasis and fascioliasis. Therefore, there is the need to health educate residents in this area on the need for hygienic practices, provision of potable water, less contact with freshwater canals, and to avoid the consumption of freshwater snails so as to prevent infections associated with freshwater snails and their attendant pathological effects on humans.

Therefore, the findings in this study will contribute a quota to support the WHA resolution to maintain a world free of schistosomiasis by controlling its morbidity and eliminating schistosomiasis as a public health problem by 2025.

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