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SEASONAL OCCURRENCE AND CERCARIA INFECTIVITY OF FRESHWATER SNAIL SPPECIES IN MAKURDI METROPOLIS: A PUBLIC HEALTH CONCERN FOR SCHISTOSOMIASIS CONTROL

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Abstract

Schistosomiasis is a neglected disease that is still devastating many rural community dwellers in Nigeria. Different species of freshwater snails such *Bulinus* and *Biomphalaria* are incriminated in the transmission of the disease. Studies on the seasonal occurrence and cercarial infectivity of freshwater snail vectors of schistosomiasis were carried out in 3 different categories of freshwater habitats over a 12-month period in different localities. The objective was to determine prevalence of freshwater snails of public health importance and their cercaria infectivity. A total of 24,415 freshwater snails collected were morphologically identified and grouped into six different genera (*Bulinus globosuss, B. forskalii*, *Pila ovata, Lanistes lybicus*, *Biomphaleria pfeifferi and Lymnae natalensis* were encountered. Snails collected were kept under laboratory condition for cercaria emergence. *B. globosus, B. forskalii* and *B. pfeifferi* were identified as vectors of Schistosomes because there secreted cercaria of S. *haematoium* and *S. mansoni* respectively. Schistosome parasite infection was higher in the ponds (83.33%); followed by dams (68.57%)) and streams (53.33%). The cercarial infection rate differ significantly (ANOVA; $p < 0.05$) across habitat types and vector species and study months. The findings indicate that the different freshwater habitats investigated are potential transmission sites for schistosomiais. These recent studies, therefore, provide an epidemiological baseline data required for evaluation and implementation of vector control of schistosomiasis in the study area.

KEYWORDS: Freshwatersnails, cercaria, infectivity, seasonal occurrence, schistosomiasis control, Makurdi, Nigeria

INTRODUCTION

Schistosomiasis remains one of the most significant neglected tropical diseases (NTDs), exerting a substantial public health and socio-economic burden across sub-Saharan Africa (World Health Organization (Bruno and Omar, 2016). Although preventive chemotherapy has reduced infection prevalence in many endemic areas, transmission persists because of the continuous interaction between humans, contaminated freshwater bodies, and the intermediate snail hosts responsible for releasing infective cercariae (Allan *et al.*, 2020). In Nigeria, schistosomiasis ranks among the most widespread parasitic infections, with transmission sustained through abundant freshwater bodies and a high presence of competent snail hosts (Angelo *et al.*,2018).

Freshwater snails of the genera *Bulinus* and *Biomphalaria* are the major intermediate hosts of *Schistosoma haematobium* and *S. mansoni* respectively (Brown, 2015) even though recent studies have shown that other schistosme species such as *S. bovis* and *S. intercalatum* are being haboured by *Bulinus* species in areas where human -animal association exists (Tchounwou *et al.*, 2019). These snails shed infective cercariae under suitable environmental conditions; the epidemiology of the disease is therefore closely linked to snail ecology, abundance, and seasonal dynamics (Okete *et al.*,2018 Environmental variables such as rainfall, water flow, vegetation, temperature, and human water-contact patterns have been shown to influence the seasonal distribution of snail vectors and cercarial infectivity Ugbomoiko *et al.* (2010); Anorue *et al.*, 2024). Consequently, monitoring of snail populations across seasons provides critical insight into the periods of highest transmission risk (Donnelly *et al.*, 2022).

Makurdi Metropolis, located along the Benue River and characterized by extensive wetlands, irrigation sites, and human dependence on natural water sources, presents ecological conditions favorable for continued schistosomiasis transmission. Studies within Benue State and neighboring regions suggest that freshwater snail species such as *Bulinus globosus*, *Bulinus truncatus*, *and Biomphalaria pfeifferi thrive in local water bodies and may* contribute to active transmission cycles (Akinwale *et al.*,2011). However, despite evidence of human infection in the region, there remains limited experiential data on the **seasonal occurrence of these snails** and the **infectivity levels of the cercariae they release -** two parameters that are key for evidence-based schistosomiasis control.

Assessing cercarial infectivity is especially essential because snail presence alone does not always equate to active transmission; only infected snails that shed viable cercariae contribute directly to disease propagation (Okete *et al.*, 2022). Understanding how cercarial shedding varies across wet and dry seasons can therefore guide the timing of interventions, such as mollusciciding, environmental management, or targeted mass drug administration (MDA).

Given the persistent public health challenge posed by schistosomiasis in Nigeria as well as the ecological suitability of Makurdi for intermediate snail hosts, there is an urgent need to investigate the seasonal patterns of freshwater snail distribution and cercarial infectivity. Such evidence will provide baseline epidemiological data necessary for designing integrated snail control strategies to synergize other schistosomiasis control King *et al.* (2020). This study aims to examine the seasonal occurrence and cercaria infectivity of freshwater snail species in Makurdi Metropolis, with the broader objective of strengthening schistosomiasis control and elimination. These findings will contribute to targeted control measures and improved public health outcomes in Makurdi, Benue State.

MATERIALS AND METHODS

Study area

The present investigation was carried out between April 2024 and March, 2025 to cover wet and rainy(dry) season periods in 10 urban areas (Wurukum, Apir, Wadata, Northbank, Kanshio, Nyiman, Welfare Quarters, Gyado Villa, Judges Quarters Extension and Ankpa Quarters, all in Makurdi metropolis, Benue State, Nigeria. The choice of these areas was influenced by availability of freshwater bodies used by humans for domestic, recreational, agricultural or livestock activities (river banks, irrigation canals, ponds, wells, drains).

Makurdi Metropolis, the administrative and political capital of Benue State, is located in north-central Nigeria within the Guinea Savanna ecological zone. Geographically, Makurdi lies between **latitude 7°38'–7°45' N** and **longitude 8°30'–8°38' E**, and is traversed by the Benue River, one of the major freshwater systems in West Africa. The metropolis is composed of urban, peri-urban, and agricultural communities that rely heavily on natural water bodies for domestic, recreational, and occupational activities (Ejeh, 2017). The climate of Makurdi is typically tropical, characterized by two distinct seasons: the **rainy season (April–October)** and the **dry season (November–March)**. Annual rainfall ranges between **1,000 and 1,500 mm**, while temperatures generally vary from **23°C to 34°C**, creating favorable ecological conditions for the survival and proliferation of freshwater snail species. Relative humidity is high during the rainy season and declines substantially in the dry season, influencing the hydrology of water bodies and the availability of suitable snail habitats. Makurdi's hydrological landscape is dominated by the **River Benue**, its tributaries, seasonal floodplains, irrigation channels, ponds, drainage systems, and numerous small perennial streams. Areas such as Wadata, North Bank, Kanshio, Welfare Quarters, Agan, Fiidi, and Owner-Occupied are known for their proximity to water sources used for fishing, washing, bathing, sand mining, and agriculture. Such activities increase human–water contact and consequently elevate the risk of schistosomiasis transmission. Vegetation in the metropolis consists primarily of savanna grasses interspersed with shrubs and gallery forests along riverbanks. These vegetative belts provide shade and organic matter that support the breeding of medically important snail species, including *Bulinus* and *Biomphalaria*, which are recognized intermediate hosts of *Schistosoma haematobium* and *S. mansoni* respectively. During the rainy season, flooding expands snail habitats, while water stagnation during the dry season creates isolated pools that may maintain residual snail populations and allow for cercarial shedding.

The population of Makurdi is estimated to exceed **500,000,** comprising diverse socio-economic groups involved in farming, fishing, trading, and artisanal activities. Due to inconsistent access to pipe-borne water, many residents depend on rivers, streams, and open wells for daily use. This dependency contributes to frequent human exposure to contaminated freshwater, thereby sustaining schistosomiasis transmission in the region.

Given the ecological suitability of Makurdi's aquatic systems, high human water-contact patterns, and the presence of potential snail hosts, the metropolis represents an important area for studying the **seasonal distribution of freshwater snails** and the **infectivity of cercariae** they shed.

Procedures for collection of snail samples

The fresh water bodies in the study areas were identified, designated and classified into ponds, streams and dams**.** Criteria for selection of freshwater bodies for snail collection include proximity to human habitation and human water contact activities. Sampling stations were selected based on human contact points.The water bodies were thoroughly examined at monthly intervals from April, 2024- March, 2025 using a long scooping net constructed by the researcher as outlined (Frandsen and Christensen, 2022); and employed (Rouxet al, 2021). The scoop made up of mosquito netting with a mesh size of 1 mm was 30 cm deep and attached to a square wooden frame of 20 cm in diameter, nailed to a long wooden handle of 95 cm in length. Snails collected were put in experimental containers (sterile plastic container) containing damp and decaying leaves with water from the and carried to Post graduate /Parasitological Research

Laboratory, Department of Zoology, Joseph Sarwuan Tarka university, Makurdi.

Recovery of snail from substratum (aestivation)

All the habitats that were sampled and harbored snails during the rainy season were examined in the dry season for the presence of snails. The substratum of these habitats was collected with a shovel from different portions and taken to the laboratory where it was washed through a 15 mesh/ 2.48 cm sieve with water. The species and number of the entire snail recovered was recorded. Snails recovered were kept in water in a 250 ml beaker to know whether they were alive or not. Those snails that were alive were then screened for patent trematode infection using the cercarial shedding technique described (Angelo *et al*.,2018).

Identification of snails

The collected snails were cleaned of the soil from the shell, measured using a vernier calipers to get the shell peristoma height and the shell width. Identification was carried out based on morphological features as described by Brown 2015 and employed by Fuss *et al*. (2019 and Okete *et al.* (2022).

Examination of snails for cercaria infectivity

Snails were screened for patent cercarial infection using the natural cercaria shedding methods as described by Fransen and Christensen (2022) with little modifications. Each snail was placed singly in 250 ml plastic containers (experimental container) of 7. 5cm depth x 13 cm length 8.5cm breadth containing 100 ml of water collected from the snails' habitat and exposed to strong artificial illumination (60 W bulbs) for a period of 4-6 hours to influence cercaria shedding. Water from the experimental container was collected, centrifuged 300 rpm for 5 minutes. 2-3 drops of the aliquots were collected with pipette and placed in a glass slide. Lugol iodine was added to the deposits /aliquots on the slide to immobilize and stain the cercariae if present. It was then examined by a light microscope (Olympus, German series) under X 10 and X 40 objectives. All brevifurcate cercariae were identified as those of *S. haematobium* by morphology as previously described by Chitsulo *et al.* (2000).

Statistical analysis

Data were entered into Microsoft Excel 2007 and exported into a computer-based software programme, SPSS version 17.0 (Statistical Package for Social Sciences) and analyze using appropriate statistical tool. Chi-square (χ^2) test was used to determine the significance of association between:

- Relative abundance of snails in the different sampling locations.
- Infection rate of snails in the water bodies at different sampling stations.

RESULTS

Distribution and abundance of freshwater snail species in Makurdi, Nigeria.

Freshwater snails occurred in 28 of the 35 freshwater bodies (streams, pond, and dams). Snails encountered were *Bulinus globosus, B. forskalii, Biomphalaria pfeifferi, Lymnaea natalensis, Pila ovata* and *Lanistes lybicus* (Plate 1*). B. globosus* was most frequently encountered with numerical abundance of 7,302 followed by Pila ovata (5,268), *Lanistes lybicus* (4,347), *Biomphaleria pfeifferi* (3,601), (2,246) and *Bulinus forskalii* (2048). There was presence of all the snail species in pond habits while *L. lybicus* occurred in stream and dam habitats (Table 1).

Plate 1: Snails species collected from freshwater habitats in Makurdi, Benue State, Nigeria: (a) *B. globosus* (b) *B. forskalii* (c) *B. pfeifferi* (d) *L. natalensis (e) L. lybicus* (f) *P. ovata*

Table 1

Abundance of freshwater snail species in freshwater habitats in Makurdi, Nigeria

Type of freshwater habitats	**Total number of site surveyed**	**Number of site infested with snail**	**Number of species of snails found**					
			Bulinus globosus	***Bulinus forskalii***	***Biomphalaira pfeifferi.***	***Lymnae natalensis***	***Pila ovala***	***Lanistes lybicus***
stream	15	10	1,246	236	1,566	224	24	0.00
Pond	12	12	5,000	1,256	1,024	1,002	4,226	4,347
Dam	8	6	1,056	556	1,011	1,020	1,018	0.00
Total	**35**	**28**	**7,302**	**2,048**	**3,601**	**2,246**	**5,268**	**4,347**

Seasonal/Monthly variation in the abundance of snail species and its relationship with rainfall from April 2024-March, 2025

A total of 18,228 and 6,186 snails were collected in rainy and dry seasons. Snail species collected in rainy season was higher than dry season. In the rainy season, snails occurred in all the months, with *B. globosus* having the highest occurrence (4,755) followed by *L. lybicus* (3,790), *P. ovata* (3790), *B. pfeifferi* (2,527), *L.natalensis* (1,790) and *B. forskalii* (1, 419). In the dry season, the highest number of snails was *B. glosus* (2547) followed by *P. ovata* 91478), *B. pfeifferi* (1074), *L. natalensis* (456), *L. lybicus* (400) and *B. forskal*ii (Table 2). In the rainy season, snails'occurrence peaks in the month of September and decreasein the month of May while in the dry season, the highest number was in November.

Cercarial infectivity in *Bulinus globosus, Bulinus forskalii* and *Biomphalaria pfeifferi* in freshwater bodies in Makurdi, Nigeria

Out of the six genera of snails collected, three groups (*B. globosus, B. forskalii and B. pfeiferi*) sheded schistosome cercaria. *B. globosus* was the highest number of snail species that was infected, shedding 60.70% of *S. haematobium* cercaria followed by *B. forkalii* that shed 59.57 % of *S. haematobium* cercaria and *B. pfeiferi* with 14.55 % of *S. mansoni cercaria* output (Table 3). Of the three habitats types that were examined, ponds had the highest percentage of infection (53.10%) followed by dams (51.51 %) and streams (31.53 %) with an overall infection of 47.70 % (Table 3).

Monthly variation in cercarial output in *Bulinus globosus, Bulinus forkalii* and *Biomphalaria* in different habitats in Makurdi, Nigeria

The results of cercarial shedding from *Bulinus globsus* showed that a total of 2,755 and 1,204 cercarial outputs in the rainy and dry seasons respectively. In all the habitats, cercarial infection was recorded in all the months except in steam where snails collected during the month of May did not shed cercaria. The highest output (1,990) was in pond followed by dam (675) and stream (382). In the dry season snails shed cercariae throughout the months except in the stream habitat where snails collected during the months of April, December, January, February and march did not shed cercaria. The highest output (1,084) was in the pond followed by dam (165) and stream (138) (Table 3a). *Bulinus forskalii*, shed total of 1139 and 1220 cercariae in rainy and dry season respectively.

In the rainy season, cercariae occurred in all the months except May – July. The highest cercarial output (682) was in recorded from pond followed by dam (455) and stream (7). In the dry season, a total of 70 cercariae were collected from the snails (table 4b). Cercarial outputs from *B. pfeifferi* is shown in Table 4c.A total of 502 cercariae were collected in the rainy season, with the highest output (408) from the stream, followed by pond (70) and dam (24). In the dry season, a total of 22 cercariae were collected, with the highest output (20) from stream and 2 cerceriae from the pond (Table 4c).

Table 2: Seasonal occurrence of freshwater snail species from April, 2024 – March, 2025 in Makurdi, Nigeria

Snail Species	Seasonal /Monthly Occurrence														
	Dry Season 1	Wet (rainy) Season							Dry Season 2						
	April 2024	May 2024	June 2024	July 2024	Aug 2024	Sept 2024	Oct 2024	Wet Season Total	Nov 2024	Dec 2024	Jan 2025	Feb 2025	March 2025	Dry Season 1&2 Total	Gross Total
Bulinus globosus	122	304	1,126	507	533	728	1557	4755	1,025	513	354	311	222	2547	**7,302**
Bulinus forskalii	62	68	83	246	44	648	330	1419	45	52	39	10	24	232	**1651**
Biomphalaira pfeifferi	13	16	871	1,213	210	128	89	2527	397	314	201	125	24	1074	**3,601**
Lymnae sp	21	48	57	234	516	630	305	1790	210	122	-	-	103	456	**2,246**
Pila ovala	125	247	256	518	521	1,022	1,226	3790	405	423	305	118	102	1478	**5,268**
Lanistes sp	15	46	310	301	752	1,512	1,026	3947	202	58	40	67	18	400	**4,347**
Total	**358**	**729**	**2703**	**3019**	**2576**	**4,668**	**4533**	**18228**	**2,284**	**1,482**	**939**	**631**	**492**	**6186**	**24415**

Table 3: Schistosome cercariae in snails found in freshwater bodies in Makurdi, Nigeria

Snail Species	Number Examined	Number (%) Infected	Type of infection
Bulinus globosus	7,302	4,434 (60.72)	*S. haemalobium*
Bulinus forskalii	1,651	220 (13.33)	*S. haematobium*
Biomphalaria pfeifferi	3,601	524(14.55)	*S.mansoni*
Total	12,554	5178 (41.30)	

Table 4: Seasonal/ Monthly distribution of cercarial outputs in: (a) *Bulinus globosus* (b) *Bulinus forskalii* (c) *Biomphalaria pfeiferri* (a)

Type of habitat	Season/Month														
	Dry Season 1	**Wet (rainy) Season 1**							**Dry Season 2**						
	April 2024	**May 2024**	**June 2024**	**July 2024**	**Aug. 2024**	**Sept 2024**	**Oct 2024**	**Wet Season Total**	**Nov. 2024**	**Dec 2024**	**Jan. 2025**	**Feb. 2025**	**March 2025**	**Dry Season 1 &2 Total**	**Gross Total**
Stream	-	-	40	45	54	59	184	382	82	56	-	-	-	138	520
Pond	23	56	520	174	280	310	650	1990	450	220	184	96	111	1084	3,074
Dam	1	15	40	82	129	129	280	675	85	41	10	16	12	165	840
Total	**24**	**71**	**560**	**256**	**409**	**439**	**930**	**2755**	**535**	**216**	**194**	**112**	**123**	**1204**	**4,434**

(b)

Type of habitat	Season/Month														
	Dry Season 1	**Wet (rainy) Season 1**							**Dry Season 2**						
	April 2024	**May 2024**	**June 2024**	**July 2024**	**Aug. 2024**	**Sept 2024**	**Oct 2024**	**Wet Season Total**	**Nov. 2024**	**Dec 2024**	**Jan. 2025**	**Feb. 2025**	**March 2025**	**Dry Season 1 &2 Total**	**Gross Total**
Stream	-	-	-	-	-	2	5	7	1	-	-	5	-	1	13
Pond	-	-	25	31	196	210	220	682	10	28	-	-	-	38	720
Dam	8	8	8	9	100	310	20	455	5	4	15	-	-	32	487
Total	8	8	33	40	296	522	240	1139	15	32	15	5	-	70	1,220

c)

Type of habitat	Season/Month														
	Dry Season 1	**Wet (rainy) Season 1**							**Dry Season 2**						
	April 2024	**May 2024**	**June 2024**	**July 2024**	**Aug. 2024**	**Sept 2024**	**Oct 2024**	**Wet Season Total**	**Nov. 2024**	**Dec 2024**	**Jan. 2025**	**Feb. 2025**	**March 2025**	**Dry Season 1 &2 Total**	**Gross Total**
Stream	-	-	201	113	70	14	10	408	10	-	10	-	-	20	428
Pond	2	5	40	15	5	5	-	70	-	-	-	-	-	2	72
Dam	-	-	10	8	4	2	-	24	-	-	-	-	-	0	24
Total	2	5	251	138	79	21	10	502	8	0	10	0	0	22	524

DISCUSSION

Bulinus globosus, B. forskalii, Biomphalaria pfeifferi, Lymnaea natalensis, Pila ovata and *Lanistes lybicu*s were encountered in freshwater habitats classified in to streams ponds, and dams in Makurdi Local Government Area of Benue State, Nigeria. Similar snail species occurrence have been reported by Angelo *et al.* (2023) around fishing communities of Mwanza, Region, north Western Tanzania. The high frequency of occurrence of snails species in the pond may be because of habitat preference and a preponderance of the pond. The ponds constituted 34.29 % of the total water bodies surveyed. *B. globosus* had the highest numerical abundance of 7,302 snails found in all the 3 habitat types. The wide distribution of these species may be attributed to its ability to tolerate wide ranges of ecological factors (Appleton *et al.*,2012) and frequent human water contacts in the study area. According to Okete *et al*. (2022), human water contact activities play major roles in the distribution and abundance of freshwater snails. In part of the community where snails were found throughout the year, activities such as brick making, vegetable farming, swimming and fishing were ongoing. These may have impacted positively on the bionomics of the snails and led to their high numerical abundance. The bank of the habitats was also littered with human excrement as a result of the long stay of inhabitations in the area. This finding agrees with the findings of several authors that population of schistosome intermediate hosts are often associated with moderate organic pollution (Chibwana *et al.*,2020). According to Colley *et al.* (2020), snails in polluted water may use faeces as food or may benefit from the general eutrophication of the environment as a result of wastes by the activities. *B. globosus* was the most abundant snail species encountered in this study, accounting for 29.43 % of the total snail species collected. This finding conforms to the work of Onyekachi *et al.* (2022) who reported *B. globosus* species to be more abundant compared to *B. pfeifferi.*

The results of this present study showed that the numerical abundance of all the snail species collected in the rainy season was higher than dry season. This recent finding is similar to the report of Opayemi and Alex (2021) who recorded a higher number of freshwater snails in the rainy season than dry season. Th higher numerical abundance of snails in the rainy season may be because of availability of water and abundance of organic matter that serves as food for the snails. and this makes the environment favourable for snails' proliferation (Abdulkadir *et al*., 2013). This ffinding also conforms to the work of Salawu and Odaibo (2013) which reported snails might prefer aquatic vegetation in the rainy season, which provide them with available food and shelter. Okete *et al.* (2018) also reported that increase eutrophication in the rainy season can lead to increase number of snail density. Distribution of snails' species in rainy season among the three habitat types also showed a higher numerical abundance of snails in the pond as compared to stream and dam habitats. Although this recent finding is ad variant with the report of (Taopiq *et al.* (2017) who recorded more snails in stream habitat during the rainy season. The higher number of snails in the pond in this report may be due to the slow water current, nutrient availability, presence of other aquatic vegetation because of organic matter that serves as food for the snails as well as making the environment favourable for snails' proliferation (Abdulkadir *et al*., 2013). The lower numerical abundance of snails' population in the stream habitats during the rainy season in this recent report may be due to the fact that the stream habitats were flooded during the rainy season which may have dislodged the snails to the nearby habitats. The prevalence of snails throughout the months during the dry season shows the aestivation action of the snails. Nevertheless, the availability of snail' vectors to survive adverse conditions such as aestivation and hibernation for prolong period constitute one of the major problems in the control of snails (Taopiq *et al*., 2017).

The results of this present study also established from cercaria shedding experiment carried out that *B. globosus, B. forskalii and B. pfefferi* are major the vectors of human schistosomes because there secreted cercariae of *S. hamatobium* and *S. mansoni* respectively. This observation is similar with the reports of Houmsou *et al.* (2012) who reported that *B. globosus, B. forskalii* and *B. pfeifferi* were the major vectors of human schistosommiasis Nigeria. It was however different from the findings of Dawaaki *et al*. (2020) who reported that B. *forskalii* was the vector of *S. intercalatum* in the urban city of Port Harcourt. Infection of *B. globosus* occurred throughout the period of study while infection of *B. forskalii* was restricted to the periods of high rainfall The patterns of monthly variation of infection rate *of B. globosus* was higher in the ponds while *B. forskalii* was high in the dams while *B. pfeifferi* was higher in the stream.

Cercarial shedding from infected snail vectors exhibited great seasonality with a higher (2,755) cercaria outputs in the rainy season than dry season (1,204). The result also showed
hhigher cercaria output (1,990) in pond, followed by dam (675) and stream (382) by *B. globosus* in the rainy season. Those differences might be associated with the level of environmental sanitation, suitable climate for the snails, level of human exposure to surface water and and other local conditions of the habitats. The overall cercaria outputs reported in the present study during rainy season is similar to the work of Tigga *et al.* (2014) and Houmsou *et al*. (2016).
Urinary Schistosomiasis among Children in Murbai and Surbai Communities of Ardo
Kola Local Government Area, Taraba State, Nigeria. *Journal of Tropical Medicine,* **7** (47):
1 – 8 that determined the prevalence of intermediate hosts infected with cercariae around the Ranchi, those authors reported high cercarial output. The findings in the present study were lower than the report of Uthpala *et al.* (2010) that work on fresh water snails in Sri Lanka, who reported prevalence of 16% infection rate. Infection rate by cercariae obtained in the present study was higher than the report of Tamirat *et al.* (2020) who reported infection rate of 6% on fresh water snails in Africa. In the present study, P. *ovata* was found to have high prevalence rate by cercariae in both dry and rainy season, which is an indication of active schistosomiasis transmission of the disease. This finding is consistent with the work of Peleta *et al.* (2019) that recorded high cercarial shedding of 1,200 in *B. globosus* with modertate infection rate was recorded among *Biophalaria* snails examined.

Monthly variation in the population density of snails may not be dependent only on climate or general seasonal ecological conditions, but often significantly on peculiar local condition caused by various factors or by the inference of man in those habitats. Infection of *B. globosus* occurred throughout the period of study while infection of *B. forskalii* was restricted to the periods of high rainfall. The patterns of monthly variation of infection rate *of B. globosus* was higher in the ponds while *B. forskalii* was high in the dams while *B. pfeifferi* was higher in the stream

These recent findings support the view of Nyanda *et al*. (2025) who stated that snail control must be inculcated into preventive chemotherapy if we must meet the WHO goal of eliminating schistosomiasis by the year 2030. This is recent finding is significant to the control and elimination of schistosomiasis as a public heal disease; because, in as much as re-infection, transmission, poor sanitary conditions and persistence of human-water contacts persist; absolute suppression of schistosomiasis may not be feasible, though chemotherapy can significantly reduce the prevalence rates. Preferably, for total elimination of schistosomiasis, control health education, portable water supply, sanitation, and focal mollusciciding is key.

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Author's Contributions

OJA conceived and designed the entire study, collected data, analysed samples and interpreted data and drafted manuscript. OFO supervised all laboratory procedures and reviewed manuscript. EEE facilitated field works and all administrative activities. LEB identified and group collected snail species and conducted data analyses. All authors carefully read and approved the manuscript before submission.

Competing Interests

There is no competing interest in this research.

Consent for Publication

All five authors have read and are aware of this submission.