Original Article

Transmission potential of *Schistosom spp.* infection among intermediate host snails in Iriwo amd Ajeri Streams, Ago-Iwoye, Ogun State, Nigeria

*[1]Uthman, T.O.O., [2]Adekunle, O.N., [3]Onabanjo, M.A. and [4]Adesola, D.A.

[1,3]Department of Biological Science, Tai Solarin Federal University of Education, Ijagun, Nigeria
[2,4]Department of Zoology and Environmental Biology, Olabisi Onabanjo University, Ago Iwoye, Nigeria

Submitted: January 2026; Accepted: April 2026; Published: April 2026

ABSTRACT

Schistosomiasis remains a major neglected tropical disease of public health importance, particularly in sub-Saharan Africa where transmission is sustained by freshwater snail intermediate hosts. This study investigated the occurrence of *Schistosoma spp* infection in *Bulinus* and *Biomphalaria* snails collected from Iriwo and Ajeri streams in Ago-Iwoye, Ogun State, Nigeria. Snail sampling was conducted fortnightly between August 2024 and July 2025 using standard scooping and hand-picking techniques. Collected snails were identified morphologically and screened for *Schistosoma spp* infection using cercarial shedding and crushing methods. A total of 765 snails were collected from both streams, out of which 79 were infected, giving an overall prevalence of 10.3%. Of the total snails, 614 (80.3%) were obtained from Iriwo stream and 151 (19.7%) from Ajeri stream. The prevalence of infection was 9.4% in Iriwo and 13.9% in Ajeri streams. The snail species identified included *Bulinus globosus*, *Bulinus truncatus*, and *Biomphalaria pfeifferi*, with *B. globosus* accounting for the highest proportion of infected snails. Seasonal variation in infection was statistically significant ($p < 0.05$), with higher prevalence observed during the dry season compared to the wet season. However, no significant difference was observed in infection prevalence between the two streams ($p > 0.05$), while infection varied significantly among snail species ($p < 0.05$). The detection of infected snails in both streams indicated sustained transmission potential of schistosomiasis in the study area. These findings highlight the role of freshwater bodies as transmission foci and underscore the need for integrated control strategies, including public health education, improved water sanitation, and targeted snail control interventions to reduce transmission risk.

Keywords: Schistosomiasis, snail infection, transmission potential, endemic, cercariae, *Bulinus*, *Biomphalaria*

***Corresponding author's email:** uthmanto@tasued.edu.ng, +2348038007210 / ORCID: 0000-0002-6507-9165

INTRODUCTION

Schistosomiasis is a chronic parasitic disease caused by trematodes of the genus Schistosoma and remains one of the most important neglected tropical diseases globally [1,2]. According to the World Health Organization, more than 200 million people are infected worldwide, with the majority of cases occurring in sub-Saharan Africa, where environmental and socio-economic conditions favor sustained transmission [3,4,5]. In Nigeria, schistosomiasis continues to pose a significant public health challenge, particularly among rural populations and school-aged children who frequently come into contact with infested water bodies [6].

Transmission of schistosomiasis is closely linked to freshwater ecosystems that support specific snail intermediate hosts. Species of the genera *Bulinus* and *Biomphalaria* play a crucial role in the life cycle of the parasite, serving as obligatory hosts for the development and release of cercariae, the infective stage to humans [7,8,9]. Human infection occurs through direct skin contact with water containing free-swimming cercariae released from infected snails [1]. Consequently, the presence of infected snails, particularly those actively shedding cercariae, is widely regarded as a key indicator of transmission potential in endemic environments [10].

In many endemic communities, human activities such as bathing, washing, fishing, and water collection increase the frequency of contact with potentially contaminated water sources, thereby sustaining the transmission cycle [11,12]. Previous studies in southwestern Nigeria have reported the occurrence of urinary schistosomiasis among school children and have identified freshwater bodies as important transmission foci [13,14]. However, there is limited recent information on the infection status of snail intermediate hosts and the associated transmission potential in specific localities such as Ago-Iwoye.

Understanding the distribution, infection status, and seasonal dynamics of snail intermediate hosts is essential for assessing transmission risk and designing effective control strategies [15]. In particular, the detection of Schistosoma-infected snails and evidence of cercarial shedding provide critical insights into the possibility of ongoing transmission in endemic settings [10,16].

Therefore, this study aimed to investigate the occurrence of Schistosoma infection in freshwater snails from Iriwo and Ajeri streams in Ago-Iwoye, Ogun State, Nigeria, and to assess the potential of these water bodies to serve as transmission foci for schistosomiasis.

MATERIALS AND METHODS

Study Area

The study was conducted in Ago-Iwoye, located in Ijebu North Local Government Area of Ogun State, southwestern Nigeria. The area lies within the tropical rainforest zone and is characterized by a humid climate with distinct wet and dry seasons. The freshwater bodies investigated were Iriwo and Ajeri streams. These streams serve as sources of domestic water and are frequently visited for activities such as washing, bathing and fishing, thereby increasing the risk of human-water contact and potential transmission of schistosomiasis. A map showing the study

area and the sampling points is presented in Figure 1.

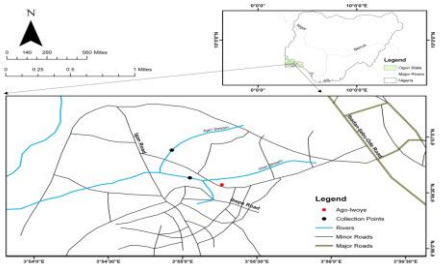

Figure 1: Map of Ago Iwoye showing snail sampling points.

Sampling Design and Snail Collection

Snail sampling was conducted fortnightly from August 2024 to July 2025. At each visit, sampling was carried out for approximately 30 minutes per stream between 8:00 am and 11:00 am. Snails were collected manually and using scoops from substrates such as aquatic vegetation, stones, submerged leaves and muddy surfaces along the stream margins. Collected snails were placed in labeled, perforated containers containing dechlorinated water to maintain viability and were transported to the laboratory for analysis.

Snail Identification

Snails were identified to species level using standard morphological keys based on shell characteristics [17,18]. Identified species included *Bulinus globosus, Bulinus truncatus*, and *Biomphalaria pfeifferi*.

Detection of Schistosoma Infection

Snails were screened for patent *schistosoma* infection using cercarial shedding technique. Each snail was individually placed in a test tube containing distilled water and exposed to sunlight for 6 hours to induce cercarial shedding. The water was then examined under microscope for presence of cercariae. Snails that did not shed cercariae were subsequently crushed between glass slides and examined microscopically for prepatent infections.

Data Analysis

Data obtained from snail collection and infection screenings were analyzed using SPSS version 22. The prevalence of *Schistosoma* infection was calculated as the proportion of infected snails relative to total number examined and expressed in percentages. Differences in infection prevalence between streams and among snail species were assessed using Chi-square (X^2) test. Results were considered statistically significant at $p < 0.05$.

RESULTS

A total of 765 snails were collected from Iriwo and Ajeri streams in Ago Iwoye, Ogun State. 614 (80.3%) of the total snails collected were from Iriwo stream (Table 1), while 151 (19.7%) of the snails collected were from Ajeri stream (Table 2). Out of the total snails examined, 79 (10.3%) were infected. Fifty-eight (9.4%) of the infected were from Iriwo, while 21 (13.9%) were from Ajeri stream. The species of snails collected from both Iriwo and Ajeri Streams were *Bulinus globosus, B. truncatus and Biomphalaria pfeifferi.*

Table 1: Monthly abundance and infection rate of snails in Iriwo Stream, Ago Iwoye, Ogun State

Month/ Year	*B. globosus*			*B. truncatus*			*B. pfeifferi*		
	Collected	Infected	% Infected	Collected	Infected	% Infected	Collected	Infected	% Infected
Aug. 2024	19	2	10.5	16	0	0.0	11	1	9.1
Sept. 2024	24	1	4.2	22	2	9.1	10	0	0.0
Oct. 2024	27	4	14.8	15	2	13.3	8	2	25.0
Nov. 2024	41	6	14.6	29	4	13.8	19	2	10.5
Dec. 2024	0	0	0.0	0	0	0.0	0	0	0.0
Jan. 2025	0	0	0.0	0	0	0.0	0	0	0.0
Feb. 2025	5	1	20.0	2	0	0.0	1	0	0.0
Mar. 2025	47	5	10.6	41	2	4.9	14	1	7.1
April 2025	56	5	8.8	36	2	5.6	22	3	13.6
May 2025	34	3	8.9	21	2	9.5	18	0	0.0
June 2025	14	1	7.1	11	1	9.1	16	1	6.3
July 2025	16	1	6.3	10	0	0.0	12	2	16.7
Total	272	29	10.7	203	15	7.4	139	14	10.1

Table 2: Monthly abundance and infection rate of snails in Ajeri Stream, Ago Iwoye, Ogun State

Month/ Year	*B. globosus*			*B. truncatus*			*B. pfeifferi*		
	Collected	Infected	% Infected	Collected	Infected	% Infected	Collected	Infected	% Infected
Aug. 2024	6	0	0.0	2	0	0.0	2	0	0.0
Sept. 2024	3	1	33.3	6	0	0.0	3	0	0.0
Oct. 2024	3	1	33.3	3	0	0.0	2	0	0.0
Nov. 2024	6	2	33.3	3	1	33.3	3	1	33.3
Dec. 2024	5	1	20.0	2	1	50.0	2	1	50.0
Jan. 2025	0	0	0.0	0	0	0.0	0	0	0;0
Feb. 2025	9	2	22.2	7	1	14.3	2	0	0.0
Mar. 2025	16	1	6.3	5	1	20.0	4	1	25.0
April 2025	13	1	7.7	9	2	22.2	7	2	28.66
May 2025	6	0	0.0	3	0	0.0	6	0	0.0
June 2025	4	1	25.0	1	0	0.0	2	0	0.0
July 2025	6	0	0.0	0	0	0.0	0	0	0.0
Total	**77**	**10**	**13.0**	**41**	**6**	**14.6**	**33**	**5**	**15.2**

Infection was detected in all three snail species from both streams. *B. globosus* recorded the highest number of infected snails in both Iriwo and Ajeri streams, followed by *B. truncatus* and *B. pfeifferi*.

Table 3: Seasonal distribution of *Schistosoma*-infected snails in Iriwo and Ajeri streams

Season	Stream	Total Snails collected	Infected Snails	Prevalence (%)
Wet season (April – October)	Iriwo	498	40	8.0
	Ajeri	126	12	9.5
Wet Season Total		624	52	8.3
Dry Season (November – March)	Iriwo	116	18	15.5
	Ajeri	25	9	36.0
Dry Season Total		141	27	19.1
Grand Total		765	79	10.3

The seasonal distribution of snail populations demonstrated a clear variation between wet and dry periods. The wet season (April – October) accounted for the majority of snails collected (624; 81.6%), reflecting favourable ecological conditions such as increased rainfall, expanded aquatic habitats and enhanced vegetation growth that support snail proliferation. However, infection prevalence was higher during the dry season (19.1%) compared to the wet season (8.3%). Ajeri stream showed particularly high dry-season infection prevalence (37.1%), suggesting a localized transmission hotspot during periods of reduced water volume. Overall, both streams demonstrate continuous transmission potential, with wet season supporting snail population expansion and dry season enhancing infection concentration, thereby sustaining year-round schistosomiasis transmission.

T

able 4: Chi-square (X^2) tests assessing factors associated with *Schistosoma* infection in freshwater snails

Variable	Comparison	X^2 value	Df	p-value
Seasons	Wet and Dry	14.50	1	0.001
Stream	Iriwo and Ajeri	0.62	1	0.43
Snail species	*B. globosus, B. truncates, B. Pfeifferi*	10.17	1	0.006

The Chi-square test revealed a significant association between season and *Schistosoma* infection in snails. There was no statistically significant association between stream location and *Schistosoma* infection. A statistically significant association was observed between snail species and infection status.

Infected snails were recorded in both streams across the study period, with variation in distribution among species and seasons.

DISCUSSION

The present study demonstrated an overall *Schistosoma* infection prevalence of 10.3% among freshwater snails collected from Iriwo and Ajeri streams, confirming the presence of infected intermediate hosts and indicating sustained transmission potential in the study area. The detection of cercariae infected *Bulinus* and *Biomphalaria* species further supports the likelihood of both urinary and intestinal schistosomiasis transmission.

The observed prevalence is comparable to earlier reports from southwestern Nigeria.

For instance, Oso and Odaibo [19] and Omonijo et al. [20] reported active transmission of urinary schistosomiasis in Ogun and Ekiti States respectively, linking infection to the presence of *Bulinus* species in local water bodies. Similarly, Agbolade et al. [21] identified transmission foci in Ijebu North, emphasizing the role of freshwater habitats in sustaining the parasite lifecycle. The consistency between these earlier findings and the present study suggests that schistosomiasis transmission has remained persistent in the Ago-Iwoye area over time.

However, the infection prevalence observed in this study is slightly higher compared to some localised reports, but lower than values documented in highly endemic regions of Nigeria. For example, studies in northern Nigeria, Istifanus et al. [22] had reported higher snail infection rates, possibly due to differences in ecological conditions, water use patterns, and control interventions. These variations highlight the focal nature of schistosomiasis transmission and the importance of localized ecological assessments.

The predominance of *B. globosus* as the most infected species in this study aligns with previous findings that identified it as a major intermediate host of *Schistosoma haematobium* in Nigeria [23]. Its higher infection rate and widespread distribution reinforced its epidemiological importance in sustaining transmission. The detection of infected *B. pfeifferi* also indicated the potential for *S. mansoni* transmission, although typically at lower intensities compared to *S. haematobium* in southwestern Nigeria.

Seasonal variation observed in this study provides further insight into transmission dynamics. Although snail abundance was higher during the wet season, infection prevalence was significantly higher in the dry season. This pattern is consistent with findings by Grimes et al. [11] and Anagbogu [24] who reported that reduced water volume during dry periods leads to increased concentration of both snails and cercariae, thereby enhancing transmission efficiency. Moser et al. [25] also reported that the proportion of infected *Bulinus* species was highest in the months of April and May following the dry season and just before the rainy season. The particularly high dry-season infection prevalence observed in Ajeri stream suggests the presence of localised transmission hotspots under conditions of reduced water flow.

Despite the absence of statistically significant differences in infection prevalence between the two streams, both water bodies harboured infected snails throughout the study period. This indicates that transmission potential is not restricted to a single focal point but is distributed across multiple sites within the community. Such findings are consistent with the concept of "micro-geographical transmission foci" described in schistosomiasis epidemiology.

In conclusion, the study confirms that Iriwo and Ajeri streams serve as active transmission foci for schistosomiasis in Ago-Iwoye. The persistence of infected snail populations, coupled with seasonal variation in infection intensity, underscores the need for targeted control measures. These should include periodic mass drug administration, environmental management of snail habitats and community-based health education to

reduce human-water contact and interrupt transmission.

DECLARATION

Authors' Contributions

TOO Conceived and designed the study, supervised and coordinateed all aspects of the research across study sites and laboratory, led manuscript drafting and handled all correspondence with the journal. O.N. validated laboratory procedures and analytical methods, conducted statistical analysis and revised the manuscript. MA and D.A. conducted collected samples, performed laboratory analyses and also contributed to initial data analysis and manuscript drafting. All authors read and approved of the final manuscript and agree to be accountable for all aspects of the work.

Conflicts of interest/Competing interests:

The authors have no relevant financial or non-financial interests to disclose.

Funding:

The authors did not receive support from any organization for the submitted work.

REFERENCES

1. Di Bella S., Riccardi N., Giacobbe D.R., Luzzati R. (2018). History of schistosomiasis (bilharziasis) in humans: from Egyptian medical papyri to molecular biology on mummies. Pathogens and Global Health. 112(5):268–273. Doi: 10.1080/20477724.2018.1495357 .

2. Ekloh W, Asafu-Adjaye A, Tawiah-Mensah CNL, Ayivi-Tosuh SM, Quartey NK, Aiduenu AF, Gayi BK, Koudonu JAM, Basing LA, Yamoah JAA, Dofuor AK, Osei JHN. (2024). A comprehensive exploration of schistosomiasis: Global impact, molecular characterization, drug discovery, artificial intelligence and future prospects. Heliyon. 14;10(12):e33070. Doi: 10.1016/j.heliyon.2024.e33070. PMID: 38988508; PMCID: PMC11234110.

3. Aula O.P., McManus D.P., Jones M.K., Gordon C.A. (2021). Schistosomiasis with a focus on Africa. Tropical Medicine and Infectious Disease. 6(3) doi: 10.3390/tropicalmed6030109.

4. Kokaliaris C, Garba A, Matuska M, Bronzan RN, Colley DG, et al. (2022). Effect of preventive chemotherapy with praziquantel on schistosomiasis among school-aged children in sub-Saharan Africa: a spatiotemporal modelling study. Lancet Infectious Diseases. 22(1):136-149. Doi: 10.1016/S1473-3099(21)00090-6.

5. World Health Organization (WHO) (2024). Schistosomiasis (fact sheet). https://www.who.int/news-room/fact-sheets/detail/schistosomiasis

6. Taiwo, O.T., Sam-Wobo, S.O., Ademolu, K.O. et al. (2026). Evaluation of Schistosoma mansoni in water sanitation and hygiene-based communities, and associated risk factors in Ogun Central, Nigeria. Discover Public Health 23, 135 https://doi.org/10.1186/s12982-026-01471-7

7. Gaye, P.M., Doucouré, S., Sow, D., Sokhna, C., Ranque, S. (2024). Freshwater snail-borne parasitic diseases in Africa. Tropical Medicine and Health. 20;52(1):61. Doi: 10.1186/s41182-024-00632-1. PMID: 39304958; PMCID: PMC11414283.

8. Ekin, İ. (2022). *Schistosoma* species and their intermediate hosts: a research on the presence of *Bulinus truncatus* host in Southeast Anatoli.

9. McManus, D.P., Dunne, D.W., Sacko, M. Utzinger, J. Vennervald, B.J. & Zhou, X.N. (2018). Schistosomiasis. *Nature Reviews Diseases Primers.* 9:4(1):13. doi: 10.1038/s41572-018-0013-8. PMID: 30093684.

10. Kamel, B., Laidemitt, M.R., Lu, L., Babbitt, C., Weinbaum, O.L., Mkoji, G.M., Loker, E.S. (2021). Detecting and identifying Schistosoma infections in snails and aquatic habitats: A systematic review. PLoS Neglected Tropical Diseases. 24;15(3):e0009175. Doi: 10.1371/journal.pntd.0009175. PMID: 33760814; PMCID: PMC8021170.

11. Grimes, J.E., Croll, D., Harrison, W.E., Utzinger, J., Freeman, M.C. & Templeton, M.R. (2015). The roles of water, sanitation and hygiene in reducing schistosomiasis: a review. Parasites & Vectors. Mar 13;8:156. Doi: 10.1186/s13071-015-0766-9. PMID: 25884172; PMCID: PMC4377019.

12. Sidibé, B., Agniwo, P., Diakité, A. et al. (2024). Human-water interactions associated to cercarial emergence pattern and their influences on urinary schistosomiasis transmission in two endemic areas in Mali. Infectious Diseases of Poverty, 13, 62 https://doi.org/10.1186/s40249-024-01229-w

13. Mafiana, C.F., Ekpo, U.F. & Ojo, D.A. (2003). Urinary schistosomiasis in preschool children in settlements around Oyan Reservoir in Ogun State, Nigeria: implications for control. Tropical Medicine and International Health. 8(1):78-82. Doi: 10.1046/j.1365-3156.2003.00988.x. PMID: 12535255.

14. Singh, K., Muddasiru, D. & Singh, J. (2016). Current status of schistosomiasis in Sokoto, Nigeria. Parasites Epidemiology and Control. 23;1(3):239-244. Doi: 10.1016/j.parepi.2016.08.003. PMID: 29988177; PMCID: PMC5991846.

15. Balogun, J.B., Adewale, B., Balogun, S.U., Lawan, A., Haladu, I.S., Dogara, M.M., Aminu, A.U., Caffrey, C.R., De Koning, H.P., Watanabe, Y. and Balogun, E.O. (2022). Prevalence and Associated Risk Factors of Urinary Schistosomiasis among Primary School Pupils in the Jidawa and Zobiya Communities of Jigawa State, Nigeria, Annals of Global Health, 88(1), 71. https://doi.org/10.5334/aogh.3704.

16. Abokwara, A., Madubueze, C. & Chirove, F. (2025). Understanding schistosomiasis transmission: A systematic review of mathematical models. Scientific African. 30.

E03077. 10.1016/j.sciaf.2025.e03077.

17. Brown, D.S. & Kristenseen, T.K. (1993). A field guide to African Freshwater snails: West African species. Danish Bilharziasis Laboratory

18. Danish Bilharziasis Laboratory (1980). A practical guide to the identification of African freshwater snails. World Health Organisations.

19. Oso, O.G. & Odaibo, A.B. ((2020). Human water contact patterns in active schistosomiasis endemic areas. Journal of Water and Health. 18(6):946-955. doi: 10.2166/wh.2020.147. PMID: 33328366.

20. Omonijo, A.O., Asaolu S.O. and Ofoezie, I.E. (2013). Schistosomiasis Transmission and Water Contact Pattern in River Ureje in Ado-ekiti Local Government Area, Ekiti State. Research Journal of Parasitology, 8: 26-36

21. Agbolade, O.M., Akinboye, D.O., Fajebe, O.T., Abolade, O.M., & Adebambo, A.A. (2004). Human urinary schistosomiasis transmission foci and period in an endemic town of Ijebu North, Southwest Nigeria. Tropical Biomedicine, 21(Suppl), 15–22.

22. Istifanus, William & Panda, Sam & Sunday, Inusa. (2018). Transmission patterns among freshwater snail hosts of schistosomiasis in Bauchi area of Nigeria. GSC Biological and Pharmaceutical Sciences. 2. 018-024. 10.30574/gscbps.2018.2.2.0006.

23. Arora, D.R. & Arora, B.B. (2014). Medical Parasitology (4th ed.). CBS Publishers & Distributors Pvt. Ltd., New Delhi.

24. Anagbogu, I.N,, Jacob, S.M., Malann, Y.D., Dankishiya, A.S., Abubakar, A., Agbana, T., Diehl, J.C. & Madara, A.A. (2026). Abundance and Seasonal Variations of Snail Intermediate Hosts of Schistosomiasis in the Federal Capital Territory, Abuja, Nigeria. International Journal of Environmental Research Public Health. 17;23(3):384. Doi: 10.3390/ijerph23030384. PMID: 41899760; PMCID: PMC13026216.

25. Moser, W., Greter, H., Schindler, C., Allan, F., Ngandolo, B.N., Moto, D.D., Utzinger, J. & Zinsstag, J. (2014). The spatial and seasonal distribution of Bulinus truncatus, Bulinus forskalii and Biomphalaria pfeifferi, the intermediate host snails of schistosomiasis, in N'Djamena, Chad. *Geospatial Health*. 9(1):109-18.