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# Prevalence of urinary schistosomiasis among school-aged children in Ipogun community, Ondo State, Nigeria

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## Abstract:

**Background:** Urinary schistosomiasis remains a public health challenge among school-aged children in Nigeria. The disease is caused by the blood fluke parasite, *Schistosoma haematobium* and harbored by freshwater snail intermediate hosts. Contact with infected surface water bodies made children vulnerable. This study investigated the prevalence of urinary schistosomiasis among school-aged children in Ipogun community, Ondo State, Nigeria.
**Methodology:** A total of 182 school-aged children (5-12 years of age) were randomly selected from the community for the study. Urine samples were collected from each participant on three consecutive days for macroscopic and microscopic examinations of the sediment to detect *S. haematobium* ova and determine the mean egg counts for positive cases. Information on children activities, knowledge of schistosomiasis and its treatment, socioeconomic status, demographics, risk factors and clinical manifestations, were obtained through structured questionnaires. Data were analysed using the Statistical Package for Social Sciences. Associations between variables were determined using ANOVA and Chi square test. Significant level was determined at $p \leq 0.05$.
**Results:** The prevalence of urinary schistosomiasis among the children was 32.4%, with prevalence of 23.1% for haematuria. The prevalence of urinary schistosomiasis was higher in males (34.5%) than females (28.6%) but the difference was not statistically significant ($p=0.42$). Participants in the 8-10 and 11-12-year age groups had the highest prevalence of urinary schistosomiasis (35.3% each, $p=0.36$) and those in the age group 11-12 years had the highest haematuria prevalence (35.3%, $p=0.18$) but the difference in prevalence was not statistically significant. Difference in the mean *S. haematobium* egg count across the age groups was also not statistically significant ($p=0.85$).
**Conclusion:** Since relatively high prevalence of urinary schistosomiasis was observed in the study area, there is need for urgent attention to control the infection in the study area.

**Keywords:** urinary schistosomiasis, egg count; prevalence, school-aged children, Ondo State, Nigeria

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# Prévalence de la schistosomiase urinaire chez les enfants d'âge scolaire de la communauté d'Ipogun, État d'Ondo, Nigéria

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## Résumé:

**Contexte:** La schistosomiase urinaire demeure un problème de santé publique chez les enfants d'âge scolaire au Nigéria. Français La maladie est causée par le parasite de la douve du sang, *Schistosoma haematobium*, et hébergée par des hôtes intermédiaires d'escargots d'eau douce. Le contact avec des plans d'eau de surface infectés a rendu les enfants vulnérables. Cette étude a examiné la prévalence de la schistosomiase urinaire chez les enfants d'âge scolaire de la communauté d'Ipogun, dans l'État d'Ondo, au Nigéria.
**Méthodologie:** Un total de 182 enfants d'âge scolaire (5 à 12 ans) ont été sélectionnés au hasard dans la communauté pour l'étude. Des échantillons d'urine ont été prélevés sur chaque participant pendant trois jours consécutifs pour des examens macroscopiques et microscopiques du sédiment afin de détecter les œufs de *S. haematobium* et de déterminer le nombre moyen d'œufs pour les cas positifs. Des informations sur les activités des enfants, les connaissances sur la schistosomiase et son traitement, le statut socio-économique, les données

démographiques, les facteurs de risque et les manifestations cliniques ont été obtenues au moyen de questionnaires structurés. Les données ont été analysées à l'aide du progiciel statistique pour les sciences sociales. Les associations entre les variables ont été déterminées à l'aide d'une ANOVA et du test du Chi carré. Le niveau de signification a été déterminé à $p \leq 0,05$.
**Résultats:** La prévalence de la schistosomiase urinaire chez les enfants était de 32,4%, avec une prévalence de 23,1% pour l'hématurie. La prévalence de la schistosomiase urinaire était plus élevée chez les hommes (34,5%) que chez les femmes (28,6%), mais la différence n'était pas statistiquement significative ($p$=0,42). Les participants des groupes d'âge 8-10 et 11-12 ans avaient la prévalence la plus élevée de schistosomiase urinaire (35,3% chacun, $p$=0,36) et ceux du groupe d'âge 11-12 ans avaient la prévalence la plus élevée d'hématurie (35,3%, $p$=0,18), mais la différence de prévalence n'était pas statistiquement significative. La différence dans le nombre moyen d'œufs de *S. haematobium* entre les groupes d'âge n'était pas non plus statistiquement significative ($p$=0,85).
**Conclusion:** Étant donné la prévalence relativement élevée de la schistosomiase urinaire observée dans la zone d'étude, il est urgent de lutter contre l'infection.

**Mots-clés:** schistosomiase urinaire, numération des œufs ; prévalence, enfants d'âge scolaire, État d'Ondo, Nigéria

## Introduction:

Urinary schistosomiasis is a water borne parasitic disease affecting over 240 million people of all ages globally (1,2). The disease is second to malaria in parasitic burden (2). It is also known as snail fever or bilharzia, named after its discoverer, Theodor Bilharz (3,4). Urinary schistosomiasis is caused by the blood fluke trematode, *Schistosoma haematobium*, and man serves as the definitive host (5). Adult schistosome worms lay eggs in the blood vessels supplying the bladder of man (6) and these eggs are released into the water bodies through urination. Under appropriate conditions the eggs hatch and release miracidia which swim to locate freshwater snail intermediate hosts. The miracidia undergo series of developmental changes inside the freshwater snail intermediate hosts until a final stage called cercariae emerged (5). Infection takes place when cercariae of the schistosome parasite penetrates human skin and then migrate through the circulatory system to develop into adult worms (7).

Urinary schistosomiasis has an important impact on human health, leading to reduced productivity and reproductive issues, and causing severe medical conditions (2). It is prevalent in many parts of the world including Nigeria (8,9), posing a significant challenge to public health with social and economic consequences (10). The disease disproportionately affects school-aged children due to their frequent water contact during domestic and recreational activities which lead to severe morbidity such as haematuria, bladder dysfunction, and chronic kidney damage (11-13).

Nigeria is one of the countries bearing highest burdens of urinary schistosomiasis globally and endemic in many rural and peri-urban areas especially where there is limited access to clean water and sanitation facilities (14,15,16). The transmission is still active in Nigeria and poses a serious health challenge. Although Mass Drug Administration (MDA) has been used to reduce morbidity, but this has not been adequate to abate transmission in many areas in the country (1). The country in its National Schistosomiasis Elimination Progr amme (NSCHEP) with the support of international partners has been implementing preventive chemotherapy with the use of praziquantel for fifteen years which has yielded reduction in morbidity but yet transmission in some communities is still noticeable. Urinary schistosomiasis related issues such as haematuria are sometimes linked to school-aged group and some communities regard the condition as normal and sign of maturity, due to lack of knowledge about the disease (13,17).

The disease is known to reduce cognitive and academic abilities of children and also results in poor physical development. The World Health Organization (WHO) set morbidity reduction of <5% prevalence target in children aged 5 to 14 years by 2020 for endemic countries, yet Nigeria is still far from achieving this target despite efforts to mitigate the transmission (1). Five years beyond, the WHO target calls for determination of the infection status in most endemic areas in Nigeria. This study focused on urinary schistosomiasis among school-aged children in Ipogun community of Ondo state, Nigeria with the objective of determining the prevalence of urinary schistosomiasis among school-aged children in the community. Although various researches on schistosomiasis had been carried out in this community (18-20) which had invoked control interventions, schistosomiasis appeared to persist in this area. Thus, monitoring the successes of such interventions becomes necessary, hence, the need for this study.

## Materials and method:

**Study area:**

The study was conducted in Ipogun community (7°19'N; 5°05'E), a town in Ifedore Local Government Area (LGA) of Ondo State, Nigeria. The "Aponmu" river, which flows through the community serves as major source of water for agricultural and domestic purposes. The river had been reported to harbour freshwater snail species including *Bulinus* species (19), which are good intermediate hosts of *S. haematobium* that cause urinary schistosomi-

asis.

Children usually visit the river for recreational activities while women visit the river to fetch water for domestic and household usage, and most men who are primarily farmers use the water for farming activities. Other sources of water in the community include "Asala" and "Odo-lona-oko" rivers which are also visited by the community members. Ipogun community was purposely chosen for this study based on the earlier findings of urinary schistosomiasis in the area (18).

**Ethical consideration:**

Ethical approval (OSHREC08/09/22/472) to conduct this study was obtained from the State Health Research Ethics Committee, Ministry of Health, Akure, Ondo State, Nigeria. Approval to conduct the study was also granted by the community leaders, school heads and parents of the children who participated in the study.

**Study design and participants:**

This was a descriptive cross-sectional study of school-aged children (5-12 years old) carried out between January and March 2024, upon obtaining the consent of their parents.

**Sample size calculation and sampling:**

The sample size of 182 children was determined using the formula of Taro Yamane for a finite population (21). The children were randomly selected from six primary schools in the local government area that gave approval for the children to participate in the study. Only children enrolled in the selected schools and those whose parents consented to participate were included in the study. Children who had not been in the community for a year or more, as well as those whose parents or guardians declined consent were excluded from the study.

**Sample and data collection:**

Clean-catch specimen of terminal urine were collected from selected children between the period 12:00 noon and 2:00 p.m. Individual participant/parent/guardian received a sterile, screw-capped universal bottle labelled with a unique identification number (22). The urine samples were collected on three consecutive days from each study participant. The samples were immediately stored in a cool box with ice packs before transportation to the Biological Sciences Laboratory, Joseph Ayo Babalola University, Ikeji-Arakeji, in black polythene bags to prevent the hatching of eggs from light penetration (22,23).

Structured questionnaires were also administered to collect information on socio-economic status, demographics, risk factors, and clinical manifestations from each participant/parent/guardian (22).

**Parasitological examination of urine:**

Macroscopic examination of the urine samples in each universal bottle was done to determine the colour for presence of blood and for clarity (22). The urine sample was first properly mixed to re-suspend urine deposits, following which 10 ml was transferred into a centrifuge tube using a sterile disposable syringe, and centrifuged for 5 minutes at 1500 rpm. Following the decantation of the supernatant, the tube was gently tapped to re-suspend the urine deposit. A drop of the re-suspended deposit was transferred to a clean grease-free glass slide with a Pasteur pipette and covered with a cover slide. The preparation was then examined under a compound light microscope (Olympus model CX31RBS FA) for the presence of *S. haematobium* eggs with 40x objective lens and an iris diaphragm suitably closed to obtain good contrast (22).

The entire sample on the glass slide was examined and the eggs with characteristic terminal spine were counted. The egg count was determined as; total eggs counts/total volume of the urine (×100). The mean (±standard deviation) egg count for each participant was determined from the egg counts of three consecutive samples.

**Statistical analysis:**

Data were analysed using the Statistical Package for Social Sciences (SPSS) version 21.0 (IBM Corp., Armonk, NY, USA). One-way analysis of variance (ANOVA) was used to determine differences in the mean ova count and Chi square test was used to determine association of infection prevalence with demographic and other factors, among the study participants. Significant level was determined at $p \leq 0.05$.

## Results:

**Socio-demographic characteristics and risk factors in the study participants:**

A total of 182 children participated in the study (Table 1). Majority of the participants (n=119, 65.4%) were males while 63 (34.6%) were females. Of the 182 participants, 15 (8.2%) usually fetch water from rivers for domestic use while 167 (91.8%) usually fetch water for the same purpose from wells. Meanwhile, 123 (67.6%) of the participants claimed not to have contact with surface water either by entering to fetch water or by swimming. However, 59 (32.4 %) responded that they used to have contact with surface water.

Majority of the participants (n=174, 95.6%) claimed to have good knowledge of schistosomiasis while only 8 (4.4%) did not have any knowledge of the disease. However, 63 (34.6%) of the participants had received

treatment against schistosomiasis at one time or the other (Table 1). The occupation of the parents of the participants is also presented in Table 1. Those who engaged in farming were 33.0%, while 12.6% of them were fishermen. Others were civil servants and traders.

**Prevalence and clinical features of urinary schistosomiasis among the study participants:**

The prevalence of urinary schistosomiasis among the participants in the study area is presented in Table 2. The overall prevalence among the participants was 32.4% (59/182)**.** The prevalence of the infection was higher in males (34.5%, 41/119) than females (28.6 %, 18/63), but the difference was not statistically significant ($\chi^2$**=**0.65, *p*=0.42).

The appearance of the urine of the study participants is shown in Table 3. Majority of the of the study participants (40.7%) had light yellow and cloudy urine, 27.5% had pale yellow and highly turbid urine, 12.1% had transparent and colorless urine, 11.0% had yellow and slightly turbid urine and 8.8 % had amber and moderately cloudy urine. Among the participants with light yellow and cloudy urine (n=74), 25.7% were infected, for pale yellow and highly turbid urine (n=50), 42.0% were infected, for yellow and slightly turbid urine (n=20), 50.0% were infected, for transparent and colorless urine (n=22), 22.7% were infected and for amber and moderately cloudy urine (n=16), 25.0% were infected. The prevalence of urinary schistosomiasis with respect to the different appearance of the urine was statistically significant (*p*=0.01) (Table 3).

Table 1: Demographic characteristics of the study participants in Ipogun community, Ondo State, Nigeria *

| Variable | Categories | Frequency | Percentage (%) | 95% CI |
|---|---|---|---|---|
| Sex | Male | 119 | 65.4 | 60.21 – 69.91 |
| | Female | 63 | 34.6 | 30.09 – 49.79 |
| Source of water for use | River | 15 | 8.2 | 6.34 – 10.67 |
| | Well | 167 | 91.8 | 86.66 – 92.64 |
| Water contact | No | 123 | 67.6 | 61.50 – 70.74 |
| | Yes | 59 | 32.4 | 25.92 – 35.49 |
| Informed about schistosomiasis | Yes | 174 | 95.6 | 88.66 – 97.64 |
| | No | 8 | 4.4 | 2.44 – 6.51 |
| Treated for schistosomiasis | No | 119 | 65.4 | 61.50 – 70.74 |
| | Yes | 63 | 34.6 | 29.26 – 38.50 |
| Occupation of parents | Civil servant | 48 | 26.37 | 7.57 – 14.65 |
| | Crop farming | 60 | 33.00 | 25.92 – 35.49 |
| | Trading | 51 | 28.02 | 7.23 – 13.86 |
| | Fishing | 23 | 12.61 | 4.47 – 26.43 |

CI = Confidence interval.

Table 2: Prevalence of urinary schistosomiasis in relation to sex of study participants in Ipogun community, Nigeria

| Sex | Number examined | Number infected (%) | $\chi^2$ | OR (95% CI) | *p* value |
|---|---|---|---|---|---|
| Male | 119 | 41 (34.5) | 0.65 | 1.314 (0.68-2.56) | 0.42 |
| Female | 63 | 18 (28.6) | | | |
| **Total** | 182 | 59 (32.4) | | | |

OR=Odd ratio; CI=Confidence interval

Table 3: Prevalence of urinary schistosomiasis in relation to urine appearance of study participants in Ipogun community

| Appearance of urine | Number examined (%) | Number infected | Prevalence of infection (%) |
|---|---|---|---|
| Light yellow and cloudy | 74 (40.7) | 19 | 25.7 |
| Pale yellow and highly turbid | 50 (27.5) | 21 | 42.0 |
| Yellow and slightly turbid | 20 (11.0) | 10 | 50.0 |
| Colorless and Transparent | 22 (12.1) | 5 | 22.7 |
| Amber and moderately cloudy | 16 (8.8) | 4 | 25.0 |
| **Total** | **182 (100)** | **59** | **32.4** |

% is calculated down the group, $\chi^2$ = 7.78, *P* = 0.01.

Table 4: Prevalence of urinary schistosomiasis, haematuria and mean egg counts with respect to age groups of the study participants in Ipogun community, Ondo State, Nigeria

| Age group (years) | Number examined | Number infected (%) | Number with haematuria (%) | Mean egg count/10 ml of urine |
|---|---|---|---|---|
| 5 – 7 | 29 | 5 (17.2) | 3 (10.3) | 5 ± 2.4 |
| 8 – 10 | 119 | 42 (35.3) | 27 (22.7) | 8 ± 4.0 |
| 11-12 | 34 | 12 (35.3) | 12 (35.3) | 6 ± 3.0 |
| **Total** | **182** | **59 (32.4)** | **42 (23.1)** | **5 ± 2.5** |
| | | $\chi^2$=2.05 | $\chi^2$=3.48 | $F$=0.52 |
| | | $p$=0.36 | $p$=0.18 | $p$=0.85 |

Analysis was made at a significance level of 5%

The prevalence of urinary schistosomiasis in relation to age groups of the participants is presented in Table 4. The highest prevalence of 35.3% each was recorded among the participants in the age groups 8-10 and 11-12 years while the least prevalence of infection (17.2%) was recorded in the age group 5-7 years. However, the difference in prevalence was not statistically significant ($\chi^2$ =2.05, $p$=0.36).

Similarly, participants in the age group 11-12 years had highest prevalence of haematuria (35.3%) followed by participants in the age group 8-10 years (22.7%) while the least (10.3%) was observed in group 5-7 years, but no statistically significant difference ($\chi^2$=3.48, $p$=0.18) existed in the prevalence of haematuria among the different age groups (Table 4). Likewise, the there was no statistically significant difference in the mean *S. haematobium* egg count among the different age groups ($F$=0. 524, $p$=0.85).

## Discussion:

The high prevalence of urinary schistosomiasis of 32.4% reported in this study confirms the continued endemicity of schistosomiasis in Ipogun community of Ondo State, Nigeria. This is in consonance with the findings of Kone et al., (24) and Balogun et al., (25) who reported schistosomiasis as still a common disease among Nigerian school-age children. The relatively high prevalence of urinary schistosomiasis in this study may be due to low mass treatment with praziquantel, the drug of choice for Mass Drug Administration (MDA) programme, in the study area.

Findings in this study showed that although the prevalence of urinary schistosomiasis was higher in males (34.5%) than females (28.6%), there was no significant disparity of infection based on gender ($p$= 0.42) whereas, past studies established significant differences in infection based on sex (26,27). The reason why this study did not show disparity of infection in relationship with gender might not be unconnected with the wide difference in the number of the males who participated in this study compared with the female participants. The number of male participants recruited was far higher than the female participants which was due to the low consent received from the parents of female children to participate in the study. Other studies however, attributed gender disparity of urinary schistosomiasis with swimming, fishing and herding of livestock, in which male children are more involved than the females (28).

Children within the age group 8-10 and 11-12 years had the highest prevalence of infection, which is in line with the report of Oniya et al., (18). In their study, children in these age groups were mostly affected by urinary schistosomiasis which they linked to frequent water contact and weaker immune defense. Therefore, providing health education that involve transmission and treatment of schistosomiasis at the elementary schools where majority of children at this age group could be easily reached is required to curb further increase in the prevalence of infection in the study area. Such education must be properly delivered to provide accurate and adequate knowledge. Also, there is need for community and government intervention to control the infection in the study area and possibly extended to other communities in Ondo State, Nigeria.

The behavioral practice of the study participants involving bathing or swimming in water bodies agrees with the findings in other African countries such as Malawi (29), Egypt (30) and Tanzania (31), which means, children naturally love to visit rivers and streams for recreations. Therefore, establishing public swimming pools that are well managed for recreational purposes is necessary to prevent children contact with the infected surface water bodies. In addition, potable water needs to be provided for community use to minimize the rate of parasitic infections and diseases, more especially, in the communities where urinary

schistosomiasis is endemic.

The color or appearance of urine may not necessarily be used as a diagnostic clinical symptom for people harboring schistosome parasites. This is because the participants who had the same urine appearance in this study consisted of individuals who both harbored urinary schistosome parasites and those without infection. However, the proportion of participants with urine that appeared yellow and highly turbid (42.0%) and those with pale yellow and turbid urine (50.0%) had significantly higher prevalence of urinary schistosomiasis than others ($p$=0.01), which may indicate that turbid urine is associated with urinary schistosomiasis. Urine colour is usually caused by factors such as urinary tract infection, kidney stones, insufficient water intake, or types of diet (32). Although, none of the urine of the participants was red or cola-cola/ brown colored, this does not rule out the presence of infection with *S. haematobium*.

## Conclusion:

Findings in this study confirm continuing existence of schistosomiasis in the study area which calls for comprehensive interventions. Such interventions should include targeted health education that focuses on transmission of the disease and mass treatment of the people in the study area. Further researches are also recommended, especially to survey the dynamics and distribution of freshwater snail intermediate hosts of schistosomes in the study area.

## Contributions of authors:

OOA and SYS were involved in the study conceptualization, design and data acquisition; OSS and OFO were involved in analysis and interpretation of data; OOA, SYS and OSS were in drafting of the manuscript; OOA and OFO were involved in critical revision of the manuscript for important intellectual content; SYS and OSS were involved in the statistical analysis; and OOA and OFO supervised the study. All authors approved the manuscript submitted for publication.

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## Conflicts of interest:

Authors declare no conflict of interest

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