Quantitative Assessment and Urinary Biochemical Parameters of *Schistosoma haematobium* Infections in Schools in Ebonyi State

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Abstract: *Schistosoma haematobium* is the only known agent of urinary schistosomiasis which is a chronic water-borne infection caused by digenetic trematodes that belong to the genus *Schistosoma.* Urinary schistosomiasis is noted to be more prevalent in Nigeria than intestinal schistosomiasis, due to the wider distribution of its snail hosts, *Bulinus species* as well as other socioeconomic factors. Ten (10 ml) of urine sample was collected from each of the informed and consenting pupils and secondary school students between 10am and 2pm. The biochemical parameters were analyzed using Combi – 9 test strips. Egg count per 10 ml of urine was performed using 10x and 40x objective lenses. A total of 485 urine specimens were collected from five different schools. Among the population studied, the overall prevalence of *Schistosoma haematobium* infection was 38.14% (185 of 485). The prevalence of urinary schistosomiasis among males was 40.74% (110 of 270) while that of females was 34.88% (75 of 215). The overall prevalence of the infection among the study population was statistically significant ($p<0.05$). Three biochemical parameters were observed among the positive cases. They are proteinuria, ketonuria and Ascorbic acid, with prevalence of 87.57% (162 of 185), 35.14% (65 of 185), and 40.54% (75 of 185) respectively. The prevalence of proteinuria among the positive cases was statistically significant ($p<0.05$), whereas those of ketonuria and ascorbic acid were statistically non – significant ($p>0.05$). The mean quantitative egg count was 17.2eggs/10ml of urine.
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Introduction

Schistosomiasis is a chronic water-borne infection caused by digenetic trematodes that belong to the genus *Schistosoma* [1]. *Schistosoma haematobium* is the only known agent of urogenital schistosomiasis [2]. It is transmitted by fresh water snails of the genus *Bulinus.* In humans, schistosomes reside in the mesenteric and vessical venules. They have a lifespan of many years and produce large number of eggs daily. The eggs produced must traverse the gut and bladder tissues on their way to the lumens of the excretory organs [3]. Many of the eggs remain in the host tissues, inducing immunologically – mediated granulomatous inflammation and fibrosis. Heavy worm burdens may produce hepatosplenic disease in *Schistosoma mansoni* and *japonicum cases,* and urinary tract disease in the case of *Schistosoma haematobium* [3]. Because schistosomes and their eggs utilize host metabolites, and because the host responses to the parasites are affected by its nutritional status, malnutrition may strongly affect both the parasite and the complex host – parasite relationships [4].

Urinary schistosomiasis caused by *Schistosoma haematobium* is noted to be more prevalent in Nigeria than intestinal schistosomiasis, due to the wider distribution of its snail host, *Bulinus species* [5], [6]. Indiscriminate passing of urine containing *S. haematobium* eggs into water supplies harbouring the snail host, also encourage transmission of the disease [7].

When compared with their adult counterparts, children with schistosomiasis harbor greater worm burden and are more intensely infected due to high transmission rates of the parasite and the frequency of exposure to infection sites [8]. Recent efforts to control schistosomiasis have led to renewed interest in quantifying egg counts.

The aim of the study was to establish the prevalence of urinary schistosomiasis among the study population and to carry out a quantitative assessment of the parasitic infections among the population as well as to determine the biochemical changes in the urine samples of infected subjects.

Materials and Methods

Study area

The study area is Ebonyi State, in Southeastern Nigeria. It has a tropical climate, with predominant rainforest vegetation, an average annual temperature of about 30^0C and an average annual rainfall of about $1500mm^3$. The study area has two distinct seasons (wet and dry). The wet season takes place between April and October while the dry season occurs from November to March.

The major sources of water supply in the communities studied are streams, ponds, and a few boreholes. There was relatively poor sanitation level and absence of proper toilet facilities hence defecation and urination are done on elevated plain ground, fenced off with palm fronds, inside the bush, and along flowing water bodies.

Primary and secondary schools in rural areas of two Local Government Areas were selected for this study. They are Ekpale Community Primary School, Ndufu-Ikwo and Ekawoke Community Secondary School, Ikwo, both in Ikwo Local Government Area. Others are St. Paul Primary and Secondary Schools, Etiti Uburu Primary and Secondary Schools, and Uburu Secondary School, all in Ohaozara Local Government Area.

Ethical consideration

Ethical clearance was sought for and obtained from the village heads, the principals, headmasters and headmistresses and from the supervising councilors for education, in the Local Government Areas studied.

Study population

The study was conducted among primary six pupils of primary schools and among junior secondary school students from classes 1-3. Simple random sampling technique was employed in recruiting the subjects. Only informed and consenting students were enrolled in the study. The participants were assured of the anonymity of the test results.

Sample collection

Ten (10) ml of urine specimen was collected from each of the informed and consenting pupils and secondary school students between 10am and 2pm after proper instructions on how to produce terminal urine specimens were issued to them orally. Afterwards, 0.1ml of formalin was added to the 10ml of the urine immediately after reception as a preservative to ensure the integrity of the schistosome eggs and to prevent them from hatching into miracidia. The specimens were subsequently conveyed to the laboratory for analysis.

Laboratory Analysis

Macroscopy

The specimens were examined macroscopically for color, turbidity and for the presence or absence of haematuria.

Urine chemistry and egg counts

The biochemical properties of the urine samples were examined for analysis using Combi – 9.

Ten (10) ml of urine was transferred to a conical test tube and allowed to sediment by gravity for 1hour. The supernatant was discarded while the sediments were transferred to a clean, grease - free microscope slide and was covered with a cover slip and examined microscopically, using 10x and 40x objectives respectively. Recovered *Schistosoma haematobium* eggs were identified, counted and recorded per 10ml of urine.

Data analysis

Data collected were analysed at $p< 0.05$ level of significance, using descriptive statistics. The analysis was performed with the aid of Statistical Programme for Social Sciences (SPSS) version 18.0**.**

Results

The studied five schools are: Ekpale Community Primary School, Ndufu-Ikwo, Ekawoke Community Secondary School, Ikwo, St Paul Primary and Secondary School, Enuokwe, Etiti Uburu Primary and Secondary and Uburu Secondary School, Ohaozara. The prevalences of schistosomiasis in those schools were: 23.81%, 47.62%, 19.04%, 57.14% and 46.15% respectively.

A total of 485 subjects were enlisted for this study, comprising of 270 males and 215 females. The ratio of males to females was 1.25:1. The ages of the subjects range from 9 years to 16 years, with a mean age of 11 years.

Among the population studied, the overall prevalence of *Schistosoma haematobium* infection was 38.14% (185 of 485). The prevalence among males was 40.74% (110 of 270) while that among females was 34.88% (75 of 215). The prevalence among the overall population was statistically significant ($p<0.05$), whereas the difference in the prevalence between males and females was statistically non – significant ($p>0.05$).

Among the positive specimens, the presence of three biochemical parameters was significant. They are proteinuria, ketonuria and Ascorbic acid, with prevalence of 87.57% (162 of 185), 35.14% (65 of 185), and 40.54% (75 of 185) respectively. The prevalence of proteinuria among the positive cases

was statistically significant (p>0.05), whereas the prevalence of ketonuria and ascorbic acid were statistically non – significant (p>0.05) respectively. Other parameters like bilirubin, nitrite, glucose, pH, and urobilinogen were all absent in specimens that were positive for *Schistosoma haematobium.* Haematuria was also positive in all the samples that were positive for urinary schistosomiasis. The mean quantitative egg count was 17.2eggs/10ml of urine.

Table 1: Prevalence of urinary schistosomiasis and mean parasite egg counts among the schools studied

Schools	Number examined	Number infected	Prevalence	Mean egg count
1	105	25	23.81	10
2	105	50	47.62	25
3	105	20	19.04	13
4	105	60	57.14	23
5	65	30	46.15	15

Key:
1: Ekpale Community Primary School, Ndufu-Ikwo,
2: Ekawoke Community Secondary School, Ikwo,
3: St Paul Primary and Secondary School, Enuokwe, Ohaozara
4: Etiti Uburu Primary and Secondary School, Ohaozara
5: Uburu Secondary School, Ohaozara.

Table 2: Gender prevalence of urinary schistosomiasis in the studied schools

Gender	Number examined	Number infected	Prevalence
Males	270	110	40.74
Females 215	74		34.42

Discussion

The overall prevalence of urinary schistosomiasis among the population studied was high (38.14%). This is comparable to other studies in Nigeria. Prevalence of 31.3% and 29.4% were found by other studies [9], [10]. A higher prevalence of 83.3% was found in the Niger Delta Area of Nigeria [11]. Also, a prevalence of 53.8% was found in Adim community, South South Nigeria [12].

The high prevalence of haematuria and proteinuria among the positive cases is comparable to the findings of other studies. A prevalence of 76.4% and 79.9% of haematuria and proteinuria respectively were found in Niger [13]. Also, a mean haematuria and proteinuria of 23.19 erythrocytes/µl and 49.9 mg/100ml was found among urinary schistosomiasis positive subjects [12].

The current study found a mean egg count of 17.2eggs/10ml of urine. This is in contrast to a higher quantitative mean egg count of 37.3eggs/10ml of urine found by [12].

This study was conducted among selected schools in rural areas in Ebonyi State, South Eastern Nigeria. The study area was characterized by few functional boreholes and water schemes. There is almost non – existent potable water supply for the community and the main sources of water supply are ponds, lakes, streams and rivers. The study was conducted among primary six pupils and among students within JSS1 – JSS3 classes of Junior Secondary Schools. The subjects always visit the water bodies in their community on their way back from school and spend time there playing, swimming and fighting .Urinary schistosomiasis transmission is known to be more prevalent with increased host-water contact periods.

Among the schools studied, the prevalence of urinary schistosomiasis was relatively low in subjects from St Paul Primary and Secondary Schools, Enuokwe (19.04%) as compared to higher prevalence of 23.81%, 47.62%, 57.14% and 46.15% in subjects from other schools. The difference might be attributable to the high level of discipline and decorum shown by the students from schools with lower prevalence. Access to the few functional boreholes available might have contributed immensely to the lower prevalence of the infection recorded in St.Paul Primary and Secondary Schools, as that can reduce the periods and frequencies of contact with infected water bodies.

The results of the current study when compared to the prevalence found in other studies conducted in Nigeria calls to question the role of the government in infection control. One of the ways of controlling schistosomiasis is the provision of potable water and mass treatment of the population with effective chemotherapeutic regimen like praziquantel. Manual boreholes that were provided are currently brokendown in the studied communities. As a result, the continuous dependence of the population on water

bodies that harbor the mollusks which serve as the intermediate hosts for schistosomiasis means that the infection will continue spreading. Increased education of the population about prevention strategies will reduce the prevalence of the disease.

Conclusion

This study underscores the need to increase prevention strategies against schistosomiasis among the population. Urinary biochemical parameters were observed to be consistently high among subjects positive for eggs of *Schistosoma haematobium,* they are haematuria and proteinuria.

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