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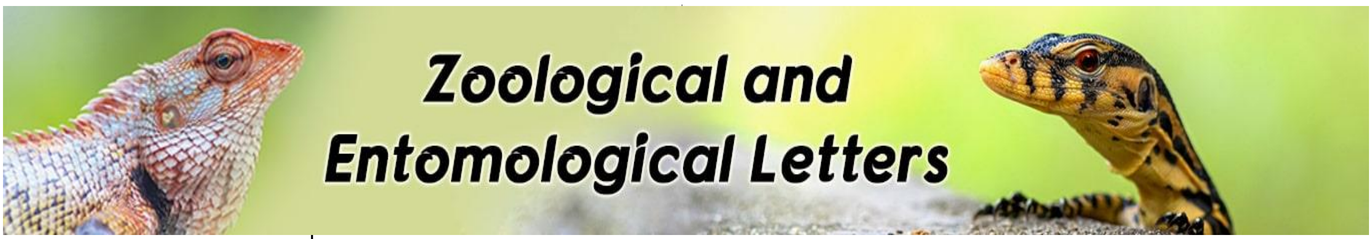

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Evaluation of urinary and intestinal schistosomiasis among primary School Pupils in Takum local government area, Taraba state, Nigeria

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Abstract
The study evaluated the prevalence of urinary and intestinal Schistosomiasis among Primary School Pupils in Takum Local Government Area, Taraba State, Nigeria in relation with associated risk factors. A total of 308 consenting schoolchildren aged 5 to 14 years were included in the study. Urine and stool samples were collected from each pupil and examined for the presence of *Schistosoma haematobium* (Causing urogenital schistosomiasis) and *Schistosoma mansoni* (Causing intestinal schistosomiasis). The urine samples were examined both macroscopically and microscopically using standard Sedimentation methods while the stool samples were examined using Kato-Katz and formolether concentration technique. A well-structured pre-tested questionnaire was administered on 308 pupils to obtain socio-demographic data such as age, sex, educational status of parents and risk factors. The overall prevalence for both forms of schistosomiasis in the study area was 7.5%. The prevalence of urinary schistosomiasis was 5.5% while intestinal schistosomiasis was 0.7% and 1.3% using kato-katz and formol-ether methods respectively. There was no significant difference (p>0.05) in the prevalence of all forms of schistosomiasis among the different primary schools. Similarly, there was no significant relationship (p>0.05) between urinary schistosomiasis and the different schools. However, there was significant difference (p<0.05) between the prevalence of intestinal schistosomiasis and the different schools by Kato-Katz method. There was no significant difference between the infections and age. However, gender significantly influenced *S. haematobium* infection but there was no significant association between gender and *S. mansoni* infection by both the Kato-katz and formol-ether Method. Odds ratio showed association between the infection and pipe borne water (OR=1.1), borehole (OR=3.3), river/stream (OR=5.3), defecating in the bush (OR=8.8), having ponds around houses (OR=3.5), fishing (OR=8.0), do wash clothes (OR=7.8), swimming (OR=8.2) and playing (OR=9.4). There was no significant difference between formol-ether concentration method and Kato-Katz technique used in detecting *Schistosoma mansoni*. The study therefore concluded that the overall prevalence for both forms of schistosomiasis in the study area was 7.5% having 5.5% urinary schistosomiasis and 0.7%, 1.3% intestinal schistosomiasis by Kato-Katz and Formol-ether concentration methods respectively. It was therefore recommended that the teaching of Health Science as a subject in primary schools should be intensified and the pupils should be taught more on personal hygiene, preventive measures and control of certain parasites.

Keywords: Urinary, intestinal, schistosomiasis, primary school pupils, Takum LGA

Introduction
Schistosomiasis, also known as bilharziasis or snail fever, is a parasitic tropical disease caused by the eggs of Schistosoma blood flukes. The disease was named after Theodor Bilharz, a German pathologist who first described the worms in 1851 [1, 2]. Schistosomiasis is a chronic, debilitating disease caused by Schistosoma parasites, which is second only to malaria as the most prevalent tropical disease. It is a major public health and socio-economic burden, particularly in sub-Saharan Africa [3]. Globally, there are over 200 million people in 76 countries infected with schistosomiasis, with 85% of cases occurring in Sub-Saharan Africa [2]. According to the WHO [2], there are over 600 million people at risk for schistosomiasis worldwide. Human schistosomiasis is caused by Schistosoma blood flukes, with the five main disease-causing species being *S. haematobium*, *S. mansoni*, *S. japonicum*, *S. mekongi*, and *S. intercalatum*. Schistosomiasis infection can cause nutritional deficiencies, impaired growth, cognitive development, physical activity, school performance, and work capacity [4]. Transmission of *S. haematobium* is dependent on human exposure to water containing the parasite's intermediate snail host, which typically occurs in activities such as

swimming, bathing, and washing [2]. The construction of dams and other water development schemes has created suitable habitats for the intermediate hosts of *S. haematobium*, increasing the risk and potential reemergence of the disease [5]. Children who attend school are more vulnerable to schistosomiasis due to their frequent water contact, making this age group the most affected by the disease [6, 7].

The Global Burden of Disease report estimated that schistosomiasis caused 1.7 million disability- adjusted life years (DALYs) worldwide in 2001, with 82% of that burden occurring in sub-Saharan Africa [2]. In Nigeria, the prevalence and intensity of *S. haematobium* infection vary widely across different regions. According to regional estimates, prevalence of mixed *Schistosoma haematobium* (Sh) and *Schistosoma mansoni* (Sm) infections ranges from 60.8% to 4.8% and 8.9% to 2.9%, respectively. Overall, an alarming number of 101.3 million people in Nigeria are at risk of *S. haematobium* infection, and 29 million are infected [8, 9, 10, 11, 12, 13]. *S. haematobium* infection prevalence ranged from 11.7% in Gwagwada, Chikun LGA [14] to 25.1% in sedentary Fulani settlements in Dumbi, Igabi LGA [15]. Additionally, studies from Jigawa and Kano States reported overall prevalences of 67.3% and 17.8%, respectively. Furthermore, a study in southwest Nigeria reported an overall prevalence of 40%, with 19% of participants infected with *S. haematobium*. Despite the prevalence of schistosomiasis in many regions of Nigeria, little is known about the situation in Takum Local Government Area, Taraba State. To put appropriate interventions against schistosomiasis in place, it is crucial to first determine the prevalence and risk factors of the disease in different transmission settings. Therefore, this study aimed to determine the prevalence and risk factors of *S. haematobium* and *S. mansoni* infection among Primary School Pupils in Takum LGA, Taraba State.

Methodology

Study Area

Takum Local Government Area in Taraba State, Nigeria. Its headquarters is in the town of Takum. It is created out of Wukari Local Government in 1975, at 7.16 ’00’’ N 9.59’00’’ E / 7.26667 “N 9.98333” E. Takum borders the Republic of Cameroon in the south, Ussa Local Government to the West, Donga Local Government to the North, District within Takum are Abuja, Kwambai, Jenuwa, Rogo, Dutse, Kashimbila, Bete, Chanchanji, Manya, Bika [16]. The climatic conditions in Takum Local Government Area greatly influence the activities of the people, who are predominantly engaged in agriculture during the rainy season and engage in fishing and petty trading during the dry season.

Study Design

A cross-sectional study titled 'Evaluation of Urinary and Intestinal Schistosomiasis among Primary School Pupils in Takum LGA, Taraba State, Nigeria' was conducted to determine the prevalence of urinary and intestinal schistosomiasis among primary school pupils in the study area. A total of 300 urine and stool samples were collected from the primary school pupils between the ages of 5 to 14 years who were randomly selected in the study area.

Ethical Consideration

The study was approved by the Education Secretary of Takum LGEA, the Head Teachers of 10 primary schools, and informed consent was obtained from the participating pupils.

Survey and Examination of Snails

The water bodies near the primary schools in Takum LGA were examined for the presence of snails, using a scoop net in areas of human water contact activities. The collected snails were taken to the Parasitology and Entomology Laboratory at Specialist Hospital Takum for identification using the standard keys described by Brown and Christensen [17]. In the laboratory, each of the snails were placed in separate containers of 250ml petri dishes, with a group of five snails in each. They were then exposed to sunlight for 30 min in distilled water, which promoted the shedding of cercariae. They were then observed under a dissecting microscope.

Collection of Urine and Stool Samples

Three hundred (300) urine and faecal samples each were collected from the pupils who consented to participate.

Urine collection: The pupils were provided with sterile, dark (Black) universal containers labeled with their names, and instructed to collect the first morning urine sample between 10:00 am and 2:00 pm. This was done to ensure that all schistosome eggs in the urine were collected [2, 18, 19]. The collected urine samples were transported to the Parasitology and Entomology Laboratory of Specialist Hospital Takum for analysis.

Stool collection: Pupils were given clean, transparent, wide-mouthed, screw-capped specimen bottles and instructed on how to collect early morning stool samples. The specimens were preserved in 10% formalin and transported to the Parasitology and Entomology Laboratory of Specialist Hospital Takum for analysis.

Laboratory Analysis

The collected urine and stool samples were examined using appropriate staining techniques to identify schistosome eggs and quantify the number of eggs per 10 ml of urine and per gram of stool, respectively.

Data Analysis

All data were analyzed using SPSS version 21. Chi-square tests were used to compare the association between prevalence with respect to schools, age, and sex. Odds ratios were used to assess the relationship between prevalence and various parameters from the questionnaire, such as water contact activities, sources of water, faecal disposal, and other risk factors. P-values less than 0.05 were considered significant.

Results

Prevalence of *S. haematobium* and *S. mansoni* infections among Primary School Pupils in the Study Area

Table 1 shows the prevalence of urinary and intestinal schistosomiasis in the primary school pupils. Overall, the prevalence of both forms of schistosomiasis was 7.5%. The prevalence of urinary schistosomiasis was 5.5% while that of intestinal schistosomiasis was 1.3%. Urinary schistosomiasis prevalence was highest in Kashimbila Primary School (13.3%) and Shibong Primary School (11.4%). The table also presents the age-specific prevalence of schistosomiasis in the school children. Kashimbila and Shibong primary schools had the highest prevalence of urinary schistosomiasis (13.3% and 11.4%, respectively). Urinary schistosomiasis was not detected in Manya and Sufa primary schools. The prevalence of intestinal schistosomiasis was highest in Kashimbila (6.7%) using the Kato-Katz technique. However, no infection was detected in the other schools using the Kato-Katz technique

Table 1: Total Number Positive for Schistosomiasis

S/N	School	Total Number Examined	*Schistosoma haematobium*	*Schistosoma mansoni*		Total Number Positive (%) with both forms of Schistosomiasis
				Kato Katz Method	Formol Ether Method	
1	Lufu Pri. School	30	1 (3.3)	0 (0.0)	1 (3.3)	2 (6.67)
2	Kashimbila Pri. Sch.	30	4 (13.3)	2 (6.7)	0 (0.0)	6 (20.0)
3	Sufa Primary School	30	1 (3.3)	0 (0.0)	0 (0.0)	1 (3.3)
4	Manya Pri. School	32	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
5	Shibong Pri. School	35	4 (11.4)	0 (0.0)	1 (2.9)	5 (14.3)
6	Bibi Pri. School	30	2 (6.7)	0 (0.0)	1 (3.3)	3 (10.0)
7	Jenuwa Gida Pri. Sch.	30	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
8	Bete Pri. School	31	3 (9.7)	0 (0.0)	0 (0.0)	3 (9.7)
9	Malumshe Pri. School	30	1 (3.3)	0 (0.0)	1 (3.3)	2 (6.7)
10	Tampa Pri. School	30	1 (3.3)	0 (0.0)	0 (0.0)	1 (3.3)
Total		300	17 (5.5)	2 (0.7)	4 (1.3)	23 (7.5)
Chisquare			11.681	18.654	5.978	16.215
Df			9	9	9	9
P value			0.232ns	0.028*	0.742ns	0.063

* - significant ($p \leq 0.05$), n.s – not significant (p>0.05).

Gender-Related Prevalence of *S. haematobium* and *S. mansoni*

The prevalence of *S. haematobium* infection was higher in male (8.3%) than female (2.1%) pupils, and this difference was statistically significant ($p \leq 0.05$). Gender-specific prevalence of all forms of schistosomiasis was also significantly different ($p \leq 0.05$) (Table 2). The prevalence of *S. mansoni* infection among male pupils was 1.2% (2/160) using the Kato-Katz technique, and 1.8% (3/160) using the formol-ether concentration technique. No females were infected using either method. There was no statistically significant difference between *S. mansoni* infection and gender (p>0.05).

Table 2: Gender-related prevalence of *S. haematobium* and *S. mansoni* infection

Gender	Total Number Examined	Total Number Positive for both forms of schistosomiasis (%)	*Schistosoma haematobium*	*Schistosoma mansoni*	
				Kato Katz Method	Formol Ether Method
Female	140	4 (2.9)	3 (2.1)	0 (0.0)	1 (0.7)
Male	168	19 (11.3)	14 (8.3)	2 (1.2)	3 (1.8)
Total	308	23 (7.5)	17 (5.5)	2 (0.7)	4 (1.3)
Chi square		13.839	9.881	2.416	1.427
Df		1	1	1	1
P value		0.000*	0.002*	0.120ns	0.232ns

* - significant ($p \leq 0.05$), n.s – not significant (p>0.05).

Age-Related Prevalence of *S. haematobium* and *S. mansoni*

Table 3 shows the prevalence of *S. haematobium* and *S. mansoni* among primary school pupils in Takum LGA, stratified by age group. The overall prevalence of *S. haematobium* was 5.5%. The age group >14 years had the highest prevalence (15.4%), followed by 11-12 years (6.2%) and 13-14 years (5.8%). The 5-6 and 7-8 years age groups were not infected. There was no statistically significant difference in the prevalence of *S. haematobium* across age groups (p>0.05). Using the Kato-Katz technique. The overall prevalence of *S. mansoni* by the formol-ether concentration method was 1.9%. Infection was found in the 9-10 years age group (3%) and 11-12 years age group (2.1%). There was no statistically significant difference in the prevalence of *S. mansoni* between age groups (p>0.05) or between the two techniques used (p>0.05).

Table 3: Age-related prevalence of Schistosomiasis

Age	Total Number Examined	Total Number Positive for both forms of schistosomiasis (%)	*Schistosoma haematobium*	*Schistosoma mansoni*	
				Kato Katz Method	Formol Ether Method
5-6	7	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
7-8	42	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
9-10	67	5 (7.5)	3 (4.5)	0 (0.0)	2 (3.0)
11-12	97	8 (8.3)	6 (6.2)	0 (0.0)	2 (2.1)
13-14	69	6 (8.7)	4 (5.8)	2 (2.9)	0 (0.0)
> 14	26	4 (15.4)	4 (15.4)	0 (0.0)	0 (0.0)
Total	308	23 (7.5)	17 (5.5)	2 (0.7)	4 (1.3)

Chi square	6.549	7.947	6.973	3.822	
Df	5	5	5	5	
P value	0.256ns	0.159ns	0.223ns	0.575ns	

Prevalence of *S. haematobium* and *S. mansoni* in relation to Risk Factors

Table 4 shows the risk factors examined in the study, including water sources, bathing and washing habits, and water-based recreational activities. The results indicated that pipe-borne water, boreholes, rivers/streams, defecating in the bush, having ponds around houses, fishing, washing clothes in streams/rivers, and swimming were associated with schistosomiasis infection, as indicated by their odds ratios of 1.1, 2.4, 5.6, 8.6, 3.5, 8.0, 7.8, and 8.2, respectively.

Table 4: Prevalence of *S. haematobium* and *S. mansoni* in relation to risk factors

Risk Factors	Number Examined	Number Positive (%)	Number Negative (%)	Odds ratio	C.I.
Water Source					
Well	268	16 (5.93)	252 (94.07)	0.400	1.280-8.721
Pipe Borne	12	1 (8.33)	11 (91.67)	1.132	0.140-9.179
Borehole	21	4 (19.05)	17 (80.95)	3.319	1.015-10.849
River/Stream	7	2 (28.57)	5 (71.43)	5.330	0.976-29.157
Types of Toilets					
Pit Latrine	287	17 (5.92)	270 (94.4)	0.400	0.068-0.835
Water System		3	(33.33)		2 (67.67)
Bush	18	6 (27.78)	13 (72.22)	8.8	2.955-27.778
Pond Around House					
Yes	74	11 (14.9)	63 (85.1)	3.5	1.466 - 8.545
No		234	12 (5.13)		222 (94.87)
Fishing					
Yes	37	14 (37.84)	23 (62.16)	8.0	3.160 - 20.222
No		271	9 (3.32)		262 (96.68)
Washing					
Yes	50	15 (30.00)	35 (70.00)	7.8	3.165 - 19.379
No		258	8 (3.10)		250 (96.90)
Swimming					
Yes	42	14 (33.33)	28 (66.67)	8.2	3.294 - 20.540
No		266	9 (3.38)		257 6.62)

Discussions

This study examined the prevalence of urinary and intestinal schistosomiasis among primary school pupils in Takum LGA, Taraba State, Nigeria. The overall prevalence of schistosomiasis was 7.5%, with a prevalence of 5.5% for urinary schistosomiasis and 1.3% for intestinal schistosomiasis. The distinct prevalence rates of urinary (5.5%) and intestinal (1.3%) schistosomiasis can help us better understand the distribution of these infections among the population. This supports previous studies that have found urinary schistosomiasis to be more common than the intestinal form [8, 13]. The prevalence of urinary schistosomiasis was highest in Kashimbila Primary School (13.3%) and Shibong Primary School (11.4%), but no urinary schistosomiasis was detected in Manya and Sufa primary schools. he differences in prevalence between schools, with Kashimbila and Shibong Primary Schools having the highest urinary schistosomiasis prevalence rates, suggest that environmental and behavioral factors may affect disease transmission. For example, differences in local water sources and hygiene practices may play a role [7, 15]. The prevalence of intestinal schistosomiasis was highest in Kashimbila (6.7%) using the Kato-Katz technique. The study also analyzed the age-specific prevalence of schistosomiasis in the school children. Kashimbila and Shibong primary schools had the highest prevalence of urinary schistosomiasis, suggesting that urinary schistosomiasis is a public health problem in Takum LGA. This study found a 1.3% prevalence of intestinal schistosomiasis in Takum LGA. However, the Kato-Katz technique found a higher prevalence of 6.7% in Kashimbila. The higher prevalence of intestinal schistosomiasis in Kashimbila suggests that it may be a transmission hotspot for the disease. The Kato-Katz technique is a commonly used diagnostic method for the epidemiological assessment and efficacy testing of drugs for intestinal schistosomiasis and other soil-transmitted helminth infections [20, 2]. However, the low sensitivity of the Kato-Katz technique may have resulted in an underestimation of intestinal schistosomiasis prevalence in other schools. Therefore, regular treatment of school children with praziquantel is needed to reduce schistosomiasis prevalence in this area [12, 13, 2]. In a similar study conducted among primary school pupils in Jigawa State, Nigeria, the prevalence of *S. haematobium* infection was higher among male pupils (65.7%) than female pupils (69.0%), and this difference was statistically significant ($p \leq 0.05$) [21, 22]. A similar study conducted among school-age children in northeastern Ethiopia found a higher prevalence of *S. haematobium* infection among male children (23.2%) than female children (18.5%) (Degarege *et al*., 2015) [23]. In contrast, a study conducted in Fikyu community in North Eastern Nigeria found an overall prevalence of urinary schistosomiasis of 10.7%, with similar prevalence rates between males and females [23]. Another study in Takum, Northeast Nigeria, found a higher prevalence of *S. haematobium* infection among males, but there was no significant difference in the proportion of males and females infected with *S. mansoni* [24, 25]. The prevalence of *S. haematobium* infection varies across regions in Nigeria. In some regions, males are more likely to be infected than females, while in other regions there is no significant gender difference in infection rates. The prevalence of schistosomiasis among school-age children varies significantly across regions and risk factors. A study in southwestern Nigeria found an overall schistosomiasis prevalence of 40%, with 19% of children infected with *S. haematobium* only and 9% infected with *S. mansoni* only [26].

Conclusions and Recommendations

This study reveals an overall prevalence of 7.5% for both forms of schistosomiasis with 5.5% urinary schistosomiasis and 0.7%, 1.3% intestinal schistosomiasis by Kato-Katz and Formol-ether concentration methods respectively with formolether concentration being more sensitive. It can therefore be deduced that both *S. haematobium* and *S. mansoni* infections are low among primary school pupils in Takum Local Government Area, Taraba State, Nigeria. There was no statistically significantly difference between the infections and age. However, gender significantly influenced *S. haematobium* infection but there was no significant association between gender and *S. mansoni* infection by both the Kato-katz and formol-ether Method. Association was recorded between the infection and the following risks factors; pipe borne water (OR=1.1), borehole (OR=3.3), river/stream (OR=5.3), defecating in the bush (OR=8.8), having ponds around houses (OR=3.5), fishing (OR=8.0), wash clothes in water bodies (OR=7.8) and swimming (OR=8.2). All these showed association with the infections. There was no statistically significantly difference (p>0.05) between the prevalence of *S. mansoni* using both techniques and age groups. To prevent further spread of schistosomiasis, the following measures are recommended: Identify and treat infected individuals in Takum LGA to prevent further transmission; Regularly survey for snails, the intermediate host of schistosomes, and destroy them to prevent the spread of infection; Federal, state, and local governments should provide safe drinking water and facilities for domestic use; Health education on personal hygiene, prevention, and control of parasitic infections should be included in primary school curricula

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