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Urogenital schistosomiasis in females from some suburban communities of Jos, north central Nigeria

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Abstract: *Schistosomiasis of the urethral tract leads to the destruction of the mucosal cells of the reproductive organs by the piercing action of the oval spines. Urogenital schistosomiasis has remained a major contributor to the disease burden in Plateau State, Nigeria. The urine syringe filtration technique and urine strip test were diagnostic methods used to determine the prevalence, intensities and symptoms of Schistosoma haematobium infections in the study population. Out of the 1245 persons screened parasitologically, 1007 were apparently healthy with a prevalence of 265 (26.3%: 95% C.I. 23.5 – 29.1%) with an overall mean egg excretion of 87eggs/10ml and females aged 11-20years had the highest prevalence (21.7%; 95% C.I 19 – 24%) compared to the children 0 – 10years who were the least infected (0.2%; 95% C.I. 0.1 – 0.5%). Statistically, a significant difference was observed among the different age groups (Cal $\chi2_{0.05} = 40.94 >$ Tab $\chi2_{0.05}$ $df_5 = 11.07$; $P < 0.05$;). The remaining 238 persons were symptomatic with a prevalence of 51 (21.4%: 95% C.I. 16.1 – 26.7) and an overall mean egg excretion of 78eggs/10mls with females aged 21-30 years (29.6%) having the highest infection. Although, statistically, symptomatic urogenital schistosomiasis was not dependent on age (Cal $\chi2_{0.05} = 8.32 <$ Tab $\chi2_{0.05}$ $df_5 = 11.07$; $P > 0.05$). In relation to associated symptoms, 4.9% persons had haematuria, 27.9% had proteinuria while a larger population of 64.6% had neither haematuria nor proteinuria in their urine. For water contact patterns, economic activities (65.7%) including, irrigation agriculture and domestic chores (23.6%) accounted for most water contacts especially during the main dry season.*
Keywords: *Haematuria, Human water contact activities. Proteinuria, Schistosoma haematobium, Urogenital Schistosomiasis,*

I. Introduction

Schistosomiasis, a systemic helminthic infection remains one of the most important socio-economic and poverty-related parasitic infections that affect humans. It is the second prevalent tropical disease after malaria [1, 2]. Urogenital schistosomiasis due to *Schistosoma haematobium* is the most prevalent causes of untold hardship as a result of its associated morbidities in the tropics [3, 4].
According to World Health Organization an estimated 235 million cases of schistosomiasis have been reported worldwide with 120 million symptomatic, 20 million with severe disease while 732 million persons are believed to be at risk of infection in known endemic areas [5].

In Africa alone, about 90% of the 207 million infected cases have been reported while in Nigeria, up to 101 million persons are at risk of schistosomiasis with nearly 29 million infected in 2008 [6,7,8]. Many people suffer from schistosomiasis, which can cause hypertension, seizures, urinary obstruction, organ damage or destruction and death. At the same time, schistosomiasis is associated with economic losses, and frequently interferes with development projects, particularly water resource development projects such as dams, irrigation schemes, planned and unplanned forestry [9]. Schistosomiasis; which sometimes leads to death, is largely a disease of morbidity. High mortality rates occur as a result of complications that arise from renal insufficiency and failure [10].

Urogenital schistosomiasis has been described in many parts of Nigeria, with prevalence of 2% to 90% [11, 12, 13, and 14]. Urogenital schistosomiasis constitutes a formidable health problem particularly in children and women as a result of the associated morbidities. Some of these morbidities include haematuria, proteinuria, dysuria, nutritional defects, impaired cognitive development, anemia, stunted growth, impairments and occasional deaths [15, 16]. According to [17], up to one-third of school age children could be actively infected but not aware of their status. [18] Noted that the prevalence and intensity of the disease has increased in areas undergoing water resource development, especially irrigation. Urogenital schistosomiasis is a disease of morbidity of not only poor rural communities, but endemic in suburban and urban areas. Human infection occurs when cercariae (that emerged from snail intermediate host) penetrate the skin of man through contact with contaminated water bodies. Transmission is influenced by several factors which include climatic suitability (temperature and moisture), lack of portable clean water supply, ignorance, poverty, sanitation and hygiene, environmental contamination with human feces, spatial and temporal distribution of snail intermediate hosts for schistosomes, parasite larvae for soil-transmitted helminthes, and human water contact activities [19,20,15].

Human water contact activities are of three major categories; economic (fishing, irrigation farming), domestic (laundry, fetching water for drinking), and recreational (bathing, swimming) which exhibits different daily and seasonal patterns that exposes individuals to infection [21]. Urogenital schistosomiasis, produces long term effect on the society, as it impairs childhood growth and cognitive development, prevents children from attending school, adults from being productive members of their communities and work forces, thereby, reducing their productive capacity [8]. Some studies, however, related the transmission patterns of urogenital schistosomiasis to socio-economic and socio–cultural activities of endemic communities in Africa, Asian, Latin America and the Caribbean [22,23,24]. Some other studies observed direct impacts caused by the disease which includes; enormous annual economic losses, inhibition of socio-economic development, lower production/income of infected individuals, a reduced workers' productivity (in terms of cash income, rates of land clearing and farm size) [25,26,].

Nevertheless, recent data and information on urogenital schistosomiasis in Jos, and perhaps parts of central Nigeria are still scanty and focal. Hence, the need to investigate and establish the prevalence as well as intensity of urogenital schistosomiasis in females in this endemic area. This will update and broaden the epidemiological picture and socio-economic impact of urogenital schistosomiasis disease in Jos, Nigeria.

II. Materials And Methods

1.1 Study Area and Population

Jos, Plateau is located in an area covering about 9400km^2 of the crystalline complex in Central Nigeria. Its average elevation is about 1250m above mean sea level and has an average annual rainfall of about 1100mm with temperature ranging from 12^{o}C-31^{o}C. River Dilimi and river Gada-Biu are two major rivers that transverse Jos city.

The study was carried out in three settlements Tudun-Wada, Abattoir and Nabong which are located on the northern part of the city. Our choice of area was as a result of increasing reports of Schistosoma infections in the hospitals in the areas. Majority of the people that live in these areas are predominantly farmers while a few are either civil servants or engage in other forms of trade. These communities lack good road networks and sanitary facilities, thus the rampant and indiscriminate defecation/urination observed around their houses, inside and along the streams located in their vicinity. Secondly, the lack of pipe borne water for drinking and other domestic chores led to the dependence of the inhabitants on the infected shallow perennial freshwater streams that flow from the rocks located in their communities. Several canals dug and connected to the streams in order to irrigate the farms during the dry periods, also collect water during the rainy seasons. These canals when they contain water together with the shallow perennial streams create permanent freshwater channels that promote the growth of aquatic vegetation from which various schistosomes host snails thrive on. Consequently, inhabitants are exposed to these sites. Although limited alternative water sources such as boreholes and mine ponds that refill in the rainy season exist. Residents still prefer the streams; which are the customary water sources, for their daily water needs. .

2.2 Ethical Approval

The present study was approved by the Research and Ethical Committee of Plateau State Hospital and Plateau State Institute for Human Virology, Jos, Nigeria. Subjects were enrolled in the study only after permission was granted by the community leaders and administrative heads of schools together with a written informed consent from participants/ parents of volunteer students.

2.3 Sample Collection

After a successful mobilization campaign, samples were collected from one thousand and seven apparently healthy volunteers with the assistance of community health workers, community leaders and administrative heads of schools. Labeled sterile wide-mouth plastic bottles were given to individuals who had already indicated interest. Urine specimen were collected after a 20-30minutes brief exercise between 10.00am and 12.00noon. Other clinical data were also obtained from the subjects. The samples were later transported to the laboratory for AIDS and Leishmaniasis Research, Department of Zoology, University of Jos, where further analysis were conducted.

In hospital population, two hundred and thirty-eight samples were collected from symptomatic subjects who visited Plateau State Specialist Hospital for routine diagnosis and treatment. Among the apparently healthy and symptomatic subjects, a questionnaire was used to evaluate the economic status of persons infected with urogenital schistosomiasis.

Urine Syringe Filtration Technique as was described by [27] was adopted in parasitological screening of all urine specimens. The eggs were counted and intensity of infections was classified according to WHO standard as follows: ≤50eggs/10ml of urine as light infection; ≥50eggs/10ml of urine representing heavy infection [27]. Proteinuria and haematuria were determined using the simple reagent strips (Haemastrix © (Bayer, United Kingdom) and Albustrix ®) (Bayer Cooperation, Elkhart), respectively.

Data analyses, using expressive percentage, parametric and non-parametric tests were used to assess the significance of varied observations. Analysis of variance (ANOVA), was used for the analysis of multiple variables. Observations were confirmed significant at $p \leq 0.05$

Direct observation method for water contact pattern as described by [21] was adopted. Briefly, three local observers (school leavers) were trained and recruited to assist in the monitoring and recording of the water contact activities of the subjects. Water contact activities of the inhabitants were observed twice weekly at two points of three major local streams during May 2008 and April 2009. Type of activity engaged by adult and children were recorded at each site.

III. Results

In this study, 1245 urine samples were screened, of which 1007 specimens were from apparently healthy individuals while the remaining 238 samples were from symptomatic persons. The prevalence and intensities of urogenital schistosomiasis in the apparently healthy populations was 265 (26.3%: 95%C.I. 23.5 – 29.1%) with an overall mean egg excretion of 87eggs/10ml. Eighty-two (8.1%) of these subjects had light infection, while 183 (18.2%) were heavily infected. Eleven to twenty year olds (21.7%; 95% C.I 19 – 24%) accounted for higher infection, with a mean egg excretion of 94eggs/10ml. Zero to ten year olds (0.2%; 95% C.I. 0.1 – 0.5%) were the least infected and had low mean egg excretion of 56eggs/10ml. Statistically, this difference was significant among the different age groups using chi-square test (Cal $\chi 2_{\ 0.05} = 40.94$ > Tab $\chi 2_{\ 0.05}$ 11.07; $p < 0.05$; df_5) (TABLE 1).

Table 1: Parasitological prevalence of *Schistosoma haematobium* in apparently healthy adults and school age children

Age Group (Yrs.)	**No Screened**	**Prevalence of urogenital schistosomiasis**		**Intensity of Infection**		
		No infected for S. haematobium	**Percentage (%) [95% CI]**	**No. with Light Infection (<50eggs/ 10ml)**	**No with Heavy Infection (>50eggs/10ml)**	**Mean Egg excretion/ 10ml**
0 – 10	16	2	0.2 [0.1-0.5]	2	0	56
11 – 20	774	218	21.7 [19 - 24]	65	153	94
21 – 30	87	19	1.9 [1.0 – 3.0]	4	15	79
31 – 40	66	13	1.3 [0.6 – 2.0]	5	8	37
41 – 50	49	9	0.9 [0.3 – 1.5]	2	7	29
≥51	15	4	0.4 [0.0 – 0.8]	4	0	22
Total	**1007**	**265**	**26.3[23.5 -29.1]**	**82(8.1%)**	**183(18.2)**	**86**

In the symptomatic population, 21.4% prevalence was recorded with an overall mean egg excretion of 78eggs/10mls. Among these individuals, 9(3.8%) of them had light infections while the remaining 42(17.6%) had heavy infections. Although 21 – 30 year olds (6.3%) had higher infection with a mean egg excretion of 105eggs/10ml. In the 11-20year olds, a 3.4%, also had the highest mean egg excretion of 143 eggs/10mls. The 0-10 year olds (0.8%), presented with the least infection and had a moderate egg intensity of 66 eggs/10ml. No significant difference was observed in relation to age (Cal. $\chi 2_{\ 0.05} = 8.32$ < Tab $\chi 2_{\ 0.05}$ $df._5$ =11.07; p >0.05) (TABLE 2 and 3).

Table 2: Prevalence of urogenital schistosomiasis in symptomatic hospital population

	Urine Analysis			High Vaginal Swab (N = 74)		
Age group (Yrs.)	No screened	No infected	Percentage (%) [95% CI]	No screened	No positive	Percentage (%)[95% CI]
0 – 10	12	2	0.8 [0.4 – 2.0]	32	1	1.4 [1.3 - 4.1]
11– 20	27	8	3.4 [1.1 – 5.7]	17	3	4.1[0.5 – 8.7]
21 – 30	73	15	6.3 [3.2 – 9.4]	4	0	0 [0.0 – 0.0]
31 – 40	63	13	5.5 [2.5 – 8.5]	14	0	0 [0.0 – 0.0]
41 – 50	48	9	3.8 [1.3 – 6.3]	4	1	1.4 [1.3 – 4.1]
≥51	15	4	1.7 [0.0 – 3.4]	3	0	0 [0.0 – 0.0]
Total	238	51	21.4 [16.1 – 26.7]	74	5	6.8[0.9-12.7]

CI: Confidence interval

Table 3: Prevalence and Intensity of urogenital schistosomiasis in the symptomatic hospital population

Age group	Prevalence		Intensity of Infection		
	No. Screened	No. infected	No. with light infection (<50eggs/10ml)	No. with heavy Infection (>50eggs/10ml)	Mean Egg excretion /10ml
0-10	12	2	0	2	66
11-20	27	8	1	7	143
21-30	73	15	2	13	105
31-40	63	13	1	12	46
41-50	48	9	7	2	33
≥51	15	4	2	2	31
Total	238	51	9(3.8%)	42 (17.6)	78

Considering the economic status, a low income range of ₦5,000 – ₦42,000 ($31.25 - 260) was recorded for infected subjects. Most subjects were earned ₦6,000 to ₦15, 000 ($37.5 - 93.75), 19.9%. This was followed by those on ₦16,000.00 – ₦26,000 ($100 - 162.5), 17.5% compared to only 12.1% who earned ≥N27, 000 ($168.75); though not more than N42, 000 ($260); and ≤ ₦5,000.00 ($31.25), 7.1%, respectively (TABLE 4).

Table 4: Economic status of urinary schistosomiasis infected subjects, measured by prevailing income in endemic communities

Household income per month (in Naira, ₦)	Amount in US Dollar ($)	No of subjects	No / % age infected	No and (%) moderately or heavily infected (>50eggs/10ml urine)
≤ 5,000	≤ 31.25	28	4(14.3)	2(7.1)
6,000 – 15,000	37.5 - 93.75	801	226(28.2)	160(19.9)
16,000 – 26,000	100 - 162.5	160	34(21.3)	28(17.5)
≥27,000	≥ 168.75	256	52(20.3)	31(12.1)

In relation to signs and symptoms associated with urinary schistosomiasis, 61(4.9%) persons had haematuria in their urine, 273(21.9%) had proteinuria; 108(8.7%) persons had both haematuria and proteinuria, while most subjects 804(64.6%) persons had neither haematuria nor proteinuria (Fig.1).

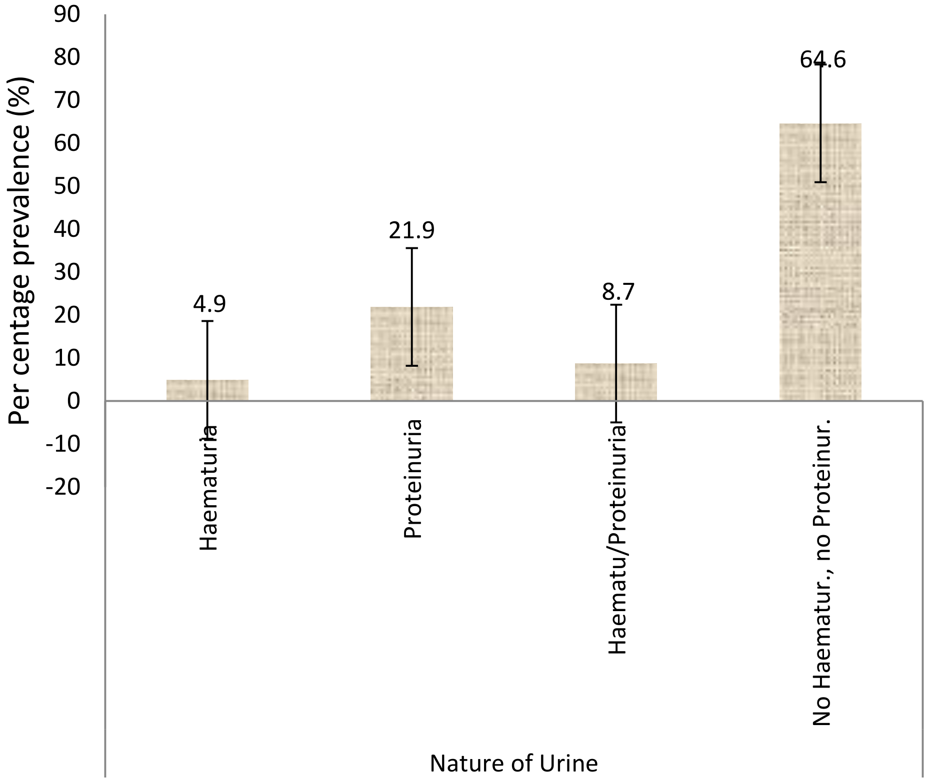

Fig. 1: Symptoms Associated with Urinary Schistosomiasis in the Study Area

Water contact activities were observed in a thousand, three hundred and seventy-six persons from the three suburban communities during four major seasons in one year. A total of 141624 minutes was spent by the subjects, during main dry season; with the highest total water contact time of 59747min. (42.2%) in Tudun Wada study community (TABLE 5). Time spent by subjects in the different communities was significantly associated with seasons ((Tab. $F.df_{3, 6} = 4.76 <$ Cal. $F = 320$; $P<0.05$; Tab. $F.df_{2, 6} = 5.14 <$ Cal. $F = 8.53$) Community residents of Tudun Wada and Abattoir recorded the highest water contact, 71310: 41834 minutes, respectively (FIGURE 2). Liner regression analysis community contact with water was weakly associated with season ($R^2 = 0.2625$: 0.1708: 0.1565), for Nabong, Abattoir and Tudun Wada, respectively.

Table 5: Seasonal and time duration of urogenital schistosomiasis transmission in the study population

Seasons	Time Duration	Percentage (%)
Onset of Rainy season (March, April, May)	39832	28.1
Main Rainy Season (June, July, August, September)	17703	12.5
Onset of Dry Season (October, November)	24342	17.2
Main Dry Season (December, January, February, March)	59747	42.2
Total	141624	

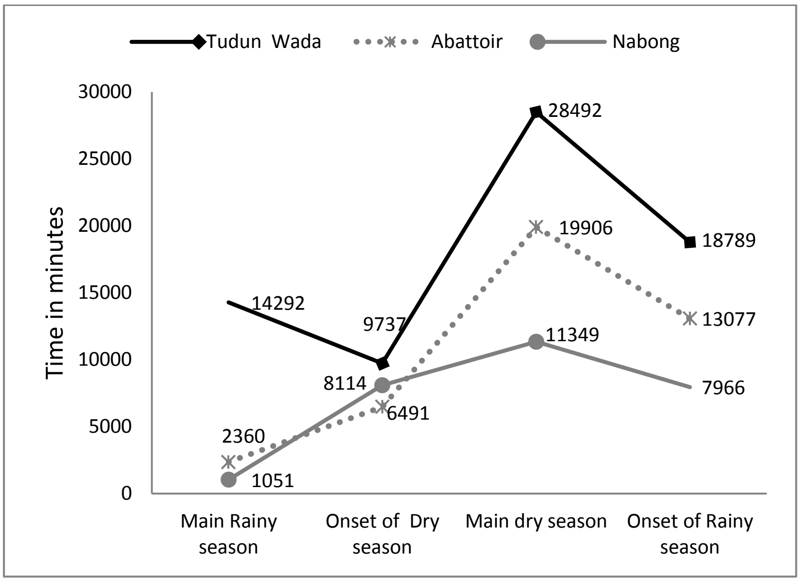

Fig. 2: Seasonal and time duration of water contact of study population in the study areas

In the study, there was variation not only in water contact activities, but in the time spent in infested waters. Tudun Wada and Abattoir communities recorded the largest duration of stay in water for economic, domestic and or recreational activities - 71,310: 46,290 minutes, respectively. More adults were seen carrying on activities in infected water bodies compared to children/teenagers (51.2 : 44.7%), respectively. In relation to water contact activities; significant number of subjects ($p < 0.01$) were engaged in the economic and domestic activities than recreational. (TABLE 6 and 7).

Table 6: Distribution and time duration of water contact of study subjects in the study communities.

Communities	Children/Teenagers (<15) No. of persons observed (%)	Children/Teenagers (<15) Time spent	Adults (≥15) No. of persons observed (%)	Adults (≥15) Time spent	Total No. of persons observed	Total Time spent
Tudun Wada	320 (47.7)	13507 (22.9)	361 (51.2)	57803 (70.0)	681	71,310(50.4)
Abattoir	185 (27.6)	35160 (59.6)	169 (23.9)	11130 (13.5)	354	46,290(32.7)
Nabong	166 (24.7)	10374 (17.5)	175 (24.8)	13650 (16.5)	341	24,024(17.0)
Total	671 (44.7)	59041	705 (51.2)	82583	1376	141624

Table 7: Distribution of Water Contact Activities associated with Transmission of S. haematobium, the Causative agent of Urogenital schistosomiasis

Major Activities	**Children**			**Adult**			**Total Contact**		
	No of Persons (n=658)	**Percentage Contact (%)**	**Time duration**	**No of Persons (n=718)**	**Percentage Contact (%)**	**Time duration**	**No of persons (n=1376)**	**Percentage (%) [95% CI]**	**Time duration**
Recreational	**97**	**14.7**	**14031**	**13**	**1.8**	**1705**	**110**	**8.0[6.0 - 8.0]**	**15736**
Bathing	27	4.1	3540	13	1.8	1705	40	2.9[2.0 -3.8]	5245
Playing	70	10.6	10491	0	0.0	0	70	5.1[3.9 – 6.3]	10491
Domestic Needs	**122**	**18.5**	**11347**	**240**	**33.4**	**20125**	**362**	**26.3[26.0 –30.0]**	**31472**
Washing (Utensils & Laundry, etc.)	**65**	**9.8**	**2596**	**207**	**86.3**	**16637**	**272**	**19.8[17.7- 21.9]**	**19233**
Fetching water for Household chores/other uses	**57**	**8.7**	**8751**	**33**	**4.6**	**3488**	**90**	**6.5[5.2 – 7.8]**	**12239**
Economic	**439**	**66.7**	**38666**	**465**	**64.8**	**55750**	**904**	**65.7[62 - 67.0]**	**94416**
Fetching for Block industry	**33**	**5.0**	**2098**	**22**	**3.1**	**1399**	**55**	**4.0[2.9 – 5.1]**	**3497**
Farming activities such as: i. Soil preparation/planting	**101**	**15.3**	**15519**	**84**	**11.7**	**10708**	**185**	**13.4[11.6 – 15.2]**	**26227**

ii. Washing agric. Products	**69**	**10.5**	**6145**	**97**	**13.5**	**18333**	**166**	**12.1[10.3 – 13.9]**	**24478**
iii. Weeding	**13**	**2.0**	**2662**	**39**	**5.4**	**20068**	**52**	**3.8[2.8 – 4.8]**	**22730**
iv. Crop watering/irrigation	**223**	**33.9**	**12242**	**223**	**31.1**	**5242**	**446**	**32.4[29.9 -34.9]**	**17484**

IV. Discussion

This study examined the prevalence, and intensity of urogenital schistosomiasis in some communities in Jos, Plateau State. The result of the present study shows that urogenital schistosomiasis exists in these communities and is moderate infections according to the classification by [28]. These results are consistent with earlier studies in Jos and among the Mwaghavul tribe of Mangu LGA where 20.5% and 23.3% were recorded respectively [29,30]. Similar results were recorded in Ezza communities of Ebonyi State (22.1%) [11]. While some other studies reported a 100% (hospital-based study) in Malawi; 76% in Madagascar; 42% in Tanzania and 47-62% in Osun State of Nigeria respectively [31,32,33,34,14] . In contrast, [35] reported a 2.07% among some residents of Gwong and Kabong in Jos north LGA while [36] reported a 6.4% in school children in Langai community in Mangu LGA of Plateau State.

Mean egg excretion in the apparently healthy (86 eggs/10ml of urine), and symptomatic individuals (78 eggs/10ml of urine), in this study; was not as high as 500-3081eggs/10ml of urine, reported in Osun State [14]. In contrast, low intensity levels of 40.1eggs/10ml and <12eggs/10ml of urines was reported in Edo [3] and Kano States [37] respectively.

The results in this study demonstrate a persisting endemicity of schistosomiasis in the study communities. The prevalence observed reflects the intensity of *S. haematobium* transmission in the study areas. We also noted that study communities lacked pipe-borne water or good alternative water sources, which resulted to the high dependence of the subjects on the cercariae infested perennial and small seasonal streams located in the areas. These streams are natural freshwater sources, distributed over the communities, which serve as the main transmission points by which the inhabitants are infected. The streams also provide ideal aquatic vegetation and conducive environment required for the breeding of Bulinus and other snail intermediate hosts species. In addition, they serve as a meeting point for the schistosome parasites, the intermediate hosts and the inhabitants.

Therefore, the high dependence of the inhabitants on the streams for their daily domestic chores, recreational and economic needs (since they are predominantly farmers); we believe may have been responsible for the high prevalence and intensity observed in the study subjects. Thus, ensuring that subjects were continuously infected and re-infected since existing control measures are at the moment inadequate.

Secondly, non-availability of household sanitary facilities, indiscriminate defecation around houses, inside and along the streams confirm the filthy environment and deficit of personal hygienic practices by the subjects. This obviously, could be responsible for the maintenance of the vicious cycle of human infection through water contact- contamination of freshwater streams-and infection of snail hosts. Although, the infections varied among the subjects in the various communities, it was not statistically significant ($P>0.05$). This was expected because the communities have similar environmental and edaphic features (i.e. rocky valleys with infected shallow freshwater streams, pools of seasonal stream and irrigation canals). These are favourably breeding sites of snail vectors. Similarly, observations with intense environmental contamination have been reported by some studies in other endemic areas in Nigeria and African countries [38,14,39].

Stratifying the present result by age the prevalence and infection intensity peaked among the 11-20years (21.7%) while the 0-10yr olds were the least infected. The high prevalence observed among these teenagers/young adults is suggestive of the risk of exposure within this age group, who spend more time in infected water for either domestic or economic activities. These activities expose them to the infected water with the risk of acquiring repeated infections and harbouring more worms. This agrees with [35,40, 41]

The general pattern of an initial rise in infection in young children followed by a decline in the older adults was observed in this study. This agrees with earlier studies [14,23,11]. School age children had higher intensity of schistosomiasis worm burden compared to adults, perhaps due to more exposure to cercariae infested water [42]. It is in the same vain that high morbidities were observed in these groups of individuals.

The decline in prevalence observed in the older subjects, we, attributable to a combined function of acquired immunity from repeated infection. Here a progressive increasing level of naturally acquired immunity against infection and changes in water contact habits (as the subjects grew older) may have played a major role in the infection pattern recorded. This agrees with similar studies who also observed that there was a reduced worm burden, less egg excretion and a decreased transmission rate in the older persons as a result of the concomitant immunity acquired during the infection [19,42,43].

The levels of urogenital schistosomiasis symptoms associated with *S. haematobium* infections in this study were low. The levels of haematuria and proteinuria in the study were low and did not conform favourably with other studies where as high as 40-80% had been reported [3,44,11]. It is notable from that a combination of symptoms, such as morbidity indicators will be useful for the purpose of rapid epidemiological survey in any wide endemic area. These symptoms have been associated with urogenital schistosomiasis [45,46] .

In relation to water contact activities for different economic, recreational and domestic activities were observed. The streams, irrigation channels and seasonal pools of water gathered during the rainy seasons served as the main transmission points. There was high contact with these transmission points especially during the main dry season and onset of rainy season (Table 4). For the different communities, more water contact activities were recorded in Tudun Wada Community. Water contact for economic and domestic nature resulted in more frequent and intensive contact with infected water bodies than recreational purposes (Table 8). Water contacts for economic needs were exhibited on different daily and seasonal periods in particular during the hot dry seasons. The frequency of contact with these cercariae infested water bodies either during crop watering/irrigation farming and crop planting/washing of agricultural products placed the subjects constantly at risk of infection. Secondly, the edaphic nature of the farms which were very often adjacent the Schistosoma infested streams, make it very difficult for the soil to retain water even during the rainy season because of the strong run-off at the hillside farms. Thus, it necessitated the creation of irrigation channels and blocking of ridge valleys during the rainy seasons. These channels of course, made good breeding grounds for the snail intermediate hosts to thrive and provided the inhabitants the opportunity for schistosomiasis transmission via wadding in the infected pools/irrigation canals, during planting, weeding and harvesting of crops. The channels on the other hand, provide immediate reservoir for watering of crops at the onset and main dry seasons until the water levels get very low for a shift into the adjacent stream. At all points in this particular activity, these individuals are exposed to high concentrations of Schistosoma cercariae. In addition, irrigation farming encouraged the most of WCA despite the risk. Furthermore, during the dry months of the year, alternative sources of water supply dry up in the absence of pipe-borne water and residents are forced to depend on the Schistosoma-infested streams. . As a result, they get infected. This is in conformity with reports by [25,47,34] that associated high exposure of subjects to water contact for economic nature.

In contrast, [48,49] reported water contact for recreational purposes (swimming, playing) as the most frequent water contact activity. While [50] in another study, reported a higher contact among subjects who were involved in water contact for domestic nature.

The water contacts were higher in the adults than children. . Water contact for economic nature was more in the children than adults. Consistent with these findings are reports by [51] and [48] who observed a more frequent contact among the 6-14yr olds, although water contact for economic nature peaked in 20-30yr olds. Similarly,[52] observed higher frequency of contact in young children who indulged in watering of cattle, washing and bathing. In contrast, [7,53,54] observed that the 20-30year olds had more contact while washing, practicing irrigation farming, fetching water for daily routine household chores, fermentation of cassava tubers or even recreation.

In water contact for domestic needs, the female adults (33.4%) had a higher contact than the children (18.5%). These women engage in domestic chores such as washing utensils, laundry and washing of their farm products. On the other hand, [11] observed a higher water contact for domestic nature among the children/adolescence in a study of Ezza people in Ebonyi State. They attributed their findings to time spent by younger people washing, fishing or playing. In addition, they observed changes in water contact habits of the older adults.

It is common knowledge that the scorching heat encourages children to play in water during the dry season. This increases the frequency of water contact [55]. This study recorded a low percentage of 8.0%. The low percentage frequency was attributed to the unattractive edaphic nature of the perennial rocky small streams, and the low water volume which did not encourage much swimming or playing. When compared to other studies; as high as 48.2 – 86% have been reported [25,48,56,57]. These studies implicated water contact for recreational purposes as the major source of contracting schistosomiasis. They further linked the recreational water contact activities to hot seasons. In addition, it was suggested that these activities; which keep subjects much longer in water contribute to the high prevalence and intensity of Schistosoma infection in studied communities. In this study however, the perennial clean streams, constantly fed by community faecal disposal, lead to very high cercariae concentration of the small water bodies which achieved similar high prevalence and high intensity of urinary schistosomiasis.

Though adults had significant higher WCA ($P<0.05$), due to economic and domestic needs, compared to children/teenagers; there was no significant difference ($p > 0.05$) in the frequency of WCAs of adults and children. In addition, the economic status of most subjects was low (< $100 per month). This is in line with the economic index of the community; majority of whom are known to be living at < $1 a day. Hence urogenital schistosomiasis is classified as a disease of poverty. Low economic status has been associated with poor educational status or insufficient vocational training. More economic disadvantages have also been derived t with resulting low economic capacity. These findings are consistent with a number of studies [14,25,58] and confirms the economic impact of urogenital schistosomiasis in these suburban and rural communities of Jos, Nigeria.

V. Conclusion

Urogenital schistosomiasis is endemic in Jos, Nigeria where favourable water sites exist for snail hosts that provide waiting route of passage from poor hygiene and sanitary practices of poor communities through their domestic and economic needs. This calls for public enlightenment on good personal hygiene, good sanitary measure, an urgent evaluation of current control measures and implementation of an integrated and effective schistosomiasis control programmes in order to curb urogenital schistosomiasis spread..

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