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Schistosoma haematobium Infections: Prevalence and Morbidity Indicators in Communities around Wasai Dam, Minjibir, Kano State, Northern Nigeria

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Authors' contributions

This work was carried out in collaboration between all authors. Author MAU did the study design and wrote the protocol. Authors MAU, UAU and IHU did the statistical analysis and literature searches while authors AY and SMD analyzed the study. All authors read and approved the final manuscript.

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ABSTRACT

Objectives of the Study: A cross-sectional study was carried out to determine the prevalence and human risk factors of *Schistosoma haematobium* infections in Farawa and Koya dam-site communities in Minjibir Local Government Area of Kano State, Northern Nigeria.
Place and Duration of Study: Farawa and Koya dam-site communities in Minjibir local government area of Kano State, Northern Niger, between October, 2014 and February, 2015.
Methodology: A total of 120 individuals, 60 selected randomly from each community were examined. Urine sedimentation method, urinalysis reagent strip method (Medi-Test Combi-9) and questionnaire administration were employed for detection of characteristic parasite egg, morbidity indicators and major risk factors for the infection, respectively.
Results: The overall prevalence of *S. haematobium* infection was found to be 70.0% (80/120). The prevalence was slightly in Koya (73.0%) than 40 in Farawa community (66.6%). Infection

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prevalence was gender-biased in favour of males with statistical significance (P<0.05), who also manifested with macrohaematuria (75.0%), proteinuria (65.0%) and urine nitrite (15.0%), in Farawa community; macrohaematuria (75.0%), proteinuria (51.9%) and urine nitrite (38.5%) in Koya community. A high rate of macrohaematuria among younger age groups (≤35 years) in both communities might be an indication of high infection intensity which portends risk of bladder carcinogenesis at old age.

Conclusion: Public enlightenment programme with a view to reducing unprotected exposure to risk factors such as irrigation agriculture, fishing, bathing and domestic water use, and mass chemotherapy targeting younger age groups, will help curb high infection prevalence in the study area.

Keywords: Urinary schistosomiasis; macrohaematuria; proteinuria; urine nitrite; risk factors.

1. INTRODUCTION

Human schistosomiasis is one of the neglected tropical diseases bedeviling the poor and downtrodden population of the tropics and subtropics that often live in remote rural areas, urban slums or irrigated areas with low hygiene standard and inadequate potable water supply [1,2]. The disease occurs as intestinal or urinary schistosomiasis. Agricultural, domestic and recreational activities are risk factors that expose individuals to infested water. The continuum of infection is linked to the continuous water contact activities and anthropogenic faecal and urine contamination, coupled with prevailing snail vector population [3]. Human schistosomiasis is an endemic disease in tropical regions from Africa, South America and Asia. The WHO has recently identified schistosomiasis as the second most important human parasitic disease in the world, after malaria [4,5]. About 76 countries are affected worldwide with the global estimates of 200 million people suffering from the disease and 600 million people at risk of the infection [4,6,7]. However, WHO [7] estimated that about 85% of all schistosomiasis cases are in Africa. Urinary schistosomiasis is caused by *Schistosoma haematobium* which deposits eggs in the vesical plexuses of the urinary bladder. *Schistosoma haematobium* infection is a common occurrence in Africa and is the world leading cause of haematuria [8]. This is because it lives in the vascular veins and blood is often found in the last few drops of urine [9]. Currently, urinary schistosomiasis is affecting hundreds of millions of people in tropical and subtropical countries. According to the estimates of the World Health Organization, each year thousands of people are liable to die of schistosomiasis and billions of adult and children are at risk of being infected due to exposure to the risk factors [10]. Steinmann, [11] observed a high prevalence of urinary schistosomiasis in areas where water development projects are constructed. Man-made dams have been created to provide water for domestic use, irrigation, hydroelectric power production and industrial use. It is estimated that more than 200 million people in close proximity to the constructed water bodies are at risk of urinary schistosomiasis since they are more exposed to infested water while searching water for their domestic use [11]. Oladejo and Ofoezie [12] reported that urinary schistosomiasis is highly endemic in Nigerian communities and that about 95% of the population lack any knowledge of the mode of transmission of the parasite or how transmission could be prevented. In Nigeria, urinary schistosomiasis is widespread in both rural and urban communities; with prevalence ranging between 2% and 90% and the vast majority of cases occurring among the poor and marginalized [13]. A study conducted in Dorawar Sallau and Dakasoye communities in Kano State, Nigeria revealed a high prevalence of *S. haematobium* infection among irrigation communities [14]. Several recent studies on schistosomiasis in Nigeria have focused on the relationship between the transmission dynamics of the disease and the socio–cultural characteristics of the endemic communities. [12], for example, investigated *S. haematobium* infection endemicity in a southern Nigerian community and reported that about 95% of the population lacked any knowledge of the mode of transmission of the parasite or of how transmission could be prevented. This research work is conducted to determine the disease prevalence among the inhabitants of the communities around Wasai Dam as well as the morbidity indicators and risk factors predisposing to *Schistosoma haematobium* infection with a view to providing community-based information on infection prevalence, taking into cognizance the manifestation of morbidity indicators in older individuals who might be predisposed to higher risk of bladder pathology degenerating to vesical carcinogenesis at a later old age.

2. MATERIALS AND METHODS

2.1 Study Area

The study was carried out in two villages around Wasai Dam (8°37-45'E and 12°135-12°10N) of Minjibir Local Government Area of Kano State, namely Farawa from the northern part of the Dam 2 km away and Koya from the west 1 km away, with geographical coordinates: 12°10' 42''N and 8°39' 33'' E and 8.65917'E [15]. The vegetation of the area can be described as Sudan Savannah. The climate of the region is the tropical wet and dry type. In a normal year, the mean annual rainfall is about 600 mm, although no consecutive years record the same amount, and averages calculated for any two periods are the same. Both communities have similar ecological and socio-cultural characteristics and their daily economic activities are mainly irrigation farming, fishing and trading, and most residents are of Hausa-Fulani ethnicity.

2.2 Study Design

This research is a cross-sectional study designed to determine infection prevalence and epidemiological factors for transmission of urinary schistosomiasis in the study population. In this community-wide survey the study population comprised the inhabitants of Farawa and Koya communities who mainly subsist on agriculture. The study subjects were randomly selected irrespective of the age-group and sex after informed consent.

2.3 Collection and Preservation of Urine Samples

Clean specimen bottles were labeled with the needed information and issued to the participating individuals whose informed consent was sought earlier. 120 urine samples, 60 each from Farawa and Koya communities, were collected at early hours (8-10 am) on the collection days [16] and taken to the laboratory for preservation and further processing. The urine samples were preserved before examination by adding 3 drops of 1% v/v sodium hypochlorite solution [3].

2.4 Urine Microscopy

Urine examination was carried out in the laboratory of Biology Department, Kano University of Science and Technology, Wudil. Urine samples were examined for the presence of *Schistosoma haematobium* egg using sedimentation method of Cheesbrough [16]. Each urine sample was mixed thoroughly with a glass rod and 10 ml transferred into centrifuge tube and centrifuged at 2000 rpm for 5 minutes at room temperature. The supernatant was then discarded and sediment transferred to a microscope glass slide and covered with a cover slip. A drop of Lugol's Iodine was added onto the cover slip prior to examination [16]. Examination of the entire sediment was carried out using x10 objective of a compound light microscope. The urine samples were also examined for visible haematuria [3].

2.5 Determination of Proteinuria and Urinary Nitrite

The determination of proteinuria and urine nitrite was carried out using urinalysis reagent strip (Medi–test Combi–9), in accordance with the manufacturer's instruction, in order to check for the presence of protein and nitrite in the urine of the study subjects.

2.6 Administration of Questionnaires

A structured questionnaire was designed for the purpose of the research and administered to the participating individuals of different age groups and both sexes, who had agreed voluntarily to provide their urine for the study. The questionnaires contained the necessary questions intended to derive demographic data and risk factors relevant to the research objective, such as residential status, occupation, water contact activity, experiencing painful urination and presence of haematuria [3]. A total of 120 questionnaires were administered to the study subjects.

2.7 Statistical Analysis

Results obtained for infection prevalence were analyzed using simple frequencies and relationships with age, sex, haematuria, proteinuria and urinary nitrite with chi-square test [17,18].

3. RESULTS AND DISCUSSION

3.1 Prevalence of Urinary Schistosomiasis in Farawa and Koya Communities

The prevalence of urinary schistosomiasis in Farawa and Koya communities is shown in

Table 1. The overall prevalence rate is 84 (70%); with percentage prevalence of 66.6% (40) in Farawa and 73% (44) in Koya. Table 2 shows the prevalence of urinary schistosomiasis in relation to age-group in Farawa community. The result revealed that the age-group 26-35 years had higher prevalence (87.5%) while 46-5 years had least prevalence (0.0%) in Farawa community. Table 3 shows the prevalence of urinary schistosomiasis in relation to age-group Koya community. In Koya community the 6-15 year age-group had higher prevalence (100%) while 26-55 years had least prevalence (0.0%). The infection prevalence was observed to be gender-biased in favour of males; 77.5% (Farawa) and 84.6% (Koya).

3.2 Prevalence of Haematuria, Proteinuria and Urinary Nitrite in *Schistosoma haematobium* Infections in Farawa and Koya Communities

Table 4 shows sex-related prevalence of urinary schistosomiasis and visible haematuria in Farawa community. The result indicated that males have higher prevalence of blood (75.0%) in their urine than females (30.0%). On the whole, 30 out of 31 (96.77%) of infected male individuals had haematuria. Table 5 shows age related prevalence of urinary schistosomiasis and visible haematuria in Farawa community which shows the 6-15 year of age have high prevalence of visible haematuria in their urine than others, while 46-55 year age-group did not manifest haematuria. Table 6 shows the excretion of protein and nitrite in urine in Farawa community. The result showed that male individuals have higher prevalence of proteinuria and urinary nitrite. The percentage proteinuria and urinary nitrite excretion is 50.0% and 11.6%, respectively. Table 7 shows sex-related prevalence of urinary schistosomiasis and visible haematuria in Koya community. Accordingly, males have higher prevalence of blood (75.0%) in urine than females (12.5%). The result revealed that 88.63% of infected males experience haematuria. Table 8 shows age-related prevalence of urinary schistosomiasis and visible haematuria. The age-group 16-25 years have highest prevalence (100%) of visible haematuria than others. Similarly, no haematuria was manifested in the age-group 46-55 years. Table 9 shows the excretion of protein and nitrite in urine in Koya community. The result showed that male individuals have higher prevalence of proteinuria and urinary nitrite. The percentage proteinuria and urinary nitrite excretion is 48.4% and 35.0%, respectively.

Table 1. Prevalence of urinary schistosomiasis in Farawa and Koya communities

Community	No. examined	No. infected	Prevalence (%)
Farawa	60	40	66.67
Koya	60	44	73.0
Total prevalence	120	84	70.0

Table 2. Prevalence of urinary schistosomiasis in relation age-group in Farawa community

Age group	No. examined	No. infected	Prevalence (%)
06–15	34	22	64.7
16–25	5	4	80.0
26–35	8	7	87.5
36–45	9	6	66.6
46–55	2	0	0.0
≥56	2	1	50.0
Total prevalence	60	40	66.6

Table 3. Prevalence of urinary schistosomiasis in relation to age-group in Koya community

Age group	No. examined	No. infected	Prevalence (%)
6–15	35	28	80.0
16–25	9	9	100
26–35	10	3	30.0
36–45	4	3	75.0
46–55	0	0	0.0
≥56	2	1	50.0
Total prevalence	60	40	73.0

Table 4. Sex-related prevalence of urinary schistosomiasis and visible haematuria in Farawa community

Sex	No. examined	No. infected	Haematuria
Male	40	31 (77.5)	30 (75.0)
Female	20	9 (45.0)	6 (30.0)
Total prevalence	60	40 (66.67)	36 (60.0)

Table 5. Age-related prevalence of urinary schistosomiasis and visible haematuria in Farawa community

Age group	No. examined	Haematuria	Prevalence (%)
06–15	34	22	64.7
16–25	5	3	60.0
26–35	8	5	62.5
36–45	9	5	55.5
46–55	2	0	0.0
≥56	2	1	50.0
Total prevalence	60	36	60.0

Table 6. Proteinuria and urinary nitrite in relation to sex in Farawa community

Sex	No. examined	Protein positive	Nitrite positive
Male	40	26 (65.0)	6(15.0)
Female	20	4 (20.0)	1(5.0)
Total	60	30 (50.0)	7(11.6)

Table 7. Sex-related prevalence of urinary schistosomiasis and visible haematuria in Koya community

Sex	No. examined	No. infected	Haematuria
Male	52	44(84.6)	39(75.0)
Female	8	0(0)	1(12.5)
Total prevalence	60	44(73.4)	40(66.6)

Table 8. Age-related prevalence of urinary schistosomiasis and visible haematuria in Koya community

Age group	No. examined	Haematuria	Prevalence (%)
06–15	35	20	57.1
16–25	9	9	100
26–35	10	8	80.0
36–45	4	2	50.0
46–55	0	0	0.0
≥56	2	1	50.0
Total prevalence	60	40	66.6

Table 9. Proteinuria and urinary nitrite in relation to sex in Koya community

Sex	No. examined	Protein positive	Nitrite positive
Male	52	27 (51.9)	20(38.5)
Female	8	2(25.0)	1(12.5)
Total	60	29(48.4)	21(35.0)

3.3 Discussion

This study has shown that *Schistosoma haematobium* infection is highly prevalent in the area due to the involvement in water contact activities by the inhabitants such as irrigation farming and fishing as reported by Abdullahi [19] who carried out prevalence studies in schoolchildren in Wasai. The 70% overall prevalence recorded in the study population is higher than what was reported by Bichi and Abubakar [20] in some villages around Wasai Dam. This implies that the study area warrants mass chemotherapy since the value obtained is greater than 50% prevalence recommended by the World Health Organization as the threshold for mass chemotherapy [10]. Although the prevalence was slightly higher than that reported by Duwa and Bassey [21] who worked on school children in a village further away from Wasai Dam in Minjibir Local Government Area, Kano State, thus implying that proximity and ease of access to the Dam encourage frequency of visit and so greater number of contact with cercariae-infested water from the Dam [21]. The prevalence of *Schistosoma haematobium* infection in Zuru Emirate of Kebbi State was 69.2%, a high figure similarly obtained in the present study [22]. Many investigations have reported the prevalence rate for the disease in different areas in Kano State. It was 67.9% in Kura Local government Area [23], 52.6% in Karfi village [24] and 66.7% overall prevalence in Dorawar Sallau and Dakasoye [3], all within irrigation scheme in Kano State. The major factors that might be responsible for the endemicity of urinary schistosomiasis in the study area are low literacy level, lack of basic amenities, indiscriminate disposal of human sewage and high water contact activity with snail-infested water from the Dam. In relation to sex the prevalence of *Schistosoma haematobium* infection was found to be slightly higher in males than females in both communities (Tables 4 and 6). This trend might be due to the fact that males are more exposed to infested water, because of their activities such as swimming, fishing, playing and irrigation farming. This was in agreement with the work of Adomeh et al. [25] in Yobe State and Tayo et al. [26] in Malumfashi who did a work on urinary schistosomiasis among school children in northern Nigeria, and reported that males were more infected due to the fact that males were more involved in activities that have to do with water bodies. This implies that *Schistosoma haematobium* infection is not gender specific disease, but rather occurs as a result of exposure to contaminated water. This research work revealed that individuals aged 16 to 35 years of age have highest prevalence in both Farawa and Koya communities compared to older age-groups (Tables 2 and 3). The higher prevalence of *Schistosoma haematobium* infection among individuals aged 6-35 years was associated with the frequency of contact with the Dam water and was responsible for transmission of the infection. Individuals between the older age-groups 36 years and above had lower prevalence. This might be due to either a decrease in transmission rate due to reduced water contact activities or reduced survival of the parasite already in the human host which might be characterised by the development of acquired immunity to the infection, as observed by Ndams and Livingstone [27].

Individuals who presented with haematuria had high prevalence of *Schistosoma haematobium* infection when compared to those without haematuria in both communities (Tables 4 and 7). The total prevalence of haematuria in relation to sex indicated that males have higher percentage of 75.0%. This value was found to be slightly lower than the value reported by Abdullahi [19] who reported 92.0% prevalence among those with haematuria. Individuals with proteinuria and urine nitrite were found to have high prevalence of *Schistosoma haematobium* infection in both communities in comparison to those not infected (Tables 6 and 9). The high prevalence of visible haematuria for both communities, and 65% and 51.9% proteinuria for Farawa and Koya communities, respectively, call for concern; the implications of abnormal urine chemistry in this respect, i.e. presence of blood, protein and nitrite in the urine of *Schistosoma haematobium*-infected subjects are the tendency for development of anaemia in chronic and repeated infection over time especially where nutritional dietary intake is marginal, renal pathology and ultimately bladder carcinogenesis in older age groups. This was documented by several researchers such as Edington and Gilles [28-29].

4. CONCLUSION

It is noteworthy that *Schistosoma haematobium* infection in the study area has reached hyper-endemic state. The proximity of the communities to the Dam portends continuous unprotected exposure to the cercariae-infested water by individuals for various purposes, hence continuous manifestation of morbidity indicators because of recurrent infections.

5. RECOMMENDATION

The authors recommend the implementation of World Health Organization's recommendation for mass treatment of the whole community if infection of *Schistosoma haematobium* infection is >50% by the local authorities. Moreover, screening of the community for bladder pathology by ultrasonography is strongly recommended to assess the risk of development of vesical cancer in aged individuals.

ETHICAL APPROVAL

Prior to data collection, the researchers made a formal introduction to the village authorities who were briefed on the aim and objectives of the study. Permission for community survey was later granted and members of the two communities approached thereafter who also granted their informed consent.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Amadou G, Seydou T, Robert D, Elisa B, Alan F. Implementation of national schistosomiasis control programmes in West Africa. Trends in Parasitology. 2006;22(7):322-326.
2. WHO. Neglected tropical diseases. WHO Annual Report. 2006; WHO/CDS/NTD/2007.4.
3. Ali MU, Ndams IS. Human *Schistosoma* infections: Intensity versus water contact patterns among irrigation communities in Kano State, Nigeria. Biological and Environmental Sciences Journal for the Tropics. 2013;10(3):120-124.
4. Opaluwa SA, Galadima M, Odama LE, Nock IH. Prevalence of schistosomiasis in some rice-farming communities of Niger State, Nigeria. The Nigerian Journal of Surgical Research. 1999;1(2):56-61.
5. Nidia S, Mar S, Julio LA, Jose LP, Teresa G, Antonio M. *Schistosoma mansoni*: A diagnostic approach to detect acute schistosomiasis infection in a murine model by PCR. Experimental Parasitology. 2006;114(2):84-88.
6. Adamu T, Abubakar U, Danga C. Schistosomiasis in Wurno district of Sokoto State, Nigeria. The Nigerian Journal of Parasitology. 2001;22(1&2):81-84.
7. WHO. Prevention and control of schistosomiasis and soil-transmitted helminthiasis: Report of WHO Expert Committee. WHO Technical Report Series. 2002;912.1-57.
8. Smith JH, Christie JD. The pathobiology of *Schistosoma haematobium* infection in humans. Human Pathology. 1986;17:333-345 Dis. 6:411-425.
9. WHO. Special Programme for Research and Training in Tropical Diseases. UNDP/World Bank/WHO. 1987; SEA/RC40/inf.3.
10. WHO. The control of schistosomiasis. Second report of the WHO Expert Committee. WHO Technical Report Series. 1993;830:1-86.
11. Steinmann P, Keiser J, Bos R, Tanner M, Utzinger J. Schistosomiasis and water resources development: Systematic review, meta-analysis and estimate of people at risk. Lancet Infec. Dis; 2006.
12. Oladejo SO, Ofoezie IE. Unabated schistosomiasis transmission in Erinle River Dam, Osun State, Nigeria: Evidence of neglect of environmental effects of water development projects. Trop. Med. Int. Health. 2006;11(6):845-850.
13. Opara K, Udoidung N, Ukpong I. Genitourinary schistosomiasis among pre-primary schoolchildren in a rural community within the Cross River Basin, Nigeria. 2007;81:393-398.
14. Ali MU, Ndams IS. Distribution of snail intermediate hosts of schistosomiasis in human water contact points along Kadawa Irrigation canals, Kano State, Nigeria. Biological and Environmental Sciences Journal for the Tropics. 2012;9(2):169-175.
15. Olofin EA. Surface water pollution: A menace to the quality of life in urban area. Paper presented at the 34th annual conference of the Nigerian Geographical Association (NGA) Owerri; 1991.
16. Cheesbrough M. District laboratory practice in Tropical countries part 1. Cambridge University Press. 1998;236-239.
17. Ugbomoiko US. The prevalence, incidence and distribution of human urinary schistosomiasis in Edo State, Nigeria. The

Nigerian Journal of Parasitology. 2000;21:3-14.
18. Bassey SE, Umar Z. A re-assessment of schistosomiasis infection in Garun-Babba, Kadawa and Kura in Kano State, Nigeria. The Nigerian Journal of Parasitology. 2004;25:107-109.
19. Abdullahi J. Low cost management of urinary schistosomiasis in endemic setting. M. Sc Thesis. Department of Biological Sciences, Bayero University, Kano, Nigeria; 2005.
20. Bichi AH, Abubakar S. Urinary schistosomiasis among residents of Wasai Dam in Minjibir Local Government, Kano State. Biological and Environmental Sciences Journal for the Tropics. 2009;6(3):93-97.
21. Duwa MR, Oyeyi YI, Bassey SE. Prevalence and intensity of urinary schistosomiasis among primary school pupils in Minjibir Local Government Area of Kano state. Bayero Jounal of Pure and Applied Sciences. 2009;2(1):75-78.
22. Daniel AA, Adamu T, Abubakar U, Dakul, DA. Preliminary studies on schistosomiasis in Zuru, Kebbi State, Nigeria. The Nigerian Journal of Parasitology. 2001;22:65-75.
23. Bassey SE. The epidemiological infection of *Schistosoma haematobium* in River irrigation project Area, Kano State. M. Sc Thesis, Department of Biological Sciences, Bayero University, Kano; 1988.
24. Yakasai MU. Prevalence of *Schistosoma haematobium* in Karfi area, Kura Local Government Area, Kano State. B. Sc Thesis, Department of Biological Sciences, Bayero University, Kano; 1991.
25. Adomeh DI. Prevalence of *Schistosoma haematobium* in parts of Yobe State, Nigeria. Nig. J. of Med. Lab. Sci. 1998;7:11-16.
26. Tayo MA, Pugh RNA, Bradley AK. Malumfashi project XI: Water contact activities in the schistosomiasis study area. Annals of Tropical Medicine and Parasitology. 1980;74:347-354.
27. Ndams IS, Livingstone RS. Some patterns of schistosomiasis in a fishing settlement near Lake Geriyo, Jimeta-Yola. Nigerian Journal of Basic and Applied Sciences. 2000;9:175-183.
28. Edington GM, Gilles HM. Pathology in the Tropics. Edward Arnold (publisher) ltd. London. 1979;145-180.
29. Ayman YA. Parasitic infections and hepatic neoplasia. Digestive Diseases Clinical Review. 2001;9(4):288-291.

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