

VARIABILITY OF URINE PARAMETERS IN CHILDREN INFECTED WITH *SCHISTOSOMA HAEMATOBIMUM* IN UKAWU COMMUNITY, ONICHA LOCAL GOVERNMENT AREA, EBONYI STATE, NIGERIA

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Abstract

Background: Schistosomiasis, a chronic, debilitating and neglected tropical and sub-tropical water-borne ailment, is highly endemic in Nigeria, especially among primary school children in rural communities. The study on the variability of urine parameters in children infected with *Schistosoma haematobium* in Ukawu community, Onicha Local Government Area of Ebonyi State, was undertaken.

Materials and Methods: Urine samples were aseptically collected from 400 primary school children in the community and analysed using chemical reagent strips and sedimentation techniques.

Results: The study revealed an overall prevalence of 27% as 108 pupils out of 400 were infected with *S. haematobium* in the area. Proteinuria, haematuria and leucocyturia were observed to occur in 67.0%, 79.0% and 74.9% respectively. Males had higher infections and higher occurrences of proteinuria, haematuria and leucocyturia (72.5%, 88.2% and 82.4% respectively). There was no significant difference with respect to sex ($P < 0.05$). Children within ages 12-15 years had the highest prevalence of *S. haematobium* (35.5%) while those within the ages of 4-7 had the least prevalence (11.4%). The difference in the rate of infection between the different age groups was significant, statistically ($P > 0.05$). Children within ages 12-15 had the highest occurrence of proteinuria, haematuria and leucocyturia while children within ages 4-7 had the least occurrence of the three urine parameters. All the pupils excreting above 40 egg/10ml of urine had proteinuria, haematuria and leucocyturia.

Conclusion: The study revealed that the community studied is endemic with *Schistosoma haematobium* infections and the level of the urine parameters increased with the intensity of infection. Prompt case detection and treatment, good personal hygiene, eradication of snail hosts, public enlightenment and proper waste disposal are hereby recommended.

Keyword: *Schistosoma haematobium*, prevalence, proteinuria, haematuria and leucocyturia

Introduction

Urinary schistosomiasis is a chronic water-borne infection that threatens the life of millions of people globally especially the less privileged in rural areas of developing countries (Houmsou *et al.*, 2012). It is caused by the digenic parasitic trematode, *Schistosoma haematobium*, found in the venous plexus which drains the urinary bladder of humans (Ekpo *et al.*, 2010; Morenikeji and Idowu, 2011). During infection, the parasites deposit their ova and block the venous plexus, resulting in obstruction of blood flow. Eventually, this bursts the veins, allowing blood and eggs to enter the urinary bladder, explaining the characteristic symptom of blood in urine or haematuria (Ekpo *et al.*, 2010). Of all water transmitting diseases, it is the most important and in socio-economic and public health importance, it is second only to malaria (WHO, 1998; Uwaezuoke *et al.*, 2008). The World Health Organization (WHO) estimated that about 779 million people in 76 tropical and subtropical countries are at risk of schistosomiasis (Steinmann *et al.*, 2006). Over 207 million people in these countries are infected; of these, 120 million are symptomatic, with 20 million having severe clinical diseases (Engels *et al.*, 2002). Out of these number of people infected globally, 93% (192 millions) reside in the sub-Saharan Africa with the largest number of cases (29 million) occurring in Nigeria, followed by United Republic of Tanzania (Hotez and Kamath, 2009; Ishaleku *et al.*, 2012).

In sub-Saharan Africa alone, it is estimated that 70 million *Schistosoma haematobium*-infected individuals experience haematuria, 32 million with difficulty in urinating (dysuria), 18 million with bladder-wall pathology, and 10 million with major hydronephrosis (Ekpo *et al.*, 2010; Van der Werf *et al.*, 2003). Mortality rate due to non-functioning kidney (from *S. haematobium*) and haematemesis has been put at 150,000 per year (WHO, 1993). However, this number is a gross underestimation of the actual burden in Nigeria due to poor diagnosis and documentation of cases. It is mostly a rural occupational disease affecting those engaged in agriculture or fishing, and residents in rural and peri-urban areas. Associated risk factors also include illiteracy, poor socio-economic standard, poverty, poor hygiene, and inadequate public infrastructure (Houmsou *et al.*, 2012). The dearth of epidemiological data and basic information

regarding prevention of the disease in rural communities with high risk groups has hindered the control efforts (Mafe *et al.*, 2005) and can adversely affect adequate patient evaluation, management and control programmes. This study was therefore undertaken to determine the variability of urine parameters in children infected with *Schistosoma haematobium* in Ukawu Community, Onicha Local Government Area of Ebonyi State, Nigeria.

Materials and method

Study Area

This study was carried out in Ukawu Community, Onicha Local Government Area in the Southern region of Ebonyi State, Nigeria. The area was chosen based on reports from local clinics and health centres of cases of urinary schistosomiasis in the area particularly among school children. The area is located along latitude 6°00'N and longitude 7° 55'E. The climate of the area is tropical and the vegetation predominantly rainforest with an average annual rainfall of about 1300mm and atmospheric temperature of 30 °C (Uneke *et al.*, 2006). There are two distinct seasons, the wet and dry seasons; the wet season occurs from April to October while dry season starts from November to March. Water contact activities like bathing, swimming and washing are generally common. Agriculture, especially swampy- rice cultivation and fishing, is the main occupation of the people in this area.

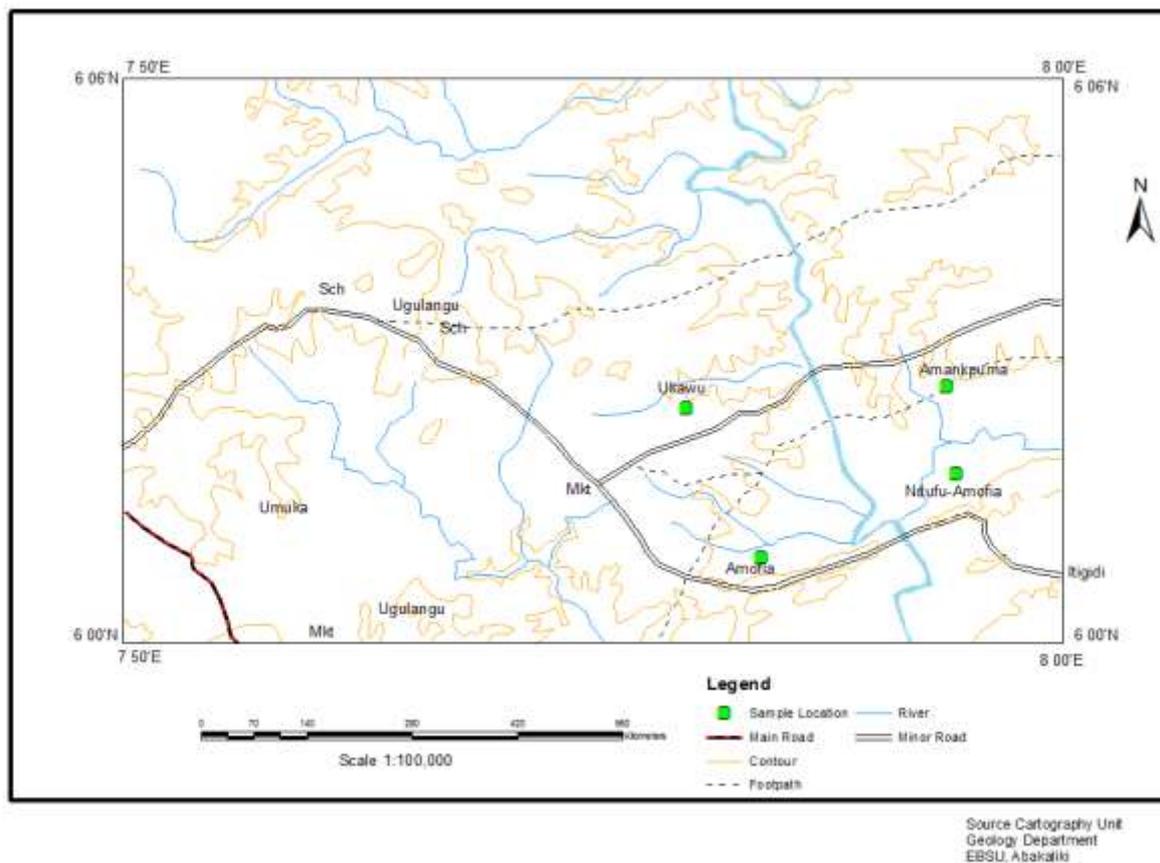


Figure 1: Map showing Ukawu Community.

Study Population

Two large primary schools in Ukawu Community of Onicha local Government Area were surveyed. The two schools included Ezeube primary school, Ndufu- Amankpuma and Igwebuike primary school, Amoffia. Two hundred and fifty-three (253) pupils were sampled from Ezeube primary school and 147 pupils from Igwebuike primary school, making a total of 400 pupils. Primary school pupils were considered from this study, because the schools are accessible without much difficulty, the peak of prevalence of schistosomiasis is to be found in this group (Uneke *et al.*, 2006; Odikamnor, 2012) and there was general good compliance from school children (Montesor *et al.*, 1998). The sex of each pupil was recorded while age was obtained from each participant by interview with the help of the teachers.

Ethical Consideration

This study received the approval of the Research and Ethics Committee of the Department of Applied Biology, Faculty of Science, Ebonyi State University, Abakaliki, Nigeria, according to the international guidelines for human experimentation in biomedical research (WHO, 1993). Approval was also sought and obtained from the parent's teachers Association (P.T.A) of each school studied and oral consent was obtained from each of the participating pupils. Pupils who declined participation were excluded from the study. All information obtained from the pupils and/or their samples were treated with utmost confidentiality and used for the purpose of the research only.

Sample Collection

The pupils themselves after a brief exercise, where they were instructed on how to collect the urine samples, collected about 20 ml of midstream urine samples in wide mouthed universal containers, making sure the terminal urine is included, as *Schistosoma* egg is much in terminal urine (Cheesbrough, 1998). Samples were obtained between 10.00 am and 2.00 pm (WHO, 1993). The specimens were appropriately labelled with identification numbers and carried to the laboratory immediately after collection for analysis. Two drops of ordinary house hold bleach was added to samples that were not analyzed the same day to preserve *Schistosoma* ova present (WHO, 1993; Cheesbrough, 1998).

Laboratory Analysis

In the laboratory, a reagent strip (Uripad, Combi 10) was dipped into each urine sample, read and recorded for proteinuria, haematuria and leucocyturia according to the manufacturer's instructions. Each of the specimens was thoroughly agitated (Uneke *et al.*, 2006). The 10ml of each pupil's urine was drawn with a disposal syringe, transferred into a centrifuge tube and centrifuged for 5 min at 5000 rpm. The supernatants were discarded, while the sediments were observed microscopically in triplicates on clean grease-free slides. *Schistosoma* ova were counted and recorded accordingly.

Statistical Analysis

In the analysis, percentage and chi-square were used to analyze the prevalence of *S. haematobium* in the area. ANOVA was used to analyze the occurrence of proteinuria, haematuria and leucocyturia in children infected. Correlation was also used to determine the relationship between intensity of disease and urine parameters of infected children.

Results

Out of 400 pupils from Ezeube primary school, Ndufu-Amankpuma and Igwebuik primary school, Ndufu Amoffia both in Ukawu Community of Onicha local government area examined for *Schistosoma haematobium* ova, 108 (27%) children were infected. Igwebuik primary school, Ndufu Amoffia had higher prevalence rate (31.3%) of *S. haematobium* than Ezeube primary school, Ndufu-Amankpuma (24.5%). There was no difference in rate of infection in both schools ($\chi^2 = 2.209$; $P < 0.05$). Out of 400 (174 male and 226 female) children examined, the males were more infected, 51(29.3%) than the females 57(25.5) though statistically there was no significant difference among sex ($\chi^2 = 0.83$; $P < 0.05$). Out of 51(29.3%) male infected with *S. haematobium*, 37(72.5%), 45(88.2%) and 42(82.4%) had proteinuria, haematuria and leucocyturia respectively while 36(63.2%), 41(71.9%) and 38(66.7%) females had proteinuria, haematuria and leucocyturia respectively, out of the 57(25.5%) females infected with *S. haematobium*.

However, there was no statistical difference in the occurrence of proteinuria, haematuria and leucocyturia among sex. Overall, proteinuria was found in 73 (67.6%) infected children, haematuria in 86 (79.61%) infected children and leucocyturia occurred in 80 (74.1%) of the infected children. Children whose parents were farmers had the highest prevalence (27.5%) of *S. haematobium* infection while children of civil servants had the lowest prevalence of *S. haematobium*, though there was no significant difference found statistically. Children within the age of 12-15 had the highest prevalence of *S. haematobium* 53(35.3%) while children within the age 4-7 had the least prevalence 10(11.4%). Children within age 12-15 had the highest occurrence of proteinuria, haematuria and leucocyturia (71.7%, 92.5% and 88.7%) respectively while children within age 4-7 had least occurrence of proteinuria, haematuria and leucocyturia (60%, 20% and 20%) respectively (Table 1).

Prevalence and Distribution of Infection in Ezeube Primary School

Out of 106 males examined at Ezeube primary school, Ndufu-Amankpuma, 29(27.4%) were infected with *S. haematobium*, while 33(22.4%) out of 147 females that were examined had *S. haematobium*. However, there was no significant difference between sexes ($\chi^2 = 0.79$; $P < 0.05$). Out of the 29(27.4%) male infected, 19(65.5%), 26(89.7%) and 24(82.8%) pupils had proteinuria, haematuria and leucocyturia respectively, while out of 33(22.4%) females

infected, 21(63.6%), 24(72.7%) and 22(60.6%) had proteinuria, haematuria and leucocyturia respectively. Statistically there was no significance difference in the occurrence of proteinuria, haematuria and leucocyturia with respect to the sex of the pupils (Table 1). The results also indicate that children within the age of 12-15 had highest prevalence of *S. haematobium* (29%) while children within age 4-7 had the least prevalence. However there was no significant difference among ages ($\chi^2=3.76$; $P<0.05$). Children within age 12-15 had highest occurrence of proteinuria, haematuria and leucocyturia while children within age 4-7 had the least occurrence of proteinuria, haematuria and leucocyturia, there was no significant difference in the occurrence of proteinuria, haematuria and leucocyturia with respect to age.

Prevalence and Distribution of Infection in Igwebuike Primary School

In Igwebuike Primary School, Ndufu-Amoffia, the males had higher prevalence rate (32.4%) than the females (30.4%) though statistically there was no significant difference with respect to sex ($\chi^2= 0.059$; $P<0.05$). Out of 22(32.4%) male infected with *S. Haematobium* in this school, 18(75%), 19(86.4%) and 18(81.8%) had proteinuria, haematuria and leucocyturia respectively, while 15(68.2%), 17(70.8%) and 16(66.7%) females had proteinuria, haematuria and leucocyturia respectively, out of the 24(30.4%) females infected with *S. haematobium*. There was no statistical difference in the occurrence of proteinuria, haematuria and leucocyturia with respect to sex (Table 1).

The results also revealed that children within the age 12-15 had highest prevalence of *S. haematobium* 24(48%) while children within age 4-7 had the least prevalence of *S. haematobium* 3(8.3%). Statistically there was a difference between the ages ($\chi^2= 15.33$; $p<0.05$). Infected children within age 12-15 had highest occurrence of proteinuria, haematuria and leucocyturia (75%, 87.5% and 87.5%) respectively while children within age 4-7 had the least occurrence of proteinuria (66.7%). There was no haematuria and leucocyturia found in children within this age bracket.

Table 1: Prevalence of *Schistosoma haematobium* and pathological urine findings among Primary school children in Ukawu Community of Onicha Local Government area, Ebonyi State, Nigeria.

<i>Ezeube primary school, Ndufu-Amankpuma</i>						<i>P value</i>	χ^2 <i>value</i>
	<i>No. exam.</i>	<i>No. infected</i>	<i>No. with Pu</i>	<i>No. with Hu</i>	<i>No. with Lu</i>		
Total prevalence	253	62 (24.5%)	40 (64.5%)	50 (80.6%)	46 (74.2%)	<0.05	2.209
Sex						<0.05	0.79
MALE	106	29 (27.4%)	19 (65.5%)	26 (89.7%)	24 (82.8)		
FEMALE	147	33 (22.4%)	21 (63.6%)	24 (72.7%)	22 (60.6%)		
TOTAL	253	62 (24.5%)	40 (64.5%)	50 (80.6%)	46 (74.2%)		
Ages						<0.05	3.76
4-7	52	7 (13.5%)	4 (57.1%)	2 (28.6%)	2 (28.6%)		
8-11	101	26 (25.71)	15 (57.7)	20 (76.9)	18 (69.2)		
12-15	100	29 (29%)	21 (72.4%)	28 (96.6)	26 (89.7%)		
TOTAL	253	62(24.5%)	40(64.5%)	50(80.6%)	46(74.2%)		
<i>Igwebuike Primary School, Ndufu-Amoffia</i>						<i>P value</i>	χ^2 <i>value</i>
	<i>No. exam.</i>	<i>No. infected</i>	<i>No. with Pu</i>	<i>No. with Hu</i>	<i>No. with Lu</i>		
Total prevalence	147	46(31.3%)	33(71.74%)	36 (78.3%)	34 (73.9%)	<0.05	2.209
Sex						<0.05	0.059
MALE	68	22 (32.4%)	18 (75%)	19 (86.4%)	18 (81.8%)		
FEMALE	79	24 (30.4%)	15 (68.2%)	17 (70.8%)	16 (66.7%)		
TOTAL	147	46(31.3%)	33(71.7%)	36(78.3%)	34(73.9%)		
Ages						<0.05	15.33
4-7	36	3 (8.3%)	3 (66.7%)	-	-		
8-11	61	19 (31.1%)	13 (68.4%)	15 (78.9%)	13 (68.4%)		
12-15	50	24 (48%)	16 (75%)	21 (87.5%)	21 (87.5%)		
TOTAL	147	46(31.3%)	33(67.4%)	36(78.3%)	42(73.9%)		
<i>Overall Prevalence for both Schools</i>							
	<i>No. examined</i>	<i>No. infected</i>	<i>No. with Pu</i>	<i>No. with Hu</i>	<i>No. with Lu</i>		

Sex						<0.05	0.83
MALE	174	51 (29.3%)	37 (72.5%)	45 (88.2%)	42 (82.4%)		
FEMALE	226	57 (25.2%)	36 (63.2)	41 (71.9%)	38 (66.7%)		
TOTAL	400	180(27%)	73(67.6%)	86(79.6%)	80(74.1%)		
Ages						<0.05	16.246
4-7	88	10 (11.4)	6 (60%)	2 (20%)	2 (20%)		
8-11	162	45 (27.8)	29 (64%)	35 (77.8%)	31 (68.9%)		
12-15	150	53 (35.3)	38 (71.7%)	49 (92.5%)	47 (88.7%)		
TOTAL	400	108(27%)	73(67.6%)	86(79.6%)	80(74.1%)		
Parents' occupation	No Exam.	No infected					
Farming	320	88 (27.5%)					
Articians	69	18 (26%)					
Civil servant	11	2 (18.2%)					
TOTAL	400	108 (27%)					

Key: Pu = proteinuria; Hu = haematuria; Lu = leucocyturia

Intensity of Infection

Table 2 shows the relationship between proteinuria, haematuria and leucocyturia and ova excretion in urine of *S. haematobium* infected children. Children that excreted 51-60 ova/10ml of urine all had the occurrence of proteinuria, haematuria and leucocyturia, while children that excreted 1-10 ova/10ml of urine had the least occurrence of proteinuria, haematuria and leucocyturia (18.8%, 31.3% and 31.3%) respectively. This result shows a strong relationship between ova excretion and proteinuria, haematuria and leucocyturia with a correlation coefficient of 0.85, 0.86 and 0.86 respectively.

Table 2: Pathological urine findings in relation to ova excretion in urine of *Schistosoma haematobium* infected children.

No. of Ova excretion	No infected	No with Pu	No with Hu	No with Lu
1-10	16	3 (18.8%)	5 (31.3%)	5 (31.3%)
11-20	22	10 (45.5%)	16 (72.71)	13 (59.1%)
21-30	18	12 (66.7%)	4 (77.8%)	12 (66.71)
31-40	12	8 (66.7%)	11 (91.7%)	10 (83.3%)
41-50	4	4 (100%)	4 (100%)	4 (100%)
51-60	36	36 (100%)	36 (100%)	36 (100%)
Total	108	73 (67.6%)	86 (79.6%)	80 (7)

Key: Pu = proteinuria; Hu = haematuria; Lu = leucocyturia

Table 3 shows that degree or severity of proteinuria, haematuria and leucocyturia depends on infection intensity (number of ova excreted per 10ml of urine). The degree or severity of proteinuria, haematuria and leucocyturia was higher in children that excreted 51-60 ova/ 10ml of urine while children that excreted 1-10 ova/10ml of urine had less degree of proteinuria, haematuria and leucocyturia.

Table 3: Intensity of infection in relation to the degree or severity of proteinuria, haematuria and leucocyturia.

Infection intensity	No. Infected	Level of Pu						Level of Hu				Level of Lu			
		-ve	T	1+	2+	3+	4+	-ve	1+	2+	3+	-ve	1+	2+	3+
1-10	16	13	-	2	1	-	-	11	5	-	-	11	1	4	-
11-20	22	12	-	4	6	-	-	5	11	6	-	9	5	8	-
21-30	18	6	-	-	10	2	-	4	1	13	-	6	4	8	-
31-40	12	7	-	-	3	5	-	1	-	2	9	2	2	8	-
41-50	4	-	-	-	-	4	-	-	-	2	2	-	-	3	1
51-60	36	-	-	-	-	12	-	-	-	15	21	-	-	15	21

Key: Pu = proteinuria; Hu = haematuria; Lu = leucocyturia

Discussion

Pathological urine findings such as proteinuria, haematuria and leucocyturia have long been associated with *S. haematobium* (Ekkahard *et al.*, 1985). Proteinuria and haematuria have been the two most used parameters for indirect screening for *S. haematobium* infection. This study went beyond these two parameters (proteinuria and haematuria) using a polyvalent urine analysis strip (Uripad, Combi 10) that was able to detect proteinuria, haematuria and leucocyturia simultaneously and revealed significant variability of urine parameters in children infected with *S. haematobium* in Ukawu Community, Onicha L.G.A of Ebonyi State, Nigeria. Out of the 400 pupils examined in Ezeube primary school, Ndufu-Amankpuma and Igwebuikwe primary school, Ndufu Amoffia (253 and 147) respectively, 108(27%) were infected with *S. haematobium* of which Igwebuikwe primary school, Ndufu Amoffia had higher prevalence of the infection 46(31.3%) than Ezeube primary school, Ndufu-Amankpuma which had 62(24.5%). This result corroborates with the results of several previous investigations on the endemicity of *S. haematobium* in Ebonyi State, Nigeria (Uneke *et al.*, 2006; Uwaezuoke *et al.*, 2008; Odikamnor, 2012).

However, the overall prevalence rate (27%) recorded for *S. haematobium* in this study is lower than 41% recorded by Uwaezuoke *et al.* (2008) in Ikwo area of Ebonyi State, 32% recorded by Afoke *et al.* (2010) in Ebonyi State, 55.7% recorded by Odikamnor (2012) in Ebonyi State, Nigeria. The low prevalence of *S. haematobium* observed in this area may be attributed to routine mass chemotherapy administered to children of the area by the governmental and non-governmental Agencies.

Out of the 108 pupils infected with *S. haematobium*, haematuria was observed most while proteinuria had the least occurrence. This agrees with the findings of Ekkahard *et al.* (1985) that obtained the prevalence of proteinuria, haematuria and leucocyturia as 73%, 84% and 77% respectively, out of 182 pupils infected with urinary and intestinal schistosomiasis.

Males had higher prevalence of *S. haematobium* in the area than females (29.3% and 25.2%). This agrees with the findings of Agi and Okafor (2005), Uneke *et al.* (2006) and Ozowara *et al.* (2011) in which males had higher prevalence than females. This disagrees with the findings of Ishaleku *et al.* (2012) in which females had higher prevalence of *S. haematobium* than the males (15.5% and 15.0%) respectively. The variation in the two results may be due to differences in cultural and social behaviours among the males and females in the study area. Higher water contact activities such as swimming and fishing in infected water bodies even farming on swampy areas among males who often assist their parents in rice farming and are engaged in other social and cultural activities, which predisposes them to greater/higher infection than their female counterpart may further explain these variations. Males also had higher rate of proteinuria, haematuria and leucocyturia (72.5%, 88.2%, and 82.4%) respectively. This also is in line with the findings of Ekkahard *et al.* (1985) that recorded a significant correlation between proteinuria, haematuria and leucocyturia and the number of *S. haematobium* ova excretion in urine.

Children within the age of 12-15years had higher prevalence of *S. haematobium* (35%) and also higher prevalence of proteinuria, haematuria and leucocyturia (71.7%, 92.5% and 88.7%) respectively while children within age 4-7 had the least prevalence of *S. haematobium* (11.4%) and the least prevalence of proteinuria, haematuria and leucocyturia (60%, 20%, 20%) respectively. This is in line with Ozowara *et al.* (2011).

Strong relationship was observed between *S. haematobium* ova excretion and proteinuria, haematuria and leucocyturia with a coefficient of 0.85%, 0.86% and 0.86% respectively and there was an occurrence of proteinuria, haematuria and leucocyturia in all children excreting ova above 40 in 10ml of urine. This is in line with the findings of Ekkahard *et al.* (1985) that recorded a strong correlation between *S. haematobium* ova and proteinuria, haematuria and leucocyturia with a coefficient value of 0.86, 0.84 and 0.83 respectively.

This research also observed that, the degree or severity of proteinuria, haematuria and leucocyturia depended on the infection intensity (the number of egg excreted per 10ml of urine). The degree or severity of proteinuria, haematuria and leucocyturia in 36 infected children excreting 51-60 egg/10ml of urine was higher while children excreting 1-10 egg/10ml of urine had less severity of proteinuria, haematuria and leucocyturia.

Children whose parents are farmers had higher prevalence (27.5%) while children of civil servants had lower prevalence of *S. haematobium* infection. This may be due to the fact that children of the farmers engage more on activities that predisposes them to *S. haematobium* infection.

Conclusion

The study revealed that the community studied is endemic with *Schistosoma haematobium* infections and the level of the urine parameters increased with the intensity of infection. Prompt case detection and treatment, good personal hygiene, eradication of snail hosts, public enlightenment and proper waste disposal are hereby recommended.

Conflict of interests None exists

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