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USING PROTEINURIA AND URINE COLOUR INTENSITY IN THE DIAGNOSIS OF SCHISTOSOMIASIS IN RESOURCE LIMITED COMMUNITIES IN FEDERAL CAPITAL TERRITORY IN NIGERIA

[1]Wasiu O Adebimpe, [2] Tamunonengiye O Israel and ^[3] Adeolu S Oluremi

1 Department of Community Medicine, Faculty of Clinical Sciences, University of Medical Sciences, Ondo Nigeria; 2 Division of HIV/AIDS, Department of Public Health, Federal Ministry of Health Abuja, Nigeria; 3 Department of Medical Laboratory Sciences, Ladoke Akintola University of Technology, Ogbomosho Nigeria

^Correspondence to: asoluremi@lautech.edu.ng

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ABSTRACT:
Nigeria has the highest number of Schistosomiasis cases in the world, with significant gaps in epidemiological data to estimate the true magnitude of the problem. Haematuria (HU) and Proteinuria (PU) could be a low cost and valid indirect marker for screening of urinary Schistosomiasis instead of the standard urine filtration technique. This is particularly important in resource limited countries where microscopy related resources are not easily accessible. This study assessed the validity of Proteinuria and Urine Colour Intensity in the diagnosis of *Schistosomiasis* in the Federal Capital Territory (FCT) in Nigeria. A community based descriptive cross sectional study was carried out among 200 eligible school children selected using a multistage sampling method. Research instruments were semi structured interviewer administered questionnaire. Laboratory assays followed standard procedures. The mean age of the children was 11.0±3.7 years. The overall prevalence of *Schistosoma haematobium* infection by microscopy was 24.0% (48/200). Using proteinuria as an index of severity of infection, 59.0% (118/200) had no infection by virtue of a negative result, 15.5% (31/200) had mild, 11.5% (23/200) had moderate while 14.0 (28/200) had severe infection. There was a statistically significant association between the number of urine eggs and colour intensity (p=0.0001) and proteinuria (p= 0.001). Our results support the findings by others that HU and PU are simple indirect methods for identifying *S. haematobium* infection, and useful tools for the rapid mapping of the prevalence and community field screening for Schistosomiasis most especially in resource limited settings of Nigeria.

Key words: Proteinuria, validity, urine colour intensity, Schistosomiasis
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INTRODUCTION:

Schistosomiasisis is unique among common parasitic diseases causing morbidity and complications among individuals and communities. It is a chronic and debilitating disease caused by digenetic trematode flat worms of the genus *Schistosoma*. The species under the genus Schistosoma that causes human Schistosomiasis are *Schistosoma haematobium, Schistosoma intercalatum, Schistosoma japonicum, Schistosoma mansoni* and *Schistosoma mekongi* [1]. The disease affects more than 70 countries, mostly people from tropical countries in Africa, East Asia, and South America [2]. Despite the high burden of Schistosomiasis especially in Africa, which accounted for more than 85% of the estimated 238 million people infected with the disease in 2010 [3], Schistosomiasis is still therefore considered a neglected tropical disease.

The disease is endemic in tropical areas where there are currently millions of people living in areas with transmission risk [1]. A recent estimate from sub-Saharan Africa indicates that 280,000 mortalities yearly can be attributed to Schistosomiasis [4]. Schistosomiasis is associated with water resources development projects such as dams, irrigation schemes, rice and fish-farming, which seems to increase the human contact and thus increase the risk of infection [5]. Urinary Schistosomiasis caused by *S. haematobium* which results to passing of eggs through the bladder wall causes damage leading to terminal haematuria, the passage of small amounts of blood and protein in to the urine [6]. Reagent strips can detect such small amounts of blood and protein present in urine and can thus be used as indicators of infection with *S. haematobium* especially in field surveys [7]. In resource limited countries where microscopy is not easily accessible, and where laboratory based human resources and availability of constant electricity for microscopy are limited, the detection of Haematuria (HU) and Proteinuria (PU) has been used as an indirect diagnostic assay for *S. haematobium* [8]. A study in Aliero Local Government Authority, Kebbi state in Nigeria reported high sensitivity and specificity figures for HU and PU in Northern Nigeria [9] However, the presence of blood in urine due to menstruation or presence of protein in urine due to urinary tract infections (UTI) and other pathologies are confounding issues with regards to reagent strip results [10].Thus using appropriate low cost scientific technology as one of the principle of Primary Health Care (PHC), the use of Urine colour intensity is also possible to be a valid proxy and an indirect marker for screening of urinary Schistosomiasis instead of the standard urine filtration technique which PHC centres in resources limited endemic settings of Nigeria could not do. This study therefore aims at determining the validity of Proteinuria and Urine Colour Intensity in the diagnosis of Schistosomiasis in resource limited endemic

settings of the Federal Capital Territory (FCT) in Nigeria.

SUBJECTS AND METHODS:

The study area was the Federal Capital Territory (FCT) of Nigeria, with a population of about 3 million from a 2016 projection of the 2006 national population census [11]. The average temperature is 30ºC, humidity of 62%, and wind of NW at 2km/hour and rainfall of 1400mm.There are five area councils in the FCT, 2 major rivers transcends the FCT as foci of transmission. Majority of communities affected were served mainly by PHCs though there are 5 General Hospitals and two Teaching Hospitals within the large urbanized areas of the FCT. This was a community based descriptive cross-sectional study.

The study population consists of school aged children 6 to 17 years whose parents consented to the study and who have not been given any form of Schistosomiasis treatment in the past one year.

The sample size was calculated using the modified Leslie Fisher's formula for the calculation of sample size for population greater than 10,000 [12] and a Nigerian national average prevalence rate of 13.0% [13]. A sample size of 173.8 was obtained, and this was rounded up to 200 to account for attrition.

Two of the five Local Government Areas LGAs in FCT were randomly selected using simple random sampling employing simple balloting. Kuje and Abaji LGAs were selected. In Stage 2, a list of communities per LGA with established foci and designated by the LGA health departments as endemic for Schistosomiasis was made. Two communities per LGA were selected by simple random sampling. In a community using the Kings palace as a center, two out of the many designated clusters were randomly selected, each having 25 questionnaires allocated to them to mark the end of Stage 3.

In Stage 4, a list of eligible children within a cluster was made and a systematic sampling of one in three children on the list was carried out until the allocated number of questionnaires was exhausted. In clusters where questionnaires were not exhausted, another cluster was chosen in the same community using simple random sampling.

A semi structured interviewer administered questionnaire was used to collect some bio data and other Schistosomiasisis related information from the respondents. Face and content validity of the instrument was done by review carried out by an epidemiologist. Three trained research assistants including two laboratory scientists were employed in data collection.

Sample Collection and Laboratory procedures:
Mid-stream urinary samples were collected into sterile plain, wide mouthed universal bottles. Each bottle was labelled with the sample number of a participant. Colour intensity was assessed visually before centrifugation. Urine colour intensity was assessed visually before centrifugation and graded [14]. For urinalysis, urinary strip whose precision and accuracy had been previously tested were dipped into the urine samples and was read following the manufacturer's instruction.

For macroscopy, each urine sample was read macroscopically for consistency, appearance, colour, presence of blood and turbidity. For microscopy, the urine sample was centrifuged, the supernatant was decanted and its sediments were examined for *Schistosoma heamatobium* eggs. Proteinuria was graded using the chart on the leaflet supplied by the manufacturers while colour intensity was done with visually. The procedure was explained to all participants and informed consent questionnaire were given to generate information on their bio-data and other selected variables in the checklist. A written informed consent was obtained from each of the parents of the children.

Data collected from the respondents were entered into spreadsheet in the computer and analyzed using the SPSS 17.0 version, after data cleaning and ensuring data validity through random checks and double entry. Tables and figures were used to report descriptive findings. The mean and standard deviation was calculated for numerical data. Univariate analysis was carried out to calculate frequencies and proportions of the different socio demographic and other categorical variables. Bi-variate analysis was carried out using Chi-squared test to determine the relationship between the main dependent variable and some independent variables of interest. Validity indices considered include sensitivity, specificity, positive and negative predictive indices as well s diagnostic accuracy. P values of less than or equal to 0.05 was considered statistically significant.

RESULTS:

A total of 200 children in the 6 to 17 years age group were enrolled for this study. The socio demographic information of the children is showed in Table 1. The respondents comprised of 80.5% (161/200) males and 19.5% (39/200) females. The mean age of all the respondents was 11.0$\pm$3.7 years. For their educational level, 67.0% (134/200) were in primary school. The parents of 55.0% (110/200) of the children were farmers, while 50.5% (/200) had lived in their respective communities for more than 5 years.

Three - quarter of the respondents was aware of the Schistosomiasis infection by symptom of terminal haematuria. Among the population studied, the overall prevalence of *Schistosoma haematobium* infection was 24.0% (48/200).

Using proteinuria as an index of severity of infection, Table 2 showed that 59.0% (118/200) had no infection by virtue of a negative result, 15.5% (31/200) showed mild, 11.5% (23/200) had moderate, while 14.0 (28/200) had severe infection. For validity of proteinuria in assessing diseases status in *S.heamatobium* diagnosis, its sensitivity was 51.3% and sensitivity 36.1% with 53.7% and 33.9% positive and negative predictive indices respectively as shown in Table 3. We initially proposed that colour intensity would have association with Scistosomiasis which was based on the premises that all cleared urine would not contain *Schistosoma haematobium* egg while the turbid samples would have eggs ranging from mild to severe. It was observed that amber colored urine had highest number of schistosoma eggs [14]. There was a significant association between colour intensity and urine eggs (p=0.0001), and proteinuria and urinary eggs (p= 0.001) as shown in Table 4.

Table 1: Socio demographic information of respondents (n = 200)

Demographic Information	Frequency (%)
Age (Mean age: 11.0 ± 3.7 years)	
6 – 9 years	19 (9.5)
10 – 13 years	151 (75.5)
14- 17 years	30 (15.0)
Gender	
Male	161 (80.5)
Female	39 (19.5)
Educational Level	
Pre-Primary	-
Primary 1-3	66 (33.0)
Primary 4-6	134 (67.0)
Secondary	-
No school at all	-
Duration of time lived in the community	
Less than 6 months	9 (4.5)
6 months – 1 year	9 (4.5)
1- 5 years	81 (40.5)
More than 5 years	101 (50.5)
Parent's occupation	
Farming	110 (55.0)
Fishing	8 (4.0)
Trading	42 (21.0)
Self-employed	26 (13.0)
Civil servants	14 (7.0)
Aware of Schistosomiasis	
Yes	150 (75.0)
No	27 (13.5)
Not sure	23 (11.5)

Table 2: Severity of infections of Schistosoma heamatobium by proteinuria (n = 200)

Variables	Frequency (%)
No infection (-)	118 (59.0)
Mild Infection (+)	31 (15.5)
Moderate Infection (++)	23 (11.5)
Severe infection (+++)	28 (14.0)

Table 3: Validity of proteinuria and diseases status in S.haematobium diagnosis

Proteinuria Test Result	Disease Status		Total
	Positive (+)	Negative (-)	
Positive (+)	44	38	82
Negative (-)	78	40	118
Total	122	78	200
Sensitivity	44/122	-	36.1%
Specificity	-	40/78	51.3%
Positive predictive value	44/82	-	53.7%
Negative Predictive value	-	40/118	33.9%

Table 4: Associations of haematuria by urine reagent strips, self-report, colour intensity and Microscopy for Schistosoma haematobium

		Urine Eggs					Test Statistics (ANOVA)	
		Trace	Mild	Moderate	Severe	Total	F test	P value
Color Intensity	**Clear**	0	0	0	0	0	40.403	0.001
	Turbid	7	4	2	0	13		
	Amber	0	0	1	34	35		
	Total	7	4	3	34	48		
Proteinuria	**Trace**	0	0	1	8	9	38.205	0.001
	+	-	-	-	-	-		
	++	7	4	1	0	12		
	+++	0	0	1	26	27		
	Total	7	4	3	34	48		

DISCUSSION:

This study revealed that the children in the studied communities were at risk of Schistosomiasis and the prevalence could be described as moderate. The high awareness of Schistosomiasis by symptoms among about 75% (150/200) of our respondents showed that the disease is well known by people in the community. This high awareness rate agreed with other published studies [15-17]. A high awareness could assist respondents to know more about the risk factors, mode of transmission and future preventive measures. It would also encourage the affected communities to take more proactive measures towards disease control.

The findings in this study showed the establishment of moderate *S. haematobium* infection in the study area based on the prevalence rate of 24%, which is higher than the Nigerian national average of 13% [13] but lower than the WHO range which considers 40% to be endemic or high (18). This result agrees with the result obtained by another study [19]. Moderate or low prevalence could mean that the communities have made some efforts in the past to increase herd immunity to Schistosomiasis. This could be in form of targeted or mass treatment of the community with drugs such as Praziquantel, or health education of at risk groups and environmental modifications that could assist disease control and prevalence reduction.

The was significant association between urine eggs with colour intensity and proteinuria ,which showed that both haematuria (HU) and proteinuria (PU) can be used as indicators of infection with *S. haematobium* especially in field surveys, as already proposed and suggested by earlier community based studies [7,20-22]; they can provide a semi quantitative result. In Nigeria, Schistosomiasis is still a problem getting the attention of Governments and development partners. In endemic areas where most serving health facilities are primary health centres and where electricity supply is erratic, the use of the standard microscopy could be elusive thereby making the use of basic low costs technology in diagnosis inevitable. Nurses and Community Health workers can perform these procedures and interpret the results correctly thus preventing missed opportunity in case management.

While concluding that HU and PU were shown to be reliable as a proxy to the filtration methods in the diagnosis of Schistosomiasis, it is important to compare both HU and PU since their sensitivity and specificity values could differ considerably from one endemic area to another. Although HU and PU are considered to be of good and high value in community and field screening for Schistosomiasis, more

complex designed local studies are required in order to obtain more valid conclusion on the subject matter of validity of both HU and PU in the definitive diagnosis of Schistosomiasis. The high prevalence of 53.6% of proteinuria among those infected with Schistosomiasis in this study suggest a dire need for coordinated and urgent steps to control the disease and prevent complications due to loss of essential proteins. Prompt diagnosis and treatment can also prevent other complications such as chronic kidney diseases and formation of urinary strictures among males.

In conclusion, an association was confirmed between HU, PU and use of urinary egg in diagnosis of Schistosomiasis as reported by earlier studies [14, 23]. This study showed moderate specificity of urine strip in evaluating proteinuria in the detection of urinary Schistosomiasis. The prevalence of proteinuria was high among the children with Schistosomiasis infections; thus, HU and PU testing can be used as a simple indirect method for identifying S*. haematobium* infection in this community. It can also be a useful tool for the rapid mapping of the prevalence of Schistosomiasis to identify high risk areas.

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Conflict of interest: None to declare

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