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UROGENITAL SCHISTOSOMIASIS: PREVALENCE, MEAN INTENSITY, PROSPECT OF URINE COLOUR VERSUS TURBIDITY AS RAPID DIAGNOSTIC TOOLS AND AGE VERSUS GENDER AS RISK FACTORS AMONG SCHOOL-AGE CHILDREN IN KATSINA STATE.

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ABSTRACT
Schistosomiasis is a neglected infectious disease that is endemic in resource-constrained settings. Nigeria has the highest cases of schistosomiasis in sub-Sahara Africa with about 29 million infected. This study was carried out with the aim to identify some risk factors of schistosomiasis and as well assess the efficacy of some urine physical parameters for a rapid screening procedure. Terminal urine samples were collected, analyzed with reagent strips and centrifuged at 400 revolution per minute for 4 minutes. Microscope (x10 objective) was used to examine and count the eggs. Raw data were imported into Epi Info software (version 7.1.2.0) from Microsoft Excel 2010 for analyses. About 357 respondents with a mean age of 9.39±2.06 years were sampled. Overall prevalence and intensity were 10.36% (7.61-13.96) and 322.2 eggs/10ml of urine samples respectively. Males had a higher prevalence [15.42% (10.86-20.97)] and mean intensity [77.5 eggs/10ml] and were 6 times more likely to be infected [COR (95% CI): 6.31 (2.17-25.09)]. Age group 11-15 years recorded higher prevalence (19.39% [12.10-28.61]) and intensity (110.9 eggs/10ml) and was 3 times [COR (95% CI): 3.21 (1.51-6.84)] more likely to be infected. Urine samples with faint yellow colour recorded the highest prevalence of 13.67% (8.43-20.52) and were 4 times [COR (95% CI): 4.33 (1.12-28.39)] more liable to infestation compared to the colourless samples. Age and gender are risk factors with faint yellow colour as the only reliable rapid diagnostic index. Provision of potable water and treatment with Praziquantel should be done urgently.

Keywords: Urogenital, Schistosomiasis, Children, Praziquantel, Dutsin-Ma, Nigeria

INTRODUCTION

Schistosomiasis is an infectious disease of poverty that is endemic in resource-constrained settings which include sub-Saharan Africa (SSA), the Middle East, Brazil, and the Caribbean. The aetiological agents of schistosomiasis are digenetic trematodes in the genus *Schistosoma* (WHO, 2020).

The urogenital form of schistosomiasis is caused by the infective stage (cercariae) of *S. haematobium* (Afiukwa *et al*., 2019). Humans become infected in unwholesome water bodies (river, ponds, streams, and so on) when they come into contact with the microscopic cercariae shed by some gastropod snails in the genus *Bulinus* (Ridi and Tallima, 2013). The infection becomes symptomatic when human bodies react to the terminal spined eggs of the parasite. Such symptoms include diarrhoea, abdominal pain, haematuria, hydronephrosis, kidney disfunction, bladder cancer, and genital sores. Estimate shows that about 112 million people are infected annually, 436 million are at risk of infection while 163, 300 people die annually due to urogenital schistosomiasis (WHO, 2020).

With SSA as the epicentre of schistosomiasis in the world (Hotez and Kamath, 2009), researchers have continued to labour meritoriously in a bid to meet up with vision 2030 (Bergquist *et al*., 2017; WHO, 2019) for the elimination of this chronic and acute neglected disease of medical significance. New endemic foci have continued to emerge (Leonardo *et al*., 2015), leading to increase in infection prevalence and reinfection (Mutsaka-Makuvaza, 2018).

Nigeria has been implicated as the epicentre of schistosomiasis in SSA with about 29 million cases as reported by Hotez and Kamath (2009). Previous studies from the southwestern, southeastern, southsouthern, northwestern and northeastern parts of Nigeria have shown prevalence rates of 41.1% (Ugbomoiko *et al*., 2012), 51% (Eyong *et al*., 2008), 59.5% (Nmorsi *et al*., 2007), 20% (Adamu *et al*., 2019) and 58.54% (Houmsou *et al*., 2016) respectively. Studies have identified age, gender, parental occupation, (Senghor *et al*., 2014; Geleta *et al*., 2015; Anzaku *et al*., 2017) as risk factors of urogenital schistosomiasis. Males have reportedly recorded significantly higher prevalence compared to females: 71.4% Versus 41.9% (Nmorsi *et al*., 2007), 23.49% Versus 2.94% (Adamu *et al*., 2019). In a study conducted in Buruku and Katsina-Ala Local Government Areas of Benue State by Houmsou *et al*. (2012), a significant association was recorded between urine colour and

urogenital schistosomiasis. Meanwhile, Hassan *et al*. (2012) reported a significant relationship between urine turbidity and urogenital schistosomiasis.
Therefore, it is imperative to adopt rapid screening approach (Lengeler *et al*., 2002) to increasing cases of the disease to provide epidemiological data needed by policy makers to tackle the menace posed to the society. This present study was carried out with the aim to determine the potential of age and gender as risk factors of infection and as well assess the efficacy of urine colour and turbidity for a rapid screening procedure.

MATERIALS AND METHODS

Study area

This present study was carried out at Dutsin-Ma Local Government, Katsina State. Dutsin-Ma is bound by Kurfi, Charanchi, Kankia, Matazu, Danmusa and Safana Local Government Areas. Its expanse Sudan savanna (Oyenuga, 1967) land mass accommodates the Hausa and Fulani ethnic groups whose major occupations are subsistent farming, nomadism and trading. Dutsin-Ma has a sandy and rocky terrain with poor drainage system.

Study Design

The cross-sectional study was carried out between March and July, 2016. The study population employed was School-Age Children from some public Primary Schools in the town. They studied under condition that could be described as below average while their parents were mostly illiterates who live below 7 US Dollars per day. By taking the prevalence of urogenital schistosomiasis to be 17.3% (Bawa *et al*., 2016), the sample size was determined using Lorenz's formula (Ndassi, *et al*., 2019). Thus, formula for sample size, N is given as:

$$\frac{Z^2 \times P\,(1-P)}{d^2}$$

Z = standard normal deviation (1.96); P = Prevalence; d = total width of confidence interval (0.05).
Approximately 220 was obtained as sample size. A total number of 357 respondents were however enrolled (using simple random sampling technique) in the study having factored in the need to skip the hurdle of anticipated withdrawals, effect size and other factors. Interviews were conducted using well designed questionnaires that elicited desired responses regarding the epidemiology of urogenital schistosomiasis.

Ethical Consideration

The written approval (without number) to carry out this study was obtained from the Educational Secretary, Dutsin-Ma Local Government Education Authority. Respondents were not forced to participate in the study and information regarding their urogenital schistosomiasis status were kept confidential.

Sample collection and processing

Terminal urine samples were collected between 10:00AM and 2:00PM from respondents using 20 ml capacity sterile plastic sample bottles. The timing of collection was warranted by the need to catch up with the peak of egg excretion due to circadian rhythm of the parasite (Doehring *et. al*., 1985; Muhammad *et al.,* 2019). Analysis of each sample was carried out within few minutes using Medi-Test Combi 10 (Duren, Germany) biomedical reagent strip to determine the turbidity, pH, specific gravity, glucose, etc. Centrifugation was carried out using Centurion Scientific Centrifuge (UK) at 400 revolution per minute for 4 minutes. Compound Binocular Microscope (x10 objective) was used to examine glass slides for the eggs of *S. haematobium* (Atalabi *et. al*., 2018).

Statistical analyses

Raw data from this study were entered into Microsoft Excel 2010 (USA) and imported into Epi Info software, version 7.1.2.0 (Atlanta, USA) for analysis using the classic and the visual dashboard. Chi square and Odds ratio were employed to describe the association among variables. Variables were considered significant at 95% Confidence Level.

RESULTS

A total number of 357 respondents, 214 males (59.9%) and 143 females (40.06%), were examined during the study. Their mean age as well as duration of residency in Dutsin-Ma were 9.39±2.06 and 8.41±2.78 years respectively. Only 26 (7.28%) had history of Praziquantel™ usage (Table 1).

Table 1: Demographic and Urine Features of Participating Respondents

Characteristics	N	%	Cumulative %	Mean	Standard Deviation
Gender					
Male	214	59.94	59.94	9.77	2.16
Female	143	40.06	100	8.81	1.75
Age Group (Years)				9.39	2.06
6-10	259	72.55	72.55		
11-15	98	27.45	100		
Duration of Residency				8.41	2.78
< 8 Years	121	33.89	33.89		
≥ 8 Years	236	66.11	100		
Urine Colour					
Colorless	57	15.96	15.96		
Creamy	1	0.28	16.24		
Dark yellow	1	0.28	16.52		
Faint yellow	139	38.94	55.46		
Pale yellow	151	42.30	97.76		
Light yellow	1	0.28	98.04		
Faint brown	2	0.56	98.6		
Red	5	1.40	100		
Turbidity					
Clear	301	84.31	84.31		
Cloudy	56	15.69	100		
Praziquantel Usage					
Yes	26	7.28	7.28	0.15	0.37
No	331	92.72	100	0.16	0.36

N, Number surveyed

Table 2 shows that the overall prevalence and intensity of urogenital schistosomiasis obtained were 10.36% (7.61-13.96) and 322.2 eggs/10ml of urine sample respectively. Males had a higher prevalence [15.42% (10.86-20.97)] and intensity [77.5 eggs/10ml] of infection (Figure 1) and were 6 times more likely to be infected compared to their female counterparts [COR (95% CI): 6.31 (2.17-25.09)]. Besides, there was a significant association between urogenital schistosomiasis and gender (χ^2 = 13.38; P = 0.0003).

Moreover, it shows that age group 11-15 years recorded higher prevalence (19.39% [12.10-28.61]) and intensity (110.9 eggs/10ml) of the infection (Figure 1). This age group was found to be 3 times [COR (95% CI): 3.21 (1.51-6.84)] more likely to be infected compared to the 6-10 years category. Age was found to be significantly associated with urogenital schistosomiasis (χ^2 = 10.54; P = 0.0012).

Table 2 further reveals that urine samples with faint yellow colour recorded the highest prevalence of 13.67% (8.43-20.52) and were 4 times [COR (95% CI): 4.33 (1.12-28.39)] more likely to be infested with the eggs of *S. haematobium* compared to the colourless samples. Besides, they were also significantly associated with urogenital schistosomiasis (χ^2 = 4.34; P = 0.0372). However, those with pale yellow colour had the highest intensity (128.3 eggs/10ml) of infection (Figure 2).

Finally, clear urine samples recorded a higher prevalence 72.97% (55.88-86.21) while cloudy samples had higher mean intensity of infection (116.2 eggs/10ml).

Table 2: Prevalence of Infection with Respect to age, Gender, Urine Colour and Turbidity

	Prevalence and Intensity of Infection			Measures of Association	
Variables	**N. E**	**Positive (%) [95% CI]**	**EC (Mean)**	**COR [95% CI]**	**χ^2 (P Value)**
Gender					
Male	214	33 (15.42) [10.86-20.97]	2559 (77.5)	6.31 (2.17-25.09)	13.38 (0.0003)
Female	143	4 (2.8) [0.77-7.01]	253 (63.3)	1	
TOTAL	**357**	**37 (10.36) [7.61-13.96]**	**2812 (322.2)**		
Age Groups (Years)					
6-10	259	18 (6.95) [4.17-10.76]	705 (39.2)	1	
11-15	98	19 (19.39) [12.10-28.61]	2107 (110.9)	3.21 (1.51-6.84)	10.54 (0.0012)
TOTAL	**357**	**37 (10.36) [7.61-13.96]**	**2812 (322.2)**		
Urine Colour					
Colorless	57	2 (3.51) [0.43-12.11]	124 (62)	1	
Creamy	1	0	0 (0)	-	
Dark yellow	1	0	0 (0)	-	
Faint yellow	139	19 (13.67) [8.43-20.52]	644 (33.9)	4.33 (1.12-28.39)	4.34 (0.0372)
Pale yellow	151	15 (9.93) [5.67-15.85]	1924 (128.3)	3.02 (0.76-20.09)	2.27 (0.1323)
Light yellow	1	0	0 (0)	-	
Faint brown	2	0	0 (0)	-	
Red	5	1 (0.2) [0.01-0.72]	120 (120)	6.47 (0.19-102.23)	2.67 (0.1021)
TOTAL	**357**	**37 (10.36) [7.61-13.96]**	**2812 (322.2)**		
Turbidity					
Clear	301	27 (72.97) [55.88-86.21]	1650 (61.1)	1	
Cloudy	56	10 (27.03) [13.79-44.12]	1162 (116.2)	2.21 (0.89-5.08)	3.11 (0.0776)
TOTAL	**357**	**37 (10.36) [7.61-13.96]**	**2812 (322.2)**		

N.E, Number Examined; CI, Confidence Interval; EC, Egg Count/10ml of urine; COR, Crude Odds Ratio

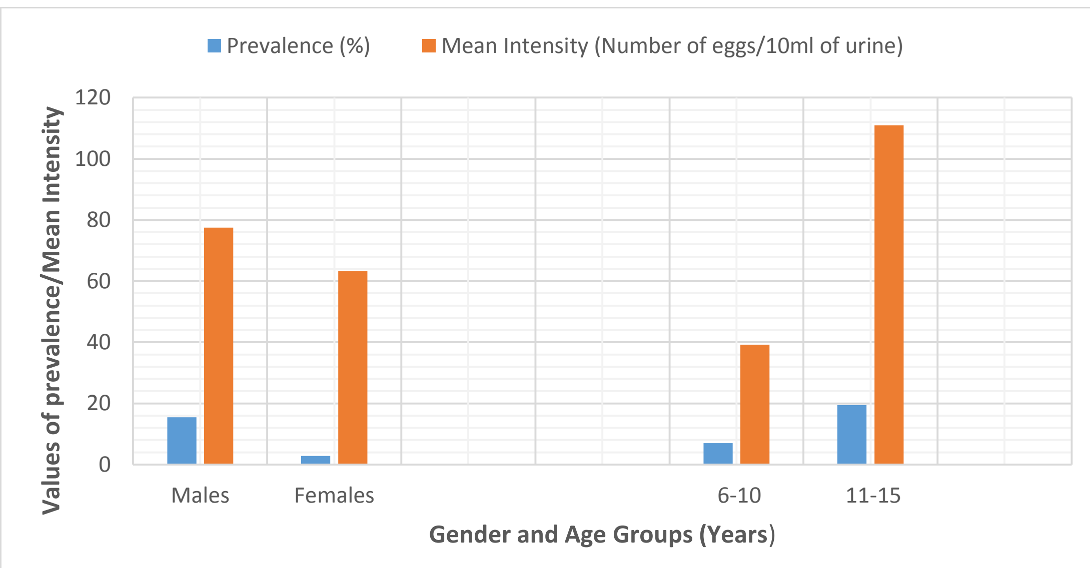

Figure 1: Bar chart showing prevalence and mean intensity by age group and gender

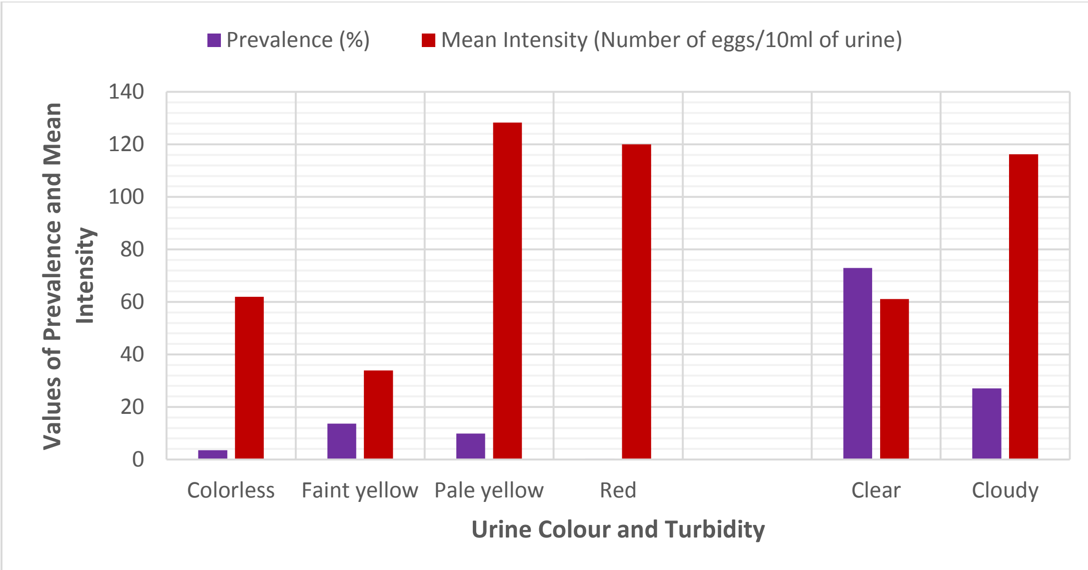

Figure 2: Bar chart showing prevalence and mean intensity by urine colour and turbidity

DISCUSSION

This study recorded overall prevalence and mean intensity of 10.36% (7.61-13.96) and 322.2 eggs/10ml of urine sample respectively. The former portrays Dutsin-Ma as a hypo-endemic area for urinary schistosomiasis. Previous studies recorded similar findings about the infection prevalence among School-Age Children (Bawa *et al*., 2016; Atalabi *et al.*, 2018). However, the findings of Bashir *et al.*, (2018) in Dutsin-Ma revealed a prevalence of 48.4% which falls to the meso-endemic category. This disparity might be due to combined effects of increase in endemic foci, and bottlenecks in mass Administration of Medicines (MAM) with Praziquantel™ among others. The outrageous mean intensity recorded in this study might corroborate this assertion because it is higher than previous findings in the study area by Atalabi *et al.* (2016a) [25.05 eggs/10ml of urine] and Atalabi *et al.* (2016b) [30.27 eggs/10ml of urine]. This figure is far higher than the reported mean intensity (8.76 eggs/10ml of urine) in southwestern part of Ethiopia (Geleta *et al.*, 2015).

Many studies have reported higher prevalence and mean intensity of urogenital schistosomiasis in males than females (Amuta and Houmsou, 2014; Atalabi *et al.*, 2016a and b; Bawa *et al*., 2016; Houmsou *et al*., 2016; Atalabi *et al.*, 2018 and Bashir *et al*., 2018). The findings of this present study [Males: 15.42% (10.86-20.97) V 77.5 eggs/10ml and Females: 2.8% (0.77-7.01) V 63.3 eggs/10ml] is not an exception to this scenario. Atalabi *et al.* (2016b) agrees with this present report that males were 6 times more likely to be infected compared to females [COR (95% CI): 6.31 (2.17-25.09)]. This could be because males are naturally more active than females and are culturally predisposed to contact with unwholesome water bodies.

Moreover, findings that age was significantly associated with urogenital schistosomiasis ($\chi^2 = 10.54$; $P = 0.0012$) in this study is reinforced by the fact that 11-15 years age group recorded higher prevalence (19.39% [12.10-28.61]) and intensity (110.9 eggs/10ml) in addition to being 3 times [COR (95% CI): 3.21 (1.51-6.84)] more likely to be infected compared to the 6-10 years category. Separate studies conducted in Benue and Taraba States ratify our findings (Amuta and Houmsou, 2014; Houmsou *et al*., 2016). The age group implicated by these findings belongs to the adolescent category. Hence the unusual activity and drive to explore the unwholesome water sources within their ecological niche compared to the younger age group.

Nonetheless, urine samples with faint yellow colour recorded the highest prevalence of 13.67% (8.43-20.52) and were found to be 4 times [COR (95% CI): 4.33 (1.12-28.39)] more likely to be infested with the eggs of *S. haematobium* compared to the colourless samples. A significant association with urogenital schistosomiasis ($\chi^2 = 4.34$; $P = 0.0372$) attests to this. Elsewhere, a study reported the merit of urine colour as a rapid means of assessing the endemicity of urogenital schistosomiasis (Houmsou *et al*., 2012). Meanwhile our findings show that pale yellow urine samples had the highest intensity (128.3 eggs/10ml) of infection. Currently, to the best of our knowledge, the World Health Organization has not stated a clear position on the validity of urine colour for rapid diagnosis of the disease.

Finally, we found out that clear and cloudy urine samples recorded a higher prevalence and mean intensity of infection of 72.97% (55.88-86.21) and 116.2 eggs/10ml respectively. However, a similar study carried out in southwestern Nigeria by Hassan *et al.* (2012) affirmed turbidity as a reliable rapid diagnostic criterion for urogenital schistosomiasis. Our studies, however, shows that there was no significant association between them.

CONCLUSION

This present study has established that urogenital schistosomiasis is hypo-endemic in Dutsin-Ma Local Government Area with age and gender as risk factors with faint yellow colour as the only reliable rapid diagnostic index. To this end, it is recommended that health education be given to School-Age Children and their parents. Provision of potable water should be a priority while more attention should be given to male children, particularly those of the age group 11-15 years.

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Competing interest

The Authors declare that they have no competing interest.

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