World Journal of Advanced Research and Reviews
eISSN: 2581-9615 CODEN (USA): WJARAI
Cross Ref DOI: 10.30574/wjarr
Journal homepage: https://wjarr.com/

(Research Article)

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Urinary schistosomiasis prevalence and risk factors among school children at matta-barrage in the Tikar Plain of Magba, West Region, Cameroon: A situational analysis in rural area

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World Journal of Advanced Research and Reviews, 2022, 14(03), 532–540

Publication history: Received on 16 May 2022; revised on 19 June 2022; accepted on 21 June 2022

Article DOI: https://doi.org/10.30574/wjarr.2022.14.3.0596

Abstract

Background: Urinary schistosomiasis (US), caused by *Schistosoma haematobium (S. haematobium)* has reported very high in Cameroon and children were more infected. The study was conducted to assess the prevalence of US and risk factors among school children at Matta-Barrage in Magba sub-division.

Methods: A cross-sectional study was conducted during one month period from May to June, 2019 among pupils at Matta-Barrage public school after parental consent. The sample was taken after physical exercise and the urine was collected at the end of micturition in a sterile urine container. Data collected were performed using SPSS version 25.0 and P-value < 0.05 was considered statistically significant.

Results: Of the 300 pupils enrolled, the overall prevalence of US was 43.0% and among children infested, 82.17% (106/129) had hematuria and 58.13% (75/129) had dysuria. The positivity rate of *S. haematobium* was higher in boys (69.0%; 89/129) versus (vs.) 31.0% (40/129) for the girls (P=0.03) and the children aged between 8-10 years were more infested (44.78%; 57/129), P=0.38. Regarding the risk factors, the multivariate analysis shows that sources of washing, sources of cooking/drinking water, and ethnic groups such as Arabe, Kotoko, Fulbe and Tikar were statistically associated with *S. haematobium* infestation (P< 0.05).

Conclusion: The prevalence of US remain high among school children at Matta-Barrage in Magba sub-division. Meanwhile, the boys and childen aged 8-10 years were more infested. The risk factors such as sources of washing, sources of cooking/drinking water, and ethnic groups such as Arabe, Kotoko, Fulbe, and Tikar were statistically associated with *S. haematobium* infestation.

Keywords: Prevalence; Urinary Schistosomiasis; Risk Factors; School Children; Magba

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1. Introduction

Schistomiasis or Bilharzia is an acute and chronic disease, caused by blood-dwelling flukes (trematode worms) of the genius Schistosoma [1]. It is the most important parasitic disease affecting human's worldwide and the second burden parasitic infection found in developing countries such as sub-Saharan Africa (SSA), Asia and South America after malaria [2]. Estimates show that, schistosomiasis affects at least 240 million people worldwide and 200.000 people die from the disease every year with a great majority (90%) of cases recorded in SSA [3,4]. The transmission routes of schistosomiasis are well known. People are infected during routine agricultural, recreational activities, which expose them to infested water [1]. Moreover, lack of hygiene, gender and certain play habits of school aged children such as swimming or fishing in infested water make them especially vulnerable to infestation [1]. Furthermore, schistosomiasis mostly affects poor and rural communities with lack of personal and environmental sanitation, limited access to clean water, overcrowding and low socioeconomic conditions [5, 6]. Therefore, the infection is more prevalent in poor communities without portable water and adequate sanitation, characteristic of most developing countries in Africa, Asia and South America [7, 8].

Of note, Schistosomiasis symptoms are caused by the body's reaction to worm eggs found in stool and urine. While intestinal schistosomiasis causes abdominal pain, diarrhea with blood in the stool, US causes hematuria (presence of blood in the urine) and dysuria (pain during urination or difficulty urinating) [1]. Among the species of schistosomes encountered, *S. haematobium* is the deadliest and the most affected region of the globe remains SSA with more than 112 million people infected per year [9]. In men, US can induce pathology of the seminal vesicles, prostate, and other organs. This disease may also have other long-term irreversible consequences, including infertility [1].

In Cameroon, US is highly endemic and its prevalence varies from one region to another with high frequencies observed in rural and semi-rural areas. Thus, the study conducted in the district of Taïbong-Dziguilao in the northern region found a *S. haematobium* infestation of 5.83% [10]. This prevalence is relatively low compared to those observed by Sumbele et al [11] and Njunda et al [12] who observed a prevalence of 37.0% and 41.1% respectively among school children in the South West and Magba sub-division in the West region. In view of the high prevalence of US and the different variations observed on the national territory, it is necessary to carry out new investigations on this morbid and fatal parasitosis in primary school pupils. This study aimed to update US prevalence and risk factors among school children of the Matta-Barrage public school in the Tikar plain of Magba, West-Cameroon.

2. Material and methods

2.1. Study design and area

We carried out a school based cross-sectional study during one month (from May to June 2019) among 300 school children aged between 5 to 16 years old at Matta-Barrage public school. Matta-Barrage is a village in the Magba sub-division, West region of Cameroon. The dam is about 14 km from the town of Magba and lies northeast of it along the road to Banyo. The dam is inhabited by five main ethnic groups namely Bamoums, Tikar, Fulbe, Junkums, Muskos, Kotokos and Arabs. Agriculture and fishing are the main activities for the inhabitants of the region. This dam serves as the main source of water for fishing, swimming and domestic use for the majority of the inhabitants of the region [12].

2.2. Enrollment strategy of the study population

School children were enrolled consecutively in this study using a structured questionnaire including socio-demographic details and risk factors such as gender, age, source of washing water, source of cooking/drinking water and ethnic groups.

2.3. Sample size determination

The minimum sample size was calculated using the Cochran's formula [13]

$$n = \frac{Z^2 \times P(1-P)}{t^2} = 257.77$$

''Z''= standard deviation of 1.96 (95% confidence interval),

''P''= prevalence of US among school children at Magba sub-division (41.1%) found by Njunda et al [12],

''t''= error (6%).

2.4. Sample collection and processing

After meeting with school officials, an information note and a parental consent form were given to the children the day before for the parents to sign. This study included children whose records were signed by the parent, guardian or legal representative. Urine sample was collected in sterile transparent containers previously labeled with an identifying code to ensure confidentiality. The samples were taken after the 10-hour break and the urine was collected at the end of urination after physical exercise. The volume of urine collected in pots varied depending on the amount of urination of each participant (Figure 1). The urine samples were then transported to the medical analysis laboratory of the Matta-Barrage integrated health center immediately for analysis.

2.4.1. Macroscopic examination

During the macroscopic examination, the color of the urine (clear, yellowish, dark, and red) and its appearance (hematic, cloudy) were observed immediately after collection. The presence of cloudy or hematic urine is considered abnormal.

2.4.2. Microscopic examination

The microscopic examination consisted in highlighting the eggs of *S. haematobium* from the urinary pellet obtained by the sedimentation method. We let our samples settle on bench for 30 to 45 minutes. The supernatant was decanted in order to obtain a considerable pellet which we observe microscopically drop by drop between slide and coverslip using X10 and X40 objectives. The eggs of *S. haematobium* was examined base on morphology of the ova and the terminal spine (Figure 2).

Figure 1 Urine samples collected (picture capture by Véronique Metiendjo)

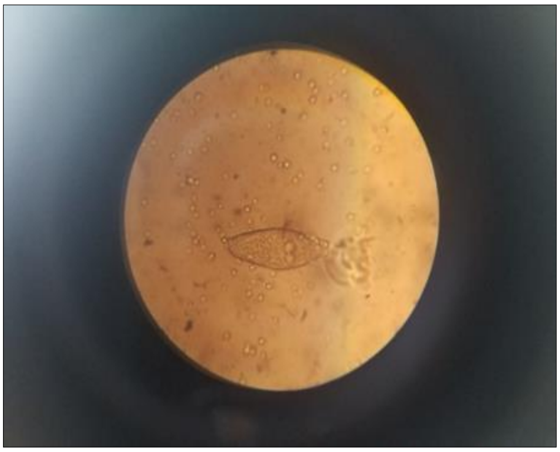

Figure 2 Sediment examination of the diagnostic terminal spine of egg of *S. haematobium* in urine sample (magnification 40 X). (Picture capture by Véronique Metiendjo)

2.5. Statistical analysis

The data collected was performed using Statistical Package for Social Sciences (SPSS) version 25.0. The proportions of *S. haematobium* infestation were compared with the characteristics of the study population and the risk factors using the chi-square test. The study of associations was performed using bivariate and multivariate analysis and associations between the variables were sought with the odds ratio (OR), expressed with its confidence interval (CI) at 95%. All P value less than 0.05 was considered significant.

3. Results

3.1. Characteristics of study population

Table 1 Characteristics of study population

Variables	Number of participants (Total=300)	Percentage (%)
Gender, n (%)		
Girls	114	38.0
Boys	186	62.0
Age group, n (%)		
5-7 years	54	18.0
8-10 years	124	41.33
11-13 years	112	37.33
14-16 years	10	3.33
Sources of washing, n (%)		
Bathing water	190	63.0
House water (Tap water, well, drilling)	110	37.0
Sources of cooking/drinking water, n (%)		
Bathing	147	49.0
Tap water/ Drilling	78	26.0
Well	33	11.0
River	42	14.0
Ethnic groups, n (%)		
Arabe	83	27.67
Kotoko	57	19.0
Fulbe	26	8.67
Bamoun	36	12.0
Mousgoun	39	13.0
Tikar	51	17.0
Manbila	8	2.67

In the current study, a total of 300 school children was recruited consecutively. The age of study population range from 5 to 16 years old. The table 1 below shows that, the boys were more represented with 62.0% (186/300) versus (vs.) 38.0% (114/300) for the girls. The age groups of 8-10 years (41.33%; 124/300) and 11-13 years (37.33%; 112/300) were more represented. More than half of study population washed with bathing water (63.0%; 190/300) and 37.0%

(110/300) used house water such as tap water, well and drilling. Regarding the sources of cooking/drinking water, the majority of study population used bathing water (49.0%; 147/300), 26.0% (78/300) used tap water and drilling, 14.0% (42/300) used well water and 11.0% (33/300) used the river water. According to ethnic groups, the Arabe was more represented with 27.67% (83/300).

3.2. Distribution of urinary schistosomiasis prevalence among study population

Out of 300 school children examined, the prevalence of US was 43.0% (129/300) and among them, 82.17% (106/129) had hematuria and 58.13% (75/129) had dysuria (figure 3).

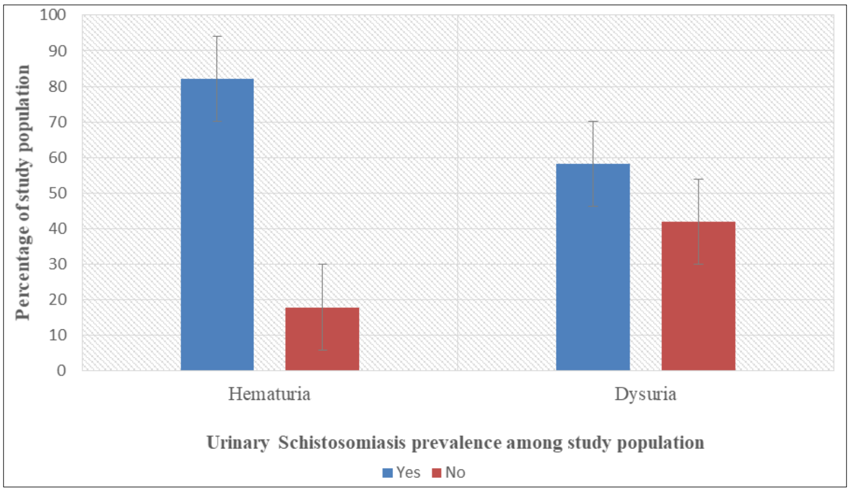

Figure 3 Distribution of urinary schistosomiasis prevalence among study population

3.3. Distribution of risk factors according to *S. haematobium* infestation

Table 2 Distribution of risk factors according to *S. haematobium* infestation

Variables	Total N=300	Positive 129 (%)	Negative 171 (%)	Odds Ratio (OR)	P-value
Gender, n (%)					
Girl	114	40 (31.0)	74 (43.27)	0.58 (0.36-0.95)	0.03**
Boy	186	89 (69.0)	97 (56.72)		
Age group, n (%)					
5-7 years	54	22 (17.05)	32 (18.71)	0.89 (0.49-1.62)	0.71
8-10 years	124	57 (44.78)	67 (39.18)	1.22 (0.77-1.95)	0.38
11-13 years	112	46 (35.67)	66 (58.93)	0.88 (0.54-1.41)	0.60
14-16 years	10	4 (3.10)	6 (3.51)	0.88 (0.24-3.18)	0.89
Sources of washing, n (%)					
Dam water	190	124 (96.13)	66 (38.60)	39.45 (15.32-101.56)	< 0.00000**
House water (Tap water, well, drilling)	110	05 (4.87)	105 (61.40)		
Sources of cooking/drinking water, n (%)					
Dam water	147	119 (92.24)	28 (16.37)	60.77 (28.36-130.20)	< 0.00000**
Tap water/Drilling	78	2 (1.56)	76 (44.44)	0.01 (0.0047-0.08)	< 0.00000**
Well	33	3 (2.32)	30 (17.54)	0.11 (0.03-0.37)	0.00006**

River	42	5 (3.88)	37 (21.64)	0.14 (0.05-0.38)	0.00001**
Ethnic groups, n (%)					
Arabe	83	46 (35. 67)	37 (21.64)	2.00 (1.20-3.34)	0.007**
Kotoko	57	32 (24. 80)	25 (14.62)	1.92 (1.07-3.45)	0.02**
Fulbe	26	16 (12.40)	10 (5.85)	2.28 (0.99-5.20)	0.04**
Bamoun	36	14 (10.86)	22 (12.86)	0.82 (0.40-1.68)	0.59
Mousgoun	39	12 (9.30)	27 (15.79)	0.54 (0.26-1.12)	0.09
Tikar	51	7 (5.42)	44 (25.73)	0.16 (0.07-0.38)	< 0.00000**
Manbila	8	2 (1.57)	6 (3.51)	0.43 (0.08-2.18)	0.49

**Statistically significant

Table 2 shows that, the prevalence of US was higher among boys with 69.0% (89/129) than the girls (31.0%; 40/129). The difference observed in the two groups was statistically significant (P=0.03). Regarding the age group, school children aged between 8-10 years with 44.78% (57/129) and children aged between 11-13 years (35.67%; 46/112) were more infested. Meanwhile the difference observed was no statistically significant (P>0.05). Concerning the sources of washing, our findings show that children who used dam water were more infested with 96.13% (124/190) vs. 4.87% (05/110) than those who used household water (OR=39.45; 95%CI: 15.32-101.56; P< 0.00000). Moreover, the sources of cooking/drinking water, the ethnic groups such as Arabe (P=0.007), Kotoko (P=0.02), Fulbe (P=0.04) and Tikar (P< 0.00000) were statistically associated with *S. haematobium* infestation.

4. Discussion

The present study reveals US prevalence of 43.0% (129/300) among children in this locality of the country. This high prevalence could be justified by the fact that the district of Magba has many temporary natural or artificial ponds, a dam retaining water from the Mapé which overflows the main gites of the bulins and therefore constitutes a focus of US in Cameroon. Additionally, this part of the country is regularly targeted by the National Program for the Fight against Schistosomiasis and Intestinal Helminthiasis (NPFSIH). In comparison with previous studies conducted on the national territory, this prevalence is higher than those observed by Dankoni et al [14] in the district of Kékem, West-Cameroon, Dankoni et al [10] in the district of Taïbong-Dziguilao, northern region and Sumbele et al [11] in Tiko in the South West region who observed 1.7%, 5.83% and 37.0% respectively. However, this prevalence is similar to those observed by Njunda et al [12], a study conducted among primary school children in the locality of Magba, West-Cameroon, which observed a prevalence of 41.1% and Ntonifor et al [15] in Munyenge in the South-west of the country who found a prevalence of 40.27%. These differences observed could be explained by the sample size, the type of study and the geographical context. This information reinforces the idea of Njiokou et al. [16] according to which, urbanization, the geographical context reduce transmission points and the creation of modern water points limits the frequency of human contact with water. Our findings adds to several studies conducted in SSA on the high prevalence of US among primary school children [17, 18, 19, 20]. Among infested school children, 82.17% (106/129) had hematuria and 58.13% (75/129) had pain during urination (dysuria). These symptoms are the main symptoms encountered during *S. haematobium* infestation. Our results corroborate with those obtained by Njunda et al [12] and Saotoing et al. [21].

Regarding the gender, the prevalence of US was more observed in boys with 69.0% (89/129) than the girls (31.0%; 40/129), P=0.03 (Table 2). Similar studies conducted among school children observed that boys were more infested than girls [17,22, 23,24, 25]. However, our results are contrary to those observed by [15, 26] who showed that, girls were more infested than boys. This high prevalence of US in boys could be justified by activities such as the manufacture of fired bricks along infested bodies of water in addition to the main activities of washing, fishing and drawing water which expose both sexes to infestation [12]. Concerning the age group, school children aged between 8-10 years and 11-13 years were more infested with 44.78% (57/129) and 35.67% (46/112) respectively (Table 2). Our findings could be explained initially by the fact that these groups were the most represented in the present study in terms of numbers. Secondly, by the fact that children in these age groups are most often involved in outdoor activities such as games (football, and running), swimming, and fishing, hygiene, walking barefoot and regular contact with infested water. Our results are similar to those obtained by Saotoing et al [25] who found a high prevalence of schistosomiasis in the age group of 9 to 11 years. Compared with the study of Njunda et al [12] which reported that *S. haematobium* infestation was more observed in children under 10 years old compared to children aged ≥10 years old. This lower prevalence of US in older children could be attributed to the fact that, as children get older, they become more aware and begin to follow basic rules of hygiene limiting their contact with people infested bodies of water [12]. This joins the low frequency of *S. haematobium* observed in our study in children aged 5-7 years (17.05%) and in those aged 14-16 years (3.10%). These low frequencies observed in these age groups could be explained by the fact that the youngest are less and less involved in bathing and fishing games and are more watched by parents. On the other hand, the older ones are more and more aware of and respect basic hygiene measures.

The current study shows that the sources of washing and the sources of cooking/drinking were strongly associated with the prevalence of US (Table 2). These findings could be justified by the lack of respect for basic hygiene rules and the frequentation of water infested with furcocercariae by the populations [26]. Of note, infestation of *S. haematobium* occurs when cercaria, the larval form of the parasite is released by freshwater snails of the Genus Bulinus, penetrates the skin during contact with infested water. Hence, avoiding domestic and recreational activities such as swimming or fishing in infested water may curb the spread of the disease [27]. Moreover, the ethnic groups such as Arabe, Kotoko, Fulbe and Tikar were statistically associated with the prevalence of US. These results could be explained by the fact that these ethnic groups live around the water dam and therefore use these waters mainly for bathing and washing clothes. In addition, these populations are mainly engaged in agriculture and fishing [12].

5. Conclusion

The present study observed a high prevalence of urinary schistosomiasis (43.0%) among pupils of the public school of Matta-barrage in the district of Magba, West-Cameroon. This prevalence was high among boys, unlike girls and among those aged between 8 to 10 years old and 11 to 13 years old, with low proportions among the youngest (5-7 years old) and the oldest (14-16 years old). In this study, the multivariate analyzes showed a strong association between the associated factors and the occurrence of US in school children in this locality of the country. These evidences argue in favor of strengthening awareness campaigns and the fight against this morbid and deadly infection.

Compliance with ethical standards

Acknowledgments

The research team would like to express their thanks to the parents/guardians or legal representative and children for their participation into this study. We also like to express our sincere gratitude to the Director of the Matta-Barrage public school of Magba sub-division for the authorization to conduct the study. Moreover, we also like to acknowledge the technical staff of the Matta-Barrage integrated health center for the technical support in specimen analysis.

Disclosure of conflict of interest

The authors declare that there are no competing interests.

Funding

No funding was received.

Statement of ethical approval

This study was performed under the academic research thesis. Thus, a protocol was reviewed and approved by the Institutional review board (IRB) of the Higher Institute of Medical and Sanitary Personnel, of the University of Ngaoundere (Ref. N° :175/2019/LC/ISPM/DR/SS).

Statement of informed consent

A written informed consent was obtained from parental, legal representative or guardian of the children.

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