Hematuria and dysuria in the self-diagnosis of urinary schistosomiasis among school-children in Northern Cameroon.

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SUMMARY

The present study was designed to assess the value of self reported hematuria and dysuria in the diagnosis of urinary schistosomiasis at the individual level. A sample of 964 school children of grade 5 and 6 from 15 schools of the French speaking educational system in the Sudano-sahelian zone of northern Cameroon were submitted to a questionnaire related to hematuria and dysuria, and provided a urine sample each. The urine samples were processed using the dip stick and sedimentation methods, and the degree of microhematuria and oviuria determined. In all 964 questionnaires were collected, 843 urine samples examined for microhematuria and 871 for oviuria. The percentage of children reporting hematuria increased with the degree of microhematuria and the intensity of infection. Among the various indicators of urinary schistosome infection, microhematuria had the highest sensitivity (76%), followed by self reported hematuria or dysuria (65%), and dysuria (52%). The specificity was highest for self reported hematuria, and lowest for self reported hematuria or dysuria. The efficiency of self reported hematuria or dysuria increased with the intensity of infection and was highest (100%) for heavy infections (>400 eggs/ml g urine). We advocate the use of self reported hematuria or dysuria for the assessment of *S. haematobium* at the individual level.

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Introduction

Schistosomiasis is a parasitic disease afflicting 200 million people worldwide, in tropical and subtropical countries. It is responsible for 754 million disability adjusted life years among children in Africa [1]. Its prevalence is rapidly increasing in the sahelian regions with the extension of water development projects [2]. Schistosomiasis control measures include chemotherapy, health education, snail control, water supply and sanitation [3]. Chemotherapy is the most favored control method. The efficacy of chemotherapy is affected by treatment seeking behavior, which is influenced by the perceptions and recognition of symptoms and signs of infection among the infected persons. The diagnosis of urinary schistosome infected persons is based on microscopic detection of terminal spine eggs in urine (oviuria), a procedure which is laborious and time consuming for mass screening in control programmes. Several approaches to the indirect diagnosis of urinary schistosomiasis have been attempted. Indirect diagnostic methods are based on hematuria, proteinuria and dysuria, the major signs of the disease. Hematuria is associated with active bladder lesions in children 2-14 years. It has been used for the assessment of *S.*

haematobium infection through reagent strips and questionnaire in Ghana, East Africa and the Sahelian region of the continent [4-8]. Hematuria has been used for the identification of schools for mass treatment, but has been of limited use for self-diagnosis [9]. Nonetheless, hematuria remains a valid indicator of infection that helps in the prevention of risk of serious disease or complication through early diagnosis and treatment [1]. Hematuria is not the only symptom of urinary schistosomiasis but the predictive value of others, such as lower abdominal pain, proteinuria, dysuria, and combination of signs have rarely been assessed. Working in Ethiopia, microhematuria (reagent strip) and dysuria was a better indicator of urinary schistosomiasis infection than either sign alone [10]. The present study was designed to assess the value of self reported hematuria and dysuria in the diagnosis of urinary schistosomiasis at the individual level.

Study area

The sudano-sahelian zone of Cameroon covers the administrative provinces of the North and Extreme North. This area has an annual rainfall of 500 - 900 mm. The rainy season extends from June to September. Small ponds and temporary rivers or "mayos" usually disappear a few months after the rains. The present study area was chosen because of the high prevalence of schistosomiasis among school aged children [11]. It includes three main ecological zones. Rice cultivation and large-scale irrigation are carried out in the Yagoua zone (Logone Plain). The Mokolo zone (Mandara Hills) is characterized by the predominance of hills. The Diamaré Plain is the main geographical feature of the Kaele and Maroua zone where there are few dams. Schistosomiasis transmission occurs mainly in small dams and ponds.

Study design and methods

School, health and administrative authorities were contacted during a preliminary visit and explained the goal of the study. The sample size was estimated at a minimum of 800 participants [12]. Community consent was obtained from the guardian of school children. Ethical clearance was obtained from the Ministry of health and the ethical committee of the Faculty of Medicine & Biomedical Sciences. In order to reach primary school children, we purposefully targeted schools with high population and attendance rates between April and June 1997. In each selected school, we targeted children aged 9-17 years who could express themselves well in French, corresponding to Grades 5 and 6 (cours moyen I et II) of the French speaking educational system. In each selected class, all consenting pupils were included in the study. A questionnaire related to hematuria and dysuria was distributed to all the target pupils. Each pupil was allowed to write his/her name on the questionnaire. One of the investigators read each of the questions in French and explained their content. The pupils were then given enough time (2 minutes or more when necessary) to circle the corresponding item of the close-ended questions. The key questions were as follows:

1. *Have you ever had blood in your urine?*
2. *Do you have blood in your urine now?*
3. *Do you have pain when you urinate?*

Labeled urine preservation vials were thereafter handed to interviewed pupils after the collection procedure had been explained. The pupils were given enough time (30 minutes) to supply urine samples. Urine collection generally occurred between 11 AM and 3 PM. The fresh urine samples were examined for hematuria by reagent strips in a field laboratory, using medi-test combi 7. The reagent end of the test strip was dipped into fresh, well mixed, uncentrifuged urine for 40 seconds. Upon removal, the test area was compared with a standard color chart. Readings were made by one of the investigators and rated as negative «-», traces «TR», light «+», moderate «++» or large «+++». The urine samples were then preserved by adding 0.1 g of sodium azide, and transported to our laboratory (Institute of Medical Research and Studies on Medicinal Plants) where they were examined microscopically using the sedimentation technique. The total urine volume was recorded. The sample was then left to rest for 30 minutes. The supernatant was siphoned and the full fresh sediment collected and examined. *Schistosoma haematobium* eggs where identified, and counted. The intensity of infection was determined as the number of *S. haematobium* eggs per 10 ml of urine [13], and classified as light (1-99 eggs), moderate (100-399) and heavy (over 400 eggs). The data were logged into a computer and analyzed using EPI INFO version 6. Frequency tables, descriptive statistics and cross tabulations were carried out as appropriate on pertinent study variables. The sensitivity, specificity, efficiency of each indicator of infection was determined for each of the indicators of *S. haematobium* infection that were self-reported hematuria, microhematuria (dip stick)

and dysuria, using oviuria as the gold standard [14]. All infected school children were treated with Praziquantel 40 mg per kg body weight at the end of the study.

Results

The present study involved 964 school children from 15 schools of the Kaélé (4), Mokolo (4) and Yagoua (7) areas. Most of the schoolchildren were boys (61%). The age of the pupils ranged from 10 to 22 years with 78% falling within the 12-15 years age-bracket. The implementation rate was 87% (n=843) for hematuria and rate 90% (n=871) for oviuria. This was related to some unpredicted shortage of supplies which occurred during fieldwork, but not to poor compliance of the school children.

Self reported hematuria and microhematuria

Almost three-quarters (74%) of the school children reported having blood in urine, while 73% were positive for microhematuria (**Table I**). Half of the urine samples (50%) were positive for microhematuria among which 26% were light "+", 8% moderate "++" and 16% large "+++". The percentage of children reporting hematuria increased with the degree of microhematuria, as 23% of the respondents with light, 31% with moderate and 53% with large microhematuria reported blood in urine.

Self reported hematuria and oviuria

Among the urine samples tested, 36% were positive for oviuria. Among the 316 children who were positive for oviuria, 238 (27%) were light, 54 (6%) were moderate and 24 (3%) were heavy infections. The percentage of infected children reporting hematuria increased with the intensity of infection (**Table II**). Infected children reporting blood in urine represented 37% of light, 61% of moderate and 66% of the heavy infections.

Self-reported hematuria and dysuria

There was a strong collinearity between self-reported hematuria and dysuria (**Table II**), even after controlling for the intensity of infection ($Chi^2>5.46$, $p<0.005$). Among the various indicators of urinary schistosomiasis infection, microhematuria had the highest sensitivity (76%), followed by self reported hematuria or dysuria (65%), and dysuria (52%). The least sensitive indicator of infection was self reported hematuria (43%). Females reported dysuria, perceived hematuria less frequently than males. The specificity of the indicators of infection was highest for self reported hematuria (84%), and lowest for self reported hematuria or dysuria (65%). All indicators had high negative predictive value (>70%) but the highest was reported for microhematuria (97%).

Efficiency of self reported hematuria and dysuria

The percentage of children reporting dysuria was low (16%-37%) when oviuria was nil. As the intensity of infection increased, so did the positivity rate for microhematuria (37%-66%), self reported hematuria (38%-67%) and dysuria (48-65%). For each level of infection, self reported hematuria or dysuria had the highest efficiency, followed by dysuria, self reported hematuria and microhematuria. Using self reported hematuria or dysuria as indicator, all cases of heavy infections (100%) could be detected. (**Table III**).

Table I: Self reported hematuria by degree of microhematuria (test strip) among school aged children in sudano-sahelian Cameroon

Do you have blood in urine ?	Degree of hematuria					
	Negative (-)	Trace (TR)[a]	Low (+)	Moderate (++)	Large (+++)	Total
Yes	72 (18%)	10 (35%)	51 (23%)	17 (31%)	72 (53%)	222 (26%)
No	327 (82%)	19 (65%)	172 (77%)	38 (69%)	65 (47%)	621 (74%)
Total	399 (47%)	29 (3%)	223 (26%)	55 (8%)	137 (16%)	843 (100%)

[a] *Trace was excluded from aggregates for the computations of verbal test quality*

Table II: Self reported hematuria and dysuria by intensity of *S. haematobium* infection among school aged children in sudano-sahelian Northern Cameroon

Do you have blood in urine ?	Number of egg of S. haematobium /10 ml of urine				
	0	1 - 99	100 - 399	400 & +	Total
Yes	94 (16%)	89 (37%)	33 (61%)	16 (66%)	232 (14%)
No	461 (84%)	149 (63%)	21 (39%)	8 (34%)	639 (86%)
Total	***555 (64%)***	***238 (27%)***	***54 (6%)***	***24 (3%)***	***871 (100%)***
Do you have pain when you urinate ?					
Yes	91 (17%)	92 (39%)	34 (63%)	16 (67%)	233 (27%)
No	464 (83%)	146 (61%)	20 (37%)	8 (33%)	639 (83%)
Total	***555 (64%)***	***238 (27%)***	***54 (6%)***	***24 (3%)***	***871 (100%)***

Table III : Accuracy of self reported hematuria, microhematuria (chemical strip) and dysuria in the diagnosis of urinary schistosomiasis.

Number of eggs per 10 ml of urine	Chemical strip	Self reported hematuria	Dysuria	Self reported hematuria or dysuria
0	16%	17%	29%	37%
1-99	37%	38%	48%	51%
100-399	61%	62%	65%	74%
400 & +	66%	67%	56%	100%

Discussion

Most of the indirect techniques used for the assessment of urinary schistosome infection have focused on the use of hematuria for the identification of individuals and communities in

need of treatment or mapping in regions where a control programme is planned [15]. The sensitivity of hematuria for the diagnosis of *Schistosoma haematobium* infection at the individual level has been reported to vary from one locality to the other, and has generally performed poorly for detecting light infections. The study herein reported evaluated self reported hematuria and dysuria as alternate tools for the self diagnosis of *S. haematobium* infection.

Self reported hematuria and microhematuria

The sensitivity of hematuria reported in the present study (76%) is comparable to the 75% reported in Tanzania [16] and lower than the 88% reported in Kenya [17]. Low degrees of hematuria were less likely to be reported by the infected individual. As the degree of hematuria increased, so did the likelihood of self reporting of hematuria. It is possible that dysuria has precedence over hematuria, or that the child is stimulated to look at the urine only when he/she has dysuria. Hematuria may therefore go undetected if it is not accompanied by dysuria. Hematuria is related to the active bladder lesions caused by the passage of *S. haematobium* eggs through the bladder wall [18]. The excretion of *S. hamatobium* eggs is known to be less constant than hematuria, especially for light infections [19].

Self reported hematuria and intensity of urinary schistosomiasis infection

The fact that self reported hematuria was lowest when oviuria was nil and increased with the intensity of infection corroborates with studies in Tanzania, where a nonlinear relationship was shown between the prevalence of heavy infection and microhematuria at the community level [14]. The visual determination of blood in urine by children has been used in the identification of communities at risk for urinary schistosomiasis [4, 20], but its diagnostic value at the individual level needs further assessment.

Efficiency of self reported hematuria and dysuria as indicators of oviuria

In the present investigations, about 29% of the children reported dysuria, and 17% reported hematuria but no eggs were found. These children may have been correct because only one urine sample was collected for the determination of oviuria. Some infections are missed by microscopical examinations of single urine samples. These are mostly low intensity infections [21]. The fact that girls were less likely than boys to report dysuria and hematuria corroborate earlier reports from Cameroon, the Democratic Republic of Congo and Malawi [9, 16]. Studies in which children have been interviewed about the symptoms of urinary schistosomiasis in both East and West Africa have only asked about blood in urine.

Though Campagne et al. (1999), Mafe et al. (1997) evaluated several indicators of urinary schistosomiasis among which macrohematuria, dysuria and microhematuria at the individual and community level, the assessment of hematuria was done by investigators and not as reported by school children in the present investigations. Furthermore, the value of a combination of the two indicators was not assessed.

Concerning the use of combinations of indicators, hematuria and proteinuria was reported as better predictors of *S. haematobium* infection than either hematuria or proteinuria alone [23-24]. Working in Mozambique, the combination of dysuria and hematuria increased the sensitivity and correctly detected the «true» parasitological prevalence as obtained from consecutive daily urine filtration [25]. Similarly, studies in Ethiopia showed that dysuria and hematuria (reagent strip) was a better indicator of urinary schistosome infection than either of the signs alone [10]. The limited value of the reagent strips in epidemiological studies stems from the fact that it only detects 54% low level infections. Combining microhematuria and self reported hematuria improved the detection of *S. haematobium* infection [22].

In a study carried out in Niger, self reported hematuria lacked objectivity, and questions concerning dysuria were poorly understood, and time consuming [6]. We did not experience such shortcomings, as dysuria and hematuria are well known among our study population. This may be due to the fact that the children interviewed in the present study were slightly older.

Implications for schistosomiasis interventions

The tool that is presently recommended for the assessment of urinary schistosomiasis at the community level is a questionnaire that is addressed through the school system and school teachers [9]. This tool relies heavily on a well-structured and effective administrative system, and may have limited practicability where the questions are poorly understood, hard to standardize in case of numerous local languages, or the school attendance

rate is low. The approach may be of limited use overtime and at the individual level, once children become aware that receiving treatment depends on the answer to a single question. The potential for a response bias is obviously high [9]. From our findings, we advocate the use of two questions assessing hematuria and dysuria. The investigator can thereafter make the combination indicator. Although self reported hematuria or dysuria had moderate sensitivity and efficiency for screening *Schistosoma haematobium* infection, it is useful for public health interventions since it detected all heavily infected individuals and the highest number of individuals with moderate infection. These are individuals who are largely responsible for transmission [22], at greatest risk of urogenital disease and in need of treatment.

It would be necessary to assess the validity of the combination indicator hematuria or dysuria for adults who excrete lower numbers of eggs and in whom bladder lesions are less active [18] and younger children who may have difficulties understanding the questions. Such studies should also evaluate self reported hematuria or dysuria as a tool for the rapid assessment of urinary schistosomiasis at the individual and community levels.

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