



## **Prevalence, Risk Factors and Effect of Urinary Schistosomiasis on Academic Performance of School Children Age 6-15 years in Asalaya Locality, White Nile State, Sudan 2017**

**Moner Khalid Mohammed<sup>1</sup>, Sayed Halaly<sup>2\*</sup>, Heithem Awadalla<sup>2</sup>,  
Amani Abdelrahman<sup>2</sup> and Siham Balla<sup>2</sup>**

<sup>1</sup>*Public Health Administration, Postgraduate Department, Directorate of Health Affairs, MOH, Taif, Kingdom of Saudi Arabia.*

<sup>2</sup>*Department of Community Medicine, Faculty of Medicine, University of Khartoum, Sudan.*

### **Authors' contributions**

*This work was carried out in collaboration between all authors. All authors read and approved the final manuscript.*

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### **ABSTRACT**

**Background:** Schistosomiasis is one of the world's most prevalent parasitic infections and it is a significant global health problem. It is the second most prevalent parasitic disease after malaria in developing countries. This study was conducted to assess the prevalence of urinary schistosomiasis, the risk factors and its effect on the academic performance of school children in Asalaya locality, White Nile State, Sudan.

**Materials and Methods:** This is an analytical cross-sectional study in which 475 school children in Asalaya Locality basic schools were investigated for urinary schistosomiasis using urine filtration techniques and microscopy. Certain risk factors were assessed by interview and the school academic performance of the participants was obtained from their academic results.

**Results:** Of the 475 school children surveyed 300 (63%) were males and 175 (37%) were females.

\*Corresponding author: E-mail: [halaly1955@gmail.com](mailto:halaly1955@gmail.com);

The urinary schistosomiasis was found in 310 school children and showed a prevalence of 65%. Males were significantly affected with schistosomiasis than females, 213 (69%) and 97(31%) respectively ( $p < 0.001$ ). School children in the age group 6-10 years were more affected by urinary schistosomiasis than those in the age group 11-15 years ( $p < 0.001$ ). The risk factors associated with the disease were source of water being river/ponds ( $p < 0.01$ ), frequency of visiting river ( $p < 0.001$ ) and activities at river sites ( $p < 0.001$ ). An association was found between the father/mother education. With regard to the academic performance of the school children, half of the affected school children 157 (51%) had poor academic performance while 71% of non-affected school children had excellent performance. The academic performance of the school children was significantly affected by their infection with urinary schistosomiasis ( $p < 0.001$ ).

**Conclusion:** The prevalence of urinary schistosomiasis was high among school children in Asalaya Locality in White Nile State in Sudan and significantly affected their academic performance. More efforts are needed to combat the disease and mass chemotherapy is recommended.

*Keywords: Urinary schistosomiasis; prevalence; risk factors; school children; academic performance; Asalaya locality; Sudan.*

## 1. INTRODUCTION

Schistosomiasis is one of the world's most prevalent parasitic infections and is a major global health problem [1]. It is the second most prevalent parasitic disease after malaria in developing countries [2,3,4]. About 800 million people are at risk of infection [2,5]. More than 250 million are actually infected with the disease and more than 80% of them are in the Sub-Saharan Africa where few control efforts are made [2,4,6]. In six sub-Saharan countries schistosomiasis was ranked in the top ten for years lived with disability (YLDs), that is about 1.5 million YLDs worldwide which seems to be underestimated [7].

In 2007 the WHO estimated 235 million cases of Schistosomiasis worldwide with 732 million people at risk of infection in known transmission areas [8,9].

Schistosomiasis (intestinal and urinary) remains a major health problem in most parts of Sudan leading to high morbidity [10]. The first case of the disease in Sudan was reported by Balfour, who found that 17% of the children in Khartoum primary schools were suffering from urinary schistosomiasis [2,11].

In the provinces of the White Nile State the prevalence of infection with both *S. mansoni* and *S. haematobium* in school children was in a range between 4.5% and 21.4% [12]. In Kenana sugar scheme in White Nile State the prevalence of urinary schistosomiasis was 12% after few years of operation [2,13]. With the progressive

expansion of water sources development, the distribution and prevalence of schistosomiasis has increased [14,15,16]. Asalaya locality is not exclusion; it lies at the White Nile river shore and hosting Asalaya Sugar Scheme with its irrigation canals running throughout the locality in addition to the canals of El-Mahala agricultural scheme.

This study was conducted to assess the prevalence of urinary schistosomiasis, risk factors and its effect on school performance of school children in Asalaya locality, White Nile State, Sudan.

## 2. MATERIALS AND METHODS

This was an analytical cross-sectional study in which the school children in Asalaya locality basic schools were investigated for urinary schistosomiasis infection and their school performance was obtained and certain risk factors were assessed.

### 2.1 The Study Area

All the primary schools in Asalaya locality which were present in four villages were selected. These villages are El-Marabie, El-Dibaibat, El-Fardose and Umfawara.

### 2.2 The Study Population

School children in Asalaya locality accounted to 5000 in 10 schools. The schools are five for boys and five for girls and their age ranged from 6 to 15 years.

### 2.3 Sampling and Sample Size

A systematic random sampling technique was used to select 500 pupils from the study population using the lists of all the students in the locality.

### 2.4 Tools and Data Collectors

A pretested and structured questionnaire was used to collect the data. It included age, gender, water source, presence of latrines at home, family income, frequency of visiting the river and activities done at the river.

The school children were asked to give terminal urine samples in pre-coded urine containers. Urine samples were kept in a cool place and thereafter the samples were processed using urine filtration technique and tested for the presence of *S. haematobium* eggs by direct microscopy.

The school performance of the children was taken as last academic results of the school children. These results were then categorized into: excellent (>90 of total scores), very good (75-89), good (55-74) and bad/poor (<54 of total scores).

Data from interviewing school children were processed and analysed using the computer program SPSS version 21.0. Descriptive statistics was used and the chi square test and the 95% CI and p value at 0.05 were used to test the significance of the presence of the *S. haematobium* infection and the school performance of the school children and other related factors.

### 3. RESULTS

Out of 500 schoolchildren 475 gave urine samples to test for *S. haematobium*, with a response rate of 95%. Nearly two thirds 300(63%) were males and 175(37%) were females. Two thirds of them 310 were infected with *S. haematobium* giving rise to a prevalence of 65% [Table 1]. Younger school children (6-10 years) were more affected than older ones ( $p<0.001$ ) [Table 1]. Risk factors found to be associated with increase infection with schistosoma haematobium in school children were river/ponds as source of water, frequency of visiting river and activities at river site [Table 2]. Half (51%) of the affected school children had poor performance while 71% of non-affected children had excellent academic performance. School children affected with *S. haematobium* significantly had lower academic performance than non-affected ones ( $p<0.001$ ) [Table 3].

### 4. DISCUSSION

Out of 500 schoolchildren 475 gave urine samples to test for *S. haematobium*, with a response rate of 95%. Nearly two thirds 300(63%) were males and 175(37%) were females. Two thirds of them 310 were infected with *S. haematobium* giving rise to a prevalence of 65%. This rate was less than what was seen in school children in Igbkuta village, Lgos State, Nigeria [17] where it was 78%, but more than that found in Zaria, Kadona State, Nigeria; Afar area, Ethiopia; Al-Takamul area, Khartoum State, Sudan; Kwara State, Nigeria and Gambella in Ethiopia; where the prevalence of infection with *S. haematobium* was 10.5%, 20.8%, 22%, 35% and 35.9% respectively [18-22].

**Table 1. Socio-demographic characteristics and Infection with *S. haematobium* among school children in Asalaya Locality (n=475)**

Characteristics of school children		Positive infection n =310	Negative infection n =165	P value
Gender	Male	213 (71%)	87 (29%)	< 0.001
	Female	97 (55%)	78 (45%)	
Age	6 – 10 Years	199 (72%)	76 (28%)	< 0.001
	11 – 15 Years	111(56%)	89 (44%)	
Father/mother Education	Illiterate	13 (52%)	12 (48%)	< 0.001
	Primary	146 (76%)	45 (24%)	
	Secondary	83 (57%)	62 (43%)	
Family income	University and above	68 (60%)	46 (40%)	> 0.05
	Less than 30,000 SDG	269 (67%)	131 (33%)	
	30,000 – 50,000 SDG	26 (52%)	24 (48%)	
	More than 50,000 SDG	15 (60%)	10 (40%)	

**Table 2. Risk factors and Infection with *S. haematobium* among school children in Asalaya Locality (n=475)**

Risk factors		Positive infection n =310	Negative infection n =165	P value
Source of water	Wells	79 (79%)	21 (21%)	< 0.01
	River/ponds	231 (62%)	144 (38%)	
Presence of latrines	Family use only	206 (69%)	94 (31%)	> 0.05
	Shared latrine	85 (57%)	65 (43%)	
	No latrine	19 (76%)	6 (24%)	
Frequency of Visiting river	Every few days	39 (76%)	12 (24%)	< 0.001
	Once a day	129 (74%)	45 (26%)	
	> once a day	142 (57%)	108 (43%)	
Activities at River site	Swimming	183 (73%)	67 (27%)	< 0.001
	Fishing	55 (55%)	45 (45%)	
	Domestic use	60 (60%)	40 (40%)	
	Washing clothes	12 (48%)	13 (52%)	

**Table 3. Academic performance of school children and infection with urinary Schistosomiasis in Asalaya Locality (n=475)**

Academic grades	Positive infection n =310	Negative infection n =165	P value
Excellent (more than 90% of total scores)	19 (6%)	118 (71%)	< 0.001
Very good (75%-89%of total scores)	60 (19%)	26 (16%)	
Good (55%-74% of total scores)	74 (24%)	15 (9%)	
Poor (less than 55% of total scores)	157 (51%)	6 (4%)	

Younger school children (6-10 years) were more affected than older ones ( $p < 0.001$ ). However, school age children were at high risk of contracting infections with *S. haematobium* than other age groups [8,23], because of various factors including higher rates of water activities, anatomical vasculature supplying the genitourinary structures and immunological factors [6,23,24,25]. These factors might also explain the variations seen in the prevalence of infection within and between countries. Males were more affected than females ( $p < 0.001$ ). This tendency of *S. haematobium* infection to affect males was seen in many studies [26-28]. This might be due to differences in the upbringing of boys and girls and to differences in exposure and playing activities between both sexes. Risk factors found to be associated with increase infection with schistosoma haematobium in school children were river/ponds as source of water, frequency of visiting river and activities at river site. The strange association between the school children infection with *S. haematobium* and their fathers/mothers being educated, was a spurious association which might be due to the aforementioned factors (source of water,

frequency of visiting river and activities at river sites). Almost all school children were exposed to these risk factors regardless of their father/mother education. There was no association between the presence of latrine at home being infected with the disease. This might be explained by the fact that although latrines were present at home but might not always be used. The infection of the school children with *Shistosoma haematobium* seems to be a function of the river/ponds as the major source of water and a function of the various activities of the school children at the river sites and canals. Providing tap water and alternative recreational areas for these children and health education may reduce their contact with water and hence reduce transmission and infection with *S. haematobium*. Half of the affected school children had poor performance while 71% of non-affected children had excellent academic performance. School children affected with *S. haematobium* significantly had lower academic performance than non-affected ( $p < 0.001$ ). Academic performance of the schoolchildren was inversely related to infection with *S. haematobium*. This result was expected since schistosomiasis is commonly associated with

anemia, chronic pain, exercise intolerance and under nutrition [29]. All these consequences can lead to poor performance. With increasing intensity of infection a significant decline in both academic performance and school attendance was noticed [28]. Absenteeism was found to be the main factor explaining variations in school performance in Bamako in Mali [28]. The disease was found to affect the cognitive processes of affected persons [29], which showed significant improvement after treatment of the infection [30]. The negative impact and the debilitation caused by untreated infections can demoralize both social and economic development in endemic areas [26,31].

## 5. CONCLUSION

The prevalence of urinary schistosomiasis among school children in Asalaya locality was high. Males were more affected than females. The main risk factors for the disease were male gender, water source being river/ponds, frequency of visiting the river and activities at river sites. There was remarkable effect of the disease on the academic performance of the school children. More efforts are needed to combat urinary schistosomiasis in the locality. This may include raising the awareness of the children, their parents and school teachers about the disease, providing safe water and alternative recreational areas to the river and canals. In addition, the schistosomiasis control programme in the locality needs to be strengthened to provide prompt early detection and management of the affected children and mass chemotherapy was recommended.

## 6. LIMITATIONS

*S. haematobium* eggs were not counted to identify the intensity of infection, absenteeism, a major determinant of academic performance was not measured and only *S. haematobium* infection was estimated, other helminth infections e.g. *S. mansoni* might be present and might affect the academic performance of children.

## ETHICAL APPROVAL AND CONSENT

The study was conducted after the study protocol was ethically approved by the Sudan Medical Specialization Board (SMSB) and the White Nile State MOH. Permission to conduct the study was also obtained from the headmasters of the schools and leaders of the villages and verbal consent was taken from the parents of the school

children. The children participated in the study on voluntary basis after being informed about the aims of the study and giving their consent. Children who were positive for *S. haematobium* infection were treated with praziquantel (in dose of 40 mg/kg body weight) in collaboration with the schistosomiasis control program in White Nile State.

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## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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