MERIT RESEARCH JOURNALS
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Merit Research Journal of Medicine and Medical Sciences (ISSN: 2354-323X) Vol. 7(8) pp. 275-280, August, 2019
Available online http://www.meritresearchjournals.org/mms/index.htm

DOI: 10.5281/zenodo.3376877

Original Research Article

Prevalence of *Schistosomiasis* Infections among School Children in Sinnar State, Central Sudan

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Abstract

***Schistosomiasis* is a wide distributed disease in Asia, South America, and African sub-Saharan countries. In Sudan it is persistently endemic in most parts of the country particularly in the center where most of the irrigating agricultural schemes were constructed. It affects most of the population of these areas particularly schoolchildren, farmers, and animal breeders. A cross-sectional study was conducted in Sinnar state of central Sudan during the period from July 2018 to February 2019. Urine and stool samples were collected from schoolchildren (boys and girls) of ages ranging from 9 to 16 years old with average ages of 13.5 years. For *S. mansoni* a total of 167 stool samples were collected and processed by a single Kato-Katz test in duplicated slides for the detection and calculation of *S. mansoni* eggs, while for *S. haematobium* a total of 229 urine samples were collected and processed by centrifugation concentrating technique for the detection of *S. haematobium* eggs. Out of the 396 samples (urines and stools) there were 65 positive samples detected, constituting a prevalence rate of 16.4% for the two species. For *S. mansoni*, out of the 167 stools there were 4 positive samples recorded from Sinnar locality. The overall result revealed that the prevalence of *S. mansoni* was 2.4 % in Sinnar state, 6.45% in Sinnar locality while all stools from Sinja locality were showed negative results. On the other hand, out of the 229 urines there were 61 positive samples, indicating the prevalence of *S. haematobium* as 26.6% in Sinnar state. The prevalence of schistosomiasis haematobium in Sinnar and Sinja localities was 4% and 53.3% respectively. However, 57% of the infected children were acquired infection by playing in the water canals. The overall prevalence of schistosomiasis in Sinnar state was 16.4 %. Infection with *S. mansoni* was 2.4% while with *S. haematobium* was 26.6%. The prevalence of schistosomiasis in Sinnar locality was 10.4% while in Sinja locality was 53.3%. The findings of this study revealed the need for an integrated control programme for schistosomiasis in Sinnar state.**

Keywords: Schistosoma mansoni, S. haematobium, Sudan, Sinnar

INTRODUCTION

Schistosomiasis is well known and widely distributed disease in Africa, South America and some parts of Asia. It comes second to malaria for morbidity related to parasitic diseases (WHO, 2018). It affects more than 240

million persons in 78 countries 85% of them are in Africa particularly schoolchildren, farmers, animal breeders and women while performing washing or collecting water for their domestic works, this in addition to more than 600 million persons at risk of infection due to their living in disease highly transmission areas (WHO, 2018). It is estimated that there are more than 21,151 deaths in sub-Saharan Africa countries and 24,068 deaths globally due to schistosomiasis and its sequel in 2016 (WHO, 2018).

The most common species of schistosomiasis are *S. mansoni* which is the causative agent of intestinal morbidity, it is most prevalent and endemic in 55 countries in Sub-Saharan African countries such as Sudan, the Middle East such as Egypt and Libya, Arab peninsula, and in South America e.g. Brazil where it is the only existing species and Venezuela, and it is also present in Some Caribbean islands. The other species is *S. haematobium*, which is endemic in 53 countries in Africa and the Middle East countries, where more than 110 million peoples are infected (WHO, 2018). Schistosomiasis is endemic in areas with poor or deficient sanitation facilities and humans are performing urination and defecation beside rivers, water pools and irrigating canals. Moreover, these areas either lack the facilities of clean water supplies or it may be insufficient and citizens are being forced to use these rivers or the irrigating canals for their domestic and recreational activities. In addition, children with their high rates of infection indiscriminate habits of swimming and playing in these waters particularly schoolchildren after their schooldays by which they participate in propagating the situation (WHO, 2017).

Schistosomiasis in Sudan constitutes one of the persistent socioeconomic and health problems, since it spreads over vast majority of the country, starting from the northern region at the borders of Egypt down to include the capital city (Khartoum) to the centre where most of the irrigating schemes and the reservoir dams were constructed such as the Gezira Managil irrigating scheme, new Halfa agricultural scheme, the Sinnar dam and its extension the Rusaires dam this in addition to many other parts of Sudan such as Darfur and Kurdofan (Abdelrahman, *et al*, 2017, Ismail, *et al*, 2014, Tamomh *et al*., 2018; Alaa *et al*., 2013; Azzam *et al*., 2017; Abdelbasit and Mutasim, 2014).

The history of schistosomiasis in Sudan is back to thousands of years, but records showed that the first case was discovered and recorded at the beginning of the last century by Belfour who was a British physician when he surveyed schoolchildren of Khartoum city for urinary schistosomiasis when he found 17% of them were suffering from the disease (Belfour, 1904). And in 1909 Belfour himself found that the disease was very prevalent in West Sinnar at the Blue Nile and Fung Provinces. Since then till this day many studies have been run and the disease is being discovered in many parts of the country.

There are many species of schistosomiasis in the world that affect humans but in Sudan *S. mansoni* and *S. haematobium* are the only species that are known to be endemic in the country.

This study was conducted to determine the prevalence of the two species of schistosomiasis among schoolchildren of Sinnar state in central Sudan.

MATERIALS AND METHODS

Study design

A descriptive cross-sectional study was conducted in Sinnar state in central Sudan in the period from July 2018 to February 2019. A total of 396 urine and stool samples were collected from schoolchildren of ages ranging from 9 to 16 years of the two genders from two main localities of the state (Sinnar and Sinja, n.d).

Study Area

Sinnar state is located in central Sudan, about 400 km southeast of Khartoum city, the water canals that were constructed to irrigate the sugar cane farms for Sinnar Sugar Factory are surrounding the boundaries of the state and contact with the water occur along these canals particularly schoolchildren after their schooldays and also from other peoples of other ages those use this water for their domestic and recreational purposes.

Study population

The study population was comprised of schoolchildren of ages ranging from 9 to 16 years old with the average age of 13.5 years from both genders, the children were chosen from general governmental schools (Al-Mutaafi mixed elementary school from Sinnar locality) and a Quranic school (Khalwa) from Um-Shoka village in Sinja locality, these ages constitute the highest group of infection due to their high contact with the manifested water canals.

Ethical consideration

The study was approved by the state education and health ministries, written and signed consents were obtained from each.

Oral consent was gained from every child after informing him/her about the importance of the study without forcing him to participate in the project.

All positive cases for schistosomiasis were treated with praziquantel 40mg/k body weight as well the other helmenths.

Samples size

A total of 396 urine and stool samples were collected from the children. Prior the commencement of sample collection an informative meeting was held with the headmasters and the teaching staffs of each school and educational lectures about the disease, its mode of transmission, the sequel of untreated patients and mode of protection from becoming infected were conducted in each school. A structural questionnaire was used to collect information about the most ways by which a child had acquired the infection was accompanied the samples collection

Samples collection procedures

Every child was given two clean, capped and labeled plastic containers, (labels were corresponded with the register book which was used to collect the information of participants) and requested him/her to provide urine and stool samples in each container as recommended. Data were only collected from those who brought the recommended samples.

Exclusion of treated children within the last three months was the main criterion considered in the study, otherwise the submission of an enough sample from the selected children was the main advantage.

Microscopic Examination

Examination of stool samples

Immediately after receiving the samples, all stools were processed by Kato-Katz technique (Katz N. *et al*, 1972) as recommended by the WHO as it is the gold standard procedure for the diagnosis of *S. mansoni*, a single double slides test for each sample was used to minimize the chance of false-negative results which is the main disadvantage of Kato-Katz test (Ibrahim A and Elbasheir M, 2016). For the test, a small amount of stool was sieved with a piece of gauze mesh to remove the large particles of the stool, then the sieved stool was transferred to fill a standard template hole which was placed on a top of clean labeled glass slides, then the template was removed carefully to leave an amount of stool on the top of the slide that was covered with a piece of cellophane tape which was soaked in a Methylene blue glycerol solution, then a clean slide was placed over the top of the stool and pressed evenly downwards to spread the faeces in a circle. Carefully the slide was removed by gently sliding it sideways to avoid separating the cellophane strip. Then the slides with the cellophane upwards were examined under the microscope. The total number of *S. mansoni* eggs in each slide was counted and recorded, then multiplied by 40 to give the total number of eggs in a gram of stool in every positive sample. The results were registered as eggs per gram of stool (EPG). Other helminthes eggs were also checked and recorded.

Examination of urine samples

All urine samples were examined by centrifugation technique. For each child investigated, 10 milliliters of urine was placed into a centrifugation tube and centrifuged at 2000 rpm for 3 minutes. Thereafter the supernatant was discarded and the deposit from each tube was placed as drops on three prepared slides and covered with coverslips, then the slides were examined systematically for the presence of *S. haematobium* eggs.

RESULTS

A total of 396 samples of urine and stool were collected from 250 children, 229 urines and 167 stools from the two main localities of Sinnar state. 124 urine and 62 stool samples were collected from Sinnar locality, and 105 urine and 105 stool samples were collected from Sinja locality. Out of the 167 stool samples which were collected from Sinnar state (62 from Sinnar locality and 105 from Sinja locality) and proceed for the detection of *S. mansoni* eggs there were 4 stools positive for the disease to constitute a prevalence rate of 2.4 % of *S. mansoni* at Sinnar state, all of these positive samples were detected from Sinnar locality samples (4/62) to determine that the prevalence of this disease in Sinnar locality as 6.4% and 0.0% at Sinja locality (table3). On the other hand, out of the 250 urines which were processed for the detection of *S. haematobium* eggs there were 61 samples recorded as positive for the disease to constitute a percentage rate of 26.6%, out of these positive cases, 56 samples were detected from Sinja locality (56/105) to state that *S. haematobium* at this locality was very high (53.3%) and 5 positive urines were detected from Sinnar locality determining the prevalence of *S. haematobium* at this locality as 4.0% (table 3). The prevalence of schistosomiasis (*S. mansoni* and *S. haematobium*) at Sinnar locality was 4.8% (9/186) while at Sinja locality was 26.6% (56/210).

Out of the 79 girls who were investigated for schistosomiasis, there were 3 girls (3.8%) positive, 2 of them (2.5%) were positive for *S. haematobium* and 1 (1.3%) for *S. mansoni* (table 2).

There was only 1 child (0.4%) infected with both species (mixed infection) detected from Sinnar locality.

Other parasites were detected while performing the Kato-Katz test, 7 children (3.0%) were found infected with *H. nana* worm and no other parasite was detected.

Playing and swimming in the water canals in addition to the lack of sanitary and modern latrines was the major

Table 1. Prevalence of *S. mansoni* and *S. haematobium* according to the samples type

Sample	No.	Positive	Negative	Percentage
All samples	396	65	331	16.4%
Urine	229	61	168	26.6 %
Stool	167	4	163	2.4 %

Table 2. Prevalence of schistosomiasis according to the sex

Sex	Number	+ve	-ve	Percentage
Boys	171	60	111	35 %
Girls	79	3	76	3.8 %

Table 3. Prevalence of *S. mansoni* and *S. haematobium* according to the study area

Sample	No	+ve	-ve	Percentage
Urine/Sinnar	124	5	119	4.0%
Stool/Sinnar	62	4	58	6.45%
Urine/Sinja	105	56	49	52.3%
Stool/Sinja	105	0.0	105	0.0%

Table 4. Prevalence of infection according to the variable types of contact with water canals

Cause of contact with water	Number	Infected	Percentage
Playing & swimming	175	42	57%
Drinking	106	8	7.5%
Helping families	112	12	10.7%
Recreational purposes	86	36	3.4%
Collecting sugar canes	77	3	1.3%
Urination & defecation	123	36	16%

cause of acquiring infection with schistosomiasis in this area (table 4).

DISCUSSION

Regarding this study a notable and high reduction in the rate of infection with *S. mansoni* was noticed in this area compared to the previous study held at Sinnar state in the year 2014 when it found that the prevalence of *S. mansoni* was 21% (Ibrahim and Ibrahim, 2014), this high reduction can be due to a program of mass treatment with praziquantel which was implemented in this state by a Korean organization (the Korea International Cooperation Agency (KOICA) in collaboration with the federal and state ministries of health. The same result was observed in Al-Jabalain province at the White Nile state when the same organization implemented mass treatment and health education to schoolchildren and villagers of this province and observed the prevalence of schistosomiasis 9 months after treatment; they found that the prevalence of *S. haematobium* was reduced by half from 28.5% to 13.5% (Young-Ha Lee *et al*., 2015). However, as it is noticed recently, the epidemiology of schistosomiasis in Sudan has been fluctuating from high endemic to moderate to low with shifting of the dominant species from *S. haematobium* or *S. mansoni* or vice versa, numerous studies held during recent years confirmed this fact. In some studies held in different parts of central Sudan which include Sinnar and the Gezira agricultural scheme, in Gezira scheme different rates of prevalence of schistosomiasis, in some combos in central Gezira the prevalence of *S. mansoni* was very high reached 30-40% with shifting of infection from *S. mansoni* to *S. haematobium* compared to previous studies held in the same area (Humaida *et al*., 2011), while in other 8 combos in the same state the prevalence of *S. mansoni* was ranging from 3.7% to 8.2% (Abu-Sinn *et al* 2011), other studies in the Gezira agricultural irrigating scheme also showed different rates of prevalence in different parts of the scheme. In a study held in 2005 the prevalence of *S. haematobium* was 68.5% while that of *S. mansoni* was 20% (Naglaa *et al*., 2013), however, another study held among schoolchildren of Barakat area in the Gezira state determined the prevalence of schistosomiasis as 37.6% (Abd Elasafi *et al*, 2015). An investigation of schistosomiasis in five localities at El-

Gezira state revealed that the prevalence of *Schistosoma* was 14.2% (Albadawi *et al*., 2018). In other parts of the country the prevalence of schistosomiasis was also assessed, in Kosti locality at the White Nile State, the prevalence of *S. haematobium* was 18.4% (Abdelrahman *et al*., 2017) but another study in the same state found the prevalence of *S. haematobium* and *S. mansoni* was 45.0% and 5.9% respectively (Ismail *et al*., 2014), however, another study in the same state but other locality (Al-Qeteena locality) which was held to investigate the prevalence of urinary schistosomiasis among schoolchildren of the White Nile Sugar Scheme found that the prevalence of *S. haematobium* was 11.3% (Tamomh *et al*., 2018), moreover, a fourth study in the White Nile state also found the prevalence of *S. haematobium* was 40% with the highest rate of infection among the age group of 12 to 15 years old (Elsiddig *et al,* 2019), another study held to investigate the prevalence of schistosomiasis and other intestinal helminths at the same state revealed that the prevalence of *S. haematobium* was 35.6% and for *S. mansoni* was 2.6% and mixed infection was 1.4% (YH Lee *et al*, 2019). A study held in south Kurdufan revealed the prevalence of *S. mansoni* as 0.0% and for *S. haematobium* as 23.7% (Alaa *et al*., 2013**)**. Among villagers of New Halfa Agricultural Scheme, the prevalence of *S. mansoni* was 27.4% while it was 0.0% for *S. haematobium* (Azzam *et al*., 2017). In Southern Darfur (Greida refugee camp), the prevalence of *S. haematobium* was very high reached 80% while that for *S. mansoni* was 0.0% (Ahmed *et al*, 2009) and in Safia and Abu Selala at Southern Darfur state the prevalence of *S. mansoni* was 0.0% and 56% for *S. haematobium.* The prevalence of schistosomiasis at Khartoum State also was investigated, in a study held to determine the prevalence of schistosomiasis in 18 sites along the River Nile found that the overall prevalence of schistosomiasis at these sites was 39.9%, with variable types of infection, e.g. 23.1% of the investigated candidates were infected with *S. mansoni*, 13.2% of them were infected with *S. haematobium* and 3.5% were infected with both species (Kardaman, *et al*, 2016), however, another study in a suburban district of Al Takamul which is located in the Eastern boundary of Khartoum North showed the prevalence of *S. haematobium* as 22% (Al-Basheer, *et al*, 2017), while another study held in another village in the southern border of Khartoum city also showed the prevalence of *S. haematobium* as 12.9% while that of *S. mansoni* as 2.95% (Hajissa *et al*., 2018). The prevalence of urinary schistosomiasis at the River Nile state at northern Sudan was also accessed, a study held to investigate the pupils of this state was revealed that the prevalence of schistosomiasis in this state was 1.8% (Suleiman *et al*., 2017).

The prevalence of schistosomiasis in overall the country was assessed several times for different purposes, an estimation of the disease prevalence in a countrywide before the split of South showed the rate as ranging from 20% in 1986 (Utroska*, et al,* 1986), to 14.9% in 2003 and 19% in 2010 (Rollinson *et al.,* 2012). In 2012, after the separation of South Sudan the estimates for the countrywide prevalence in Sudan had increased to 23.7% (Lai *et al.,* 2015).

The prevalence of schistosomiasis was investigated in other countries, in neighboring Ethiopia the prevalence of *S. mansoni* was 20.2% in the Wonji Shoa town (Solomon, 2014).

CONCLUSION

The overall prevalence of schistosomiasis in Sinnar state was 16.6% *S. haematobium* was more prevalent (26.6%) than *S. mansoni* which was 2.4%. However, the prevalence of *S. haematobium* in Sinja locality was very high reached 53.3% while that of *S. mansoni* in the same area was not detected 0.0%. The major source of infection was playing of children in the water canals. However, the finding of the study showed the need an integrated control programme against schistosomiasis.

RECOMMENDATIONS

Building constructive control programme is very important; this programme should be based on social education, provision of safe water supply with advising the people to use healthy sanitation facilities, on the other hand, as it is seen in this study the dominant species of schistosomiasis in Sinja locality was *S. haematobium* with 0% of *S. mansoni* this finding should draw attention to run a population study on the snails which inhabiting this area.

ACKNOWLEDGMENTS

I would like to present my gratitude and appreciations to my colleagues at Sinja province, Mrs. Nosaiba Ajib, Mrs. Hajir Salah and their assistants for their constructive helping during collecting the samples and performing the Kato-Katz technique; also I would like to send my thankfulness to Dr. Adam El-Faki El-Badawi from the National Health Laboratory (Stack) for his help and advice, for all, I am very gratitude and thankfulness.

REFERENCES

Abdelrahman A, Ali M, Elbashir H, Samira A, Nour (2017). Assessment of *Schistosoma haematobium* prevalence among pupils in Um Hani village at Kosti locality, White Nile State, Sudan (2011-2012). Advance Research Journal of Multidisciplinary Discoveries. 16.0, C-9 (2017):57-60, ISSN-2456-1045. http://www.journalresearchijf.come

Afifi A, Ahmed AA, Sulieman Y, Pengsakul T. Epidemiology of Schistosomiasis among Villagers of the New Halfa Agricultural Scheme, Sudan. *Iran J Parasitol*. 2016;11(1):110–115.

Albadawi, Sudan, Talha, A, I Mohamed, Sanaa, E Mohamed, Abdlalla, S Ibrahim, Eltayeb, A Ali, Elniama, Abakar, Adam, Elsharief Abdalla, Usama, Bakri, M Nour, Y. (2018). Prevalence of Intestinal and Urinary Schistosomiasis in Five Localities in Gezira State.

Al-Basheer, Babiker. and Aljafari, Alfatih, (2017), Urinary schistosomiasis among primary school children at Takamul area, eastern Khartoum state ;Sudan: An example for urban schistosomiasis, Annals of Tropical Medicine and Public Health, volume10,2,53-356,doi 10.4103/1755-6783.208720

Eltayeb NM, Mukhtar MM, Mohamed AB (2013) Epidemiology of schistosomiasis in Gezira area Central Sudan and analysis of cytokine profiles. Asian Pac J Trop Med. 2013 Feb;6(2):119-25. doi: 10.1016/S1995-7645(13)60006-1

Balfour A. (1904) First report of Welcome Research Laboratories Khartoum, Sudan Government.

Hajissa K, Muhajir AEMA, Eshag HA, *et al*, (2018). Prevalence of schistosomiasis and associated risk factors among schoolchildren in Um-Asher Area, Khartoum, Sudan. *BMC Res Notes.*;11(1):779. Published 2018 Oct 31. doi:10.1186/s13104-018-3871-y

Hind A. Elsiddig, Elham Khider, Saada M. Nour, Abdelrafie M. Makhawi and Mogadam B. E. Mogadam, (2019) Prevalence of urinary schistosomiasis among schoolchildren in White Nile State, Sudan, *African Educational Research Journal,* Volume 7, Issue 1 February 25 2019 Pages 29-32

Ibrahim M. Abdelbasit, and Elbasheir M. Mobarak (2016). The unreliability of Kato-Katz technique limits its usefulness for evaluating Schistosoma mansoni infections in high prevalence area in central Sudan. *International Journal of Tropical Medicine and Public Health*. 6. 1. 10.5455/220123/ijtmph..

Ibrahim M. Abdelbasit, and Ibrahim E. Mutasim. (2014)"Evaluation of microscopical and serological techniques in the diagnosis of *Schistosoma mansoni* infection at Sennar State, Central Sudan." *Asian Pacific Journal of Tropical Disease* vol. 4,1 (2014): 8–13. doi:10.1016/S2222-1808(14)60305-4

Katz N, Chaves A, Pellegrino J (1972). A simple device for quantitative stool thick-smear technique in Schistosomiasis mansoni. Rev Inst Med Trop Sao Paulo. 1972 Nov-Dec;14(6):397-400

Lai, Y.S., et al., (2015) Spatial distribution of schistosomiasis and treatment needs in sub-Saharan

Nagla Gasmelseed, Lana M. El-amin, Ahmed Monis, Abakar A.D, (2014), Prevalence of *Schistosoma Mansoni* Using Different Diagnostic Techniques In the Gezira State, Sudan, Journal of Natural and Medical Sciences (JNMS) vol. 15 (2) 2014 ISSN 1858-6805 e-ISSN 1858-6813

Rollinson, D., *et al*., (2012) Time to set the agenda for schistosomiasis elimination. Acta Trop,

Shaza Humaida, Ahmed EL Gaddal, Mamoun MA Homeida, (2011), Schistosomiasis: epidemiology and burden of disease in Sudan

Solomon Taye. Comparison of Kato-Katz and Formol-Ether Concentration Methods for the Diagnosis of Intestinal Helminthic Infections among School Children of Wonji Shoa Town, Eastern Ethiopia: A School Based Cross-Sectional Study. *American Journal of Health*

Research. Vol. 2, No. 5, 2014, pp. 271-274. doi: 10.11648/j.ajhr.20140205.18

Suleiman Y, E. Eltayeb R, Pengsakul T, Afifi A, A Zakaria M (2017) Epidemiology of Urinary Schistosomiasis among School Children in the Alsaial Alsagair Village, River Nile State, Sudan. Iran J Parasitol. 12(2):284-291.

Tamomh, Abdelhakam. (2018). Urinary schistosomiasis among basic school children in a new irrigated sugar scheme area, White Nile State, Sudan. 6. 10.15406/jmen.2018.06.00194.

Utroska, J.A., *et al*.,(1989) An estimate of the global needs for praziquantel within schistosomiasis control programs, World Health Organization: Geneva, Switzerland.

Africa: a systematic review and geostatistical analysis. Lancet Infect Dis, 15(8): p. 927-40

WHO/Department of control of neglected tropical diseases, Schistosomiasis and soil-transmitted helminthiases: number of people treated in 2016 reference number: Nos. 49, 2017, 92, 749–760

World Health Organization; (2018). Global Health Estimates 2016: Deaths by Cause, Age, Sex, by Country and by Region, 2000-2016. Geneva,

Young-Ha Lee, Hoo Gn Jeong, Woo Hyun Kong, oon-Hyung Lee, n-Ik Cho, Hae-Sung Nam, Hassan Ahmed Hassan Ahmed Ismail, *et al* (2015) Reduction of Urogenital Schistosomiasis with an Integrated Control Project in Sudan