Original Article

Haematobium Schistosomiasis Prevalence Among School Age Children In Irrigated Schemes At Shendi Locality, River Nile State, Sudan: Implication Of Behavior And Risk Factors

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Abstract

Background: Schistosomiasis categoried as water-based diseases transmit by skin contact with the contaminated water. Children at school age are the highly vulnerable victims of the disease. The aims of the study was to measure the schistosomiasis prevalence and determine the influence of ecological and behavioral factors associated with the situation of the disease prevalence.

Methods: In this cross-sectional study the multi-stage cluster random method was used to select a sample size of 1188 children, aged six to18 years, from 16 villages located around the agricultural schemes in the Shendi locality. The data were collected using structured questionnaires, observation and laboratory investigation for the urine samples of the selected children. In addition, checklists lists were used to drive the levels of knowledge about the schistosomiasis.

Results: The results showed 33.3% positive cases. Males reported higher prevalence (35.1%) than females (27.5%), this difference was associated with the dominant culture in the area, that male responsible for providing family needs, and they were more exposed to the disease incidence. The prevalence of schistosomiasis was highest (59.8%) among age groups of 11-15 years. The bridges to cross over the irrigation canals also was one of the important risk factors enhancing it spread in the area. A highly significant association was found between the schitosomiasis prevalence, behavioral and ecological factors.

Conclusion: The urinary schistosomiasis representing a public health problem in the area. Environmental and cultural factors were significantly associated with the prevalence of the disease in the locality.

Keyword: Haematobium Schistosomiasis, Public health, Infectious-disease, Water-based disease

الملخص

خلفية: البلهارسيا هي واحدة من أكثر الأمراض المرتبطة بالماء انتشارا والتي تنتقل عن طريق ملامسة الجلد بالماء الملوث بالأطوار المعدية للمرض. الأطفال هم أكثر ضحايا تلك الأمراض في البلدان النامية. تهدف هذه الدراسة لقياس انتشار البلهارسيا وتحديد تأثير البيئية والعوامل السلوكية المرتبطة بحالة المرض.

طريقة البحث: هذه الدراسة مقطعية وتم جمع العينات بإتباع نموذج العينات المتعددة المراحل العشوائية العنقودية لاختيار حجم عينة من ١١٨٨ طفل، تتراوح أعمارهم بين ٦ إلى ١٨ سنة، من ١٦ قرية تقع حول المخططات الزراعية في محلية شندي. تم جمع البيانات باستخدام الاستبيانات المحكمة، وعن طريف الملاحظة والتحاليل المختبرية لعينات البول من الأطفال المختارين في الدراسة. بالإضافة إلى ذلك، تم استخدام قوائم التحقق المراجعة لقياس مستويات المعرفة حول البلهارسيا.

النتائج: أظهرت النتائج أن نسبة الحالات الإيجابية ٣٣,٣ ٪. حيث وجد أن معدل انتشار أعلى في الذكور (٣٥,١ ٪) مقارنتاً بالإناث (٢٧,٥ ٪). أظهرت الدراسة أن معدل انتشار البلهارسيا (٥٩,٨ ٪) بين الفئة العمرية ١١-١٥ سنة وكانت أعلى نسبة إصابة بالمقارنة مع كل الفئات العمرية الأخرى. عدم وجود أو/ وبعد الجسور لعبور قنوات الري كانت أيضا واحدة من عوامل الخطر الهامة التي تعزز فرص الإصابة وانتشار المرض في المنطقة.

الخلاصة: وجدت الدراسة علاقة قوية بين انتشار مرض البلهارسيا والسلوكيات والعوامل البيئية، حيث أظهرت العوامل البيئية والثقافية أقوي مؤثر مرتبط بحدوث المرض في المنطقة.

Introduction

Schistosomiasis also known as Bilharzia caused by a group of helminths parasites (1) The disease is transimitted by snail, its endemic in most rural areas and more spread in tropical biomes and subtropical ecosystems (2). Schistosomiasis is the most prevalence one of the water-based diseases group. It is one of the greatest risks impair the public health, specially in the rural agriculture areas of developing countries for example in sub-Saharan Africa where approxi-mately 200,000 deaths per year are associated with the schistosomiasis prevalence(3).

Schistosomiasis is amongst the majorcause of high morbidity in developing countries.The diseases are considered the most common and decrease the productivity of the affect humans and incapacitating the livestock. Health-related quality of life (HrQoL) total score was significantly lower in villages with high prevalence rate of S. haematobium (24.0%, p,0.001) and within the lower socioeconomic quartiles (22.0%, p,0.05). A greater effect was seen in the psychosocial scales as matched to the physical function scale. In villages with the moderate prevalence, detection of any parasite eggs in the urine was associated with a significant 2.1% (p,0.05) reduction in total score as reported by Terer CC, et al 2013 (5). The schistosomasis endemic is limited in 78 counries (5) and may conservative increase with particular agricultural activities. Recent estimation reveals that, It has been anticipated that, in 2013, there were approximately 261 million people – including about 240 million cases in Africa – who required preventive chemotherapy because they were at risk of schistosome infection (6). In our study area, Schistosomiasis expected to be increased due to the historical presence of the disease in this area and the establishment of the new investment agricultures schemes. Thus, the Schistosomiasis assessment could be one of the most useful indicators to evaluate the public health of the children. The aims of our study was to measure the schistosomiasis prevalence and determine the ecological and behavioral factors associated with the schistosomiasis prevalence,.

World Health Organization (WHO) reported that in 2009 the global prevalence of schistosomiasis has some changed, and it has been eliminated from many countries. However, the cost of schistosomiasis still high, and it contributes to co-morbidity with other health problems, such as human immunodeficiency virus (HIV), hepatitis, and malaria, in regions where these diseases are endemic (7).

Schistosomiasis considered one of the globally, neglected tropical diseases (NTDs) (3), although they are further most common diseases among the poor people, especially in rural area (7). Schistosomes is classified as the second most common prevalent (NTDs) helminths after the soil-transmitted helminthiasis (hookworm) (8). Recent studies of the schistosomiasis disease incidence show that the occurrence of symptoms and the cost in disability-adjusted life years is growing and

abundant greater than it was formerly (4). Therefore, it concludes that the Schistosomiasis are still a health problem in developing countries, especially among the children in rural area and villages located close to open-water resources.

There are two core schistosome types that cause infection to human in Africa they are Schistosoma mansoni, causes intestinal schistosomiasis infection, and Schistosoma haematobium, which causes urogenital schistosomiasis. Schistosoma intercalatum and Schistosoma guineensis are rarely reported and have limited distribution (3,10,11).

It was reported in 1996 that, around 500 to 600 million people were at risk of being infected with the schistosomiasis largely in rural areas, often as work-related disease. Schistosomiasis primarily affects people who are incapable to avoid touching with infested water, either because of their occupation for examples, agriculture and fishing, or due to the lack of other reliable source of drinking water, using infected water for bathing and washing. As a result of a of immunocompromize and rigorous contact with contaminated water during playing or swimming, young school children aged 10 to 17 years are among the most vulnerable to the schistosomiasis infection(12). WHO reported in 2004 that, schistosomiasis is found to be endemic in 76 countries and regions worldwide (13). Schistosomiasis is a chronic, long lasting disease, leading to a burden of 3·3 million cases worldwide disability-adjusted life-years (DALYs) (10,11). Researchs results showed that wider distribution and usage of praziquantel drug, improved drinking water supply and sanitation status, result in slightly decrease of Schistomosiasis prevelances(14). African sub-Saharan region was reported for 93% (192 million) of the cases globally. Most reported cases were subclinical symptomatic infections, with mild complication such as anemia and malnutrition(15).

Although 46 African countries reported schistosomiasis active transmission, however Asia account the more pathogenic type of disease. There is growing difference between sub-Saharan Africa and the rest of the world in terms of transmission and control (16)

In Sudan, the prevalences of urinary Schistosomiasis were common in all the Nile banks from Halefa to Nemoli village on the Sudanese. The disease spread to all the agricultural development schemes which were inaugurated after the Gezira such as Managil, Rahad and sugar cane schemes in Jinaid, NewHalfa, Asalaya and Kinana (17).

A study was conducted in Elkriab primary school, near ELslait irrigation scheme Sudan to determine the prevalence rates and intensity of infection with the schistosomiasis disease among school pupils. The results displayed that the prevalence of schistosomiasis in this area was 28% of school children. The result also showed that in 74% out of 97 children infected with S. haematobium, the intensity exceeded 500eggs/10 ml of urine (9).

School-age children frequently have the highest incidence and intensity of infection. Amuta et al reported that, The age-related prevalence showed (70.5%,) in the 11-15 year old children than those in 1-5 year old group (44.9%,). A significant variance was saw in the prevalence between the age groups (P=0.014). Males were more infected (60.6%,) than females (47.7%,). (18).

Schistosomiasis is found in poor sanitation areas where humans are in contact with water contaminated by human waste (urine, genital tract excretions and faeces) as part of their daily lives activities, during recreational or professional activities (18).

The overall prevalence of urinary schistosomiasis, is high in the White Nile River basin, Sudan, and is strictly associated with frequencies of contactwith water, bathing, swimming, and wading the stream (19) .

A study in Ethiopia, among the moderate-risk community for urinary schistosomiasis, revealed that; sex, father's occupation and living separately from parents were found to be associated with the disease infection (20). Knowledge, behavior and practices are key factors in schistosomiasis prevalence. knowledge about the schistosomiasis cause, transmission, symptoms and prevention among the rural population in Yemen was found to be inadequate, and that this could be a challenging obstacle to the elimination of schistosomiasis in these communities (21).

Altahir, 2009 (22) , revealed that knowledge, attitude, was significantly improved, and also reveals reduction of Schistosomiasis infection after health education intervention. According to World Health Organization (WHO) reports, based on a study conducted by **Balola** and **Abdul Raheem, 2014** (23). In the study of the schistosomiasis prevalence among school children, in Khartoum state, knowledge of the disease among the interviewed was, 57.1% of the population had poor knowledge about the symptoms of intestinal Schistosomiasis, while 67.1% had poor knowledge about the urinary Schistosomiasis complications, and 69.6% had poor knowledge about intestinal disease complications. The same conclusions also was determined in in Shendi locality by **Elawad, 2005** (24)

Ahmed, (2006) (11), reported that, occupation linked to water-contact activities such as fishing, farming, bathing and laundering show high exposure to the diseases. A study conducted by **(Eline and Henry,2006)** to determine the current status of schistosomiasis infections in the Gazera – Managel Scheme and the impact of the new irrigation system on transmission in Sudan reported that the significant risk factors were farming as the paternal occupation, living in houses built with material other than red bricks, proximity to a water canal, unavailability of water supply and latrines , and past history of infection and treatment (25).

Jember TH., 2014 in Southern Ethiopia, and **Altaher (2009)** in his study about the epidemiology of Schistosomiasis in Kordufan –Su-

dan. He revealed high prevalence of S. haematobium among males (22). **Huang, 2005**, also reviewed that at an individual level, sex, age, educational level and ethnicity are all associated with different patterns of water use and water contact behaviour thereby affecting infection rates (27). **Huang, 200**5 also reported that, S. japonicum risk of infection is also influenced by the dominant local environment, including both the distance of house location from the snail-colonized water sources, access to safe drinking water, and the improvement of sanitation status.

Material and Methods

The main objective of this cross-sectional study was to measure Schistosomiasis prevalence among school children in Shendi locality and determine the factors associated with the disease burden.

Sample size include 1188 school-age children were randomly selected from the household. Multistage cluster random method was followed to determine the units of the study from their homes in the villages around agricultural schems.

Below equation used to derive the sample size:

$N = Z2 \times PQ \div d2$

N = the desired sample size.

Z = the standard normal deviate, usually set at (1.96) or more simply at (2.0)

P = the proportion in the target population estimated to have a particular characteristic,(it there are no reasonable estimate, than use 50% or 0.50).

$Q = 1.0 – P$

d = the degree of accuracy desired, usually set at 0.05 or occasionally at 0.02

The data were collected by the questionnaires and laboratory investigations of urine. All the study uints (school-age children) were introduced for the study purposes and a written consents taken before the data collection.The collected data were processed, and analyzed using the statistical package for sciences (SPSS). Frequency, Cross tables, parcharge and pie charge used to present the results. The statistical analysis Qui-squier test was used to examin the significant of association between prevalence of schistosomiasis, their influencing factors and potential risk factors.

Results

Among the examined children, 33.3% were found to be infected with haematobiums Schistosomiasis (Figure1). The infection was higher among males.

Figure (1): Haematobium Schistosomiasis Prevalence by gender among School Age Children in Irrigated Schemes at Shendi locality, Sudan

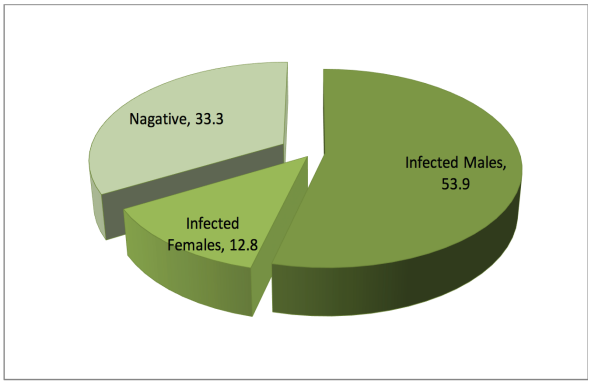

Table (1) shows that the level of knowledge among the Children was poor. About 70.5%, of the children did not know the causative agents. Furthermore, most of the children lacked knowledge about the effects of the diseases, mode of transmission, asymptom of schistosomiasis, predisposing factors, control, prevention measurement, treatment, and factors enhancing the spread of the disease in a percentage crosponding to; 88.5%, 83.4%, 89.7, 88. 7% , 92.2%, 89.1%, 87.2%, and 91.9% respectively.

Table (1): Level of knowledge about Schistosomiasis among the children at school age in Shendi locality, Sudan

Children knowledge	Good		Acceptable		Poor		None	
	No.	%	No.	%	No.	%	No.	%
Causative agents	4	0.3	160	13.5	187	15.7	837	70.5
Effects of Schistosomiasis	2	0.2	31	2.6	104	8.8	1051	88.5
Mode of transmission	7	0.6	23	1.9	167	14.1	991	83.4
Symptom of Schistosomiasis	7	0.6	16	1.3	99	8.3	1066	89.7
Schistosomiasis predisposing factors	5	0.4	17	1.4	112	9.4	1054	88.7
Schistosomiasis control measures	5	0.4	16	1.3	72	6.1	1095	92.2
Prevention measurement	6	0.5	21	1.8	102	8.6	1059	89.1
Treatment	3	0.3	45	3.8	104	8.8	1036	87.2
Factor influence disease spread	1	0.1	14	1.2	81	6.8	1092	91.9

Table (2) shown that the prevalence of Schistosomiasis was highest among the children those, their families jobs related contacting polluted water by (45.5%), followed by farmers and the least prevalence was among other jobs which did not associate contact with water. A highly significant association was found between occupation and the prevalence of the schitosomiasis, P-value (0.000)

Table (2): The association between types of occupation for the family head and the prevalence of schistosomiasis in Shendi locality

Occupation	Urine Exam Results				Total	P-value
	Positive		Negative			
	No.	%	No.	%		
Farmer	188	39.0%	294	61.0%	482	.000
Employee	70	45.5%	84	54.5%	154	
Others	138	25.0%	414	75.0%	552	
Total	396		792		1,188	

Table (3) shows that children aged 11-15 years reported the highest prevalence among the other age groups. Most of them contact canals either for the purpose of playing or help their families.

Table (3): Age distribution for the prevalence of Schistosomiasis in Shendi locality RiverNilestste Sudan

Children age	Urine Exam Results				Total	P-value
	Positive		Negative			
	No.	%	No.	%		
5-10 years	45	20.5%	174	79.5%	219	.000
11-15years	276	38.9%	434	61.1%	710	
16-20 years	75	29.0%	184	71.0%	259	
Total	396	33.3%	792	66.7%	1188	

Table (4) shows that children living with parents reported highest infection (34.7%) compared to those living with only father (5.7%) or mother (16.1%).

Table (4): Association between the social status of the children and the prevalence of Schistosomiasis in Shendi locality

Children living status	Urine Exam Results				P-value
	Positive		Negative		
	%	No.	%	No.	
Children living with parent	389	34.7%	733	65.3%	< 0.000
Children living with Father only	2	5.7%	33	94.3%	
Children living with Mather only	5	16.1%	26	83.9%	
Total	396	33.3%	792	66.7%	

Figure (2) report that the incidence of the disease increase among the children whom still at school (35.5%) compared to the children whom left the school (26.5%) this might be linked to the nearest distances of the most school from the contaminated water sources.

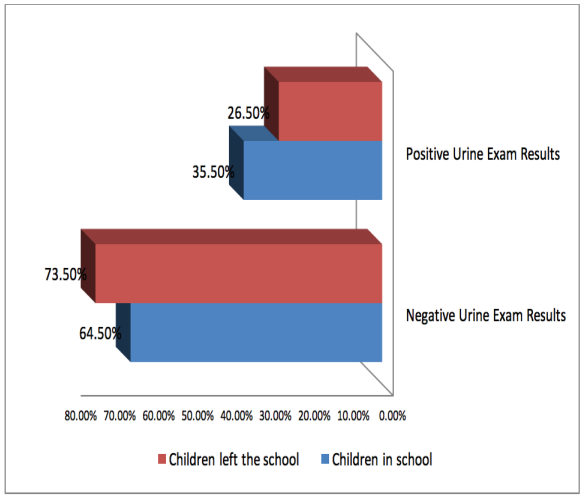

Figure (2): Association between the educational status of children and the prevalence of Schistosomiasis in Shendi locality, Sudan

Table (5) shown that the distances between the bridge which used to cross-over the canal was highly significant in the prevalence of schistosomiasis. Most of the near bridges were poorly constructed by the villagers' member, using local materials such as stones and branches of trees, the children contact with the channel's water while using these types of the bridges to crossover to the other side of the canal, While the well-constructed one which used for crossover found at far distances more than 100 meters from the residential area of the children. Regading the exposure due to canal cross-over the study revealed that the children those use the good-constructed bridges were found more protected (37.1%) from getting infected compared to those who use the conventional local constructed bridges (62.9%). The distances between the well-constructed bridge schools and village positions were highly significantly associated with the schistosomiasis P-value (0.000)

Table (5): Association from home to open water sources and the distance of the available bridge compared with the prevalence of schistosomiasis in Shendi locality, Sudan

Distance from home to open water sources and available bridge	**Urine Exam Results vs nearest available bridge**				**Urine Exam Results vs home to open water sources**			
	Positive		**Negative**		**Positive**		**Negative**	
	No.	%	No.	%	No.	%	No.	%
>50 meters of distance of the nearest bridge to cross the canals	34	40.5%	50	59.5%	140	38.9%	220	1.3 cm
50-100 meters of distance of the nearest bridge to cross the canals	215	46.9%	243	53.1%	205	41.8%	285	58.2%
<100 **meters of distance of the nearest bridge to cross the canals**	147	22.8%	499	77.2%	51	15.1%	287	84.9%
Total	396 (33.3%)		792 (66.7%)		396 (33.3%)		792 (66.7%)	

Table (6) shown highly significant difference was found between the rates of infection and the frequencies of contact with the canal's water P-value (< 0.000). The more frequencies contact with the canal water, lead to increase infection among the children.

Table (6): Association between the frequencies of contact with open water sources and the prevalence of Schistosomiasis in Shendi locality, Sudan

Frequencies of open water contact	Urine Exam Results				P-value
	Positive		Negative		
	No.	%	No.	%	
Do not contact open water	36	19.3%	151	80.7%	
daily contact	106	31.7%	228	68.3%	
weekly contact	138	38.3%	222	61.7%	
monthly contact	68	30.2%	157	69.8%	
Others period of contact	48	58.5%	34	41.5%	
Total	396	78%	792	22%	< 0.000

Discussion:

The prevalence of schistosomiasis diseases among the pupils seems to be increasing in the River Nile state which might be due to increase the number of investments in irrigated agriculture schemes in the area. Altahir MN, 2009 revealed the same finding from his study conducted among primary school children determined that; the prevalence rate among the pupils was found to be 37.5%. The high prevalence of schistosomiasis expects to burden hard effects upon the student health and their productivity levels (22).

The results in table (1) refelect that most of children lacked knowledge about the effects of the diseases, mode of transmission, asymptom of schistosomiasis, predisposing factors, control, prevention measurement, treatment, and factors enhancing the spread of the disease.These results are going with the Elawadb KH, 2005 mentioned (24). WHO, 2014 reported (25), the same results about knowledge of schistosomiasis, symptoms,and complications. This report also concluded that the disease prevalence in Khartoum was very high, even though knowledge about the disease was poor. The same conclusions also were determined by Jember TH, 2014 (26), and Huang y, 2005 (27), but some results observed that sometimes exposure was occurring not due to poor or lack of knowledge only, but could be linked with the lack of other safe or protected alternatives.

The occupations of the family in Shendi were enhancing the spread of schistosomiasis infection. Contact with the open-water of the irrigation channels is the main sources of the disease infection. Table (2) results go with what Afifi A, Ahmed AA, Sulieman Y, Pengsakul T, reported (2009) (11), that, occupation related to water-contact activities such as fishing, farming bathing and laundering showed

high exposure to the diseases. The same results presented by (Eline and Henry, 2006) reported that the significant risk factors were farming as the paternal occupation (25).

The higher prevalence of the disease among males compared to females in the area showed in figure (1) may be associated with social and cultural factors. This result is similar to the results reported by (Tadesse, 2014) (28), Altahir MN(22). reported 2009 and similar to what Huang y, 2005, reported which showed that males had high levels of both prevalence and intensity (27).

As in Table (3) the distribution of the disease by age was highly significant P-value (0.000). (22) Altahir MN, 2009 reported similar results (22). Elawadb KH, 2005 (24), from his study conducted among primary school children also conducted that; the higher infestation was found among the 10-14 group, and 5-9 came next 28.9%, followed by the age group greater than 15 years 26.1%. Similar findings stated by Huang y, 2005 (27), Altahir MN.,2009(22) and Tadesse, 2014 (28).

Table (4) shown that the social status of the Children were highly significant P-value (0.000) associated with the disease prevalence. When the child lives with one of the parents, he/she knew that the care of the child exclusively his responsible, while when he lives with the parents, each depends on the other to care about the child.

Figure (2) report that, educational status was very significantly associated with the prevalence of the disease P-value (0.003)

Results in Table (5) & Table (6) were similar and sometimes identical with what was reported by Huang, 2005 (30), Elawad, 2005 and also goes with what reported by, (22) Altahir MN., 2009 (22) and Tadesse, 2014 (28).

Conclusions

Prevalence of schistosomiasis is increasing among the population in theShendi locality. The prevalence of schistosomiasis was highest among males and age group of 11-15 years. The gender variation in the prevalence of schistosomiasis was associated with the dominant culture in the area, that male responsible for providing family needs and they were more exposed to the risk factors of the disease incidence (e.g., contact with polluted water).Lack of knowledge about the disease among children and their families, living near open water sources and the distance of bridge from schools and houses was most influencing factors for the disease prevalence. We can conclude that, ecological and behavioral factors are very significantly associated with the schistosomiasis prevalence.

Institutions are recommended to support for the local schitosomiasis control program and raise awareness of the community in infested villages to improve their lifestyle and to prevent the incidence of schitosomiasis. Environmental factors manipulations need to take top priority for the local schitosomiasis control program such as building bridges and provide other sanitation measures to prevent

the contact with contaminated water.

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