Impact of Mass treatment, Snail Control and Health Education on the Prevalence of *Schistosoma haematobium* among pupils in Rural Areas at Kosti locality - White Nile State - Sudan (2011-2014).

Original Research Article

ISSN : 2456-1045 (Online)
(ICV-MDS/Impact Value): 3.08
(GIF) Impact Factor: 2.174

Journal Code: ARJMD/MDS/V-20.0/I-1/C-4/DEC-2017
Category : MEDICAL SCIENCE
Volume : 20.0 / **Chapter**- IV / **Issue** -1 (DEC-2017)
Journal Website: www.journalresearchijf.com
Paper Received: 22.12.2017
Paper Accepted: 02.01.2017
Date of Publication: 05-01-2018
Page: 16-22

Name of the Authors:

Abdelrhman A.G ALTIJANI *PhD*[1], **HASSAN Elbashir** *Prof* [3 2], **ABDELRAHMAN Samira** *Prof* [3], **NOUR Bakri** *Prof*[3].

[1]*BPEH- MPEH- PhD in Integrated Control of Communicable Disease Control- College of Applied Medical Science, King Khalid University KSA, as well as Faculty of Medicine and Health Science University of El Imam El Mahdi, Sudan.*

[2]*Wad- Medani, Faculty of Agriculture Science, University of Gezira, Sudan.*

[3]*Wad- Medani, Blue Nile National Institute for Communicable Diseases, University of Gezira, Sudan.*

Citation of the Article

Abdelrhman A.A; Elbashir H; Samira A; Bakri N. (2017) *Impact of Mass treatment, Snail Control and Health Education on the Prevalence of Schistosoma haematobium among pupils in Rural Areas at Kosti locality - White Nile State - Sudan (2011-2014).Advance Research Journal of Multidisciplinary Discoveries. 20.0,C-4 (2017) 16-22*

ABSTRACT

An interventional study was conducted in rural areas Kosti Locality- White Nile State, Sudan during the period from (June 2011- March 2014). Study aims to determine the prevalence of *Schistosoma haematobium* among pupils, to identify the most affected age group and to assess the Impact of these interventions on prevalence of *Schistosoma haematobium*. A total of 400 pupils were interviewed using questionnaire to assess knowledge as a factor related to schistosomiasis. The prevalence of infection was significantly higher among boys than girls ($P \leq 0.05$). No significantly different between age groups, and between the study areas, Umm-hani (1.95%) and El-tawella (1.1%) but in El-hamaraya it was significantly different (9.67%). The interventions (mass treatment, health education and snail control) reduced the prevalence of schistosomiasis in the study areas 15 months after interventions at Umm-hani and El-tawella. Mass treatment and snail control showed erratic results at Al-hamaraya. The study concluded that the interventions (mass treatment and health education) were effective to reduce the prevalence of S. haematobium than (mass treatment and snail control).

Keywords :

Schistosoma haematobium,
Mass treatment,
Health Education,
White Nile State, Sudan.

I. BACKGROUND

Schistosomiasis is an acute and chronic disease caused by blood flukes (trematode worms) of the genus Schistosoma (1). The term human schistosomiasis includes a complex group of acute and chronic parasitic infections caused by mammalian water borne blood flukes Schistosoma (2) (3) (4) causing schistosomiasis (Bilharziasis). Globally, schistosomiasis ranks second among parasitic disease of socio-economic and public health importance and is found in 48 countries of Africa (5). The 2011 estimated population at risk of schistosomiasis has increased to 770 million, based on changing demographic in endemic countries and anthropogenic changes to the environment occurring via water project development (6). The risk for schistosomiasis is widespread, especially in the major irrigation systems in the Gezira area between the Blue and White Nile rivers. In the country, 5 million people are infected by schistosomiasis. Urinary schistosomiasis is caused by S. haematobium in Sudan (7). Though, the disease is endemic throughout all populated areas of Sudan except the province of Red Sea, S. haematobium is predominant in the north and west (8). Schistosomiasis is the most prevalent parasitic disease in Sudan, with twenty-four million people at risk, 5 million cases of infection and a prevalence rate of 20% (9). However, the infection is prevalent in areas that have a reservoir of human infection, the presence of an intermediate *Bulinus* species snail host and the poor socioeconomic conditions or poor sanitation that allow urinary contamination of local freshwater (10). The prevalence rises rapidly from the age when youngsters begin to wander a field. The peak prevalence and intensity of infection occur in children aged (10-14) years (3) (4). It is estimated that 400 million school-age children are infected with schistosomiasis (11). In some endemic areas, the rate of symptomatic infection is lower in females than in males and infections peak in individuals aged 10-15 years. The prevalence is significantly high among male compared with female (7). The prevalence in this group may approach 100% (12) (13) (7). In endemic areas, schistosome infection is first acquired in early childhood and infection increases in prevalence and intensity with age, peaking in the age group of 15- 20 years (14).

Different ways to prevent transmission of infection or reduce the likelihood of heavy infection includes: Reduction or elimination of intermediate host snail (15) (14). The most practical approaches to control appear to be, in the short term, provision of periodic drugs to limit intensity of infection and morbidity (15).

II. MATERIAL AND METHODS

Study design: An interventional study among pupils was conducted in three areas during period from June 2011- March 2014.

Study area: Locality of Kosti - White Nile State. The Location and Border for Locality of Kosti lies between longitude 13.12- 13.40° E and between latitude 13.39- 32.45° N, and at Altitude 382 m above sea level. The work was executed in Umm hani, El-tawella and El-hamaraya. In Umm hani, the work conducted was mass treatment and health education, in El- tawella it was health education, while in El-hamaraya the work conducted was mass treatment and snail control using Bayluscide 83.1% WP.

Study Population: Basic school children (pupils).

Inclusion criteria: Basic school children in the age (6 to 16 years old), those lived in the study area.

Exclusion criteria: None student, Children younger than (6 years old), and above than, (16 years old).

Sample size: At the study area (two areas) four basic schools were selected according to the burden of schistosomiasis in Kosti locality. The number of pupils in these schools were 1425 individuals, and the sample size (382) pupils were determined using the following formula. $\mathbf{n = z^2. (pq) /d^2}$

Where:
n = Sample Size,
z = the value of the standard normal variable corresponding to is 95% level of significance (1.96),
p = Expected prevalence (46 %), q = 1 – P (0.54),
d = marginal error (0.05) $(1.96)^2. (0.5)(0.5)/(0.05)^2 = 381.6 = 386$

The sample then completed to 400 pupils, (200) pupils in Umm hani (two school) and (200) pupils in El-tawella (two school). However (98) pupils were added to sample size at El-hamaraya (all pupils in the Khalwa) (Table 1).

Table (1) showed the sample size of 498 pupils as distributed in the study area.

Class room	El-tawella schools				Um hani schools				El-hamaraya Khalwa	
	Boys		Girls		Boys		Girls		Boys	Girls
	N	S	N	S	N	S	N	S		
Second	71	19	67	18	75	22	51	15	Selected all pupils	
Third	73	20	63	17	66	19	54	16		
Fourth	75	20	77	21	72	21	59	17		
Fifth	64	17	47	13	52	15	52	15		
Sixth	58	16	39	10	55	16	51	15		
Seventh	56	15	53	14	43	14	52	15		
Total	397	107	346	93	363	107	319	93	83	15
498	200				200				98	

N = number of pupils in each class. S = Sample size.

Sampling technique: Proportional sampling was done based on the number of students in each class of the six classes. 107 boys and 93 girls in each study area from the total pupils and 83 boys and 15 girls at El-hamaria (Khalwa), then were nominated and interviewed using a predesigned questionnaire, from each a 10 ml sample of terminal urine was collected in a labeled clean specimen container between 10:00AM and 14:00PM according to WHO guideline; the collected samples were tested for heamaturia, using a reagent strip within approximately 10 minutes.

The completed questionnaires were verified and checked prior to analysis for completeness and accuracy.

Data was entered into Statistical Package for Social Sciences SPSS version (16.0). The relationships between variables were examined using the chi- square test.

Data Collection:

A questionnaire was used to collect the information from the randomly selected pupils. It covers pupil's age, sex, and the class room. In addition also it tackles monthly income of the family, source of water supply and latrine in the house, knowledge and practices regarding Schistosomiasis. Socioeconomic factor was included.

Baseline survey:

The school baseline survey was conducted in June 2011, random samples of the 400 pupils (subjects) were nominated, and then each one was interviewed using a questionnaire. In addition, all pupils in "El-hamaraya Khalwa" were taken as part of this study.

From each subject (498), a 10-ml sample of terminal urine was collected in a labeled clean specimen container. The samples were collected between 10h: 00 and 14h: 00 (16) (7). The collected samples were tested for heamaturia, using a reagent strip within approximately 10 minutes (16). Those reflected positive reactions were subjected to further criterion of centrifugation and sedimentation to check the eggs presence or not, using a microscope at 10x magnification (16) (17) (7) (18).

Interventions:

2. Health education:

Health education programme was conducted in two of the study areas Umm hani and El-tawella. Two schools in each area were selected, the school teachers (8) two teachers in each school were nominated by their school administration, one of them teacher of science in class eight.

Health education training:

The objectives of this training: by the end of training (three days) the participants (teachers) should be able to:

1. Define schistosomiasis.
2. Describe its mode of transmission.
3. List population groups at higher risk to the disease.
4. Disease necessary measures to control schistosomiasis among school children and the general population.
5. Participant in health days through health education and schistosomiasis treatment.

Health education of students:

Objectives of teaching: by the end of the programme the childre should be able to:

1. Define schistosomiasis.
2. Describe its mode of transmission.
3. Identify signs and symptoms of the disease.
4. Adopt healthy behaviors to protect themselves against the causal agents.

Duration of the programme: 15 minutes every Thursday for four months.

Teaching methods: Teaching verbally and illustrations on posters.

Teaching materials: Posters.

Key messages:

1. Avoid playing and swimming in the canals or White Nile.
2. Use latrine to urinate or defecate to avoid contaminating water sources.
3. Go to the doctor at the onset of symptoms (blood in urine and/or stool).
4. Follow the instruction of health worker to using the treatment.

Assessment and evaluation: all children were evaluated using pre and post questionnaire to assess the knowledge about schistosomiasis.

1. Mass treatment:

The work was conducted in the two study areas Umm hani and Al-hamaraya. According to pupils height as shown in table (2) the dose was determined and the drug Praziquantel was used (2). Pupils were treated once during the study with a single dose of Praziquantel in Umm hani schools (200) and Al-hamaraya Khalwa (98) using the height measure.

Table (2) Recommended drug and dosages in curative chemotherapy interventions:

No	Height (cm)	Dose/ Praziquantel
1	94- 109	1 tablet (600 mg).
2	110- 124	1 ½ tablet (900 mg).
3	125- 137	2 tablet (1200 mg).
4	138- 149	2 ½ tablet (1500 mg).
5	150- 159	3 tablet (1800 mg).
6	160- 177	4 tablet (2400 mg).
7	≥ 178	5 tablet (3000 mg).

Source: (WHO, 2006a).

1. Snail control:

Al-hamaraya village is located between two In Let Channels. One in the north and the other in the south. The village is bordered by the White Nile in the east. The two In Let Channels and the area between them were sprayed by Bayluscide 83.1% WP at a dose of 1 kg per 10 litres water using Hudson Knap Sac sprayer at the volume (10 L). Each load covers 300 meters along the In Let Chanel and river bank to control the snails (19). The intervention was conducted once during the study.

Evaluation of interventions:

Interventions evaluation was conducted at all locations; the parameters for evaluation were the re-infection of schistosomiasis among pupils at the three areas of intervention. As well as the responses to the questionnaire at Umm hani and El-tawella areas. For the re-infection of schistosomiasis, the evaluation has been done through collection of urine for the subjects (pupils) under study. Urine was collected three times from each area. The first collection was 3 months, the second 11 month and the third 15 month after the start of intervention.

Ethics Statement:

The study proposal received ethical approval from the Ministry of Health and Ministry of Education, then administration of the schools in the study areas after getting the consents from their parent and school administration Kosti Locality- White Nile State.

III. RESULTS

Table (3) Showed that the impact of various intervention upon the status of the infectious disease, *S. haematobium* among pupils (boys – n = 83- 107) using urine sedimentation.

Intervention	Infection Percentage											
	Pre- intervention			Post intervention								
				(1)			(2)			(3)		
	Age group/ year			Age group/ year			Age group/ year			Age group/ year		
	9±1	12±1	15±1	9±1	12±1	15±1	9±1	12±1	15±1	9±1	12±1	15±1
Umm-hani Mass treatment and Health Education	6 (14%) n= 43	3 (9%) n= 35	4 (14%) n= 29	0	0	0	0	0	0	0	0	0
El-tawella Health Education	4 (10%) n= 41	1 (3%) n= 35	4 (13%) n= 31	0	1 (3%) n= 36	0	1 (3%) n=37	1 (3%) n= 29	0	0	0	0
El-hamaraya Mass treatment and Snail Control	23 (88%) n= 26	15 (50%) n= 30	12 (44%) n= 27	6 (23%) n= 26	19 (65%) n= 29	13 (50%) n= 26	11 (46%) n= 24	12 (50%) n= 24	4 (16%) 25	16 (80%) n= 20	18 (60%) n= 30	9 (33%) n= 27

Table (4) Showed that the impact of various intervention upon the status of the infectious disease, *S.haematobium* among pupils (girls- n= 15- 93) using urine sedimentation.

Intervention	Infection Percentage											
	Pre- intervention			Post intervention								
				(1)			(2)			(3)		
	Age group/ year			Age group/ year			Age group/ year			Age group/ year		
	9±1	12±1	15±1	9±1	12±1	15±1	9±1	12±1	15±1	9±1	12±1	15±1
Umm-hani Mass treatment and Health education	1 (4%) n= 27	1 (3%) n= 33	1 (3%) n= 33	0	0	1 (3%) n= 33	0	0	0	0	0	0
El-tawella Health Education	0 n= 32	1 (3%) n= 29	0 n= 32	0	0	0	0	0	0	0	0	0
El-hamaraya Mass- treatment and Snail Control	6 (86%) n= 7	8 (100%) n= 8	-	1 (25%) n= 4	4 (50%) n= 8	0	4 (50%) n= 8	-	-	3 (60%) n=5	-	-

Urine reagent sedimentation technique:

Table (5) showed that the prevalence of S. haematobium in the pre-intervention the prevalence was not significantly different ($P \leq 0.05$) in the study area, between Umm-hani (1.95%) and El-tawella (1.1%) but in El-hamaraya was significantly different (9.67%). While the result after intervention the prevalence was not significantly different ($P \leq 0.05$) in the study areas, between Umm-hani (1.1%) and El-tawella (0.71%) but in El-hamaraya was significantly different (4.29%), however the prevalence was decreased to (1.1%), to (0.715) in El-tawella and to (4.29%) in El-hamaraya. In the second post intervention the prevalence was not significantly different ($P \leq 0.05$) in the study areas, between Umm-hani (0.71%), El-tawella (0.71%) but in El-hamaraya was different (7.11%) prevalence was equally in El-tawella (0.71%) and Umm-hani (0.71%), so was high in El-hamaraya (7.11%). Lastly in the third post intervention the prevalence was not significantly different ($P \leq 0.05$) in the study area, between Umm-hani (0.71%) and El-tawella (0.71%) but in El-hamaraya was significantly different (7.91%).

Table (5) Impact of various intervention upon the status of the infectious disease, *S. haematobium* among pupils (girls- 16 - 93) using urine sedimentation. Percentage data transformed to $\sqrt{x + 0.5}$. Actual percentage between parentheses.

Intervention	Infection Percentage			
	Pre-intervention	Post intervention		
		(1)	(2)	(3)
Umm-hani:- Mass treatment and Health education	1.95a (3)	1.1 a (1)	0.71 a (0)	0.71 a (0)
El-tawella:- Health education	1.1 a (1)	0.71 a (0)	0.71 a (0)	0.71 a (0)
El-hamaraya:- Mass treatment and Snail control	9.67 b (93)	4.29 b (25)	7.11 b (50)	7.91 b (62)
SE ±	0.28	1.21	0.0001	0.0001
CV %	9.59	103.36	0.00	0.00

Means in the same column followed by the same letter(s) are not significantly different according to Duncan's Multiple Range Test (DMRT) at ($P \leq 0.05$).

Table (6) showed that the prevalence of *S. haematobium* in the pre- intervention survey the prevalence was not significantly different ($P \leq 0.05$) in the study areas, Umm-hani (3.45%) and El-tawella (2.93%) but in El-hamaraya was significant by different (7.72%) compared to the pervious areas i.e Umm-hani and El-tawella. However, the same result was repeated in all post intervention periods.

Table (6) Impact of various intervention upon the status of the infectious disease, *S.haematobium* among pupils (boys- 82- 107) using urine sedimentation. Percentage data transformed to $\sqrt{x + 0.5}$. Actual percentage between parentheses.

Intervention	Infection Percentage			
	Pre- intervention	Post intervention		
		(1)	(2)	(3)
Umm-hani:- Mass treatment and Health education	3.45 a (12)	0.71 a (0)	0.71 a (0)	0.71 a (0)
El-tawella:- Health education	2.93 a (7)	1.1 a (1)	1.48 a (2)	0.71 a (0)
El-hamaraya:- Mass treatment and Snail control	7.72 b (60)	6.70 b (46)	6.01 b (37)	7.51 b (57)
SE ±	0.53	0.49	0.46	0.54
CV %	19.5	30.1	29.3	31.2

Means in the same column followed by the same letter(s) are not significantly different according to Duncan's Multiple Range Test (DMRT) at ($P \leq 0.05$).

Table (7) showed that the level of disease infection was higher among pupils to whom the disease was known than among those to whom the disease was unknown, at Umm-Hani, at pre- intervention. While the result at El-Tawella was similar among the two groups in the known and the unknown. At the post- intervention the level of disease infection was decreased to nil at both sites. So, there was no clear association between infection and knowledge.

Table (7) Impact of various interventions upon the status of the infectious disease, *S. haematobium* among pupils (168 - 200) using urine sedimentation - with relation to Knowledge about schistosomiasis.

Intervention	Infection percentage – Pre-intervention.		Infection percentage - Post intervention (3).	
	Known	Unknown	Known	Unknown
Umm-Hani: Mass treatment and Health education	6 (7%) n= 88	10 (9%) n= 112	0 n= 160	0 n= 8
	P.value = 0.65		No P.value	
El-Tawella: Health education	5 (5%) 103	4 (4%) n= 97	0 n= 137	0 n= 35
	P.value = 0.65		No P.value	

IV. DISCUSSION

Schistosomiasis is the most prevalent parasitic disease in Sudan, with twenty-four million people at risk, 5million cases of infection and prevalence rate of 20% (9). So according to pervious reports on *S. haematobium* the overall prevalence of infection in the White Nile State was found to be 12- 46% (20).

This study showed that the prevalence of infection was higher among boys than girls. In study done in White Nile State, Sudan (21) reported the highest prevalence of *S. haematobium* was among boys than girls. Also (22) (23) (24) found that boys have significantly higher intensity of *S. haematobium* infection than girls. However, in some endemic areas, the rate of infection was lower in females than in males (7) (25) said the males were recorded higher prevalence rate than females. This was attributed to the greater exposure of males to the parasite because of their water contact activities like fishing, swimming and farming in irrigation schemes (26). But other studies (27) (28) (22) showed that there was no significant difference in the prevalence of *S. haematobium* infection between boys and girls. The interventions (mass treatment, health education) were reduced the prevalence of S. haematobium in the study areas 18 months after interventions at umm-Hani and El-Tawella, previous studies were conducted in White Nile State, Sudan and a similar result were achieved (22) (29) (30) in Lake Malawi and (31) in Ethiopia. Mass treatment and snail control were showed erratic results at Al-hamaraya. This may be due to the fact that

pupils, boys and girls, visit the Nile flood for playing, fishing and/or washing of clothes. There was no significant difference in the prevalence of schistosomiasis between age group and this confirming the previous work in the White Nile State, Sudan (21) that the rate of infection was not different between groups by age. This may be an indication that all age groups equally exposed to infection through water contact (28). As a result of a low level of resistance and intensive water contact when playing and swimming (Rozandaal, 1997; Webber, 2005). However, other studies (3) (32) (4) (7) (30) (33) (34) revealed that the peak prevalence and intensity of infection occur in children aged (10-14) years. So, the infection increases in prevalence and intensity with age, peaking in the age group 15- 20 years (14). And the Children of < 10 years of age had a significantly higher rate of prevalence of S. haematobium infection than those children ≥ 10 years of age (22).

Questionnaire analysis, the health education was decreased the prevalence of the disease, the previous study confirmed that. Infection was significantly higher among pupils who did not have information about the disease (35). However, the educational method employed succeeded in significantly decreasing the prevalence of schistosomiasis infection (36). Health education aimed at reducing transmission and it re-infected by encouraging health behaviors (37).

ACKNOWLEDGEMENTS

I would like to express my appreciation to all who made it possible for me to a accomplish this work. Special thanks to Dr. Awadallah Belal Dafaallah for statistical analysis. Grateful thanks to the staff of schistosomiasis control program White Nile State and Korea International Cooperation Agency for their practical helps conducted a flied study. Finally full thanks to all staff of Blue Nile National Institute for Communicable Diseases, University of Gezira for their supports especially U.Arwa Ibrahim Othman, Mr. Abu Elgasm Mostafa.

REFERENCES

[1] **WHO.**WHO.int/mediacenter/factsheets/fs115/en. [Online] 12 2014. http://www.who.int/mediacentre/factsheets/fs115/en/.

[2] Preventive Chemotherapy in Human Helminthiasis, Coordinated use of Anthelminthic Drugs in Control Intervention: A manual for Professional and Programme Managers. Geneva: **World Health Organization, 2006a.**

[3] **Davis Andrew, Gordon G. Cook, Allmuddin L. Zumla.** Mason Topical Disease 22 Edition. London: Elsevier, 2009.

[4] **Rollinson D and Hay I.S.** Advances in Parasitology, 1St Edition. London : Elsever, 2010.

[5] Prevalence of schistosomiasis and associated factore among students attending at elementary schools in Amibera District Ethiopia. **Awoke W, Bedimo M and Tarekegn M. s.l**. : Open Journal of preventive Medicine, 2013, Vol. 3(2), pp. 199- 204.

[6] **King H. Charles, Amaya L. Bustinduy, Jemery Famar, Peter Hotez, David Lalloo, Nicholas White, GagandeepKang, Thomas Junghanss. Mansons** Tropical Disease. London : Elsever, 2014.

[7] High prevalence of urinary schistosomiasis in two communities in South Darfur, implication for interventions. **Deribe Kebede, Abdeljbar Eldaw, Samir Hadziabduli, Emmanuel Kailie, Mohamed D Omer, Alam E Mohammed, Tanole Jamshed, Elmonshawe A Mohammed, Ali Mergani, Gafer A Ali, Khalid Babikir, Abdulrahman adem, Faroug Hashim.** 14, 2011, Parasites and Vectors, Vol. 4, pp. 1-5.

[8] **WHO.** World schistosomiasis Risk Chart. Geneva Appia : World Health Organization, 2012. pp. 1-5 .

[9] Country Cooperation strategy for who, Sudan 2008-2013. Regional office for the Eastern Mediterranean : **World Health Organization, 2009a**.

[10] **Satoskar R. Abhay, Gary L. Simon, Peter J. Hotez, Moriya T. Suji.** Medical Parasitology. Texas : Landes Bioscience, Austin, 2009.

[11] **WHO.** Communicable disease (control of Schistosomiasis and soil – transmission helminth infection). Geneva : World Health Organization, 2001.

[12] **Behrman, Amy J.** Schistosomiasis. Pennsylvania. : School of medicine,University, 2005.

[13] **Assafa Dawit, Ephrem Kibru, S. Nagesh, Solomon Gebreselassie, Fetene Deribe, Jamal Ali.** Medical Parasitology. Addes Abab, Ethiopia. : Jimma University, 2004.

[14] **Walker H. David, Richard L. Guerrant, Petrer F. Weller**. Tropical infectious disease Principles, Pathogens, and Practice (3rd ed). Washington : Elsevier, 2011.

[15] Tropical infectious disease Principles, Pathogens, and Practice (2nd ed). **Washington : Elsevier, 2006.**

[16] **WHO.** Basis Laboratory methods in medical Parasitology. Geneva : World Health Organization, 1991.

[17] The control of Schistosomiasis, technical report series-no 830. Geneva : **World Health Organization, 1993.**

[18] **Wallace B.Robert , Neal Kohatsu, John M.Last.** Public Health and Preventive Medicine. (15th ed). New York : McGraw-Hill Companies, 2008.

[19] **Rozendaal, J.A.** Vector control, Methods for use by individuals and communities. Geneva : World Health Organization, 1997.

[20] **WHO.** Communicable Disease Tool Kit Sudan – Who Country Office. Khartoum : World Health Organization, 2005.

[21] Prevalence, risk factors, and clinical manifestations of Schistosomiasis among schoolchildren in the White Nile River basin, Sudan. **Ismail A H A H, Sung- T Hong, Azza T B B. Randa M A H, Hoo- Gn J, Woo- Hyung K, Han-lk L, Hae- Sung N, Young H L.** 478, s.l. : Parasites and Vectors, 2014, Vol. 7, pp. 1-13.

[22] Schistosoma haematobium infections among schoolchildren in central Sudan one year after treatment with Praziquantel. **Ahmed M. Abedaziz, Hana Abbas, Fathi. M. Mansour, Gasim. I. Gasim, Ishag Adam.** 108, Khartoum : Parasites and Vectors, 2012, Vol. 5, pp. 1-7.

[23] Prevalence and intensity of Schistosoma mansoni infections among schoolchildren attending primary schools in an urban setting in Southwest, Ethiopia. **Mitiku Bajiro, Daniel Dana and Bruno Levecke.** 677, Jimma : BioMed Center, 2017, BioMed Center, Vol. 10.

[24] Prevalence and distribution of Schistosoma haematobium infection among school children living in southwestern shores of Lake Malawi. **Sekeleghe Kayuni, Rosanna Peeling, Peter Makaula.** 1, 2017, Malawi Medical Journal, Vol. 29, pp. 16- 23.

[25] Profile of an epidemiological study of urinary schistosomiasis in tow local government areas of Benue state, Nigeria. **Houmsou R.S, Amuta E.U, and Sar T.T.** 1, Jalingo : Michael Joanna Publications, 2012, International Journal of Medicine and Biomedical Research, Vol. 1, pp. 39-48.

[26] Prevalence and Intensity of Urinary Schistosomiasis among primary school- pupils in Minjibir local Government area of Kano State. **Duwa, M.R, Oyeyi, T.I and Bassey, S.E. 1, Kano :** Bayero Journal of Pure and Applied Sciences, 2009, Bayero Journal of Pure and Applied Sciences., Vol. 2, pp. 75-78.

[27] Urinary Schistosomiasis among preschool- aged children in a rural communities in near Abeokuta, Nigeria. **Ekpo F. Uwem, Akintunde Laja-Deile, Akinola S. Oluwole, Sammy O SamWobo, Chieedu F. Mafiana.** 58, 2010, Parasites and Vectors, Vol. 3, pp. 1-5.

[28] Urinary schistosomiasis among preschool-aged children in Sahelian rural communities in Mali. **Abdoulaye Dabo, Haroun Mahamat Badawi, Boubacar Bary, Ogobara K Doumbo. 21, Mali** : BioMed Center, 2011, Parasites & Vectors, Vol. 4, pp. 1-7.

[29] **Awad, Ahmed M.** Schistosomiasis control programme White Nile State,Sudan. Kosti : s.n., 2014. pp. 1-10, Monthly.

[30] Prevalence and distribution of Schistosoma haematobium infection among school children livin. **Sekeleghe Kayuni, Rosanna Peeling, Peter Makaula.** 1, 3 2017, Malawi Medical Journal, Vol. 29, pp. 16-23.

[31] Schistosomiasis Control Strategies, with Emphasis on Snail Control Using Molluscicides. Belete, **Eshetu Molla**. 8, 6 2015, International Journal of Health Sciences & Research, Vol. 5, pp. 572- 584.

[32] Prevalence of schistosoma haematobium infection in school aged children of Konduga local Government Area, Northeastern Nigeria. **Biu. A. A, H. B. Kolo, E. T. Agbadu. 4, Vom** : African Studies on Population and Health, 2009, International Journal of Biomedical and health sciences, Vol. 5, pp. 1-5.

[33] Prevalence and intensity of Schistosoma mansoni infections among schoolchildren attending primary schools in an urban setting in Southwest, Ethiopia. **Mitiku Bajiro, Daniel Dana and Bruno Levecke**. 667, 12 4, 2017, BioMed Centeral Research Notes, Vol. 10, pp. 1-6.

[34] Factors associated with Schistosomiasis outbreak at Omindamba primary school, Omusati region, Namibia: a case-control study, March. Uzenia **Ndatelela Mupakeleni, Kofi Mensah Nyarko, Francina Ananias, Peter Nsubuga, Emmy-Else Ndevaetela.** 212, 2016, Pan African Medical Journal., Vol. 28, pp. 1-9.

[35] Schistosomiasis infection among primary school students in a war zone, Southern Kordofan State, Sudan: a cross- sectional study. **Abou-zeid A. Alaa, Tigani A. Abkar, Rashid O. Mohamed.** 1643, s.l. : BioMed Central., 2013, Vol. 13, pp. 1471- 2458.

[36] The influence of health education on the prevalence, intensity and morbidity of schistosoma haematobium infections in children over a two- year period in the Limpopo Province, South Africa. **Wolmarans. CT, KN de Kock.** 1, s.l. : South Africa Journal Epidemiology infection, 2009, South Africa Journal Epidemiology infection, Vol. 24, pp. 13-13.

[37] **Jamison T. Dean, Joel G. Breman, Anthony R. Measham, George Alleyne, Mariam Claeson, David B. Evans, Prabhat Jha, Anne Mills, Philip Musgrove**. Disease control priorities in developing countries (2nd ed). Washington DC 433 : Oxford University Press, 2009. pp. 467- 471. 1 2 3 4 09 08 07 06.

*****

Corresponding Author :
Abdelrhman A.G ALTIJANI*
BPEH- MPEH- PhD in Integrated Control of Communicable Disease Control- College of Applied Medical Science, King Khalid University KSA, as well as Faculty of Medicine and Health Science University of El Imam El Mahdi, Sudan
.Email: – abdelrhman6[at]gmail[dot]com