

Association between Intestinal Schistosomiasis and Enteric Fever in New Halfa City, Sudan

¹Tayseer Elamin Mohamed Elfaki, ²Eman Jamal Abdalla

¹Department of Parasitology and Medical Entomology, College of Medical Laboratory Science, Sudan University of Science and Technology, Khartoum, Sudan

²Department of Parasitology, Tiba's Centre for Maternal, Children Health and Family Planning, Khartoum, Sudan

Abstract: The study aimed to determine association between intestinal schistosomiasis and enteric fever in New Halfa city. A cross-sectional study was carried out during the period from December 2010 to June 2011. A total number of 75 subjects (29 (38.7%) were males and 46 (61.3%) were females, age between 6-60 years old, mean age was 17 ± 12 years) were included in this study. Stool and blood samples were taken from all subjects. Parasitological and clinical data were obtained and recorded. Out of 75, 75 (100%) faecal specimens were positive for *Schistosoma mansoni* (29 (38.7 %) were males and 46 (61.3%) were females) when examined by direct wet mount and Kato-Katz technique. Kato-Katz technique was used to determine the intensity of infection, out of 75, 54 (72.0%) were mild infection, 20 (26.7%) were moderate and 1 (1.3%) was severe infection. *Salmonella* was detected by using stool culture and the serum samples tested for antibody titer by using screening Widal test by slide method. The results showed that, when used culture media 15 out of 75 (20.0%) was growth and 60 out of 75 (80.0%) no growth. When used the Widal test the result was 44 out of 75 (58.7%) were insignificant, 14 out of 75 (18.7%) were suggestive and 17 out of 75 (22.7%) were significant.

Keywords: Culture media, Enteric fever, Kato-Katz, New Halfa, Schistosomiasis, Widal test.

1. INTRODUCTION

Schistosomiasis, classified as a Neglected Tropical Disease (NTD), is a parasitic disease caused by blood flukes or trematodes of the genus, *Schistosoma*. Schistosomes are parasitic helminthes that infect humans via invasion of the skin while in contaminated water [1]. The disease is spread by contact with water contaminated with the parasites and harboring infected freshwater snails, known as the intermediate hosts [2]. They may infect the urinary tract or intestines; however, genital schistosomiasis has been reported [3]. The infection presents with abdominal pain, diarrhea, bloody stool or urine. In chronic cases there could be liver damage, renal failure and infertility [2]. Schistosomiasis infect almost 210 million people worldwide [4] with estimated death rate of 12, 000 [5] to 300, 000 people per annum [6]. The disease is commonly found in Africa, Asia and South America [2]. In about 74 developing tropical countries, around 700 million people live in areas of high endemicity of this disease and about 20 million suffer from severe consequences from the disease [7]. Schistosomiasis is second only to malaria, as a parasitic disease with the greatest economic impact [8], yet among the most neglected. On the other hand, typhoid fever is a common worldwide bacterial disease transmitted by the ingestion of food and/or water contaminated with the faeces of an infected person, which contain the bacterium, *Salmonella enteric* serovar *typhi* [9]. It is a systemic infectious disease [1] characterized by an acute illness, the first typical manifestations of which are fever, headache, abdominal pain, relative bradycardia, splenomegaly, and leucopenia [10]. An estimated 16 to 33 million cases of typhoid fever occur annually and the incidence is highest in children and young adults between 5 and 19 years old [11]. Approximately 2 million individuals die each year from diarrheal diseases and *Salmonella* is the leading cause of this malady. Humans are the only reservoir and host for the typhoid fever bacteria [1]. Both schistosomiasis and typhoid fever are water-borne and share some symptomatology and social circumstances such as poverty imperative in their transmission. Therefore, in areas where

both diseases are common, co-infection is an inevitable possibility as both can be contracted together. A relationship between persistent or recurrent *Salmonella* infections and schistosomiasis has been described in both adults and children [12]. The mechanism of *Salmonella-Schistosoma* relationship has been explained by the fact that the *Salmonella* bacterial pili adhere to a mannose receptor-like surface glycoprotein on the tegument of *Schistosoma mansoni* [13]. This successful adherence makes it possible for the adult worm to provide a site for intravascular persistence [12]. The consequence of this relationship is that *Salmonella* bacteria would evade the toxic effects of antibiotics mobilized against them by hiding within the parasite, making them reservoirs for persistent infection after therapy [14]. Also, when anti-schistosomiasis drugs are administered, the death of the parasite would liberate the bacterium into the bloodstream [1]. Further, since most of the *Salmonella* bacteria in the teguments of the *Schistosoma* parasites are continuously exposed to sub-therapeutic concentrations of antibiotics in the course of treatment of typhoid fever infections, the development of antibiotic resistance is constantly reported [1]. The main objectives of this study were to determine association between intestinal schistosomiasis and enteric fever in New Halfa City, to detect intensity of schistosomiasis in stool by using Kato-Katz technique, to detect enteric fever by using stool culture and Widal test and to correlate intensity of intestinal schistosomiasis with growth of *Salmonella*.

2. MATERIALS AND METHODS

Study area:

This study was carried out in New Halfa City in eastern Sudan, during the period from December 2010 to June 2011. New Halfa city was constructed in 1964 to settle the inhabitants of old Halfa in the northern border of Sudan were displaced after construction of the High Dam on the Nile in Egypt. It is an agricultural area, 500 km from Khartoum and 450 m above sea level, located around 15° N 35° E [15].

General characteristics of the studied population and ethical clearance:

The study was conducted on 75 subjects from New Halfa City with an age ranging between 6-60 years old and the mean age of 17 ± 13 years, 29 of them were males (38.7%) and 46 were females (61.3%). The surveyed populations were categorized into six age groups: (1-10), (11-20), (21-30), (31-40), (41-50) and (51-60) year. The frequency of each age group was 27 (36%), 32 (42.7%), 7 (9.3%), 3 (4%), 5 (6.7%) and 1 (1.3%) of the total population respectively. Ethical clearance for this study was obtained from College of Medical Laboratory Science- Sudan University of Science and Technology, Ministry of Health-Kassala State Department of Preventive Medicine Office of the anti-bilharzia and intestinal worms, New Halfa city and an informed consent was obtained from all subjects included in this study.

Sampling:

A total of 75 questionnaires were administered. A total of 75 stool samples and blood samples were collected, from those filled the questionnaire.

Design of questionnaire:

The design of questionnaire include gender, age, observation of blood and mucus in the stool, visit to water bodies (risk factor), history to previous infection and previous treatment, presence of latrines in the houses, source of drinking water and a simple knowledge on the sign and symptoms of the diseases and also employs the activities that put an individual at the risk of infection.

Parasitological investigations:

1- Direct wet preparation:

For detection of *S. mansoni* in faecal specimens, 75 samples were examined by direct wet preparation as described by WHO (1993) [16]. Three slides were prepared for each stool specimen.

2- Kato-Katz technique:

Kato-Katz technique was used for the quantitative assessment of eggs in 1 gram of stool as described by Berhe *et al.* (2004) [17]. The intensity of infection was obtained by counting the number of *S. mansoni* eggs per gram (epg) of stool. Results were expressed as (≤ 50 epg) presented as mild infection, (51-200 epg) as moderate infection, (201-300 epg) as severe infection and (≥ 400 epg) as hyper infection.

Bacteriological investigations:**1- Culture:**

For detection of *Salmonella* in faecal specimens, 75 samples were isolated in Selenite F Broth media, MacConky and Xylose Lysine Deoxychoate media and identification by Gram stain and biochemical tests (Indole test, Citrate utilization test, Urease test, Kligler Iron Agar) as described by Cheesbrough (2004) [18].

2- Widal agglutination test for *Salmonella* antibodies:

Widal agglutination test was performed on each blood sample using the Widal agglutination kit (Spinreact, Bacterial Antigens, Spain) containing somatic (O) and flagella (H) antigens of *Salmonella typhi* and *Salmonella paratyphi* A-C. A negative saline control was introduced in each batch of test. The procedure used was as described by Jones (1996) [19].

Statistical analysis:

Data were analyzed using Statistical Package for Social Sciences (SPSS) under windows, version 15.0. Chi square test statistical analysis was performed and the *p* values of less than 0.05 were considered statistically significant. Data were presented in tables using Excel after analysis using SPSS.

3. RESULTS

Overall prevalence of *S. mansoni* infection using wet preparation and Kato-Katz technique according to gender:

A total of 75 stool samples were examined for *S. mansoni* eggs. Out of these, 75 (100%) were found to be positive when detected by using direct wet preparation and Kato-Katz technique. From the 75 positive cases, 29 (38.7%) were males and 46 (61.3%) were females (table 1). Within these 75 positive cases, 54 (72%) were mild infection, 20 (26.7%) were moderate infection and 1 (1.3%) were severe infection. The differences in prevalence according to gender was found to be statistically significant ($p=0.000$).

Prevalence of *S. mansoni* among population with mucus and blood in their stool:

Out of 75, 13 (17.3%) have blood and mucus in their stool while 62 (82.7%) have no blood and mucus in their stool. Chi-square test was used to determine the relationship between intensity of infection and presence of blood and mucus in their stool (table 2). The relation between intensity of infection and presence of mucus and blood in stool was insignificant ($p=0.19$).

Prevalence of *S. mansoni* according to knowledge about the disease:

Out of 75, 45 (60%) have knowledge about disease while 30 (40%) have no knowledge about disease.

Overall prevalence of *S. mansoni* according to duration of previous infection:

Out of 75 surveyed populations, 67 (89.3%) were previously infected with *S. mansoni*. Among those, 67 (89.3%) were found to be positive for *S. mansoni*. Among the other group without history of previous infection, 8 (10.7%), 8 (10.7%) were positive. Out of 67, 56 (83.6%) previously infected for (1-11 month), 56 (83.6%) were found to be positive for *S. mansoni* by direct wet preparation, 6 (9%) of previously infected for (12-23 month), 6 (9%) were positive, 5 (7.4%) of previously infected for (24-35 month), 5 (7.4%) was found to be positive. The relation between recent infection and the duration of previous infection was insignificant ($p=0.211$).

Detection of *Salmonella* by using stool culture and Widal screening test:

The *Salmonella* was detected by cultured the stool samples. Out of 75, 15 (20%) stool samples were showed growth while 60 (80%) were showed no growth. When using Widal test to detect antibodies of *Salmonella* in serum, out of 75, 44 (58%) presented as insignificant results, 14 (18%) as suggestive results and 17 (24%) as significant results (table 4).

The relationship between intensity of *S.mansoni* infection and the growth of *Salmonella*:

The relationship between intensity of *S.mansoni* infection and the growth of *Salmonella* was detected by using Chi-square test. Out of 15 stool samples which were showed growth, 10 were presented as mild infection and 5 were presented as moderate infection. Out of 60 stool samples which were showed no growth, 44 were presented as mild infection, 15 were presented as moderate infection and 1 was presented as severe infection (table5).

The relationship between intensity of *S.mansoni* infection and Widal test:

The relationship between intensity of *S.mansoni* infection and Widal test was detected by using Chi-square test (table 6).

The relationship between the growth of *Salmonella* and Widal:

The relationship between the growth of *Salmonella* and Widal test was detected by using Chi-square test (table 7).

According to questionnaire and information which had taken from the study subjects, the majority were farmers with low level of education. All of them have history of water contact and no latrines in their houses. The source of drinking water was water canal and donkey car and this water was used for all domestic purposes.

Table 1: Overall prevalence of *S. mansoni* infection using wet preparation and Kato-Katz technique according to gender

<i>S. mansoni</i>	Gender		Total
	Male	Female	
Wet preparation	29	46	75
Kato-Katz technique	29	46	75

Table 2: Relationship between intensity of *S. mansoni* among population with mucus and blood in their stool

Blood and mucus in stool	Intensity of infection			Total	p value
	Mild	Moderate	Severe		
Yes	12	1	0	13	0.19
No	42	19	1	62	
Total	54	20	1	75	

Table 3: The relationship between intensity of *S. mansoni* infection and the age groups

Intensity of <i>Schistosoma</i> infection	Age groups (year)						Total	p value
	1-10	11-20	21-30	31-40	41-50	51-60		
Mild	18	25	3	2	5	1	54	0.62
Moderate	8	7	4	1	0	0	20	
Severe	1	0	0	0	0	0	1	
Total	27	32	7	3	5	1	75	

Table 4: Detection of *Salmonella* by using stool culture and Widal screening test

	Culture		Widal Test		
	Growth	No growth	Insignificant	Suggestive	Significant
<i>Salmonella</i>	15	60	44	14	17
Total	75		75		

Table 5: The relationship between intensity of *S.mansoni* infection and growth of *Salmonella*

Intensity of infection	Result of culture		Total	<i>p</i> value
	Growth	No growth		
Mild	10	44	54	0.72
Moderate	5	15	20	
Severe	0	1	1	
Total	15	60	75	

Table 6: The relationship between intensity of *S.mansoni* infection and Widal test

Intensity of <i>S.mansoni</i> infection	Result of Widal test			Total	<i>p</i> value
	Insignificant	Suggestive	Significant		
Mild	34	9	11	54	0.33
Moderate	10	5	5	20	
Severe	0	0	1	1	
Total	44	14	17	75	

Table 7: The relationship between growth of *Salmonella* and Widal test

Result of culture	Result of Widal test			Total	<i>P</i> value
	Insignificant	Suggestive	Significant		
Growth	8	2	5	15	0.51
No growth	36	12	12	60	
Total	44	14	17	75	

4. DISCUSSION

Schistosomiasis is a disease caused by parasites belonging to the *Schistosoma* group. An annual worldwide incidence of *Schistosoma* infections is about 150-200 million individuals almost 250,000 die mostly in consequence of portal hypertension. Several types of *Schistosoma* are human pathogens such as *S. mansoni*, *S. haematobium*, *S. japonicum*, *S. mekongi* and *S. intercalatum* [20]. Salmonellosis is an infection with bacteria called *Salmonella*. Most persons infected with *Salmonella* develop diarrhea, fever, and abdominal pain after infection. Studies on relationship between schistosomiasis and salmonellosis revealed some sort of correlation between each other as the *Schistosoma* acts as a vehicle for *Salmonella* infection [21]. This study was conducted in New Halfa city to determine the association between intestinal schistosomiasis and enteric fever. For this purpose, 75 stool samples were collected to detect the eggs of *S. mansoni* by wet preparation and detect *Salmonella* by cultured the stool. From the same patients blood samples were collected to detect antibody of *Salmonella* in their serum. The infection of *S. mansoni* was highly concentrated in age group 11-20 years. This was partially explained by the increase of water contact with this age group. Although, New Halfa city is considered as an endemic area of *S. mansoni* infection due to the presence of many irrigation canals heavily infested with snails of *S. mansoni*, so that, the intensity of *S. mansoni* infection was presented as mild in 54 (72.0) samples, moderate in 20 (26.7) and severe infection in 1 (1.3) sample. The majority of infection was mild could be possibly due to many investigators believe that the epidemiologic pattern results from the slow development of acquired immunity to re-infection over time [22]. Also the regular treatment with praziquantel had remarkably reduced the incidence of schistosomiasis in the area. The *Salmonella* was detected by cultured the stool samples. Out of 75, 15 (20%) stool samples were showed growth while 60 (80%) were showed no growth. When using Widal test to detect antibodies of *Salmonella* in serum, out of 75, 44 (58%) presented as insignificant results, 14 (18%) as suggestive results and 17 (24%) as significant results. This show that insignificant results of Widal test more than suggestive and significant.

In this study the Chi-square test was used. The p value is 0.05 and less than 0.05 is significant and more than 0.05 is insignificant. So, all p value gets from results compare with (0.05). There is no relationship between intensity of *S. mansoni* infection and age groups ($p=0.62$) that mean the intensity of infection not affected by age groups. There is no relationship between intensity of *S. mansoni* infection and growth of *Salmonella* ($p=0.72$) that mean there is no association between infection of *S. mansoni* and growth of *Salmonella*. These results were in disagreement with the previous study done in Nigeria by Modebe *et al.* [23] which shows that there is relationship between *S. mansoni* infection and *Salmonella*. There is no relationship between intensity of *S. mansoni* infection and Widal test ($p=0.33$) that mean there is no association between infection of *S. mansoni* and *Salmonella* by using Widal test. Forty five out of 75 (60%) have knowledge about infection with *S. mansoni* while 30 out of 75 (40%) have no knowledge about infection although the majority of them with low level education this due to they are living in endemic area with *S. mansoni* and health education program applied.

According to questionnaire and information which taken from patients, the majority of patients were farmers with low level education. All of them have history with water contact. The source of drinking water was canal and donkey car and this water was used for all domestic purposes. All of them have no latrines in their house.

There is no association between intestinal schistosomiasis and enteric fever in New Halfa was reported in this study among patients affected with intestinal schistosomiasis.

5. CONCLUSION

This study concluded that there is no association between intestinal schistosomiasis and enteric fever infection in the study area.

6. RECOMMENDATIONS

The results of the present study recommended:

1. Treatment of patients with *S. mansoni* and *Salmonella* infection.
2. Using advance techniques and further investigations for this study.

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3. For detection of the egg of *S.mansoni* in stool sample by using wet preparation more than one slide must be prepared and examined.
4. For detection of the antibody of *Salmonella* in serum tube method should be use in spite of slide method to get the titer of antibody of *Salmonella*.

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