PREVALENCE AND ASSOCIATED FACTORS OF SCHISTOSOMIASIS AMONG PRIMARY SCHOOLCHILDREN IN AL–MAHWEET GOVERNORATE, YEMEN

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Abstract. Schistosomiasis is among the mainly prevalent suffering of human who live in areas of poverty in the developing world. Epidemiological surveys indicated that schistosomiasis is widely distributed in Yemen. Two main forms of human schistosomiasis exist in Yemen. Urinary schistosomiasis caused by Schistosoma haematobium infection and intestinal schistosomiasis caused by Schistosoma mansoni infection. This cross–sectional inquiry aims to appreciate the prevalence and corresponding risk factors of schistosomiasis included in primary schoolchildren in Al–Mahweet governorate, Yemen. Urine and faecal specimens (samples) were collected from 196 primary school children. Urine samples were examined using sedimentation method for presence of Schistosoma haematobium eggs. While faecal samples were examined using Kato Katz techniques for the presence of Schistosoma mansoni. Structured questionnaires were administered to the subjects of the target population in order to determine infection in relation to associated factors. Overall, 30.1 % of study participants were found to be positive for schistosomiasis; 35.7 % were infected with Schistosoma mansoni and 24.5 % were infected with Schistosoma haematobium. The relation between the prevalence of schistosomiasis infection and the factors of age and gender were not statistically significance (P= 0.183 and 0.560) respectively. The highest rate (61 %) of schistosomiasis infection, were recorded among the schoolchildren who using streams as a main source of water. The urban area of Al–Mahweet governorate had a lower prevalence of schistosomiasis infection (11.9 %), as compared to schoolchildren from rural area (29.4 %). Other multivariate analysis confirmed that schoolchildren fathers' education status (P= 0.007), sanitary facilities (P= 0.001) and place of residence (P= 0.001) were the key factors significantly associated with schistosomiasis infection among these children. This study reveals that schistosomiasis infection is still highly prevalent in Al–Mahweet governorate, Yemen. This study recommended that, beside periodic drug distribution, a comprehensive intervention strategy should be designed and be implemented to reduce schistosomiasis prevalence.

Keyword: Schistosomiasis, School children, Al–Mahweet governorate, Prevalence, Yemen.

Introduction

Despite progress in control, schistosomiasis remains endemic in 76 countries, with an estimated 200 million people infected, of whom 120 million are symptomatic and 20 million have severe disease [GOSELLE, et al., 2010; ANTO, et al., 2013; HAILE, et al., 2012]. Eight hundred million people worldwide are at risk of this infection [SADY, et al., 2013; GRIMES, et al., 2014, YUSUF, et al., 2015]. It is the most important water–borne disease and presents the greatest risk to health in rural areas in developing countries [BOLAJI, et al., 2014]. In Yemen schistosomiasis is the second most common health disease after malaria, with 2–3 million people infected [RAJA'A, et al., 2000; AL–SHAMIRI, et al., 2011].

There are two main forms of human schistosomiasis exist in Yemen. Urinary schistosomiasis caused by Schistosoma haematobium infection and intestinal schistosomiasis caused by Schistosoma mansoni infection [ABDULRAB, et al., 2013]. It affects populations where substandard conditions of living are predominant i.e. poor sanitation, insufficient safe water supply and low standard hygiene is practiced [RAJA'A, et al., 2001]. Among the Middle East countries, Yemen has the highest percentage of people living in poverty where more than 50% of the population of nearly 25 million
people lives below the poverty line [SADY, et al., 2013].

The geographical distribution of the various Schistosoma species depends on the availability of a suitable snail host [AbdelRahman, et al., 2010].

Also there are various physical and chemical factors collectively have an effect on the abundance of snails under natural conditions [IHUOMA and JUDE, 2004].

Primary schoolchildren are particularly vulnerable to schistomiasis because of their habitat of playing in water, where they may contract the infection. As such, they are the ideal target group to investigate the prevalence of schistosomiasis and the data collected from this age group can be used to assess not only whether schistosomiasis threatens the health of schoolchildren, but can also be used as reference for evaluating the need for community intervention [NWORIE, et al., 2012].

Hence, aims of present study were to assimilated prevalence and distribution of schistosomiasis and to identify associated key factors of this disease among schoolchildren after two years of running the programme of active control and prevention of Schistosoma surveillances in Al–Mahweet governorate areas.

Material and methods

Study area

The study was conducted in the Al–Mahweet governorate areas, west Sana’a city the capital of Yemen. The present study formed part of an evaluation of a school–based deworming project, and was carried out in randomly selected schools of Al–Mahweet governorate areas.

Study population

The study population included children attending grade one to nine in six primary schools in Al–Mahweet governorate areas.

In the period from March to April, 2012, the schools were randomly selected by balloting from the list of schools in towns and villages of Al–Mahweet governorate areas.

The schools involved in the study were, (Al–Khansa and 26–September schools located in urban of Al–Mahweet city), (Belqes and Mohammed Aldorah schools located in rural of Shebam–Kaokaban), Abla school located in rural of Al–Taweela and 26–September school located in rural of Al–Rogom.

The age of selected children ranged between 9 and 17 years. 196 schoolchildren (91 females and 105 males) were selected from the selected schools.

Data collection

After obtaining written consent from the parent of the children, semi–structured interview questionnaires were administered to the study subjects to identify risk factors associated with schistosomiasis.

The questionnaire was consisted variables including demographic information, socioeconomic status, previous history of schistosomiasis treatment, sanitary facilities, sources of water, lastly if they have had symptoms of schistosomiasis before.

The interview was conducted in an empty classroom and the answers recorded as ‘yes’, ‘no’ or ‘don’t know’.

Parasitological sample collection and examination

Following the questionnaire, children who were volunteer to participate in the study were given orientation on how to handle and submit their urine and stool samples. Thereafter, after doing some exercise, the children were given plastic sheet and applicator stick to bring their fresh urine and stool samples.

Urine samples were collected using wide–mouthed, screw–cap plastic containers.

Subjects were instructed to produce mid–stream or terminal urine sample. The names, sexes and ages of the subjects were entered against the appropriate number on epidemiological field form on submission of the samples.
Each sample container was labeled appropriately. The subjects' ID, the schools’ name and the town or community were written on them. The containers were then neatly packed into thick bags and sent to the laboratory for analysis.

Sedimentation method of urine analysis was used for the analysis. The samples were neatly arranged on the laboratory bench for analysis. They were allowed to settle for 20 minutes then the supernatant urine was decanted carefully so as not to disturb the deposit, leaving behind about 10 mL. The deposit was then suspended in the remaining urine by shaking vigorously and the suspension poured into labeled 10 mL centrifuge tubes corresponding to the respondents ID number of the urine container.

The standard centrifugation method as described by Cheesbrough (2006) was employed. The contents were spun in centrifuge for 2 minutes. Pasteur’s pipette was then used to remove all but a few drops of urine above the supernatant. With the pipette, the supernatant was mixed with the remaining urine and suspension transferred to a microscopic slide, covered with coverslide, observed under the light microscope with an X40 magnification for Schistosoma haematobium eggs [CHEESBROUGH, 2006]. The process was repeated for same sample till an egg was found or sample depleted.

Faecal samples were obtained from selected schoolchildren using a wide mouth plastic specimen bottles labeled with the laboratory identification number assigned to each child. The samples were processed within an hour of collection.

Schistosoma mansoni infection was determined. The Kato Katz technique [KATZ, et al., 1972; WHO, 1991] was used to prepare stool smears on slides for microscopic examination.

Data Analysis

The data obtained were entered into MS Excel and analyzed using SPSS software version 11.5. Prevalence rates were reported in percentages and 95% confidence intervals. Chi-square ($\chi^2$) was used to evaluate significant association among the study variables.

A P–Value less than 0.05 was considered statistically significant

Results and discussion

The overall prevalence of schistosomiasis infection was (30.1 %).

Schistosoma mansoni eggs were identified in 70 (35.7 %) stool samples, whereas Schistosoma haematobium eggs were identified in 48 (24.5 %) urine samples. 62 (31.6 %) of male and only 8 (4.1 %) of female, were infected with, Schistosoma mansoni, while 41 (20.9 %) of male and only 7 (3.6 %) of female, were infected with, Schistosoma haematobium. (Table 1).

Figure 1 shows the prevalence of schistosomiasis infection in relation to age groups of the schoolchildren, which, 32.1 % of the infected children were in the age group of 9–12, while 28.1 % of the infected children, were in the age group of 13–17.

Table 1.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Schistosoma mansoni Infected (%) n= 196</th>
<th>Schistosoma haematobium Infected (%) n= 196</th>
<th>Average of total samples Infected n= 392</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>62 (31.6)</td>
<td>41 (20.9)</td>
<td>103 (26.3%)</td>
</tr>
<tr>
<td>Female</td>
<td>8 (4.1)</td>
<td>7 (3.6)</td>
<td>15 (3.8%)</td>
</tr>
<tr>
<td>Total</td>
<td>70 (35.7)</td>
<td>48 (24.5)</td>
<td>118 (30.1%)</td>
</tr>
<tr>
<td>Age group</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9–12 years</td>
<td>40 (20.4)</td>
<td>23 (11.7)</td>
<td>63 (16.1%)</td>
</tr>
<tr>
<td>13–17 years</td>
<td>30 (15.3)</td>
<td>25 (12.8)</td>
<td>55 (14%)</td>
</tr>
<tr>
<td>Total</td>
<td>70 (35.7)</td>
<td>48 (24.5)</td>
<td>118 (30.1%)</td>
</tr>
</tbody>
</table>

And 40 (20.4 %) of the age group of 9–12, and 30 (15.3 %) of the age group of 13–17, were infected with, Schistosoma mansoni, while 23 (11.7 %) of the age group of 9–12, and 25 (12.8 %) of the age group of 13–17, were infected with, Schistosoma haematobium.
Prevalence of schistosomiasis infection based on schools location, ranged from 11.9% – 36.4%.

The highest prevalence of the infection (36.4%), were in Al–Rogom area schools as a rural location, while the lowest prevalence (11.9%), were in Al–Mahweet city schools as an urban location (Table 2).

### Table 2. Prevalence of schistosomiasis infection based on school location.

<table>
<thead>
<tr>
<th>Location</th>
<th>No. examined</th>
<th>No. infected</th>
<th>% infected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Al–Mahweet city</td>
<td>49</td>
<td>14</td>
<td>11.9</td>
</tr>
<tr>
<td>Rural:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shebam–Kaokaban</td>
<td>48</td>
<td>28</td>
<td>23.7</td>
</tr>
<tr>
<td>Alrogom</td>
<td>49</td>
<td>43</td>
<td>36.4</td>
</tr>
<tr>
<td>Altawela</td>
<td>50</td>
<td>33</td>
<td>28.0</td>
</tr>
<tr>
<td>Total</td>
<td>196</td>
<td>118</td>
<td>100%</td>
</tr>
</tbody>
</table>

### Risk factors associated with schistosomiasis infection

Table 3 shows that, the risk factors of (place of residence, fathers’ education and sanitary facilities), were significantly associated with schistosomiasis infection (p > 0.05).

<table>
<thead>
<tr>
<th>Risk factors</th>
<th>Infected (%)</th>
<th>Not infected (%)</th>
<th>Total</th>
<th>$X^2$</th>
<th>p–value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Place of residence:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Al–Mahweet City</td>
<td>14 (11.9)</td>
<td>35 (44.9)</td>
<td>49</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shebam–Kaokaban</td>
<td>28 (23.7)</td>
<td>20 (25.6)</td>
<td>48</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Al–Rogom</td>
<td>43 (36.4)</td>
<td>6 (7.7)</td>
<td>49</td>
<td>38.204</td>
<td>0.001</td>
</tr>
<tr>
<td>Al–Tawela</td>
<td>33 (28.0)</td>
<td>17 (21.8)</td>
<td>50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>118 (100)</td>
<td>78 (100)</td>
<td>196</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Fathers’ education:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Illiterate</td>
<td>16 (13.6)</td>
<td>6 (7.7)</td>
<td>22</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Literate</td>
<td>34 (28.8)</td>
<td>12 (15.4)</td>
<td>46</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary school</td>
<td>21 (17.8)</td>
<td>11 (14.1)</td>
<td>32</td>
<td>14.028</td>
<td>0.007</td>
</tr>
<tr>
<td>Secondary</td>
<td>24 (20.3)</td>
<td>16 (20.5)</td>
<td>40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>University</td>
<td>23 (19.5)</td>
<td>33 (42.3)</td>
<td>56</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>118 (100)</td>
<td>78 (100)</td>
<td>196</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Presence of electric power:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>83 (70.3)</td>
<td>60 (76.9)</td>
<td>143</td>
<td>1.290</td>
<td>0.166</td>
</tr>
<tr>
<td>No</td>
<td>35 (29.7)</td>
<td>18 (23.1)</td>
<td>53</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>118 (100)</td>
<td>78 (100)</td>
<td>196</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Source of water:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pond</td>
<td>4 (3.4)</td>
<td>7 (9)</td>
<td>11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dams</td>
<td>9 (7.6)</td>
<td>5 (6.4)</td>
<td>14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stream</td>
<td>72 (61)</td>
<td>38 (48.7)</td>
<td>110</td>
<td>2.523</td>
<td>0.471</td>
</tr>
<tr>
<td>Well</td>
<td>33 (28)</td>
<td>28 (35.9)</td>
<td>61</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>118 (100)</td>
<td>78 (100)</td>
<td>196</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Sanitary facilities:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sewage system</td>
<td>15 (12.7)</td>
<td>28 (35.9)</td>
<td>43</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Closed pit</td>
<td>26 (22)</td>
<td>27 (34.6)</td>
<td>53</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Open pit</td>
<td>52 (44.1)</td>
<td>14 (18)</td>
<td>66</td>
<td>25.929</td>
<td>0.001</td>
</tr>
<tr>
<td>Others</td>
<td>25 (21.2)</td>
<td>9 (11.5)</td>
<td>34</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>118 (100)</td>
<td>78 (100)</td>
<td>196</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Pre schistosomiasis treatment:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>93 (78.8)</td>
<td>54 (69.2)</td>
<td>147</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>25 (21.2)</td>
<td>24 (30.8)</td>
<td>49</td>
<td>2.045</td>
<td>0.153</td>
</tr>
<tr>
<td>Total</td>
<td>118 (100)</td>
<td>78 (100)</td>
<td>196</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

While, risk factors of (presence of electric power, source of water and pre schistosomiasis treatment), were not significantly associated with the infection
(p > 0.05).

The present study is aimed to assess the prevalence and associated risk factors of schistosomiasis infection in school children of Al–Mahweet governorate.

Overall prevalence of schistosomiasis infection was 30.1 %.

This result is similar to findings of previous study conducted in Yemen, indicated that the overall, 31.8 % of the test persons were found to be positive for schistosomiasis.

However, it is higher than other studies in Yemen [SADY, et al., 2013].

Study conducted in Al–Mahweet town and rural areas, reported that prevalence rates of schistosomiasis were 27 % [RAJA'A, et al., 2001].

Other study conducted in Al –Mahweet governorate, Yemen, reported that the overall, 24.8 % of test persons were indicated to be positive for schistosomiasis [ABDULRAB, et al., 2013].

Another study conducted in Sahar district, Sa'dah governorate, Yemen, for estimated prevalence rates of schistosomiasis among third–year schoolchildren after 4 schistosomiasis control campaigns, reported that the total average prevalence of schistosomiasis infection was low (3.4 %) [RAJA'A and MUBARAK, 2006].

This could be due to effects of the deworming programs.

However, it is lower than the prevalence rate reported by study conducted in the Assahul valley of Ibb governorates in Yemen, reported that the overall Schistosoma mansoni prevalence was 35 % [RAJA'A, et al., 2000].

However, it is higher than to the findings of previous studies from different part of Yemen.

Study conducted in Al–Mahweet town and rural areas, reported that the prevalence rates of Schistosoma mansoni were 22 % [RAJA'A, et al., 2001].

Other study conducted in Yemen, reported that the overall, 9.3 % were infected with Schistosoma mansoni [SADY, et al., 2013].

Another study conducted in Taiz Governorate, Yemen, reported that the Schistosoma mansoni prevalence in the study population was 31 % [ABDULRAB, et al., 2013]. Study conducted in Sahar district, Sa’dah governorate, Yemen, for estimated prevalence rates of Schistosomiasis among third–year schoolchildren after 4 Schistosomiasis control campaigns, reported that the prevalence of Schistosoma mansoni infection was 2.3 % [RAJA'A and MUBARAK, 2006].

Also it is higher than to the findings of previous studies from different countries.

Study conducted in Northern Ethiopia, reported that the overall prevalence of Schistosoma mansoni in the schoolchildren was 23.9 % [ASSEFA, et al., 2013].

Other study conducted in Southern Ethiopia, reported that the prevalence of Schistosoma mansoni was 12 % [MITIKU, et al., 2010].

Study conducted in Kaduna State, Nigeria, reported that the overall prevalence of Schistosoma mansoni was (20.3 %) of the study population were positive [ALHASSAN, et al., 2013].

However, it is lower than the prevalence rate reported in North Western Tanzania reported that the prevalence of Schistosoma mansoni was 64.3 % [MAZIGO, et al., 2010].

Other study conducted in southern Ethiopia, by Terefe and collab. reported that the overall infection rates of Schistosoma mansoni was 73.7 % [TEREFE, et al., 2011].
Overall prevalence of *Schistosoma haematobium* infection was 24.5%. This result is similar to the findings of previous study conducted in Yemen, reported that the overall, 23.8% were infected with *Schistosoma haematobium* [SADY, et al., 2013].

However, it is higher than the prevalence rate reported by the study conducted in Al–Mahweet town and rural areas, Yemen, reported that the prevalence rates of *Schistosoma haematobium* were 7% [RAJA’A, et al., 2001].

Other study conducted in Taiz Governorate, Yemen, reported that the prevalence of *Schistosoma haematobium* was 18.6% [ABDULRAB et al., 2013].

Another study conducted in Sahar district, Sa’adah governorate, Yemen, for estimated prevalence rates of Schistosomiasis among third–year schoolchildren after 4 Schistosomiasis control campaigns, reported that the prevalence of *Schistosoma haematobium* infection was low (5.6% – 3.3%) [RAJA’A and MUBARAK, 2006].

Also it is higher than the prevalence rate reported by the studies conducted in different countries.

Study conducted in Nasarawa State, Nigeria, reported that (16.3%) of the urine samples collected were positive for *Schistosoma haematobium* [REUBEN, et al., 2013].

Study conducted in Maiduguri, reported that the overall incidence of *Schistosoma haematobium* was (14.5%) [JOSEPH, et al., 2010].

However, it is lower than the prevalence rate reported by the studies conducted in different countries.

Study conducted in Ghana, by Tetteh–Quarcoo, and collab., reported that the Prevalence of *Schistosoma haematobium* infection was 30.7% [TETTEH–QUARCOO, et al., 2013].

Other study conducted in South Africa, reported that the Prevalence of *Schistosoma haematobium* infection was 73.2% [MEENTS and BOYLES, 2010].

Another study conducted in northern Nigeria, reported that the Prevalence of *Schistosoma haematobium* infection was 41.6% of the urine sampled examined [SARKINFADA, et al., 2009].

This study results also showed that, the highest prevalence of schistosomiasis infection (32.1%) was in children with ages ranging from 9–12 years followed by those with ages ranging from 13–17 years (28.1%).

This finding is in agreement with reports by study conducted in the Assahul valley of Ibb governorates in Yemen, reported that the highest prevalence of schistosomiasis infection (37%) was in children with ages ranging from 9–13 years [RAJA’A, et al., 2000].

However, this study finding is in disagreement with reports of many investigators in different localities of Yemen.

Study conducted in Al–Mahweet town and rural areas, reported that the highest prevalence of schistosomiasis infection (37%) was in children with ages ranging from 14–18 years followed by those with ages ranging from 9–13 years (30%) [RAJA’A, et al., 2001].

Other study conducted in Yemen, reported that prevalence of schistosomiasis was meaningfully higher among children aged >10 years assimilated to those aged < 10 years [SADY, et al., 2013].

Also it is disagreement with reports of studies conducted in different countries.

Study conducted in Northern Ethiopia, reported that the highest (31.2%) prevalence of schistosomiasis was recorded in children with ages ranging from 10–14 years followed by those aged 5–9 (11.4%) and 15–19 (9.8%) years [ASSEFA, et al., 2013].

This might be due to higher rate of water contact among those children with ages ranging from 9–12 years, while the least infection in the age groups 13–17 years might due to low outdoor water contact activities and the development of age–acquired immunity to re–infection.

In relation with gender this study results showed that the infected males were (26.3%) while the infected females were (3.8%).

The high rate of infected male might due to the fact that male is more in
contact with water through swimming activities than female.

This study finding is in agreement with reports of many investigators in different localities of Yemen.

Study conducted in Al–Mahweet town and rural areas, reported that that the infected males were (33 %) while the infected females were (9 %) [RAJA'A, et al., 2001].

Other study conducted in the Assahul valley of Ibb governorates in Yemen, reported that the infected males were (43 %) while the infected females were (9 %) [RAJA'A, et al., 2000].

Also it is in agreement with reports of studies conducted in different countries.

Study conducted in Northern Ethiopia, reported that the higher prevalence was detected in male children (30.71 %) than in females (14.12 %) [ASSEFA, et al., 2013]. However it is in disagreement with reports of studies conducted in different countries.

Study conducted in Lagos State. Nigeria, reported that the frequency of infection was higher among the female pupils (61 %) compared to the male counterpart (39 %) [OLUWASOGO and FAGBEMI, 2013; BARBAT, et al., 2013; BUTU et al., 2015].

Other study conducted in Southwest Nigeria, reported that no statistically significant difference in infection between male (48.6 %) and female pupils (47.6 %) [BABATUNDE, et al., 2013].

This study findings showed that was no significantly associated with schistosomiasis infected and previous history of schistosomiasis treatment (P-value = 0.153).

Children who were treated before were at higher risk of infection (78.8 %), than those who were not treated (21.2 %).

This might due to the treatment by ineffective drugs could not reduce the output of eggs in the infected individuals.

Also might due to the intervention implementing with chemotherapy only, neglecting the other components of the comprehensive control program.

In relation to the education status of children's fathers, this study finding showed that the relation between schistosomiasis infection and the children's fathers education status was significantly associated (P= 0.007).

This finding agrees with study conducted in Yemen, reported that the children fathers education status was significantly associated with schistosomiasis infected (P= 0.008) [SADY, et al., 2013; RODINO et al., 2014].

However, this study finding is in disagreement with reports of many investigators in different localities of Yemen.

Study conducted in Al–Mahweet town and rural areas, reported that the relation between the prevalence of schistosomiasis and children fathers education status had no significantly associated [RAJA'A, et al., 2001].

Other study conducted in the Assahul valley of Ibb governorates in Yemen, reported that the relation between the prevalence of schistosomiasis and children fathers education status had no significantly associated (P= 0.146) [RAJA'A, et al., 2001].

In relation to source of water supply for household use, this study results showed that the highest prevalence rate schistosomiasis infection was recorded among the students who using streams as their main source of water (61 %).

There was no significant relationship (P= 0.471) between schistosomiasis infection and sources of water supply.

Therefore, the recorded cases of infection among students using these sources of water supply may be as a result of contamination of these water sources with cercariae.

This explain that the incidence of schistosomiasis infection in pupils was higher in Al–Rogom schools (36.4 %), due to spread of streams in this location more than other locations.

This study results also showed that the students from the urban area of Al–Mahweet governorate had a lower prevalence of schistosomiasis infection (11.9 %), as compared to students from Al–Mahweet governorate rural area, which the average of infection rate was (29.4 %).
This finding is in agreement with previous study conducted in Al–Mahweet town and rural areas, reported that the prevalence of schistosomiasis from the urban area were, lower than (16 %) the prevalence of schistosomiasis from the rural area were (39 %) [RAJA’A, et al., 2001]. The high of the schistosomiasis infection in the rural areas of Al–Mahweet governorate are attributed to ignorance, poor living condition, inadequate sanitation, water contact activity with snail infected streams and ponds.

Also, parents’ occupation of most of the Al–Mahweet governorate rural area students are farming.

Therefore, the students actively engaged in these activities which expose them to schistosomiasis which serves as a major risk factor for schistosomiasis infection.

**Conclusions**

There is a relatively high prevalence of schistosomiasis infection among primary school students in Al–Mahweet governorate.

It is therefore indispensable that a comprehensive epidemiological survey of schistosomiasis in Al–Mahweet governorate, Yemen at large in order to further identify high risk communities for successful design and implementation of control programme.

The problems of lack of portable water supply in Al–Mahweet governorate and its environs put the children at high risk of exposure to schistosomiasis.

There is need for start intervention by local government and concerned organizations to step up measures in improving water supplies in these areas.

Massive screening to identify the infected individuals and treat them in order to reduce transmission of the infection is imperative.

Health education programmes on the associated risk factors and the dangers posed by the disease need to be carried out.

Besides periodic drug distribution, a comprehensive intervention strategy should be designed and be implemented to reduce schistosomiasis prevalence.

**References**


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