Schistosomiasis haematobium Prevalence and Risk factors in EL-Fayoum Governorate, Egypt

Ahmed Abdelhalim Yameny

Society of Pathological Biochemistry and Hematology, Egypt

Ahmed A. Yameny (Email: dr.ahmedyameny@yahoo.com)

ABSTRACT
Schistosoma haematobium infection is an important water-borne disease in Egypt, its prevalence decreased less than 0.2 % (2016). There are more than 300 villages in Egypt with prevalence more than 3%, especially among school children, which require prolonged treatment and continuous examinations. The Ministry of Health and Population in Egypt has announced the start of a campaign to confirm the final elimination of schistosomiasis by 2020. This study was conducted to detect the prevalence of Schistosoma haematobium and risk factors among 1000 patients attending Ministry of Health Laboratory Centers, in El-Fayoum Governorate by microscopic examination in rural and urban areas, the prevalence among study patients was 7.9%. An interview questionnaire was designed to obtain demographic data and risk factors, such as residential status, age, water contact activity, occupation, and education level. The higher percentage of infection was 10.3% among 11-21 years group. Infection among males was higher than that among females (9.0% vs. 6.8% respectively). Percentage of infection was 11.2% for rural residence compared to 2.4% for urban residence, regarding occupation the higher percentage of infection was 27.6% among farmers and/or fishermen. According to contact with canal water, the percentage of infection among those who had water contact was 16.9%, and only 0.9% for people with no water contact. This study therefore recommended that schistosomiasis control program in these infected areas should be done upon to educate the population on risk factors that predispose an individual to urinary schistosomiasis and the need of proper control to snails, the intermediate host beside treatment of infected people.

Keywords: Schistosoma haematobium, Egypt, prevalence, risk factors, final elimination, El-Fayoum

1. Introduction
Schistosomiasis is a disease of poverty. It gives rise to much suffering and death, it also contributes to the perpetuation of poverty by impairing the cognitive performance, growth of children, reducing the work capacity and productivity of adults\(^1\). It was recorded that 85% of all schistosomiasis infections are found in sub-Saharan Africa, mostly among poor people who live in remote areas without access to health services, safe water, sanitation, and education\(^2\). Contact of the definitive host with cercaria-infested water is essential for humans to be infected. Surface water such as rivers, ponds or lakes, streams and irrigation canals are the usual sources of infection\(^3\). Three categories of exposure to Schistosome infected
water are; occupational exposure during agriculture related jobs, recreational exposure during bathing, playing, or swimming in canal water and domestic exposure while washing clothes and utensils in canal water\(^{(3,4)}\). In Africa, schistosomiasis reported near to 300,000 deaths per year\(^{(5)}\). In Egypt, Schistosomiasis was the major public health problem for several decades due to high prevalence and morbidity especially among rural populations, which caused by both S. haematobium and S. mansoni\(^{(6)}\). This infection has been recorded in Egypt from early pharaonic times (3200 B.C.) by the demonstration of circulating Schistosome antigens and Schistosome eggs in mummies\(^{(7)}\). After the discovery of the parasite's life cycle in 1915, Egypt started to fight against the disease, a changing pattern of schistosomiasis infection has been observed as S. haematobium was decreasing from 48% in 1935 to less than 0.2% in 2016, and S. mansoni as decreasing from 32% in 1935 to less than 0.2% in 2016\(^{(8)}\). The World Health Assembly in 2012 called, for the first time, for Schistosoma transmission interruption wherever possible. recognition of 'persistent hot spots' among treated areas within control districts indicates that we clearly need to break both human-to-snail and snail-to-human transmission in order to fully prevent new infections, to reach elimination of Schistosoma\(^{(8)}\).

The Ministry of Health and Population in Egypt has announced the start of a campaign to confirm the final elimination of schistosomiasis by 2020, after the ministry has achieved success in reducing the prevalence of schistosomiasis to about 0.2% by the end of 2016. Treatment by targeting 6 million schoolchildren and citizens at a total cost of 40 million pounds including pesticide, praziquantel and covering the cost of health teams and watercourse treatment in cooperation with the World Health Organization\(^{(9)}\). There are more than 300 villages in Egypt with prevalence more than 3%, especially among school children, Which require prolonged treatment and continuous examinations\(^{(9)}\).

A better understanding of risk factors for schistosomiasis is important in controlling the disease, we therefore aimed to investigate the S. haematobium risk factors and prevalence, the present study used both the microscopic examination of urine to detect the infection rate and Questionnaires to study the risk factors, EL-Fayoum Governorate is supplied by water through a single canal (Bahr Youssef) from the Nile River, it has had the longest ongoing Schistosomiasis control program in Egypt.

**Research objective:**
Is to estimate the Prevalence of Schistosoma haematobium and Risk factors in EL-Fayoum Governorate, Egypt

**2. Material and methods**

**2.1. Study population and ethical consideration**

This study included 1000 patients attending Ministry of health laboratory centers, in EL-Fayoum Governorate, this study subjects were randomly selected irrespective of the age-group and both sex were included. All the studied population were informed about the purpose of samples collection and their consents were obtained. Patients were free to refuse sample collection.

**2.2. Study design**

This research is a cross-sectional study designed to determine infection prevalence and risk factors for transmission of urinary schistosomiasis in the study population. This study was targeting customers who came for laboratories of health centers for urine analysis.

**2.3. Collection and processing of urine samples**

Clean specimen bottles were labeled with the needed information and issued to the participating individuals whose informed consent was sought earlier, each patient was
given a wide mouth screw-capped container into which to void urine. This was carried out between 10.00 am and 2.00 pm when ova count of *S.haematobium* is expected to be at its peak\(^{10}\). In this study, urinary schistosomiasis was defined as the presence of ova of *S.haematobium* in the urine.

### 2.4. Urine microscopy

Urine examination was carried out in the laboratory of health centers and by the researcher. Urine samples were examined for the presence of *S.haematobium* eggs as in sedimentation method of Cheesbrough (2006)\(^{11}\). Each urine sample was mixed thoroughly with a glass rod and two samples were taken each 10 ml urine, one sample for sedimentation centrifugation and other 10 ml urine sample for Nuclepore membrane filtration technique. The first 10 ml transferred into centrifuge tube and centrifuged at 2000 rpm for 5 minutes at room temperature. The supernatant was then discarded and sediment transferred to a microscope glass slide and covered with a cover slip. A drop of Lugol’s Iodine was added onto the cover slip prior to examination. Examination of the entire sediment was carried out using x10 objective of a compound light microscope.

The second 10 ml urine sample were examined using the Nuclepore membrane filtration technique for *S.haematobium* eggs detection as in method of Cheesbrough (2009)\(^{12}\).

### 2.5. Administration of Questionnaires

An interview questionnaire was designed for the purpose of the research and administered to the participating patients of different age groups and both sexes, who had health centre customers to provide their urine for the study. The questionnaires contained the necessary questions intended to obtain demographic data and risk factors relevant to that research objective, such as residential status, age, water contact activity, occupation and education level\(^{13}\). A total of 1000 questionnaires were administered to the study subjects.

### 2.6. Statistical analysis

Results collected, coded, tabulated and analyzed through computer facilities using statistical methods and relationships with age, sex, and other risk factors for schistosoma infection. *S.haematobium* infection was defined as any number of eggs greater than zero found in 10 ml of urine, was performed to assess the association between the status of *S.haematobium* infection and the associated risk factors.

### 3. Results

Percentages of *S.haematobium* infection: Table (1) shows percentages of *S.haematobium* infection as detected by different direct parasitologic techniques. Sedimentation technique revealed a percentage of 6.4% which increased to 7.7 % using nucloare filtration technique. Prevalence increased to 7.9 % when results of both techniques were considered.

<table>
<thead>
<tr>
<th>Direct Parasitologic Techniques</th>
<th><em>S.haematobium</em></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Negative</td>
</tr>
<tr>
<td></td>
<td>NO.</td>
</tr>
<tr>
<td>Sedimentation</td>
<td>936</td>
</tr>
<tr>
<td>Nuclepore filtration</td>
<td>923</td>
</tr>
<tr>
<td>Both techniques</td>
<td>921</td>
</tr>
</tbody>
</table>

Sedimentation with sensitivity of 81% while nucleporefiltration sensitivity was 97.5%
Distribution of *S. haematobium* infection among study sample:

Table (2) displays distribution of *S. haematobium* infection among study sample according to some risk factors. The total study sample was stratified according to age into four categories. The higher percentage of infection was 10.3% among 11-21 years group. It was 8.8% among those less than 11 years and 5.2% for those between 21 and 36 years. Only 2% belonged to the age group between 36 and 70 years. Young age group was a risk factor for *S. haematobium* infection it was 4.6 times and 5.5 times more in the <11 years group and 11-21 years group respectively than the older group of (36-70 years old). GMEC increased with age from 6.8 eggs/10 ml urine in age group <11 years to 24.5 eggs/10 ml urine in age group 36-70 years, except in 21-36 years group in which it decreased to 4.4 egg/10 ml urine.

According to sex, the distribution of *S. haematobium* infection among males was higher than that among females (9.0% vs. 6.8% respectively). However, the difference was not statistically significant (O.R=1.3 and CL=0.851-2.158). Also GMEC for males was 9.08 eggs/10 ml urine higher than that for females (6.39 eggs/10 ml urine).

As for residence living in a rural area showed 4.7 times the risk of infection compared to urban areas. Percentage of infection was 11.2% for rural residence compared to 2.4% for urban residence. The difference was statistically significant (95% CL = 0.096 – 0.395). Also GMEC was 8.93 egg/10 ml urine among residents of rural areas and only 2.84 egg/10 ml urine for those living in urban areas.

Regarding occupation the higher percentage of infection was 27.6% among farmers and/or fishermen. It was only 5.4% among students, and 3.7% among house wives. It is 9.8 times more for farmers and/or fishermen than house wives, (95% CL for farmer and/or fishermen was high it 3.619-26.569). Also GMEC was 9.8 egg/10 ml urine among farmer and/or fishermen, 8.06 among among students, 4.74 egg/10 ml urine among house wives and 6.26 among others.

Considering education, 13.5% of illiterate or read and write were infected. Percentage of *S. haematobium* infection was only 5.1% among those having primary or preparatory educations were infected, and only 4.2% of those who had a secondary education were infected. No infection was diagnosed among those having university or higher education. Risk of infection was 2.9 and 3.5 times more for preschool and illiterate/read and write respectively than for those having a secondary education. Also GMEC was 8.28 egg/10 ml urine for secondary group and nearly equal for other groups (ranging between 7.4 egg/10 ml urine to 7.9 egg/10 ml urine).

According to contact with canal water, the percentage of infection among those who had water contact was 16.9% and only 0.9% for people with no water contact. Risk of infection was 22.5 times more for those with water contact, (95% CL for water contact was 9.027-56.302). Also GMEC was 8.08 egg/10 ml urine among people who had water contact and 2.45 egg/10 ml urine for those with no water contact.
## Table (2): Distribution of *S. haematobium* infection among study sample:

<table>
<thead>
<tr>
<th>Risk factors</th>
<th>No. examined</th>
<th><em>S. haematobium</em></th>
<th>Odds ratio</th>
<th>95% Confidence limits</th>
<th>GMEC/10 ml urine</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>NO.</td>
<td>%</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>1-Age group in (years):</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 11</td>
<td>319</td>
<td>28</td>
<td>8.8</td>
<td>4.667*</td>
<td>1.092 – 19.951</td>
</tr>
<tr>
<td>11 -</td>
<td>380</td>
<td>39</td>
<td>10.3</td>
<td>5.547*</td>
<td>1.316 – 23.383</td>
</tr>
<tr>
<td>21 -</td>
<td>193</td>
<td>10</td>
<td>5.2</td>
<td>2.650</td>
<td>0.569 – 12.338</td>
</tr>
<tr>
<td>36 – 70 °</td>
<td>99</td>
<td>2</td>
<td>2</td>
<td>1.0</td>
<td>-</td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>513</td>
<td>46</td>
<td>9.0</td>
<td>1.355</td>
<td>0.851 – 2.158</td>
</tr>
<tr>
<td>Female ®</td>
<td>487</td>
<td>33</td>
<td>6.8</td>
<td>1.0</td>
<td>-</td>
</tr>
<tr>
<td><strong>Residence</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban ®</td>
<td>375</td>
<td>9</td>
<td>2.4</td>
<td>1.0</td>
<td>-</td>
</tr>
<tr>
<td>Rural</td>
<td>625</td>
<td>70</td>
<td>11.2</td>
<td>4.67</td>
<td>0.096 – 0.395</td>
</tr>
<tr>
<td><strong>Occupation</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Farmer and/or Fisherman</td>
<td>98</td>
<td>27</td>
<td>27.6</td>
<td>9.811*</td>
<td>3.619 – 26.569</td>
</tr>
<tr>
<td>Student</td>
<td>521</td>
<td>28</td>
<td>5.4</td>
<td>1.465</td>
<td>0.555 – 3.870</td>
</tr>
<tr>
<td>House wife ®</td>
<td>134</td>
<td>5</td>
<td>3.7</td>
<td>1.0</td>
<td>-</td>
</tr>
<tr>
<td>Others</td>
<td>247</td>
<td>19</td>
<td>7.7</td>
<td>2.150</td>
<td>0.784 – 5.894</td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preschool</td>
<td>96</td>
<td>11</td>
<td>11.5</td>
<td>2.976</td>
<td>0.997 – 8.885</td>
</tr>
<tr>
<td>Illiterate + read and write</td>
<td>282</td>
<td>38</td>
<td>13.5</td>
<td>3.582*</td>
<td>1.374 – 9.340</td>
</tr>
<tr>
<td>Primary + preparatory</td>
<td>486</td>
<td>25</td>
<td>5.1</td>
<td>1.247</td>
<td>0.467 – 3.329</td>
</tr>
<tr>
<td>Secondary °</td>
<td>120</td>
<td>5</td>
<td>4.2</td>
<td>1.0</td>
<td>-</td>
</tr>
<tr>
<td>University or higher</td>
<td>16</td>
<td>0</td>
<td>0.0</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Exposure to canal water</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>439</td>
<td>74</td>
<td>16.9</td>
<td>22.545*</td>
<td>9.027 – 56.302</td>
</tr>
<tr>
<td>No</td>
<td>561</td>
<td>5</td>
<td>0.9</td>
<td>1.0</td>
<td>-</td>
</tr>
</tbody>
</table>

®: reference group
Figure (1): Distribution of urinary Schistosomiasis according to age groups

Figure (2): Distribution of urinary Schistosomiasis according to gender

Figure (3): Distribution of urinary Schistosomiasis according to age Residence
Figure (4): Distribution of urinary Schistosomiasis according to Occupation

![Infected % according to Occupation](image)

Occupation: Others, Housewife, Student, Farmer

Infected%: 7.70%, 3.70%, 5.40%, 27.60%

Figure (5): Distribution of urinary Schistosomiasis according to age Education

![Prevalence of urinary Schistosomiasis according to Education](image)

Education: University, Secondary, prim+prep, Illiterate, preschool

Prevalence: 0.00%, 2.00%, 4.00%, 16.00%, 16.00%

Figure (6): Distribution of urinary Schistosomiasis according to Exposure to canal water

![Prevalence of Urinary Schistosomiasis according to Exposure to canal water](image)

Exposure: Yes, No
4. Discussion

The prevalence of *S. haematobium* among study sample was 7.9 % by both parasitological techniques sedimentation and nuclepore filtration (table 1).

Risk factors of *S. haematobium* as revealed by distribution of infection among studied population sample (table 2):

Age as a risk factor: This study revealed that the age group from 11-20 years showed highest infection rate (10.3%) followed by group aged < 11 years (8.8%) and least percentage of infection was among those aged 36 years and more. This finding was approved by other studies, Abdel-Wahab and Esmat, (2000). That reported followed by the age group in El-Fayoum also, the highest infection rate was age among the group 11-20 years 20.9% followed by the age group 0-10 (16.1%) (4). Talaat and El-Ayat, et al, (1997). In a village in Giza, the prevalence of *S. haematobium* showed a peak at the age of 10-14 years, it was (35.9%) compared by infection in village (12.3%) (14). Meanwhile, a study by Eric and Muchiri in coastal Kenya (2006), showed that the prevalence of infection among age group 12-20 years was 15% compared with 27% for the 5-11 years old group (15). Also study by Kalu, KaluMong et al, in Nigeria (2016) showed that the prevalence of infection was higher among children ages 11 to 15 years old (22.22%) (16). While a study by Kabuyaya et al, in South Africa (2017) showed aged 13 years were the most infected (25%) (17).

Concerning gender and its relation to infection, this study showed that the infection rate between males (9.0%) is higher than among females (6.8%) (Abdel-Wahab 2000) also carried out an epidemiological study in El-Fayoum and showed that the infection rate among males (16%) was also higher than among females (11.5%) (4). Also Talaat (1997) study in Giza showed that the rate was (15.9%) among males and (8.4%) among females (14). But a study carried out in Kenya for nine years (from 1984-1992) in most years females had a higher prevalence of infection than males, over the course of the nine years of the study, except three years during which males had a higher prevalence than females (e.g., 1988, 1989, and 1990) (15). KaluMong et al, in Nigeria (2016) showed that the prevalence of infection was higher in males (18.38%) than females (10.08%). While a study by Kabuyaya et al, in South Africa (2017) showed females had the higher rate of *S. haematobium* infection 60.8% and males was 39.2% (17).

In our result Risk factors for *S. haematobium* infection in El Fayoum were an age less than 20 years and male gender and
male bathing or children playing or swimming in canal water. Males work in agriculture and fishing requires water contact males are exposed to infection than females.

As regards residence and occupation this study showed that infection rate in Rural areas (11.2%) was higher than that of Urban areas (2.4%) also, the study showed the higher infection rate was among fisher + farmer (27.6%), student (5.4%), house wife (3.7%) and others (7.7%). Water activities as most people in villages works in agriculture and fishing in addition to other activities bathing, swimming, washing utensils and clothes are more susceptible to infection, also KaluMong et al, in Nigeria (2016) showed that prevalence of urinary schistosomiasis in relation to occupational status, farmers had the highest infection 19.27%. Kabuyaya et al, in South Africa (2017) showed S. haematobium infection had a strong relationship with these factors: main source of domestic water, bathing and washing clothes at an open source of water.

Regarding education This study showed the highest infection rate was among illiterate + read and write (13.5%) followed by preschool group (11.5%) than primary preparatory (5.1%). The result was among pupils of secondary schools (4.2%) and followed by university or higher 16 cases only examined with no infection with S. haematobium. In accordance with this, Husein et al, (1996) proved that children not attending school are at higher risk of schistosomiasis infection than those attending school (18). This was explained by the fact that children not attending school spend more time playing in water or working in agricultures, hence at greater risk of infection. Meanwhile, Talaat(1997), Hang and Manderson (1992) showed that literacy and school attendance were not related to infection (14,19). while studies one in South Africa (2017), and other study in Ethiopia (2015), showed that 90.0% of those infected had knowledge about bilharzias where, although children were a ware of the disease, the environmental in which they lived remained a threat to them, they do not have a better option (17,20).

5. Conclusion and Recommendations

Based on the results of this study which showed that urinary schistosomiasis is prevalent in some areas in EL-Fayoum even though it is moderate, the infection depends on water contact activities with some risk factors as age, gender, education, residence and occupation, this study therefore recommended that schistosomiasis control program in these infected areas should be done upon to educate the population on risk factors that predispose an individual to urinary schistosomiasis and the need of proper to control of snails the intermediate host beside treatment of infected people.
Conflict of interest
There are no conflicts of interest.

Financial support and sponsorship
This research did not receive any specific grant from funding agencies in the public, commercial, or not for profit sectors.

References
Sciences and Research  Vol.1; Issue: 1; December 2016 ,pp. 35- 40.


