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EPIDEMIOLOGICAL SITUATION OF URINARY SCHISTOSOMIASIS IN TAMWAH AREA, GIZA, EGYPT: ASSESSMENT AND CONTROL

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Abstract

Preliminary studies were carried out on schistosomiasis in Giza Governorate for the last three years. These studies revealed that Tamwah village was one of areas afflicted by the highest number of *Schistosoma haematobium* infection cases. The study assessed the epidemiological situation of *S. haematobium* by parasitological and snail surveys. During April 2016, urine samples of 1285 children collected from three primary schools were centrifuged for microscopic examination. Also a snail survey was done along the shore (700m length). The snail were classified and examined for cercariae by light exposure and crushing. The results revealed that *S. haematobium* was 4.04% (52 cases). Majority were males (76.9% out of positive cases), with highly significant. There was a strong correlation between age of children and infection (44.2%) among oldest children (11 years) lowest (3.8%) was among the youngest group (6 years). *Enterobius vermicularis* ova in females' urine samples was 0.54% (7 cases). One was mixed infection with *S. haematobium*. The highest percentage among children infected with *S. haematobium* had pus cells 6- 30/HPF and RBCs less than 100/HPF in urine. There were crystals of uric acid, Ca oxalates and triple phosphate 5.8 %, 1.8% & 0.8% respectively. The snails were *Lanistes carinatus*, *Bellamya unicolor*, *Physa micropleura, Succinia cleopatra*, *Cleopatra bulimoides*, *Bulinus trancatus* & *Lymnaea natalensis*. The commonest was *B. trancatus* followed by *L. natalensis*. *Builinus spp* were positive for schistosomiasis cercaria and *Lymnaea spp* were positive for virgulate xiphidiocercariae; parasites of bates, birds and amphibians.

Key words: Tamwah village, Giza, *S. haematobium*, patients, snails, recommendations.

Introduction

Schistosomiasis is a human disease caused by the parasitic blood flukes of *Schistosoma spp*. Over 239 million people are chronically or acutely infected with one or more species, suggested that more than 400 million people worldwide may be affected (Rollinson, 1987). Population at risk increased to over 779 million (WHO, 2011) due to changing demographics in endemic countries and anthropogenic changes to the environment occurring via water project development. About 106 million African people were risky for schistosomiasis (Steinmann *et al,* 2006), estimated about 85% of infected people (Chitsulo *et al*, 2000).

The various species of the genus *Schistosoma* are trematodes of family Schistosomatidae, which are dioecious, digenean multicellular helminthic parasites whose adult habitat the circulatory system of vertebrates. Sixteen species of *Schistosoma* infect man or animals. Five are responsible for human infections; *S. haematobium, S. mansoni, S. intercalatum, S. japonicum* and *S. mekongi* (Rollinson *et al,* 1987). *S. haematobium* the agent of urogenital schistosomiasis is endemic in fifty three countries in the Middle East and Africa (WHO, 2012) while *S. mansoni* is the most prevalent species endemic in fifty five countries e.g. Arabia Peninsula, Egypt, Libya, Sudan, Sub-Saharan Africa, Brazil, some Caribbean islands, Venzuela and Suriname (Chitsulo *et al*, 2000). *S. japonicum* is endemic in Indonesia, China and the Philippines while *S. mekongi* in several areas of Cambodia and the Lao Peoples' Democratic Republic and *S. intercalatum* is found in rainy areas of Central Africa.

In Egypt *S. haematobium* was endemic since ancient ages (Ruffer, 1910; Deelder *et al*, 1990; Contis *et al,* 1996; David, 1997). The first descriptive prevalence pattern was in (1937) by Scott who reported that schistosomiasis was highly prevalent in both the Nile Delta and the Nile Valley South of Cairo in districts where the perennial irrigation system was used. The highest prevalence was recorded in the Northern and Eastern parts of the Delta where 85% of the population was infected with either one or both species of the parasite. *S. mansoni* was very low in the Southern part of the Delta and completely absent from the Nile Valley South of Cairo in basin or perennial irrigation system. After Scott's study, several large scale surveys were conducted to record the pattern of schistosomiasis infection. The Nile Delta governorates showed a gradual reduction in the overall prevalence of *S. mansoni* while *S. haematobium* continued to decrease to disappearing completely. In Upper and Middle Egypt governorates, the consistent reduction in the prevalence of *S. haematobium* except in Qena, Sohag and Aswan following the construction of the High Dam was recorded where basin irrigation was converted to perennial irrigation system (Wright, 1973; El Alamy *et al*, 1977; Miller *et al*, 1981; Cline *et al*, 1989; Abdel-Wahab *et al*, 1993; Mickelson *et al*, 1993). Prevalence of *S. haematobium* ranged from 4.8% to 13.7% in Upper Egypt (El-Enien *et al*, 1993; Hammam *et al*, 2000). In a village of Giza governorate, *S. haematobium* was 7.4% in harmony results with other Egyptian areas (Kessler *et al*, 1985; Webbe *et al.*, 1990). The infection was high amongst the villagers especially the primary school children (Talaat *et al*, 1999). In nine Egyptian Governorates, there was already change in transmission pattern of both species in Lower and Upper Egypt (El Khoby *et al*, 2000). Ministry of Health and Population (MOH) recorded that only 20 villages in the whole country showed prevalence more than 3.5% and none would have more than 10% by the end of 2010. The success in controlling schistosomiasis in Egypt was implemented through several control programs strategy recommended by the WHO. Two factors were responsible for the schistosomiasis pattern: the irrigation type used whether perennial or basin. Conversion from basin to perennial irrigation resulted by Aswan High Dam construction and the MOH control programs (Barakat, 2013). Schistosomiasis persistence in Egypt update, in some areas as Giza Governorate, makes one feel sorrow.

This study aimed to assess the epidemiological situation of *S. haematobium* in Tamwah village, one of Giza villages with highest prevalence rate of *S. haematobium* infection, and try to control such problem through the available measures.

Subjects, Materials and Methods

A preliminary study on the areas of the highest prevalence of schistosomiasis was done during the last three years. The data were collected tabulated and statistically analyzed. Tamwah is one of villages belonged to Abu Alnomros Center, Giza governorate, lies on the Nile River where its borders are Al-Badrashin Center in the south, Met Shamasi in the west, Manyal Shihah in the north and Nile River in the east. The population about 28,000 in 2016, its location by Global positioning system GPS was 29.939720, 31.265508. There are three primary schools; Fatma Al Zahraa, Osman ben Afaan and Tamwah primary school.

The field studies were carried out during April 2016. (1285) urine samples were collected in 30ml sterile capped plastic containers from children of three primary schools at morning. Questionnaires about personnel and environmental data were done for each examined child. The urine samples were labeled and transferred to laboratory. 10ml of the specimen lower part was poured into new tube for centrifugation, examined microscopically by 10 & 40X power lenses.

Snails sampling was conducted in April 2016, in sites where there was major human water contact along the shores of small branch of Nile River. The screened shore length was 700 m. Sampling was carried out by 2 trained field collectors using standard snail scoops or occasionally hand collection. Sampling time was between 08:30 hr. &

10:30 hr. Snails from each site were labeled and transported in separate perforated plastic containers to the laboratory and processed. Snails were identified to species level based on morphological characters using standard keys (Brown, 1994; WHO, 1998). Snails were placed individually in 24-well culture plates containing 1 ml of clear, filtered water (same source as site of collection) and exposed to indirect sunlight for 4 hr to induce cercarial shedding. The time of cercariae shedding was carefully selected to coincide with the early peak shedding time (midday) (Steinauer *et al*, 2008). Wells were examined for cercariae under a dissecting microscope. Those did not shed cercariae within a month were crushed and examined. Recovered cercariae were fixed in 70% ethanol for identification (Frandsen *et al*, 1984).

Statistical analyzed: Using SPSS version 20 (IBM, Inc. New York, USA). Chi-square test was chosen to compare differences of varies factors in the distribution of Schistosomiasis. Those who did not bring sample were excluded. The 0.05 cut-off value was used as a criterion for significance. All tests were interpreted in a two-tailed fashion (Lehmann, 1975, Altman, 1992).

Results

The results were shown in tables (1 to 8) and photos (1 to 9).

Table 1: Parasites in persons' urine samples according to sex in Tamwah village, Giza Governorate.

Sex		Normal	*S. haematobium* +ve	*E.vermicularis* +ve	*Both parasites* +ve	Total
Male	No.	651	40	0	0	691
	%	94.2%	5.8%	0.0%	0.0%	100.0%
Female	No.	576	11	6	1	594
	%	97.0%	1.9%	1.0%	0.2%	100.0%
Total	No.	1227	51	6	1	1285
	%	95.5%	4.0%	0.5%	0.1%	100.0%

Pearson Chi-Square = 20.959, P< 0.01

Table 2: *S. haematobium* in persons' urine samples according to sex.

Sex		Normal	*S. haematobium* +ve	Total
Male	No.	651	40	691
	%	52.8%	76.9%	53.7%
Female	No.	582	12	594
	%	47.2%	23.1%	46.2%
Total	No.	1233	52	1285
	%	100.0%	100.0%	100.0%

Pearson Chi-Square =11.76, P< 0.01

Tests	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	11.76	2	.003
Likelihood Ratio	12.56	2	.002
Linear-by-Linear Association	9.71	1	.002
N of Valid Cases	1285		

Table 3: Parasites in persons' urine samples according to age

Age in years		Normal	*S. haematobium* +ve	*E.vermicularis* +ve	*Both parasites* +ve	Total
6	No.	376	2	0	0	378
	%	99.5%	0.5%	0.0%	0.0%	100.0%
7	No.	399	2	5	0	406
	%	98.3%	0.5%	1.2%	0.0%	100.0%
8	No.	115	6	1	1	123
	%	93.5%	4.9%	0.8%	0.8%	100.0%
9	No.	156	11	0	0	167
	%	93.4%	6.6%	0.0%	0.0%	100.0%
10	No.	91	7	0	0	98
	%	92.9%	7.1%	0.0%	0.0%	100.0%
11	No.	90	23	0	0	113
	%	79.6%	20.4%	0.0%	0.0%	100.0%
Total	No.	1227	51	6	1	1285
	%	95.5%	4.0%	0.5%	0.1%	100.0%

Pearson Chi-Square=128.19,P<0.01

Table 4: *S.haematobium* in persons' urine samples according to age.

Age		Normal	*S. haematobium* +ve	Total
6	No.	376	2	378
	%	30.5%	3.8%	29.4%
7	No.	404	2	406
	%	32.8%	3.8%	31.6%
8	No.	116	7	123
	%	9.4%	13.5%	9.6%
9	No.	156	11	167
	%	12.7%	21.2%	13.0%
10	No.	91	7	98
	%	7.4%	13.5%	7.6%
11	No.	90	23	113
	%	7.3%	44.2%	8.8%
Total	No.	1233	52	1285
	%	100.0%	100.0%	100.0%

Pearson Chi-Square =108.693

Test	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	108.693	5	.000
Likelihood Ratio	85.775	5	.000
Linear-by-Linear Association	87.858	1	.000

Table 5: Parasites in persons' urine samples according amount of blood in specimens.

Urine		less than 5/HPF	6 - 30/HPF	over 30/HPF	over 100/HPF	Total
Normal	No.	1209	12	3	0	1224
	%	98.8%	1.0%	0.2%	0.0%	100.0%
S. haematobium +ve	No.	10	17	15	9	51
	%	19.6%	33.3%	29.4%	17.6%	100.0%
E.vermicularis +ve	No.	4	1	1	0	6
	%	66.7%	16.7%	16.7%	0.0%	100.0%
Both parasites +ve	No.	0	0	1	0	1
	%	0.0%	0.0%	100.0%	0.0%	100.0%
Total	No.	1223	30	20	9	1282
	%	95.4%	2.3%	1.6%	0.7%	100.0%

Pearson Chi-Square = 813.23, P<0.01

Test	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	813.234	9	0.000
Likelihood Rati	271.053	9	0.000
Linear-by-Linear Association	567.836	1	0.000
N of Valid Cases	1282		

Table 6: Parasites in persons' urine samples according according to amount of pus cells in specimens.

Urine		less than 5/HPF	6 - 30/HPF	over 30/HPF	Total
Normal	No.	1153	61	13	1227
	%	94.0%	5.0%	1.1%	100.0%
S. haematobium +ve	No.	8	29	14	51
	%	15.7%	56.9%	27.5%	100.0%
E.vermicularis +ve	No.	4	1	1	6
	%	66.7%	16.7%	16.7%	100.0%
Both parasites +ve	No.	0	1	0	1
	%	0.0%	100.0%	0.0%	100.0%
Total	No.	1165	92	28	1285
	%	90.7%	7.2%	2.2%	100.0%

Pearson Chi-Square = 393.71

Test	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	393.710[a]	6	.000
Likelihood Ratio	191.016	6	.000
Linear-by-Linear Association	290.565	1	.000
N of Valid Cases	1285		

Table 7: Types of crystals in persons' urine samples according to age.

Age in years		Nil	uric acid	Ca. Oxalates	Triple phosphate	Total
6	No.	354	17	3	4	378
	%	93.7%	4.5%	0.8%	1.1%	100.0%
7	No.	359	31	12	4	406
	%	88.4%	7.6%	3.0%	1.0%	100.0%
8	No.	113	8	1	1	123
	%	91.9%	6.5%	0.8%	0.8%	100.0%
9	No.	156	8	2	1	167
	%	93.4%	4.8%	1.2%	0.6%	100.0%
10	No.	88	7	3	0	98
	%	89.8%	7.1%	3.1%	0.0%	100.0%
11	No.	107	4	2	0	113
	%	94.7%	3.5%	1.8%	0.0%	100.0%
Total	No.	1177	75	23	10	1285
	%	91.6%	5.8%	1.8%	0.8%	100.0%

Pearson Chi-Square = 15.326 , P> 0.01

Test	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	15.326	15	.428
Likelihood Ratio	17.087	15	.314

Table 8: *S. haematobium* in persons' urine samples according to contact with Nile water.

Water contact		Normal	Positive for *S. haematobium*	Total
yes	No.	199	39	238
	%	16.1%	75.0%	18.5%
No	No.	1034	13	1047
	%	83.9%	25.0%	81.5%
Total	No.	1233	52	1285
	%	100.0%	100.0%	100.0%

Pearson Chi-Square =114.55, P< 0.01

Test	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	114.550	1	0.000		
Continuity Correction	110.682	1	0.000		
Likelihood Ratio	83.170	1	0.000		
Fisher's Exact Test				0.000	0.000
Linear-by-Linear Association	114.461	1	0.000		
N of Valid Cases	1285				

Discussion

The present results revealed that the prevalence of *S. haematobium* infection among school children was 4.04% (52 cases).The result agreed greatly with estimates that mentioned that *S. haematobium* was steadily decreasing for more than a decade in Middle and Upper Egypt (Miller *et al*, 1981; Kitron *et al*, 1985) and disappeared from Nile Delta (Cline *et al*, 1989; Barakat *et al*, 1995).

The prevalence of *S. haematobium* infection was (7.4%) in the village of El-Gezira El-Shakra, El Saf district, Giza Governorate in Upper Egypt. The prevalence of the population sample and school children was 7.4% and 10.6%, respectively (Talaat *et al*, 1999). The results agreed with other areas of Egypt (Kessler *et al*, 1987; Webbe *et al*, 1990). Urinary schistosomiasis prevalence was similar in magnitude to cross-sectional reports from representative samples in 1993. The prevalence of *S. haematibium* were 8.9%in Al-Minya, 5.2% in Assiut and 5.4% Qena Governorates (El-Enien *et al*, 1993; Hammam *et al*, 1993a; b) respectively. Although the elucidation of this decrease remains to be defined, chronologically, the decrease was first noted almost a decade after closure of the High Dam (Miller *et al*, 1978a,b)

The present study showed that most of cases were males (76.9% out of positive cases) frequent attending to water for swimming, fishing, washing and cleaning their animals in Nile water while female children were contact with Nile water during aiding their mothers in cleaning dishes, clothes, carpets …etc. The difference betw- een males and females was highly significant. Also showed a strong correlation between age of children and infection where the highest prevalence rate (44.2%) was among oldest children (11 years) while the lowest (3.8%) was among the youngest group (6 years). There was a strong correlation between schistosomiasis infections and frequent contact with Nile water reflected the high frequency of older children in swimming and fishing in Nile.

The present results agreed with Talaat *et al*. (1999) who reported that the prevalence of *S. haematobium* infection among children was higher than among adult. Also males were highly infected more than females in a village in Giza Governorate. During childhood in endemic areas, it was found that both prevalence and intensity of *Schistosoma* infection increase with age due to continuing exposure to high-risk water bodies. This increasing infectious burden was associated with a parallel increase in morbidity. This is due to the acute inflammation that induced by the about 50% of parasite eggs that remain trapped in the body (Chen *et al*, 1989; Smith *et al*, 1986). Maximum egg excretion peaks were among children between 12-15 years of age (King *et al*, 2006)

In any event, local transmission is particularly favored because of children passed highest egg output in feces or urine and consistently more likely to be indiscriminate because of urination and defecation habits. They contribute in enhancing perpetuation of the local transmission cycle (WHO, 2002). Schistosoma eggs have been found in the stool or urine of children as young as 2 years old, provoking questions about the true age of onset of disease caused by Schistosoma infection, particularly with regard to the age targets of current population-based control program, now focused on school age children; 5-15 years ages (WHO, 2002). More studies will be needed for defining this issue (Bosompem *et al*, 2004; Odogwu *et al*, 2006)

The present work showed that the percentage of presence of *Entrobius vermicularis* ova in urine samples was 0.54 % (7 cases), all of them were females. One of them had mixed infection with *S. haematobium*. The number of these cases here did not reflect the true prevalence of infection with *E. vermicularis* because these ova were accidently found in urine samples of females. Stool examination has little practical use in detection of such parasite where eggs are found in the feces of about 5–15% of infected individuals. The recommended methods for detecting the eggs of *E. vermicularis* were the scotch tape and the sell-tape swab methods (Brooker *et al*, 2014)

The highest percentage among children infected with *S. haematobium* had pus cells 6-30/HPF and red blood cells less than 100/HPF in their urine samples. That may reflect the moderate no. of parasites in the infected children where the highest count of eggs/ precipitate of 10 ml urine did not exceed 10 eggs. So the microscopic examiner should take into consideration the low burden of parasites among people and does not neglect the normal samples that do not contain red blood cells or white blood cells where the percentage of clear and normal urine samples containing *S. haematobium ova was* 19.6% out of all positive cases.

Other findings in urine samples of the children was the crystals where the parentages of urine samples contained crystals of uric acid, ca oxalates and triple phosphate were 5.8 %, 1.8% and 0.8% respectively. The reports of urine samples were referred to specialist in Tamwah Unit for treating and follow up the children.

Tamwah village lacks good sanitation where people use trenches instead. People were suffering from odor and taste of drinking water. They prefer using Nile water in washing clothes, dishes, carpets…etc. daily for avoiding filling their trenches with waste water because of relative expensive cost required for empting them. Transmission is significantly linked to areas characterized by underdevelopment and lack of sanitation (Bruun *et al*, 2008) where the perpetuation of parasite life cycle requires water contaminated with human sewage as well as suitable environmental conditions (King, 2001). Also consistent exposure to reinfection is highly associated with a lack of safe water sources for agricultural, domestic and recreational activities (Bruun *et al*, 2008). Schistosomiasis is a preventable disease of poverty, most prevalent in rural areas, unplanned peri-urban areas and also is common among refugee camps where transmission is highly difficult to be controlled (Barbosa *et al*, 2010) (Ugbomoiko *et al*, 2010).

The collected snail species were *Lanistes carinatus*, *Bellamya unicolor*, *Physa acuta, Cleopatra bulimoides*, *Bulinus trancatus*, *Succinia cleopatra* and *Limnaea cailliaudi*. No snails belonged to *Biomphalaria alexandrina* were found. The most abundant species was *B. trancatus* followed by *L. natalensis*. No snails belonged to *Biomphalaria alexandrina* were found.

Twenty eight species of snails were known to exist in Egypt (Lotfy *et al*, 2015). The MOH records showed that *Bulinus truncatus* and *Biomphalaria alexandrina*, were present from 1991 to 1995 while *B. alexandrina* was more abundant than *B. truncatus* in the canals surrounding of El-Gezira El-Shakra village, El Saf district, Giza Governorate (Talaat *et al*, 1999). Thirteen species in different water courses in Egypt during two successive years were *B. truncatus, Biomphalaria alexandrina, Physa acuta, Helisoma duryi, L. natalensis, Cleopatra bulimoides, Planorbis pantries, Lanistes carinatus, Bellamya unicolor, Melanoides tuberculata, Succinia Cleopatra, Theodoxus niloticus and Valvata nilotica. B. alexandrina* was most abundant during spring and autumn represented by 14 & 26 snails/site, respectively while *B. truncatus* was most abundant during winter (7.7 & 3.6snails/site) during the two years, respectively. *Lyminaea* spp was represented by 7snails/site in summer (Khayat *et al*, 2011).

The present result revealed that 10.8% (8 out of 74 collected snails) of *Builinus spp* were positive for furcocercus cercaria of *S. haematobium* and 5% (2 out of 40 collected snails) of *Lymnaea* spp were positive for virgulate xiphidiocercariae which are the intestinal parasites of bates, birds and amphibians. Virgulate xiphidiocercaria is characterized by the leptocercus tail which is shorter than that of *Faschiola spp*. Its oral sucker contains bilobed or pyriform virgula organ. The differentiation between different types of cercariae found in the snails was demonstrated (Frandsen *et al*, 1984).

Three control measures were achieved during and after this study. Health education of school children and people during collection of urine samples and during snail survey has been done. After collection of snails, an aquatic bulldozer removed the heavy growth vegetation found on the surface water of Nile. Mass treatment with praziquantel for population above 5 years was carried out by General Administration of Endemic Diseases Control of Giza and under supervision of General Administration of Endemic Diseases Control of Ministry of Health. The consensus of population of Tamwah village is 28000 inhabitants, 23000 of them are above 5 years. The number of individual received treatment was 17547 (76.29% of total targeted group) where other people were outside of the village at time of mass treatment.

Praziquantel is effective against all human *Schistosoma* species. It is also effective in the other snail-borne trematode infections as paragonimiasis and infections due to the adult cestodes, *Taenia solium*, *T. saginata, Hymenolepis nana* and *Diphyllobothrium spp*. The main aim of mass treatment is to reduce the average burden of *Schistosoma* infection to great extent. Individual ‘cure’ may or may not occur. But, in some endemic areas, the community might benefit totally by an important ‘externality’ of mass treatment-the blocking of egg-miracidium-snail stages, that diminishes transmission by reducing or minimizing cercarial pollution in water supplies (King *et al*, 2011; Ozier, 2011). Although PZQ dosage was standardized in large-scale morbidity control programs (WHO, 2002) there was variation in treatment dose for individual patient (Anonymous, 2010). In control programmes although a single oral dose of 40 mg/kg is effective in *S. haematobium and S. mansoni*, it was found that higher than usual doses of PZQ was needed to effectively decrease infection levels in some areas of Egypt and Senegal (Danso-Appiah *et al*, 2002). PZQ mass treatment was the schistosomiasis solution in endemic areas but only if regularly repeated (Almorshidy *et al*, 2015). Also, combination of PZQ with artemether in the mass treatment gave high chance for killing all parasite immature rather than mature ones (Almorshedey *et al*, 2016).

Although the Egyptian lows prevent using molluscicides in Nile River, using molluscicides in the control program of schistosomiasis still offers the greatest opportunity for rapid control of transmission. The advantage of using molluscicides is that its use is not requiring the active cooperation of the population as in case of mass treatment or health education. An advantage of considerable importance is that the use of molluscicides controls the vectors of other animal trematode infections which are of economic importance, especially fascioliasis, so it contributes greatly in protection of the animal health (King *et al*, 2015).

During studying the geography of Tamwah area, it was noticed that there is a narrow branch from Nile constituting the main source of infection. That branch is V-shaped with one ended side so people used it as a basin for swimming where the speed of its water stream is much slower than the main canal. The shape of blunted end of that canal inspire us an idea or suggestion for establishing fish farm in the ended side of that branch and bordering it by strong fence for preventing people from using infected water. Also swimming pool inside the youth center of the village should be constructed as an alternative place instead of Nile. Other critical problems should be solved to decrease transmission as lack of sanitation and good drinking water.

Recommendations

Although using molluscicides in the control program of schistosomiasis give the greatest opportunity for rapid control of transmission, Egyptian lows incriminate using such chemicals in Nile River. So, the available control measures of schistosomiasis are restricted in mainly three measures; First, health education. Second, mass treatment. Also timing and regular repeating mass treatment are very important. Third, mechanical removing of aquatic vegetation from Nile should be regular with less than two week interval in between. The idea or suggestion for establishing fish farm in the ended side of Nile branch and bordering it by strong fence for preventing people from using infected water should be achieved. Also swimming pool inside the youth center of the village should be constructed as an alternative place instead of Nile. Other critical problems should be solved as lack of sanitation and good drinking water. At research level studying the safe dose for radiating the infected Nile to kill cercariae instead of panned molluscicides is very important.

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Explanation of figures

Fig. 1, 2: Maps showing the location of Tamwah village, Giza Governorate

Fig. 3: A suggestion for isolating the shore (700m), the source of infection, by building a high and strong fence along 700m length and establishing a fish farm (700×100m area).

Fig. 4: Ended side of Nile River branch, main source of infection with cercariae of *S. haematobium.*

Fig. 5: An aquatic bulldozer removed vegetation in water and act as a good shelter for snails.

Fig. 6: Women attended to Nile for washing dishes and carpets.

Fig. 7: *Schistosoma haematobium* ovum.

Fig. 8: Virgulate xiphidiocercariae.

Fig. 9: Furcocercus cercaria of *S.haematobium*

Fig. 10: *Bulinus truncatus*


F. 1
El-Nasr Rd
CAIRO GOVERNORATE
GIZA GOVERNORATE
Nile Corniche
Nile
Nile
طريق أسوان الزراعي الغربي


F. 2
CAIRO GOVERNORATE
GIZA GOVERNORATE
Nile


F. 3
700 m
fish farm
100 m
Governmental buildings


F. 4


F. 5
F. 6
F. 7
F.8
F. 9
F. 10