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SCHISTOSOMIASIS IN NAG HAMMADY CITY, RELATIONSHIP BETWEEN INFECTION AND ANEMIA AMONG CHILDREN AND YOUTH, QENA GOVERNORATE, EGYPT

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Abstract

The highest prevalence of schistosomiasis is usually found in school-age children and youth, where it represents the main cause of iron deficiency anemia. Study was done on 859 patients; their age from 5-18 years old at Nag Hammady at the period from July 2013 to July 2014 all of them had subjective history of contact or swimming in water canals. Urine was examined for urinary schistosomiasis by concentration and positive cases were subjected to urine analysis by Nucleopore filtration technique, S. *haematobium* was 30.96%, while stool samples were macroscopically examined mainly for enterobiasis and gravid segments and then were microscopically examined as stained direct smear and by sedimentation and Kato-Katz techniques.

The intestinal parasites other than intestinal schistosomiasis were not encountered and the pure *S. mansoni* was 0.69% of examined patients. The overall pure schistosomiasis was 31.66%. Iron deficiency anemia was 27.7% in non-infected cases and in schistosomiasis patients iron deficiency anemia were found in 43.38% with statistically significant (P value=0.001).

Key words: Upper Egypt, Nag Hammady, *Schistosoma haematobium Schistosoma mansoni,* Anemia.

Introduction

Schistosomiasis is the second most important parasitic infection after malaria and affects more than 200 million people in 74 countries (WHO, 2002) and approximately 207 million people were infected (Steinmann *et al*, 2006), most of them were in Africa, accounting for more than 97% of the estimated number of infections worldwide (Utzinger *et al*, 2009). In Egypt, schistosomiasis is still a public health problem despite the tendency of being overlooked (Othman and Soliman, 2015).

The highest prevalence of illness usually found in school-age children and adolescents, where it represents the main cause of iron deficiency anemia (Guyatt *et al*, 2001).

Generally, schistosomiasis is a parasitic disease caused by blood flukes (trematodes) of the genus *Schistosoma*. Three main species parasitize humans: *S. haematobium*, *S. japonicum*, and *S. mansoni* (Tchuem *et al*, 2003).

The study aimed to evaluate the magnitude of schistosomiasis and its relation to anemia among children and youth in Nag Hammady City, Qena Governorate.

Subjects, Materials and Methods

This study was done on 859 patients (685 from rural areas and 174 from urban ones) attended the out-patients' clinics, at Nag Hammady General Hospital and Nag Hammady Tropical Hospital in the period from July 2013 to July 2014. They were 583 males and 276 females with ages ranged from 5-18 years old. Medical sheets were filled out on each case including, name, sex, age, close contact with water, and complains suggestive parasitosis. All of them are presented by one of the following, abdominal pain, dysuria, hematuria, dysentery, and or pallor (anemia).

Laboratory examination: urine and stool samples were freshly collected in labeled containers. Urine was examined for urinary schistosomiasis by concentration. Positive cases for *S. haematobium* were subjected to urine analysis by Nucleopore filtration technique, which consisted of a microscopic examination of a filter used to collect the *S. haematobium* eggs from 10ml of urine to determine intensity of infection (Plouvier *et al,* 1975). The stool samples were macroscopically examined mainly for enterobiasis and gravid segments. Then, the samples were microscopically examined as the stained direct smear and by sedimentation and Kato-Katz techniques (Katz *et al,* 1972). Sometimes smears were stained with Modified Zeihl-Nelsen stain when indicated for cryptosporidiosis (El-Naggar *et al*, 2006).

Blood samples were collected for CBC and anemia was defined by values less than11.5 mg/dL (WHO, 2001). Severe anemia was designated for hemoglobin levels < 9 mg/dL.

The present study was previously approved by the Ethical Health Committee by the Egyptian Ministry of Health and Population. Informed consent was obtained from the patients' parents.

Statistical analysis: Data were tabulated and analyzed through computer facilities using the Statistical Package for Social Science (SPSS) version 20. Chi-square [X2 at degrees of freedom (df)] tests were used, where appropriate. Alpha error (α) to tolerable type-I error is 0.05, and p-value less than alpha was considered significant.

Results

The patients were divided according to their age into three groups: G.1: 5-9years old (N=312), G.2: 10-14years old (N=407), and G.3: 15-18years old (N=140). Schistosomiasis was detected in 272/859 (31.66%) patients, *Schistosoma haematobium* was detected in 266 (30.96%) patients out of 859 examined patients, while *S. mansoni* was detected in 6 (0.69%) patients. In G.1 (312 patients) *S. haematobium* was 99 (31.73%) and *S. mansoni* was 2(0.64%), in G.2 (407 patients) *S. haematobium* was 142(34.88%), *S. mansoni* was 4(0.98%) and in G.3 (140 patients) *S. haematobium* was 25(17.85%).

Schistosomiasis it was higher in patients living in rural areas 241(41.33%) than those in urban areas 31(17.81%) with statistical significant difference. Schistosomiasis sex distribution was 231(39.62%) in males and was 41(14.85%) in females with statistical significant difference.

The overall anemia was 421(49.01%) in controls, and schistosomiasis patients was 156 (57.35%) with statistical significant difference. Iron deficiency anemia was found in 159 (27.7%) of non-infected cases and the other; 106 (18.05%) suffered from normocytic normochromic anemia, while in schistosomiasis patients iron deficiency anemia was found in 118(43.38%) and the other; 38 (13.97%) suffered from normocytic normochromic anemia with statistical significant difference. Patients infected with taeniasis, enterobiasis, hymenolepiasis, ascariasis, amebiasis and/or giardiasis were excluded.

Details were given in tables (1, 2, & 3).

Table 1: Socio-demographic characteristics of Schistosomiasis and Non-infected control.

Variants	Schistosomiasis patients	Non-infected control	P. value
Age (G.1) 5-10y (N=312) (G.2) 10-15y (N=407) (G.3) 15-18y (N=140)	 101(32.37%) 146(35.86%) 25(17.85%)	 211(67.63%) 261(64.14%) 115(82.15%)	 <0.001
Sex Female(N=276) Male(N=583)	41(14.85%) 231(39.62%)	235(85.15%) 352(60.38%)	<0.001
Residence: Urban (N=174) Rural (N=685)	 31(17.81%) 241(41.33%)	 143(82.19%) 444(48.67%)	. <0.001

Table 2: Anemia: Schistosomiasis and Non Infected control

Characteristics.	Schistsomiasis and Non Infected control		P value
Total sample 859	Patients (N=272)	Control (N=587)	
Anemia 421/859 (49.01%)	156/ 272 (57.35%)	265/587 (45.14%	<0.001
No Anemia 438/859 (50.99%)	116/ 272(52.65%)	322/587(54.86%)	

Table 3: Schistosomiasis and Non infected control and Anemia

Anemia	Schistsomiasis and Non infected control		P
Anemic patients (421)	Patients (N=156)	Control (N=587)	value
Normochromic Normocytic anemia (146)	38/ 156	106/587	<0.001
Hypochromic Microcytic anemia (265)	118/156	159/587	

Discussion

Schistosomiasis in Ancient Egypt has shown evidence of its occurrence in the Nile Basin Valley since the remote times. Haematuria with urinary bladder disturbances was mentioned in four Papyrus papers dated back to 1950-1900 BC (Ruffer, 1910). The overall prevalence of schistosomiasis in children and youth (5-18 years old) was 272 out of 859 (31.66%) based on the urine and stool examinations. *Schistosoma haematobium* was detected in 266 (30.96%) patients, while *S. mansoni* was detected in 6(0.69%) patients out of 859 examined patients.

In G.1 (312 patients) *S. haematobium* was 99(31.73%) and *S. mansoni* was 2(0.64%), in G.2 (407 patients) *S. haematobium* was 142(34.88%), *S. mansoni* was 4(0.98%) and in G.3 (140 patients) *S. haematobium* was 25(17.85%). There was higher significant in G.1 and G.2 than G.3. No doubt, children 5-15 years old are susceptible to infection due to more contact to water canals or Nile River for swimming while youth in G.3 (15-18) were less exposed to water canals due to increase level of learning and health education.

In the present study, *S. haematobium* was 266/859 (30.96%) distributed as 31.73% in G.1, 34.88% in G.2 and 17.85% in G.3, with significant difference between males and females (P <0.001), in male (38.59%) and in female (4.85%). Also, there was significant difference (P<0.001) regarding *S. haematobium* and residence, it was (34.30%) in rural patients and in urban ones (17.81%) with significant difference (P<0.001). This might be attributed to increase level of learning, good water supply, sanitary water disposal and lack of contact and/or swimming in water canals.

The present findings agreed with Woolhouse (1998) who found that the peak prevalence of urinary schistosomiasis occurs in the school-aged and youth. El Khoby *et al.* (2000) in Egypt found that the peak of prevalence from 10-14 years old and Mansour *et al*. (1981) found a higher prevalence of urinary schistosomiasis in school children 5-16 years (61.1%).

On the other hand, El Khoby *et al*. (2000) and Hammam *et al.* (2000) found that the overall *S. haematobium* among the whole population was low 4.8%. This might be attributed to fact the present study selected children and youth who has history of contacts and/or swimming in water canals.

In the current work, *S. haematobium* infection were higher in males than females, and this coincided with a study done at Qena Governorate by Hammam *et al.* (2000) they found that the prevalence was higher in males than females. Also, El Khoby *et al*. (2000) found that males had higher infection rates than females in all age groups of the Egyptian patients.

On the other hand, Hussein and Rabie (2007) in Qena Governorate reported that the schistosomiasis infection were more prevalent in males in some regions and in females in other regions.

The present results agreed with Mansour *et al*. (1981) who found that *S. haematobium* was 28.7 % in three rural villages in Qena Governorate. Also, King *et al.* (1982) found that *S. haematobium* infection rate in six rur-

al villages of Qena Governorate was 37.1%.

The outcome results of schistosomiasis *haematobium* prevalence in present work which was 30.96% more or less varied with other Egyptian Governorates. The infection rate was 53.7% for *S. mansoni* in Giza (Talaat *et al,* 1999). *S. mansoni* was rare in Upper Egypt, being consequential in only El Fayoum Governorate, which had a prevalence of 4.3% and an average intensity of infection of 44.0 ova/gm of stool (El-Khoby *et al,* 2000). The changing pattern of the infection with *Schistosoma* sp. in El Fayoum Governorate was reported by Abdel-Wahab *et al.* (2000) who found that the prevalence of *S. haematobium* ranged from 0% to 27.1% and averaged 13.7%. The schistosomiasis infection rates were 42% in Sohag Governorate (Wright, 1973), 27% in Beni-Suef Governorate and4% in Aswan Governorate (Miller *et al*, 1981), 8.9% in El-Menia Governorate and 5.21% in Assiut Governorate (El Khoby *et al*, 2000). On the other hand, the prevalence of *S. haematobium* infection in current work as well as other governorates in Upper Egypt was more or less higher than that estimated in the governorates of lower Egypt ranged between 0.26% (El Khoby *et al*, 2000) to 2.8% in Gharbia Governorate (El-Hawey *et al*, 2000). This might be attributed to the changes in irrigation method and to lack of appropriate environmental ecology for schistosomiasis intermediate hosts.

In Africa, the prevalence of *S. haematobium* varied between 9% among school children in Uganda (Kapito-Tembo *et al,* 2009) up to 45.4% in Mali (Schur *et al*, 2013). Moreover, in Southern Sudan the prevalence of *S. hematobium* and *S. mansoni* reached up to 73% among school children in Sudan (Deganello *et al,* 2007). Generally speaking, in sub-Saharan Africa, a total of 70 million individuals out of 682 million were estimated to experience haematuria associated with *S. haematobium* infection, and 32 million with dysuria. Infection with *S. mansoni* was estimated to cause diarrhoea in 0.78 million individuals, blood in stool in 4.4 million and hepatomegaly in 8.5 million (van der Werf *et al,* 2003).

In the present study, *S. mansoni* infection was detected in 6 (0.69%) out of 859 patients, one patient had a mixed *S. mansoni* and *S. hematobium*. This result agreed with El Khoby *et al*. (2000) who found the prevalence was 0.44%, but differed with Sameh *et al.* (2013) who found no *S. mansoni* case in Qena Governorate. Also, Sayed *et al*. (2014) in Qena reported that the overall prevalence of *S. haematobium* was 13.9%; with maximum among 6-18 year-old age group and higher in males than in females. Risk factors for S. *haematobium* infection were this age group; particularly males. They added that the infective rate among snails was 1.82% in *Bulinus truncatus* and 0.0% among *Biomphalaria alexandrina* and *Melania tuberculata.*

In the present study, 421(49.01%) patients were anemic, while schistosomiasis patients was 156(57.35%), with significant difference (P value=0.001). Iron deficiency anemia (microcytic hypochromic anemia) were found in 159 (27.7%) of non-infected control cases and 106 (18.05%) had normocytic normochromic anemia. In schistosomiasis patients, the iron deficiency anemia were found in 118(43.38%) and 38 (13.97%) had normocytic normochromic anemia with significant difference (P value=0.001). Schistosomiasis inflicts significant adverse effects on health such as anemia, stunting, protein-calorie malnutrition, fatigue, and poor cognitive development, of which anemia results from iron deficiency due to extra-corporal blood loss; splenic sequestration; autoimmune hemolysis and inflammatory anemia (Gryseels *et al,* 2006). In general, anemia in patients with liver disease is often multifactorial and associated with iron and folic acid deficiency or even an inflammatory process as well as short survival red blood cell in chronic liver disease with the increased spleen being a major site of red blood cell destruction (Dias *et al,* 2013). In addition,

urinary schistosomiasis hematuria blood loss can be formidable and associated with anemia, and severity of infection contributed to morbidity in children (Koukounari *et al,* 2007). Also, schistosomiasis causing hyperplasia of the reticuloendothelial system and venous congestion led to portal hypertension (Bosch *et al,* 2008). Generally, chronic kidney disease in Egyptian patients was a major global public health problem and the renal complications of tropical parasites particularly schistosomiasis are heterogeneous. On the other hand, El-Tonsy *et al.* (2013) reported that *S. mansoni* accelerates hepatic dysplastic changes in the presence of other risk factors making cancer appear early and with a more aggressive nature, compared to the same risk in absence of schistosomiasis.

Kamel *et al*. (2014) suggested that the increased expression of certain platelets and lymphocytes activation markers in chronic HCV and *S. mansoni* induced chronic liver disease that may have a role in disease progression.

Conclusion

Schistosomiasis is a public health problem not only in Egypt, but also worldwide. Schistosomiasis apart from causing iron deficiency anemia especially in the children and youth, infection causes many severe or even fatal complications. No doubt, the early diagnosis and treatment of schistosomiasis minimize its risk.

Consequently, the Public Health Authorities must take into consideration the marked increase of schistosomiasis, particularly *S. haematobium* in Upper Egypt and its impact on human health and welfare.

References

Abdel-Wahab, MF, Esmat, G, Ramzy, I, Narooz, S, Medhat, E, *et al*, 2000: The epidemiology of schistosomiasis in Egypt: Fayoum Governorate. Am. J. Trop. Med. Hyg., 62, 2: S55-64

Bosch, J, Abraldes, JG, Berzigotti, A, García, JC, 2008: Portal hypertension and gastrointestinal bleeding. Semin Liver Dis. 28, 1:3-25.

Deganello, R, Cruciani, M, Beltramello, C, Duncan, O, Oyugi, V, *et al,* 2007: *Schistosoma hematobium* and *S. mansoni* among Children, in Southern Sudan. Emerg. Infect. Dis. 13:10-9.

Dias, HS, Domingues, AL, Cordeiro, FT, Jucá, N, Lopes, EP, 2013: Associating portal congestive gastropathy and hepatic fibrosis in hepatosplenic *mansoni* schistosomiasis. Acta Trop. 126, 3:240-3.

El Hawy, M, Amer, A, Abdel-Rahman, S, Elibiary, M, Abdel-Hafez, M, 2000: The epidemiology of schistosomiasis in Egypt: Gharbia Governorate. Am. J. Trop. Med. Hyg. 62:42-8.

El Khoby, T, Galal, N, Fenwick, A, Barakat, R, El-Hawey, A, *et al*, 2000: The epidemiology of schistosomiasis in Egypt: Summary findings in nine Governorates. Am. J. Trop. Med. Hyg. 62:88-99.

El-Naggar, SM, El-Bahy, MM, Abd Elaziz, J, El-Dardiry, MA, 2006: Detection of protozoal parasites in the stools of diarrhoeic patients using different techniques. J. Egypt. Soc. Parasitol. 36, 1:7-22.

El-Tonsy, MM, Hussein, HM, Helal, Tel-S, Tawfik, RA, Koriem, KM, *et al*, 2013: Schistosoma mansoni infection: is it a risk factor for development of hepatocellular carcinoma? Acta Trop. 128, 3:542-7.

Gryseels, B, Polman, K, Clerinx, J, Kestens, L, 2006: Human schistosomiasis. Lancet 368, 9541:1106-18.

Guyatt HL, Brooker, S, Kihamia, CM, Hall, A, Bundy, DA, 2001: Evaluation of efficacy of school-based anthelmintic treatments against anaemia in children in the United Republic of Tanzania. Bull. WHO 79:695-712.

Hammam, M, Zarzour, A, Moftah, F, Abdel-Aty, M, Hany, A, 2000: The Epidemiology of schistosomiasis in Egypt: Qena Governorate. Am. J. Trop. Med. Hyg. 62, 2:80-7.

Hussein, ANA, Rabie, SAH, 2007: Prevalence of urinary schistosomiasis and infections with trematode larval stages in the *Bulinus truncatus* snails from Qena, Upper Egypt. J. Appl. Sci. Res. 4, 11:1610-7.

Kamel, MM, Fouad, SA, Basyoni, MM, 2014: P selectins and immunological profiles in HCV and *Schistosoma mansoni* induced chronic liver disease. BMC Gastroenterol. 2014 Jul 28;14:132 doi: 10.1186/1471-230X-14-132

Kapito-Tembo, AP, Mwapasa, V, Meshnick, SR, Samanyika, Y, Banda, D, 2009: Prevalence distribution and risk factors for *Schistosoma hematobium* Infection among School chil-

dren in Blantyre, Malawi. PLoS. Negl. Trop. Dis. 3, 1:361-8.

Katz, N, Chaves, A, Pellegrino, JA, 1972: A simple device for quantitative stool thick-smear technique in schistosomiasis *mansoni.* Rev. Do Instit. Med. Trop. de São Paulo, 14: 397-400.

King, C, Miller, F, Hussein, M, Barkat, R, Monto, A, 1982: Prevalence and intensity of *Schistosoma haematobium* infection in six villages of Upper Egypt. Am. J. Trop. Med. Hyg. 31, 2:320-7.

Koukounari, A, Gabrielli, AF, Toure, S, Bosque, E, Zhang, Y, *et al*, 2007: *Schistosoma haematobium* infection and morbidity before and after large-scale administration of praziquantel in Burkina Faso. J. Infect/ Dis. 196:659-69.

Mansour, NS, Higashi, GI, Schinski, VD, Murrell, KD, 1981: A longitudinal study of *Schistosoma haematobium* infection in Qena Governorate, Upper Egypt. 1- Initial epidemiological findings. Am. J. Trop. Med. Hyg. 30: 795-805.

Miller, F, Hussein, M, Mancy, K, Hilbert, M, Monto, A, *et al,* 1981: An epidemiological study of *Schistosoma haematobium* and *S. mansoni* in thirty-five Egyptian villages. Trop. Geograph. Med. 33:35-65.

Nour, HH, El-Gobashy, SE, El Kholy, A, Kamal, AM, Ali, M, *et al*, 2015: Laparoscopic management of distal ureteric stone in bilharzial ureter: results of a single center prospective study. J. Egypt. Soc. Parasitol. 45, 2:309-14

Othman, AA, Soliman, RH, 2015: Schistosomiasis in Egypt: A never-ending story? Acta Trop. 148: 179-90.

Plouvier, S, Leroy, JC, Colette, J, 1975: A propos d'une technique simple de filtration des urines dans le diagnostic de la bilharziose urinaire en enquête de masse. Med. Trop. 35:229-30.

Ruffer, MA, 1910: Note on the presence of Bilharzia *haematobium* in Egyptian mummies of the twentieth dynasty (1250-1LXX3B.C.), Brit. Med. J. 1:16-20.

Sameh, SH, Zaytoun, H, Osama, H, AbdEllah, AR, Ghweil, SH, *et al,* 2013: Prevalence of intestinal parasitosis among male youth in Qena Governorate (Upper Egypt), and its relation to socio-demographic characteristics and some morbidities. Life Sci. J. 10, 3:23-9.

Sayed, FG, Alsalahy, M, Abd-el-Kader, MS, Abdalla, OH, Ahmed, SS, 2014: Prevalence of schistosomiasis among patients attending Qena General Hospital over the years 2011 and 2012. J. Egypt. Soc. Parasitol. 44, 2:489-95.

Schur, N, Hürlimann, E, Stensgaard, AS, Chimfwembe, K, Mushinge, G, *et al*, 2013: Spatially explicit *Schistosoma* infection risk in eastern Africa using Bayesian geostatistical modelling. Acta Trop. 128, 2:365-7.

Steinmann P, Keiser, J, Bos, R, Tanner, M, Utzinger, J, 2006: Schistosomiasis and water resources development: systematic review, meta-analysis, and estimates of people at risk. Lancet Infect Dis 6:411-25.

Talaat, M, El-Ayyat, A, Sayed, H, Miller, F, 1999: Emergence of *Schistosoma mansoni* infection in Upper Egypt: the Giza Governorate. Am. J. Trop. Med. Hyg. 60, 5: 822-6.

Tchuem-Tchuente, LA, Southgate, VR, Jourdane, J, Webster, BL, Vercruysse, J, 2003: *Schistosoma intercalatum*: an endangered species in Cameroon? Trends Parasitol. 19:389-93.

Tchuem, LA, Southgate, VR, Jourdane, J, Webster, BL, Vercruysse, J, 2003: *Schistosoma intercalatum*: An endangered species in Cameroon? Trends Parasitol. 19:389-93.

Utzinger, J, Raso, G, Brooker, S, De Savigny, D, Tanner, M, *et al*, 2009: Schistosomiasis and neglected tropical diseases: towards integrated and sustainable control and a word of caution. Parasitology 136:1859-74

Van der Werf, MJ, de Vlas, SJ, Brooker, S, Looman, CW, Nagelkerke, NJ, *et al*, 2003: Quantification of clinical morbidity associated with schistosome infection in sub-Saharan Africa. Acta Trop. 86, 2/3:125-9.

WHO, 2001: Iron Deficiency Anemia Assessment, Prevention, and Control: A guide for programme managers. Geneva, Switzerland.

WHO, 2002: Expert Committee: Prevention and Control of Schistosomiasis and Soil-Transmitted Helminthiasis. Tech. Rep. Ser. No. 912:1-57.

Woolhouse, MEJ, 1998: Patterns in parasite epidemiology: the peak shift. Parasitol. Today 14:428-34.

Wright, W, 1973: Geographical distribution of schistosomes and their intermediate host. In: Epidemiology and Control of Schistosomiasis. Ansari, N, editor. (Bilharziasis) Baltimore: University Park Press.