

# Schistosomes infection rate in relation to environmental factors in school children

*Yahia A. Raja'a, MSC, PhD, Hashim M. Assiragi, MBChB, Ali A. Abu Luhom, MBChB, Abu Bakr S. Mohammed, MBChB, Mohammed H. Albahr, MBChB, Mohammed A. Ashaddadi, MBChB, AbdulRahman N. Al Muftihi, MBChB.*

---

## ABSTRACT

**Objective:** An epidemiological comparative survey aimed at determination of prevalence and focal distribution of Schistosomes infection and intestinal parasites to provide a reference for evaluating the need for community intervention.

**Methods:** All children of 14th October Primary School were involved. The children were from 7 villages that lie on the Assahul valley of lbb governorates in Yemen. The total number was 230 with (82%) boys and (18%) girls. Their age was between 5-18 years with a mean of  $10.24 \pm 2.6$  years. Millipore and modified Kato techniques were adopted to quantify urinary and intestinal Schistosomes eggs. Other ova, larvae, cysts were recorded whenever seen.

**Results:** It was revealed that there was a Schistosomes infection rate of 37%. The mansoni prevalence was 35%, hematobia was 5% and mixed infections were 3%. Light infection was classified among 17% of all children; moderate infection among 18% and no intense mansoni infection was determined. Whereas in the case of hematobia species, 2% were intense and 3% were light.

Intensity in all children was 5% eggs/g feces in case of intestinal bilharzia and 1% egg/10ml urine in case of urinary. With regard to the prevalence of any soil-transmitted parasites, it was found to be 69% (Ascariosis 68%, Trichuriasis 10%). Double infection was found in 10%. Hookworm eggs were not seen. Infection rates with other parasites were as follows: Giardiosis 18%, Amoebiosis 14%, ova of Hymenolepes nana were seen in 13%, Taeniosis affected 13% and E. Vermicularis 1%.

**Conclusion:** Bivariate analysis revealed significant associations between Schistosomes infection with residence near the valley, male sex and frequent water contact activities. No significant association was found with the age of the child, parents' education, availability of latrine or household standpipe water. In conclusion, schistosomosis was moderate, whereas soil transmitted helminthosis were intense.

**Keywords:** Schistosomosis, intestinal parasites, environmental factors.

**Saudi Medical Journal 2000; Vol. 21 (7): 635-638**

---

The World Health Organization estimates that human Schistosomes infects 200 million in the world.<sup>1</sup> Yemen's MoPH reports rank schistosomosis hematobia and mansoni as number 11, after malaria, in the list of the major health problems.<sup>2</sup> The disease was reported from various areas of Yemen such as Taiz,<sup>3</sup> Marib,<sup>4</sup> lbb,<sup>5</sup> Hajj,<sup>6</sup> Sana'a,<sup>7</sup> Saada,<sup>7</sup> Central highlands<sup>8</sup> and AlMahweet.<sup>9</sup> It is not identified in areas such as Aden or Yahr<sup>10</sup> and is not studied in other areas such as the Assahul valley in lbb

governorates. Despite the fact that safe and effective treatment is available, together with the achievements in household safe water supply (51% covered) in the country, the infection is not expected to decrease substantially in the near future. This expectation is based on the expansions of cultivated areas associated with the dams construction policy, inadequate coverate with household water supply (49% still lacking). Large proportions (37%) of houses still lack latrines and there is inadequacy in

---

From the Department of Community Medicine, Faculty of Medicine and Health Services, Sana'a University, Republic of Yemen.

Received 30th December 1999. Accepted for publication in final form 4th April 2000.

Address correspondence and reprint request to: Dr. Yahia A. Raja'a, Department of Community Medicine, Faculty of Medicine and Health Sciences, Sana'a University, PO Box 2058, Sana'a, Republic of Yemen. Tel. 967 1 234440 Fax. 967 1 234410 email: yahiarajaa@hotmail.com

public health services and high levels (50%) of illiteracy.<sup>11</sup> Therefore, the epidemiological map of the infection is not completely plotted. Moreover, the pattern of infection and the factors influencing its transmission are not adequately explored.

Similar studies tackled the pattern of infection in children of Yemen showed that the age interval, 9-13 years, was the most affected group in AlMahweet whereas it was 10-12 years in the Taiz study. The infection rates were significantly higher among the boys than in the girls in AlMahweet and were comparable in Taiz. Factors such as residence in rural areas, sex, age and frequent visits to contaminated water with cercariae were found significantly correlated to intensity and rate of infection in AlMahweet, while other factors such as literacy and job of custodian were not. These factors were not studied in the Taiz study, nor encountered in the literature of any other area of Yemen.

The current study not only reveals the rates of infection with Schistosomes and reveals other intestinal parasites in an area where the disease was not reported before, moreover, explores the impact of some demographic, social, environmental and behavioral factors on the pattern of the disease. This information could be supportive for the combined control approach for Schistosomes and other intestinal parasites.

**Methods.** Prevalence and intensity of Schistosomes infections and of other intestinal parasitic infections were assessed cross sectionally in school children of Assahul valley of Ibb governorate. Impacts of social, demographic and environmental factors on schistosomosis were assessed by means of comparative study design.

The valley is situated in the center of Yemen, linked with Zabid valley, which ends at the Red Sea. It is about 1200m above the sea level, with extensive agriculture, predominantly cereals and Qat (*Catha edulis*) and enjoys a temperate climate throughout the year. There is a health center serving a population of about 3000 individuals and situated about 10 km far from the surrounding villages.<sup>11</sup>

An examination team visited the school and collected detailed personal and behavioral information from each child in the questionnaire forms. Midday urine and stool samples were obtained from each individual in containers (labeled with name and number) and taken back to the laboratory for examination. Ten mls of each urine sample were examined for urinary Schistosomosis within 5 hours of collection applying Millipore filtration technique.<sup>12</sup> Volumes were adjusted to 10 ml and counts were recorded as (n) eggs/10 ml urine. The modified Kato technique was applied for stool examination and results were reported as (n) eggs/g of feces.<sup>13</sup> Other ova or larvae were recorded whenever seen under the microscope.

All children that enrolled in the 14th of October Primary School were considered as the study population. They originated from 7 villages along the valley. As there is no official body in the country responsible for issuing ethical clearances, consents were taken from the General Directorate of Education and Director General of Health in the Governorate. Single doses of Praziquantel (40 mg/kg) and albendazole (400mg) or both were dispensed to infected children according to body weight. All compiled data were entered in a standard questionnaire form. Logarithmic transformations were extended to Schistosomes egg counts in order to normalize data. Data was processed for univariate and bivariate analysis by the SPSS 9.1 computer program.

**Results.** Of a total of 230 school children who participated in the study, 189 (82%) were boys and 40 (18%) were girls. Their age varied between 5-18 years, with a mean age of  $10.24 \pm 2.6$  years. Mean age of boys was  $10.28 \pm 2.56$  years and that of girls was  $10.1 \pm 2.82$  years. Prevalence of any Schistosomes species was 37%. Combined infection was determined in 3%. *S. mansoni* eggs were detected in 35% of specimens while *S. hematobium* in 5% only, with intensities of 5 egg/g feces and 1 egg/10ml urine. Rate of light and moderate infections in the case of *S. mansoni* were 17% and 18%. Whereas, in *S. hematobium* it was 3% for light infection and 2% for intense. Enlarged liver and spleen was found in 31% and 5% of the subjects. Symptoms such as bloody stool was found in 33%, hematuria in 23%, abdominal pain in 73% and itching was 33%. Soil transmitted helminthes and

**Table 1** - Prevalence of intestinal parasites among school children in Assahul valley in 1998.

Soil transmitted parasite	Number (%)
<i>Ascaris lumbricoides</i>	157 (68)
<i>Trichuris trichura</i>	24 (11)
Any infection	159 (69)
Double infection	22 (10)
<b>Other parasites</b>	
<i>Giardia lamblia</i>	42 (18)
<i>Entamoeba histolytica</i>	32 (14)
<i>Hymenolepes nana</i>	30 (13)
<i>Taenia spp.</i>	29 (13)
<i>Enterobius vermicularis</i>	3 (1)

**Table 2** - Schistosomes rate of infection versus environmental and social factors, Assahul valley, 1998.

Independent factors		Infected n (%)	Not infected n (%)	Significance
Sex	Boys	81 (43)	108 (57)	0.00001
	Girls	4 (9)	37 (90)	
Frequency of visits to contaminated water	0 week	15 (20)	60 (80)	0.0001
	1-3 week	54 (43)	71 (57)	
	4-7 week	16 (55)	13 (45)	
Residence	Nearby	69 (43)	90 (57)	0.003
	Far	17 (24)	54 (76)	
Latrine	Used	20 (29)	48 (71)	0.292
	Not used	65 (40)	81 (60)	
Stand pipe availability	No	21 (35)	39 (65)	0.077
	Yes	52 (41)	76 (59)	
Mother's literacy	Literate	4 (20)	16 (80)	0.077
	Illiterate	81 (39)	129 (61)	
Age group	5-8 years	23 (35)	43 (65)	0.39
	9-13 years	56 (37)	94 (63)	
	14-18 years	7 (50)	7 (50)	
Father's literacy	Literate	30 (32)	63 (68)	0.146
	Illiterate	54 (40)	81 (60)	

Calculated from the total number of each sex in the study. Significance calculated by Chi square.

other intestinal parasites were found as revealed in Table 1. With respect to the relationship between rate of infection with the studied factors, see Table 2. Risk of infection in boys was 4.45 times that in girls (CI=1.73 – 11.44). Living closer to the valley is 1.81 times more risky than living farther (CI=1.16 – 2.84).

**Discussion.** Information targeted from this study was to be utilized for control purposes. The found prevalence indicates to moderate infection with Schistosomes. This allows for recommending annual or biannual targeted treatment of school children as WHO recommends. The found rates of infection (37%) exceeded the estimations reported for the whole country (6%),<sup>14</sup> from Maitam valley (13%), Mahweet (29%) or Hajja (21%). The only similar exceeding rates (37% for *S. hematobium* and 64% for *S. mansoni*) were reported from Taiz. A comparable finding was reported from Jabal Asharq (34.5% for both species).<sup>8</sup> Geometric mean of 5 egg/g feces for *S. mansoni* and 1.07 egg/10 ml urine for *S. hematobium* is greater than that found in the AlMahweet study (2.49 egg/g feces) and comparable with intensity of *S. hematobium* (1.27 egg/10ml urine). Prevalence of liver enlargement is online with prevalence of infection (31% and 35%) despite that "real" prevalence is higher due to use of Kato

technique. This information together with rates of intense infection is extremely important as a baseline for any control program for monitoring reductions in morbidity. Gender difference in rates of infection, is indicating to a preservative water contact behavior similar to that found in Maitam valley and AlMahweet studies. Yet, unlike that suggested in Taiz.

The more closely the residence to the watercourse, (<1 kilometer), the more exposed are the children, nevertheless influenced by necessity or leisure. Age differences were not positively correlated to infection rate, unlike that of the Mahweet study, yet similar to Taiz study. A larger sample size would clarify the relationship.

The high rate (69%) of any soil-transmitted helminthes, permits for suggesting annual universal treatment as WHO recommends. Such a combined rate was not reported in any previous literature in the country. However, rates exceeding 50% were reported, solely, from Haja town (54% Trichuriasis), AlMahweet (61%) and Maitam (53%) both for Ascariasis. This information provides a sound basis for controlling morbidity due to soil-transmitted helminthiasis. Moreover, would be very supportive when utilized with that of Schistosomes for a combined control program, eg. Partnership for Child Development.

## References

1. World Health Organization. The Control of Schistosomiasis. Geneva: 1993.
2. MOPH. Year plan of health development 1996–2000. MOPH 1995; 29.
3. Hazza YA, Arfa'a F, Haggar M. Studies in Schistosomiasis in Taiz province. *Am J of Trop Med and Hyg* 1983; 32.
4. Nagi MA, Molan AL. Schistosomiasis among school children in Marib province of Republic of Yemen. *International Med J* 1992; 2312.
5. Al-Haddad AM, Assabri AM. Health impact of uncompleted sewerage project in Maitam valley, Ibb City – Republic of Yemen. *YMJ* 1998; 2: 68-76.
6. Azazy AA, Al-Dullaimi SS. Prevalence of intestinal parasites in pupils of an elementary school in Haja town, Yemen. *YMJ* 1999; 3: 66-68.
7. MOPH. Yemen Bilharzia Control Project. Annual Report. Yemen: MOPH; 1993; 3.
8. Schaap HB, Den Dulk MO, Polderman AM. Schistosomiasis in the Yemen Arab Republic, prevalence of *Schistosoma mansoni* and *S. hematobium* infection among school children in the central highlands and their relation to altitude. *Trop Geog Med* 1992; 44: 19-22.
9. Raja'a YA, Sulaiman SM, Al-Bakri M et al. Schistosomiasis among Schoolchildren in AlMahweet Governorate, Northwest of Yemen. A final report submitted to WHO: SG96/6.
10. Zain GH. Prevalence of intestinal parasitic infections among schoolchildren in Yemen [Dissertation] Khartoum: U of K; 1998; 73.
11. Central Statistics Organization. The results of the 3rd round (July-September) of the family budget survey 1998 (preliminary report). Yemen: Ministry of Planning and Development; 1999; 94.
12. World Health Organization. Urine filtration technique for *Schistosoma hematobium* infection. WHO mimeographed document PDP. Geneva: 1993; 83-84.
13. Teesadele CH, Amin MA. A simple thick smear technique for the diagnosis of *Schistosoma mansoni*. *Bull of the World Health Organization* 1976; 79: 703-705.
14. Farag FH. Intestinal parasitosis in the population of the Yemen Arab Republic. *Trop Geog Med* 1985; 37: 29-34.