Intestinal parasitosis and nutritional status in schoolchildren of Sahar district, Yemen

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الداء الطفيلي المعوي والوضع التغذوي لأطفال المدارس في منطقة صحار، في اليمن

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الخلاصة: تم تقدير كثافة ومعدل انتشار داء البلهارسيات، والطفيليات المنقولة بالتربة بين طلاب الصف الثالث في منطقة صحار، بمحافظ صعدة بالجمهورية العربية اليمنية بعد تنفيذ أربع جولات من حملات مكافحة داء البلهارسيات. وقد تم استخدام القياسات البشرية (الأنثروبومترية) لتقييم الوضع التغذوي وعلاقته بمعدلات العدوى. ووُجِدَ أن معدل انتشار العدوى بداء البلهارسيات كان منخفضاً حيث بلغ 5.6٪، منها 3.3٪ للبلهارسيا الدموية (المتوسط المنسبي 0.16 بيضة/10 مل بول) و2.3٪ للبلهارسيا المنسونية (0.18 بيضة/غ براز) كما وُجِد الصَّفَر الخراطيني (الأسكاريس) في 0.4٪ من الأطفال، في حين لم يُعْثَر على أي من سائر الديدان الطفيلية المنقولة بالتربة. وأوضحت النتائج وجود التقزُّم في 50.9٪ من الأطفال المفحوصين، والهزال في 4.5٪ منهم، ونقص الوزن في 48.7٪، ولو أنه لم يشاهد أي ترابُط إيجابي بين حدوث العدوى وبين مؤشِّرات الوضع التغذوي.

ABSTRACT The prevalence and intensity of schistosomiasis and soil-transmitted parasites was estimated among third-year schoolchildren of Sahar district, Sa'dah governorate, Yemen, after 4 schistosomiasis control campaigns. Anthropometric measurements were used to assess nutritional status in relation to infection rates. The prevalence of schistosomiasis infection was low at 5.6%: 3.3% for ***Schistosoma haematobium*** (geometric mean 0.16 eggs/10 mL urine) and 2.3% for ***S. mansoni*** (0.18 eggs/g faeces). ***Ascaris lumbricoides*** was found in 0.4% of the children while other soil-transmitted helminths were not found. Stunting was found in 50.9%, wasting in 4.5% and underweight in 48.7% of the children examined; however, no positive association was found between infection and nutritional status indicators.

La parasitose intestinale et l'état nutritionnel chez des écoliers du district de Sahar (Yémen)

RÉSUMÉ La prévalence et l'intensité de la schistosomiase et des géohelminthiases ont été estimées chez des écoliers de troisième année dans le district de Sahar, Gouvernorat de Sadah (Yémen) après quatre campagnes annuelles de lutte contre la schistosomiase. Des mesures anthropométriques ont été utilisées pour évaluer l'état nutritionnel en association avec les taux d'infection. Avec 5,6 %, la prévalence de l'infection par les schistosomes était faible : 3,3 % pour ***Schistosoma haematobium*** (moyenne géométrique de 0,16 œufs/10 mL d'urine) et 2,3 % pour ***S. mansoni*** (0,18 œufs/g de selles). ***Ascaris lumbricoides*** a été détecté chez 0,4 % des enfants tandis qu'on n'a pas trouvé d'autres géohelminthes. Un retard de croissance a été constaté chez 50,9 % des enfants examinés, une émaciation chez 4,5 % et un déficit pondéral chez 48,7 % ; aucune association positive n'a toutefois été trouvée entre l'infection et les indicateurs de l'état nutritionnel.

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Introduction

Schistosomiasis and soil-transmitted helminthiasis are important health problems in several regions of the world, causing considerable morbidity and mortality. After malaria, schistosomiasis is the second most common health disease in Yemen [*1*]. Both *Schistosoma haematobium* and *S. mansoni* infections are prevalent in 12 governorates of Yemen while only *S. haematobium* is reported from Hadhramaut and Amran Governorates [*2–10*] (Arfaa F, unpublished report, 1990). Zero transmission was reported in Hodeida and Aden Governorates. However, the situation is unknown in Al-Mahrah, Al-Baidha, Shabwah and Al-Jawf Governorates.

Sa'dah Governorate is an endemic area for both *S. haematobium* and *S. mansoni* infections. Both species were reported by Arfaa in 1982 in rural areas surrounding Sa'dah city. He found rates reaching 48% for *S. mansoni* and 8% for *S. haematobium* (Arfaa F, unpublished report, 1990). In a study in 1992 on 400 schoolchildren, rates of infection reaching 76% for *S. mansoni* and 49% for *S. haematobium* were recorded [*9*]. In response to this high endemicity, the Yemeni Ministry of Health established a schistosomiasis control unit to carry out school surveys, apply selective treatment for positive cases, deliver health education and apply molluscicide treatments to aquatic areas. Non-governmental organizations were encouraged to assist in the programme. Four successive campaigns, including targeted de-worming, selective treatment and focal molluscicide, have been implemented in the area over a 5-year period since 1999.

This cross-sectional study was carried to assess the current prevalence of schistosomiasis and soil-transmitted helminthiasis among schoolchildren after the implementation of these prevention activities and after expansion in the agricultural activities of the area. In addition, it aimed to estimate the prevalence of other intestinal parasites and the nutritional status of schoolchildren in Sahar district of Sa'dah Governorate.

Methods

Sahar district (690 km^2) is the rural area surrounding Sa'dah city. It lies in the remote north of Yemen, 250 km from the capital city, Sana'a. It is an agricultural area where mainly fruits and grains are cultivated using underground water and rainwater for irrigation. The population of the district is 113 797, with 21 393 schoolchildren enrolled in 90 schools according to the statistical yearbook 2002.

From the enrolment list of 78 primary schools in Sahar district, 15 schools were randomly selected using the random numbers list of *Epi-Info*, version 6. All children of the third-year class who were present on the day of the survey were included (mean number of pupils per class 37). Two teams of researchers visited 2 schools daily. The total number of children examined was 557.

Urine samples and stool samples were collected from children for analysis for *Schistosoma* spp., *Ascaris* spp. and other soil-transmitted parasite infections. Filtration and modified Kato–Katz techniques were adopted for urine and stool analysis [*11,12*]. Wet preparations were used to detect protozoa infection and hookworm eggs within 2 hours after collection. The number of children infected and the arithmetic and geometric means of egg counts were calculated (number of eggs per 10 mL of urine for *S. haematobium* and number of eggs

per 1g faeces for *S. mansoni* and *Ascaris lumbricoides*).

Two digital Seca scales measuring to the nearest 100 g and 2 stadiometers measuring to the nearest 1 mm were used to measure the weights and heights of the children. Nutritional status indicators were classified according to World Health Organization (WHO) definitions [*13*]. Underweight was defined as low weight-for-age, wasting was low weight-for-height and stunting was low height-for-age, i.e. below –2 standard deviations (SD) from the reference values.

The results were analysed using *Epi-Info*, version 6. Chi-squared and Fischer exact tests were used to compare the relationship between nutritional status and parasite infection. Anthropometrical measurements were processed using the *Epi-Nutri* program of *Epi-Info*.

Praziquantel (400 mg/kg) and albendazole (400 mg) were dispensed the following day, as appropriate, for all children testing positive for parasites.

Results

Of the total of 557 children investigated, 413 (74.1%) were boys and 144 (25.9%) girls. The mean (SD) age of all children was 10.1 (1.3) years: 10.1 (1.4) years for boys and 10.1 (1.3) years for girls. The range of ages was from 7 to 14 years. Urine samples were obtained from 548 pupils and stool samples from 540. Full sets of measurements, i.e. urine, stool and anthropometric, were available for 530 pupils.

Schistosome infection was identified in 30 children (5.6%), with light intensity of egg counts (Table 1). *S. haematobium* eggs were identified in 18 urine samples (3.3%), whereas *S. mansoni* eggs were identified in 12 stool samples (2.3%). Double infection with both species was not found.

Ova of *A. lumbricoides* were found in only 2 cases and no other soil-transmitted helminths were seen (Table 1). Tapeworm infections were found in 14 children: 13 *Hymenolepis nana* and 1 *Taenia saginata*.

Table 1 **Prevalence of intestinal parasites and intensity of schistosomiasis and ascariasis among schoolchildren of Sahar district, Yemen**

Infection	No. tested	Parasite positive No.	Parasite positive %	Mean egg count Arithmetic	Mean egg count Geometric
Parasite					
Schistosoma haematobium	539	18	3.3	4.92[a]	1.12[a]
Schistosoma mansoni	534	12	2.2	0.11[b]	1.12[b]
Ascaris lumbricoides	534	2	0.4	9.06[b]	1.02[b]
Entamoeba histolytica	534	34	6.4	–	–
Hymenolepis nana	534	13	2.4	–	–
Taenia saginata	534	1	0.2	–	–
Multiple infections					
1 parasite	50	74	13.5	–	–
2+ parasites	550	3	0.5	–	–

n = ***total number of children tested.***
[a]***Number of eggs/10 mL urine.***
[b]***Number of eggs/1 g faeces.***

The mean heights and weights of the children by age group are shown in Table 2. A high proportion of pupils were stunted (50.9%), wasted (4.5%) or underweight (48.7%) by WHO norms (Table 3). Comparing infected and non-infected children of the same cohort, the association of schistosome infection with underweight and wasting was not statistically significant, whereas there was a statistically significant inverse relationship with stunting (Table 3).

Discussion

Two species of schistosome infection were identified in the study population. The rate of infection found in this study was lower than rates reported previously from Sa'da (76.3% for *S. mansoni* and 49.0% for *S. haematobium*) [*9*]. This finding can be attributed to the 4 schistosomiasis control campaigns in the previous 5 years in the area. The campaigns comprised health education, case finding and treatment in schoolchildren and molluscicide. This implies that annual campaigns are effective in lowering the prevalence and transmission of the infection. Helminthiasis is also very low in the area. Therefore, the minimal package of activities to control for schistosomiasis and soil-transmitted helminthiasis which is recommended by WHO should be continued [*14*].

The anthropometrical measurements revealed that the children of Sahar district are shorter and lighter than WHO standards. Around half of the children were found to be stunted or underweight, which is better than

Table 2 **Anthropometric values of 534 schoolchildren in Sahar district, Yemen**

Age (years)	Sex	No.	Mean (SD) height (m)		Mean (SD) weight (kg)	
7	Boys	5	116.7	(10.8)	20.2	(3.0)
	Girls	2	118.6	(2.3)	21.1	(0.7)
8	Boys	35	120.5	(4.8)	20.9	(1.9)
	Girls	15	121.2	(7.7)	21.5	(3.1)
9	Boys	99	123.7	(5.7)	22.0	(2.3)
	Girls	29	124.0	(7.2)	22.3	(3.3)
10	Boys	122	127.3	(6.0)	22.3	(3.3)
	Girls	38	127.3	(5.6)	23.4	(3.3)
11	Boys	74	129.9	(6.6)	24.8	(3.3)
	Girls	41	133.3	(6.2)	26.6	(3.5)
12	Boys	40	135.1	(7.4)	26.8	(3.9)
	Girls	13	138.4	(7.5)	28.6	(3.8)
13	Boys	14	135.0	(7.6)	27.2	(4.5)
	Girls	1	138.7	(0.0)	33.7	(0.0)
14	Boys	5	147.9	(17.1)	35.3	(9.0)
	Girls	1	137.0	(0.0)	26.8	(0.0)

SD = standard deviation.

Table 3 **Nutritional status in relation to schistosome infection of schoolchildren in Sahar district, Yemen**

Undernutrition indicator[a]	Total	Schistosome positive		Schistosome negative		*P*-value
	No.	No.	%	No.	%	
Stunting[b]	272	9	31.0	259	52.0	$\chi^2 = 4.82$, ***P*** = 0.028
Wasting[c]	17	2	10.0	15	4.2	Fisher exact test, ***P*** = 0.228
Underweight[b]	260	9	31.0	247	49.9	$\chi^2 = 3.78$, ***P*** = 0.052

[a]***World Health Organization definitions.***
[b]***Total readings are 534.***
[c]***Total readings are 378.***

the results of the Al-Mahweet study which reached 59% for stunting [*15*]. This difference could be attributed to the relatively higher socioeconomic status of people in Sa'dah than Al-Mahweet. The prevalence of underweight was almost similar to that reported from Al-Mahweet. The association between schistosome infection and underweight and wasting was not statistically significant. The reason behind that could be the low intensity of infection. Moreover, in the present study wasting, which is an indicator of acute undernutrition, was high in the infected children: 2 out of 20 (10.0%) infected children versus 15 out of 357 (4.2%) in Al-Mahweet [*14*]. Examination of a larger number of infected children may be needed to confirm this relationship.

In conclusion, the low level of schistosomiasis infection in this study after 4 rounds of a parasite control campaign suggests that these control programmes, with a minimal package of control of schistosomiasis and soil-transmitted helminthiasis, are effective in reducing the rates of infection. No statistically positive association was found between infection and nutritional status.

Acknowledgements

This investigation received technical and financial support from the Joint EMRO/TDR Small Grants Scheme for Operational Research in Tropical and Other Communicable Diseases. The assistance of Benevolence International Foundation, the Director General of Health and Sheikh Assoraby are highly appreciated.

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