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Intestinal Colonization of Symptomatic and Asymptomatic Schoolchildren with *Blastocystis hominis*

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A study of single stool specimens was done to determine the prevalence of intestinal parasites among 1,000 primary school children. A questionnaire was completed by each child's parents. Specimens were examined by using wet-mount preparation, formaline-ether concentration, and Sheather's flotation technique. Trichrome and acid-fast stains were done. *Blastocystis hominis* was observed in 203 (20.3%) of the specimens examined, and 175 specimens contained this organism in the absence of other pathogenic parasites. Older children had fewer *B. hominis* infections (6 to 7 years old, 50% infection rate; 8 to 9 years, 27.5%; 10 to 12 years, 9.5%). The most common complaints reported by 75 children harboring the parasite were a mild recurrent diarrhea, abdominal pain, nausea, anorexia, and fatigue. Blastocystosis is quite common among schoolchildren. Contaminated drinking water is suspected to be the source of infection.

There has been a dramatic increase in the frequency of *Blastocystis hominis* infection in association with diarrhea and distinct clinical symptoms, especially in AIDS patients (2, 4). Data from Canada suggested that this parasite can cause acute and chronic gastroenteritis (5). Association of this parasite with epidemics of diarrhea in tropical and subtropical countries has been reported (1, 9, 10).

The present work studies the prevalence of intestinal parasites among primary school children (6 to 12 years old) in the Irbed area of northern Jordan. We have observed *B. hominis* in the stools of 203 children. Some have a variety of symptoms, depending on parasite numbers.

Stool specimens (1,000) were collected from September 1992 through March 1993 from primary school students of both sexes in the Irbed region of northern Jordan. The schools were selected from a list of schools that was provided by the Ministry of Education to represent public, private, and United Nations Refugee World Aid schools in Irbed city and public schools in two villages 7 km from Irbed. These 1,000 students were representative of the general school population in terms of age, sex, socioeconomic grouping, and place of residence.

A questionnaire was completed for each student by one of the parents. The questions covered age, sex, residency, previous parasitic infections, health status, activities, personal hygiene, number in the household, education and occupation of parents, source of drinking water, and presence of animals. This information was later correlated with laboratory findings.

Wet-mount preparations (one including iodine) were examined. Formaline-ether concentrations for the detection of helminth eggs and protozoan cysts, smears from Sheather's flotation, and modified acid-fast-stained smears were prepared to identify *Cryptosporidium* oocysts. Trichrome-stained slides were prepared to identify pathogenic protozoa.

Stool specimens containing the parasite were cultured on selective media for enteric bacteria (i.e., media selecting for *Salmonella* spp., *Shigella* spp., *Yersinia enterocolitica*, enterotoxigenic *Escherichia coli*, *Aeromonas* spp., and *Vibrio cholerae*). Standard techniques to identify the pathogenic bacteria isolated from the specimens were used.

Percentages and proportions were calculated for age groups, both sexes, and different school types. The Z score test was used for statistical comparison. A P value less than 0.05 was considered significant.

B. hominis trophozoites were observed in 203 (20.3%) of the 1,000 stool specimens examined. Of those children suspected to have blastocystosis, 28 harbored other pathogenic parasites such as *Giardia lamblia*, *Dientamoeba fragilis*, *Enterobius vermicularis*, and *Hymenolepis nana* eggs (Table 1). None had potentially pathogenic bacteria in association with the parasite. The remaining 175 children harboring *B. hominis* alone or with nonpathogenic protozoa were classed according to the questionnaire information as asymptomatic or symptomatic. Asymptomatic children (100) had soft stools with few *B. hominis* trophozoites (less than three per high-power field [HPF]). Symptomatic children (75) reported one or more of the following symptoms: mild diarrhea (three to four soft stools per day) (90%), abdominal pain (95%), nausea (87%), cramps (85%), anorexia (75%), fatigue (60%), bloating (50%), and alternating diarrhea and constipation (30%). Stool specimens of symptomatic children containing *B. hominis* alone were soft to diarrheic and contained more than five trophozoites per HPF.

B. hominis could be detected easily in the iodine wet mount without concentration. Two forms of trophozoites, granular and vacuolated, appeared in the same stool specimen, and in some specimens small and large trophozoites with a large central body and granular cytoplasm were seen.

The male-to-female ratio was 2:1. Infection rates of 50, 27.5, and 9.5% were observed in the 6- to 7-year, 8- to 9-year, and 10- to 12-year age groups, respectively. Differences in the infection rates were statistically significant ($Z = 6$, $P < 0.05$) (Table 2). There was no correlation between the cases and the presence of animals. More cases occurred in the rural areas where well water was used for drinking.

Reports of pathogenesis of *B. hominis* have been increasing (11). Very few workers have studied the pediatric population (6, 7). *B. hominis* was found in small numbers in stool specimens of healthy asymptomatic individuals (fewer than three trophozoites per HPF). In most of the symptomatic

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TABLE 1. *B. hominis* in association with other pathogenic parasites in both sexes

Parasite species	No. of children infected	
	Male	Female
B. hominis alone	105	70
B. hominis with:		
G. lamblia	12	2
G. lamblia plus *H. nana*	1	0
D. fragilis	1	0
E. vermicularis	4	1
H. nana eggs	1	1
Ascaris lumbricoides eggs	5	0
Total	129	74

children, the number of trophozoites exceeded five per HPF. In this study, we observed *B. hominis* in 203 of 1,000 (20.3%) specimens examined. The 28 specimens that contained other pathogens (*Entamoeba histolytica* and *G. lamblia*) were excluded. The remaining specimens were divided according to the information in the questionnaire into asymptomatic (100 of 175) and symptomatic (75 of 175) groups, with an infection rate of 43%. This rate is not considered high, since the schools included in this study were in Irbed city as well as in two villages with a low-socioeconomic-status population and poor sanitary conditions.

Infection rates of 46.6 and 66.1% in symptomatic patients were reported for other populations (3, 8). Symptoms were variable, but most of the children complained of recurrent diarrhea and one or more other symptoms, including nausea, cramps, abdominal pain, anorexia, bloating, and fatigue. Stools of these children were soft to diarrheic, but no mucus or blood was observed. The infection rate (50%) was higher in the younger age group (6 to 7 years). Association of infection with *G. lamblia* (Table 1) indicates that these two parasites might share the same mode of transmission. Clusters of cases were noticed in siblings going to the same school. More infections appeared in some schools and areas. These shared a common source of drinking water. Contaminated water could be the major source of infection. Children from villages have a higher infection rate (40%) than that observed for Irbed city (28%). The rural areas depend on untreated rainwater stored in wells rather than piped water as a source of drinking water, especially during the summer. The finding of *B. hominis* in stools from children drinking well water has been previously reported (7). A list of students infected with pathogens including *B. hominis* was sent to their schools, and treatment was recommended. Results of this study were consistent with findings in another study (6).

The decrease of the infection rate with age was observed in both studies and could be explained by development of immunity.

On the basis of our findings, we believe that the presence of *B. hominis* in the absence of other pathogens in stools of symptomatic children, especially when trophozoite numbers exceed five per HPF, is not incidental and should be reported and treated. The practice of considering *B. hominis* a nonpathogen should be discontinued. Physician awareness of the proven pathogenicity of this parasite, especially in children, is crucial for the treatment of symptomatic children.

TABLE 2. *B. hominis* in schoolchildren grouped by age and by sex

Type of school	No. of children infected with *B. hominis* alone in age group (yrs):				Total infected (%)
	6–7	8–9	10–12	>12	
Irbed city					
Public	18, 10[a]	9, 3	2, 4	2, 0	48 (28)
Private	1, 4	1, 0	0, 1	0, 0	7 (4)
UNRWA[b]	10, 7	11, 10	6, 5	0, 0	49 (28)
Village (public)	26, 12	16, 12	3, 2	0, 0	71 (40)
Total	55, 33	37, 25	11, 12	2, 0	175

[a] The first number refers to males, and the second number refers to females.
[b] United Nations Refugee World Aid.

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