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Blastocystis hominis among Immunocompromised and Immunocompetent Children in Alexandria, Egypt

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Abstract

Background: It is not clear whether *Blastocystis hominis* simply resides in the digestive tract without causing harm or it plays an important role in immunocompromised persons.

Aim of the work: Is to determine the frequency of *B. hominis* infection among immunocompetent and immunocompromised children and to correlate some sociodemographic, hygienic and symptomatic factors with *B. hominis* infection.

Methods: 101 children were enrolled in this study. They are categorized into 2 groups immunocompromised leukemic cases and immunocompetent (controls). Their stool specimens were examined microscopically by oil immersion lens using trichrome stain.

Results: *B. hominis* was detected in 54.5% of immunocompromised and 67.4% of immunocompetent ones. Children aged 5<10 showed the highest prevalence in both groups. Children whose fathers are farmers and of rural areas showed also highest prevalence of *B. hominis* Although there was positive association with good environmental parameters in immunocompetents, there was negative association in immunocompromised. Such data deserve highlighted comments.

Conclusion: The data suggest that the isolation of *B. hominis* doesn't necessitate treatment even in immunocompromised patients since its pathogenicity is debatable. Unless there is more convincing, evidence of pathogenicity efforts should be saved for remedying serious illness of vulnerable groups.

Keywords: *Blastocystis hominis,* Immunocompromised, Leukemia, Trichrome

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Introduction

Blastocystis hominis (B. hominis) is one of the most common parasites isolated from stool specimens in symptomatic and asymptomatic persons. It is transmitted by oro-fecal route. Such unicellular protozoan has three major forms; vacuolar, granular, and amoeboid. The vacuolated form (10-30 µm) was the most frequently detected in fecal specimens. It was considered as harmless yeast, but it is now getting acceptance as an agent of human intestinal disease especially under immunosuppressive conditions [1-3]. Clinical features of illness that have been attributed to **B.** *hominis* are variable ranging from mild diarrhoea to acute gastroenteritis [4,5].

B. *hominis* **is cosmopolitan in distribution with omnipresence** [6]. It is also the most frequently isolated parasite in epidemiological surveys [7]. Prevalence varies world widely and even within various communities of the same country. Developing countries, as usual, have higher prevalences of the parasite (30%-50%) than developed countries (1.5%-10%) this has been attributed to poor hygiene, exposure to animals, and consumption of contaminated food or water [8].

Infection appears to be common in immunocompromised patients. Incidence of *B. hominis* among them was reported between 12.2% and 23.3% [9]. It was reported in 14.1% of children with leukemia and in 5.7% of controls in a case control study to detect the intestinal parasitic infection in Tehran, Iran. Leukemia is the most prevalent malignancy in children below 15 years. It occurs due to malignant deformity of stem cells. A large number of leukemic children may become victims of infections that are considered one of the lethal causes in leukemia [10].

Aim of the Work

Aim of the work is to determine the frequency of *B. hominis* infection among immunocompetent and immunocompromised children and to correlate some sociodemographic, hygienic and symptomatic factors with *B. hominis* infection.

Materials and Methods

Study setting

The sample was collected from Alexandria University children's Hospital.

Study design and sample

It is a case series study, 55 children having acute lymphocytic leukemia were enrolled in the study, and they were aged 2-14 years. Forty-six of immunocompetent children were chosen as matched by age and sex to represent the control group; they included the siblings of leukemic cases and others from different departments who had no immunodeficient disorders. Consent was taken from the mothers of the target children.

Data collection

An interviewing questionnaire was designed to collect data from the hospital's reports and mothers of target children, it included the following data: a) Demographic data, such as residence, occupation of their fathers, housing conditions regarding crowding index, source of water supply etc. In addition, it included data about personal hygiene and habits such as hand washing, nail trimming etc. b) Hospital's report included GIT manifestations as vomiting, colic, diarrhoea, and general manifestations as loss of weight, loss of appetite and jaundice.

Microscopical examination

It included examination of stool specimens. A portion of the specimen was used to prepare thin smears for staining by trichrome stain [11,12].

Statistical analysis [13]

Data were coded, tabulated, and analyzed using computer program SPSS version 15. Chi-square (X^2) test was used for testing the association between categorical variables. In case of small frequency, [Fisher Exact test (FEt) in a 2 ×2 tables] was used instead. Odds ratio (OR) was used to determine the risk factors affecting parasitic infections. The associated 95% confidence interval was also calculated. OR was considered statistically significant if the confidence don't include 1.00

Results

It was found that about 67.4% of controls had *B. hominis* infection and shown only in 54.5% of the immunocompromised ones **(Table 1)**.

Infection was higher among control (71.4%) than immunocompromised individuals were (50%) in the age group <5 years.

It was found that both male and female of control group had higher percentage of infection (60.7% and 77.8% respectively) than immunocompromised children (57.9 and 47.1% in order).

As regard father occupation, it was observed that the percentage of infection was equaled among immunocompromised and controls in children whose fathers were professional. While statistically, insignificant higher percentages were observed among controls than leukemic cases in all other groups [FEp>0.05].

Regarding area of residence, it was found that either in rural or urban areas the percentage of infection were higher among controls (71.4% and 65.6% respectively) than leukemic cases (51.4% and 60.0% respectively) **(Table 2 and Figure 1)**.

Studying the relevant symptoms in both immunocompromised and immunocompetent groups to declare the association between *B. hominis* and such symptoms; about 90% of the infected controls were asymptomatic *versus* 34.5% of the infected immunocompromised group. The difference was statistically significant **(Table 3 and Figure 2)**.

All the studied socioeconomic parameters were associated with higher percentages of infection among controls than cases of leukemia. Use of private tap water was associated with *B. hominis* infection in 55.6% of cases and 65.9% of controls. Same pattern was observed among those who used public tap water in whom percentage of infection were 50% among leukemic cases versus 80% among controls.

As regard storage of water, also higher percentages of infection were noticed among controls than cases whether they did not store water or stored water in plastic container or zir.

Regarding use of latrine, it was observed that either they use private or shared latrines, statistically insignificant higher percentages of infection were recorded among controls (66.7% and 100% respectively) than leukemic cases (56% and 40% respectively).

Table 1 Percentage of *Blastocystis hominis* infection detected among leukemic patients and control.

	Cases (n= 55)		Control (n= 46)	
	No.	%	No.	%
+ve	30	54.5	31	67.4 %
-ve	25	45.5	15	32.6 %
χ^2 (p)	1.728 (0.223)			

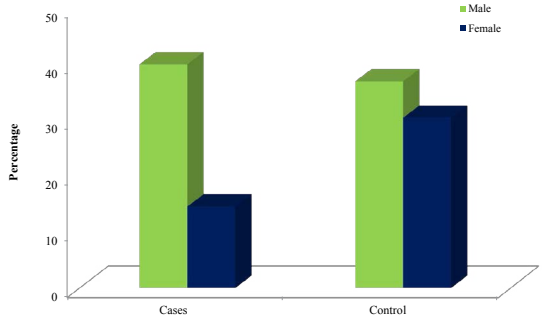

Figure 1 Distribution of *Blastocystis hominis* among examined children according to gender.

Table 2 Distribution of *Blastocystis hominis* among examined children according to socio demographic characteristics.

Socio demographic characteristics	Cases (n= 55)			Control (n= 46)			χ^2 (p)
	Total examined No.	Total infected No.	%	Total examined No.	Total infected No.	%	
Age in years							
<5	14	7	12.7	7	5	10.9	2.608 (0.271)
5 - <10	27	17	30.9	19	14	30.4	
10 - <15	14	6	10.9	20	12	26.1	
Gender							
Male	38	22	40	28	17	36.95	2.262 (0.133)
Female	17	8	14.5	18	14	30.4	
Father occupation							
Professional	30	20	36.4	21	14	30.4	MCp= 0.261
Employee	3	1	1.8	10	5	1.9	
Farmer	15	5	9.1	9	7	15.2	
Not work or died	7	4	7.3	6	5	1.9	
Are of residence							
Rural	35	18	32.7	14	10	21.7	4.725* (0.030)
Urban	20	12	21.8	32	21	45.7	

χ^2: *Chi square* test; **FEp:** p value for Fisher Exact test; **MCp:** p for Monte Carlo test

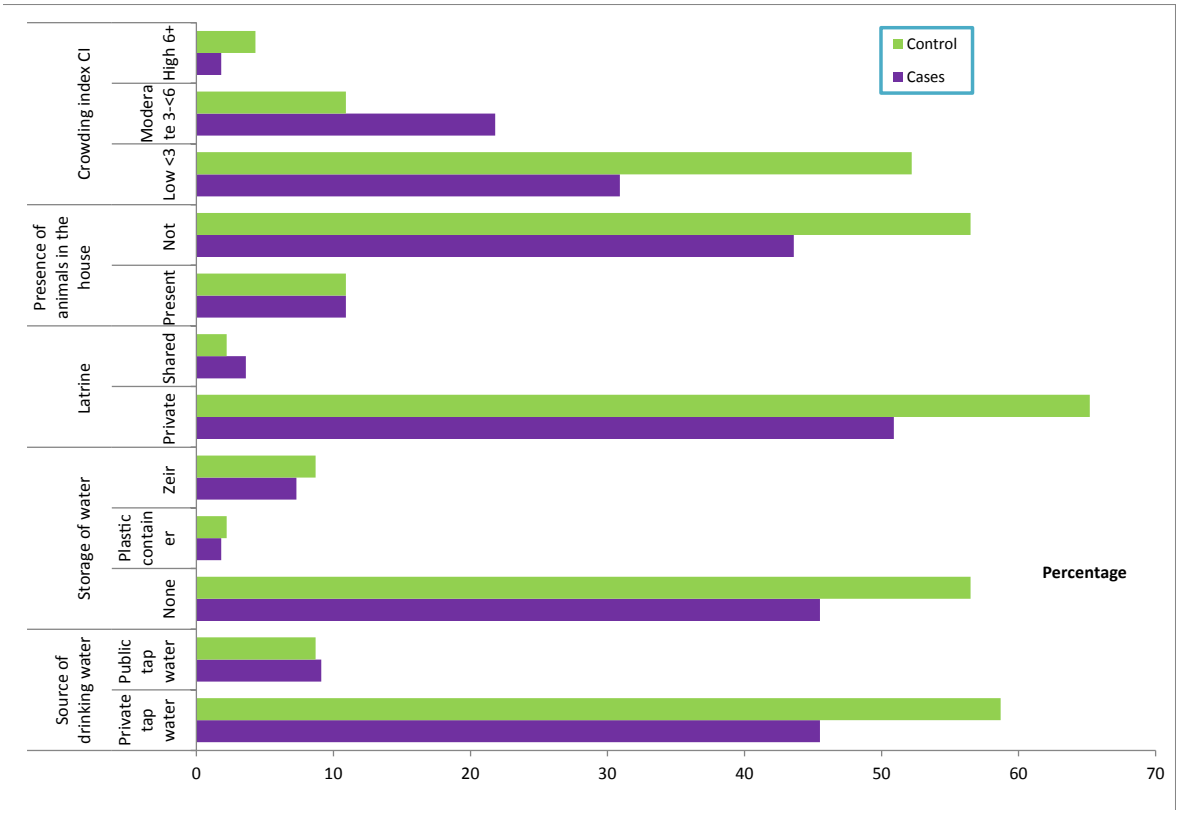

Figure 2 Distribution of Blastocystis hominis among immuno compromised and immuno competent according to environmental parameters.

Percentages of infection were higher among controls than immunocompromised whether animals were present or not.

All groups of crowding levels showed higher percentage of infection among controls than immunocompromised cases. At the same time, the highest percentage of infection was observed among leukemic cases (66.7%) and controls (71.41%) of moderate crowding index level than low or high levels. However, no statistical significant differences were detected **(Figure 1)**.

There is an astonishing peculiar phenomenon shown in the association between personal hygiene and distribution of infection among examined immunocompetent children. As the percentage of infection increased with almost all parameters

Table 3 Distribution of *Blastocystis hominis* among immuno compromised and immuno competent according to environmental parameters.

Environmental parameters	Cases (n= 55)			Control (n= 46)			FEp
	Total examined No.	Total infected No.	%	Total examined No.	Total infected No.	%	
Source of drinking water							
Private tap water	45	25	45.5	41	27	58.7	0.731
Public tap water	10	5	9.1	5	4	8.7	
Storage of water							
None	45	25	45.5	40	26	56.5	1.000
Plastic container	3	1	1.8	1	1	2.2	
Zir	7	4	7.3	5	4	8.7	
Latrine							
Private	50	28	50.9	45	30	65.2	0.612
Shared	5	2	3.6	1	1	2.2	
Presence of animals in the house							
Present	13	6	10.9	7	5	10.9	0.749
Not	42	24	43.6	39	26	56.5	
Crowding index CI							
Low	34	17	30.9	36	24	52.2	0.082
Moderate	18	12	21.8	7	5	10.9	
High	3	1	1.8	3	2	4.3	

Low CI: <3 persons/room; Moderate CI: 3<6 persons/room; High CI: ≥6 persons/room; FEp: p value for Fisher Exact test; *: Statistically significant at $p \leq 0.05$.

where hygienic manner was applied. Whereas statistically insignificant lower percentage of infection was only seen among those of immunocompetent group who did nail trimming (66.7%) than those who did not (68.0%)

On the other hand higher percentages of infection among immunocompromised children were noticed when they do not follow hygienic maneuvers, eat food outdoors, play in the street and do not trim their nails. The difference in the two former conditions was statistically significant. (OR=5.45, 12.46). The reverse was obtained when they wash their hands before eating and after defecation and when they wash vegetables **(Table 4)**.

Table 5 shows that there is no significant association between complaints and infection with *B. hominis.*

Discussion

B. hominis was the most common parasite isolated from stool samples [14,15]. Higher prevalence among immunocomporomised is questionable. According to the literature, developing countries have higher prevalence of the parasite (30%-50%) than developed countries (1.5%-10%) [16-18]. In the present study 67% were recorded among controls and 55% among leukemic cases. The lower percentages among immunocompromised could be attributed to pharmacologic effect of cytotoxic drugs upon the parasite [10].

Leukemic children under treatment may be less active, are losing appetite, and have more care from their mothers so they are less exposed to infection than normally active ones.

Similar information was documented among immunocompetent (71.8% *B. hominis* infection) by a laboratory in Ethiopia [19]. So that being immunocompromised is not a cause of parasitic infection.

In 2007, Ozcakir et al. [1] also reported that *B. hominis incidence* in the patient group was lower (11.2%) than healthy volunteers (13%), using trichrome staining technique.

Our study showed that the highest prevalence of *B. hominis* infection among both immunocompromised and immunocompetent children aged 5<10 years old than younger and older groups.

These results were in agreement with Nascimento and Moitinho [20], against that reported by Yaicharoen et al. [21] whose study showed no definite pattern of the relationships between age and infection rate, attributed it to multifactorial etiology.

As regard father occupation the highest prevalence was among immunocompetent children, only whose fathers were farmers. This could be explained by being residents in hospital for leukemia therapy. The same happened regarding area of residence that the highest prevalence was in immunocompetent children of rural area.

Statistical analysis showed no significant difference between male and female. However, Hegazy et al. [22] reported that the prevalence of *B. hominis* in males was higher than females (60.5% versus 39.5%)

B. hominis a parasite with doubtful pathogenicity in an immunocompetent host. Opportunistic subtype could cause symptoms in immunocompromised cases.

In the present study, about 90% of infected immunocompetent children were asymptomatic. This could be explained by recent data that demonstrated the pathogenicity of a parasite is subtype-dependent. Such subtypes are different pathogenic and non-pathogenic strains [23].

Other authors suggested co-occurrence of *B. hominis* infection with other pathogenic parasites might confuse its pathogenic potential [24].

Table 4 Distribution of *Blastocystis hominis* infection among immuno compromised and immune competent in relation to personal habits and hygiene.

Personal habits and hygiene	Cases (n= 55)			Control (n= 46)			χ^2 (p)
	Total examined No.	Total infected No.	%	Total examined No.	Total infected No.	%	
Eating food outdoors							
No	29	13	23.6	35	25	45.5	9.036* (0.003)
Yes	26	17	30.9	11	6	10.9	
Washing hands before eating							
No	45	24	43.6	28	17	30.9	4.380* (0.036)
Yes	10	6	10.9	18	14	25.5	
Washing hands after defecation							
No	44	23	41.8	26	16	29.1	4.150* (0.042)
Yes	11	7	12.7	20	15	27.3	
Washing vegetables before eating							
No	27	14	25.5	17	10	18.2	1.326 (0.249)
Yes	28	16	29.1	29	21	38.2	
Play in the street							
No	10	3	5.5	25	18	32.7	FEp < 0.001*
Yes	45	27	49.1	21	13	23.6	
Nail trimming							
No	22	14	25.5	25	17	30.9	0.407 (0.523)
Yes	33	16	29.1	21	14	25.5	

χ^2: *Chi square* test; FEp: p value for Fisher Exact test; *: Statistically significant at $p \leq 0.05$.

The association of clinical symptoms and *B. hominis* even in immunocompromised children could be ignored as some authors documented that all patients improved without receiving any specific therapy [25].

On the contrary, some authors recommended proper diagnosis and management of the disease with emphasis on its pathogenic potential [19].

In this research we found patients with immunocompromised system and ready for infections had lower infection level than immunocompetent ones.

Although there was positive association between *B. hominis* infection and bad environmental parameters in immunocompetent children, immunocompromised children had negative association.

The same trend was seen, regarding hygienic parameters in both studied groups, where good hygienic manners were positively associated with *B. hominis* infection.

This is in agreement with others who found high prevalence among preschool children residing in an urban sitting and having good access to sanitary services [3,16].

In addition, high infection role of *B. hominis* is directly proportional to hygienic and sanitary conditions of the studied population.

Kassem et al. [26] also stated that high prevalence of *B. hominis* infection was in moderate socioeconomic status and no significant effect of crowding index.

However playing in the street and eating food outdoors were risk factors for *B. hominis* infection among immunocompromised children where 95% CI=(2.72-65.33) and (1.52-20.39) respectively.

This is in accordance with others attributed high prevalence of *B. hominis* infection to living in poor hygienic conditioned environment [27].

Considering associated manifestations, some authors didn't consider its presence in stool of immunocompromised or immunocompetent to be any more significant than that of *Entamoeba coli* or *E. dispar* [28]. Similar information was reported by the present study.

Conclusion

The data suggest that the isolation of *B. hominis* does not necessitate treatment even in immunocompromised patients since its pathogenicity is debatable. Unless there is more convincing evidence of pathogenicity efforts should be saved for remedying serious illness of vulnerable groups. Further studies on molecular basis are recommended.

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Table 5 Comparison between negative and positive *Blastocystis hominis* according to history of complaints.

	Blastocystis hominis				Total	
	- ve		+ ve			
	No	%	No	%	No	%
Pain						
No	31	72.1	43	74.1	74	73.3
Yes	12	27.9	15	25.9	27	26.7
χ^2 (p)	0.053 (0.818)					
Fever						
No	34	79.1	49	84.5	83	82.2
Yes	9	20.9	9	15.5	18	17.8
χ^2 (p)	0.494 (0.482)					
Tirdness weakness						
No	43	100.0	54	93.1	97	96.0
Yes	0	0.0	4	6.9	4	4.0
FEp	0.134					
Difficulty in breathing						
No	41	95.3	55	94.8	96	95.0
Yes	2	4.7	3	5.2	5	5.0
FEp	1.000					
Difficulty in swallowing						
No	43	100.0	55	94.8	98	97.0
Yes	0	0.0	3	5.2	3	3.0
FEp	0.259					
Loss of appetite						
No	39	90.7	47	81.0	86	85.1
Yes	4	9.3	11	19.0	15	14.9
FEp	0.259					
Loss of weight						
No	40	93.0	48	82.8	88	87.1
Yes	3	7.0	10	17.2	13	12.9
FEp	0.147					
Jaundice						
No	40	93.0	56	96.6	96	95.0
Yes	3	7.0	2	3.4	5	5.0
FEp	0.648					

χ^2: *Chi square* test; FEp: p value for Fisher Exact test.

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