

***Cryptosporidiosis* and other intestinal parasitic infections in patients with chronic diarrhea**

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ABSTRACT

Objective: To consider the relationship of the parasitic infections including *cryptosporidium* with chronic diarrhea. Also the effect of chronic disease as pulmonary tuberculosis (TB) and nosocomial infection on the occurrence rate of parasites in cases of chronic diarrhea.

Methods: Stool samples were collected from 205 patients in teaching, general, child and maternity hospitals in Basrah, Iraq, suffering from chronic diarrhea during 2000. Out of these patients, there were 40 patients with pulmonary TB and 50 inpatients with nosocomial infection. Also 175 apparently healthy individuals who have no episodes of diarrhea for at least 2-months were served as a control group. Direct smear method and then formalin ether sedimentation method were carried out for stool samples to detect intestinal parasites. Fecal smears were prepared from the sediment and stained by the modified Ziehl Neelsen stain for the recovery of red pink oocysts of *cryptosporidium*.

Results: Out of the 205 examined patients, *cryptosporidium* oocysts were found to be excreted in 20 (9.7%) patients in comparing to 1.1% of the control group. The difference is statistically significant. There were 109 (53.2%) patients found to be positive for intestinal parasitic infections compared to 26 (14.8%) of the control group. The difference is also statistically significant. Out of the 40 TB patients, 2 (5%) were found to excrete *cryptosporidium* oocysts and also 27 (67.3%) were positive for intestinal parasites. In addition, there were 4 (8%) excreting *cryptosporidium* oocysts and 23 (46%) infecting by intestinal parasites among the in patients with nosocomial infection.

Conclusion: Both acid and non-acid fast parasites should be considered in the differential diagnosis of undiagnosed chronic diarrhea especially among patients with pulmonary TB or nosocomial infection.

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C*ryptosporidiosis* is an emerging, zoonotic disease of human intestinal tract. It is associated with self limited, mild to severe diarrhea, lasting for several days in immunocompetent humans. While it causes prolonged, life threatening, cholera like diarrhea often becomes irreversible in immunocompromised hosts.¹ Food contaminated with feces from infected persons or animals has always been considered as a risk factor.² Spread from person to person has been implicated in many outbreaks in the world.¹ Direct contact with feces while caring for hospitalized infected persons, nosocomial infections involving both medical care staff and other neighboring patients could takes

place.^{3,4} *Cryptosporidium* has been considered as an etiology agent of persistent diarrhea, with significant morbidity and mortality in those with chronic diseases.^{3,5} Intestinal parasitic infections are relatively common in the developing countries including Iraq.⁶ Therefore, this study is designed to consider the relationship of the parasitic infections including *cryptosporidium* (acid-fast protozoa) with chronic diarrhea. In addition, the effect of chronic disease as pulmonary tuberculosis (TB) and nosocomial infection on the occurrence rate of parasites in cases of chronic diarrhea has been conducted.

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Methods. The study comprised of 205 patients suffering from diarrhea for at least 2-weeks. Their ages ranged from 2-months to 65-years with mean age of 19.44 +13.98 years. There were 115 males and 90 females. Those were presented either as out patients or inpatients to teaching, general, child and maternity hospitals in Basrah, Iraq during 2000. Out of these patients, there were 40 patients of pulmonary TB and 50 in patients for various conditions of illness in addition to diarrhea (nosocomial person to person contact). The first group included 23 males and 17 females. Their ages ranged from 14-60-years with a mean of 35.5 + 15.85. Periodically, they were receiving their anti-TB treatment since at least 6-months ago from the TB centre in Basrah. The second group included 24 males and 26 females, aged from 2-months to 65-years, with a mean of 12.85 + 18.34 years. In addition, 175 apparently healthy individuals (105 males and 70 females) who have no episodes of diarrhea for at least 2-months were studied. Their ages ranged from 2-months to 56-years with a mean of 23.7 + 20.1-years. Direct smear method and then formalin-ether sedimentation concentration test⁷ were carried out for all stool samples to detect the diagnostic stages of the non-acid fast parasites. Fecal smears were prepared from the sediment and stained by the modified Ziehl-Neelsen method⁷ for the detection of acid-fast parasites (*cryptosporidium*, *cyclospora* and *Isospora*). The Standard Normal Deviate (SND) test or Chi (X^2) was used as a test of significance. Differences were recorded as significant whenever the probability (P) was less than 0.05. The odds ratio and 95% confidence intervals of the odds ratio were estimated for a single $2X^2$ table (to determine whether there was a crude disease exposure association).

Results. Out of the 205 examined patients with chronic diarrhea, *cryptosporidium* oocysts were found to be excreted in 20 (9.7%) patients (Table 1). The *cryptosporidium* infection rate among the control group was 1.1% (Table 1). The difference is statistically significant (SND=3.42; $P<0.01$). There were 109 (53.2%) patients found to be positive for intestinal parasitic infections (including *cryptosporidium*) compared to 26 (14.8%) of the control group (Table 2). Statistically, the relationship is significant (SND=6.75; $P<0.01$). Sex distribution was 63 (30.7%) males and 46 (22.5%) females among patients with chronic diarrhea (Table 2). It is interesting to diagnose a first 2 cases of *cyclospora* in the country. The most common parasites other than *cryptosporidium* were *Entamoeba histolytica* (23.8%), *Giardia lamblia* (*G.lamblia*) (13.8%) and *Blastocystis hominis* (28.4%). Out of the 40 TB patients, 2 (5%) were found to excrete

Table 1 - Distribution of positive *cryptosporidium* infection among patients with chronic diarrhea and apparently healthy individuals in relation to age.

Age (years)	Chronic diarrhoic patients		Apparently healthy individuals	
	N examined	N (%) infected	N examined	N (%) infected
<6	119	13 (10.9)	60	1 (1.7)
6-15	16	2 (12.5)	20	0
16-25	18	1 (5.5)	20	0
26-35	17	3 (17.6)	17	0
36-45	11	0	25	0
45-55	10	0	18	0
56-65	14	1 (7.1)	15	1 (1.7)
Total	205	20 (9.7)	175	2 (1.1)
SND=3.42, $P<0.01$				

cryptosporidium oocysts and also 27 (67.3%) were found to be positive for intestinal parasites. In addition, there were 4 (8%) excreting *cryptosporidium* oocysts and 23 (46%) infecting by intestinal parasites among the in patients with nosocomial infection. Prevalence of *cryptosporidiosis* in relation to residency and socioeconomic status is statistically insignificant. Even the infection was higher in commercial available water (22.7%) than tap water (8.2%) among patients with chronic diarrhea but statistically is insignificant ($X^2=2.2917$; P 0.05; $OD=2.8$). The clinical features of *cryptosporidiosis* in addition to chronic diarrhea (100%) were abdominal cramping (90%), weight loss (80%), nausea (75%), lassitude (50%), fever (50%) and headache (55%).

Discussion. Since the majority of diarrheal diseases occur in childhood,³ this group was involved mainly of less than 6-years-old which comprise of 58% of the total patients. Thus, the high rate of *cryptosporidiosis* (10.9%) was found in this age group. Although, there was no significant difference between all age groups, 26-35-years-old had the highest rate of *cryptosporidiosis* (17.6%), but this is possibly due to the examined small samples. *Cryptosporidium* and other intestinal parasites can be considered as a main cause of morbidity and mortality and may be life threatening to those with chronic diarrhea. Therefore, acid and non-acid fast parasites should be considered in the differential diagnosis of undiagnosed chronic diarrhea. It is interesting to record the first 2 cases of *cyclosporiasis* in Iraq and the Mediterranean region. Thus, the combination of formalin ether sedimentation and modified acid-fast stain methods has been regarded with high sensitivity and specificity.³ Even this rate of parasitic infections is

Table 2 - Distribution of parasitic infections including acid-fast protozoa among chronic diarrhoeic and apparently healthy groups in relation to sex.

Parasites	Chronic diarrhoeic patients N=205			Apparently healthy individuals N=175		
	Male	Female	Total	Male	Female	Total
Single						
<i>Cryptosporidium</i>	15	3	18	-	-	-
<i>Cyclospora</i>	2	-	2	-	-	-
<i>B.hominis</i>	18	13	31	9	2	11
<i>G.lambli</i>	8	7	15	3	-	3
<i>E.histolytica</i>	13	13	26	1	1	2
<i>E.vermicularis</i>	3	4	7	2	4	6
<i>T.trichiura</i>	1	-	1	-	-	-
<i>A.lumbricoides</i>	1	-	1	-	-	-
<i>H.nana</i>	-	1	1	-	-	-
Mixed						
<i>Cryptosporidium</i> and <i>T.trichiura</i>	-	1	1	-	-	-
<i>Cryptosporidium</i> and <i>B.hominis</i>	-	1	1	1	1	2
<i>E.histolytica</i> and <i>B. hominis</i>	2	-	2	-	-	-
<i>B.hominis</i> and <i>G.lambli</i>	-	1	1	1	-	1
<i>B.hominis</i> and <i>E.vermicularis</i>	-	1	1	-	1	1
<i>T.trichiura</i> and <i>G.lambli</i>	-	1	1	-	-	-
Total	63	46	109	17	9	26
	(30.7)	(22.5)	(53.2)	(5.1)	(9.7)	(14.8)
SND - 6.75, P<0.01						
<i>B</i> - blastocystis, <i>G</i> - giardia, <i>E.histolytica</i> - entamoeba, <i>E.vermicularis</i> - enterobius, <i>T</i> - trichuris, <i>A</i> - ascaris, <i>H</i> - hymenolepis						

of significant level from the public health point of view, it would be higher if more than a single stool sample from each individual was examined due to the intermittent shedding of acid-fast oocysts⁸ and *G.lambli*.⁹ The aggravating effects of chronic disease as TB or nosocomial infection on the rates of intestinal parasitic (including *cryptosporidium*) infections were also investigated in this study. There were significant differences in relation to either the control group or to the patients with just chronic diarrhea. Even there was no comparable published study on TB patients, the possible mechanism which contribute to the increased vulnerability to parasitic infections is the alteration of the microenvironment of the gut by the anti TB therapy. Nosocomial infection is considered as an important factor, which has a role in the prevalence of intestinal parasites including *cryptosporidium* in patients with chronic diarrhea. Epidemiologically, *cryptosporidium* is transmitted from person to person in a hospital environment was indicated by positive serological tests^{4,10} or positive fecal examination.^{11,12} Interestingly, the major risk factor is the drinking water which could be considered as a source of infection.¹³ The commercial water usually stored in barrels and containers for few days before consumption. This might lead to continuous exposure to contamination with oocysts. These results showed that abdominal cramping, vomiting, watery diarrhea, belching, weight loss and headache were the most clinical features for *cryptosporidiosis*.^{2,14} Macroscopic examination of

stool samples reveals that, loose watery appearance is a characteristic feature for *cryptosporidiosis*.¹⁵

In conclusion, both acid and non-acid fast parasites should be considered in the differential diagnosis of undiagnosed chronic diarrhea especially among patients with history of chronic disease as TB or nosocomial infection.

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