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Transmission of *Dientamoeba fragilis*: Evaluation of the role of *Enterobius vermicularis*

Nogay Girginkardeşler*, Özgür Kurt, Ali A. Kilimcioğlu, Ülgen Z. Ok

Celal Bayar University, School of Medicine, Department of Parasitology, Manisa 45010, Turkey

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Abstract

The role of *Enterobius vermicularis* in the transmission of *Dientamoeba fragilis* has been evaluated in two groups of patients admitted to the Parasitology Laboratory of Celal Bayar University: one group with *E. vermicularis* infection ($n=187$, Pinworm Group), and the other with *D. fragilis* infection ($n=126$, Dientamoeba Group). The presence of the other parasite, pinworm or *Dientamoeba*, was investigated with the microscopic examination of cellophane tape and stool samples for three consecutive days. In the Pinworm Group, 9.6% of the patients were found to be coinfected with *D. fragilis*, while 25.4% of the patients in the Dientamoeba Group were found to be coinfected with pinworms.

The coincidence rates of *D. fragilis* and *E. vermicularis*, higher than the prevalence of each parasite in similar populations, suggest a common relation between these two parasites, possibly in entering the human body. *E. vermicularis* infection was found to be significantly more common in younger children ($p<0.001$), indicating that younger children may also be at higher risk for *D. fragilis* infection. These findings also raise the question of whether the unrelated symptoms of the pinworm infected patients such as abdominal pain and diarrhea may actually be due to overlooked *Dientamoeba* infections.

Keywords: *Dientamoeba fragilis*; *Enterobius vermicularis*; Transmission

1. Introduction

Dientamoeba fragilis, a frequently seen but rarely diagnosed protozoon, is regarded as a neglected cause of diarrhea [1]. Since the first description by Jepps and Dobell in 1918, many aspects of *D. fragilis* have been left unresolved. This interesting non-flagellated flagellate is reported to be more common than *Giardia lamblia* in institutions where permanent stained smears are examined by experienced staff as a routine procedure [1,2]. Today, clinical symptoms such as diarrhea, abdominal pain, nausea, anorexia and flatulence, which usually disappear with the elimination of the parasite, are reported to be associated with *D. fragilis* [3–6]. In contrast to other pathogenic colon-dwelling protozoa it has no known cyst stage, which raises questions about its mode of transmission to humans via the fecal-oral route [7]. Dobell was the first to suggest that *D. fragilis* may be transmitted in the eggs of a nematode, such as *Ascaris* or *Trichuris* [8]. Although same findings have not been confirmed by other investigators, Sukanahaketu [9] reported some structures resembling *D. fragilis*, inside the ova of *Ascaris lumbricoides* in patients coinfected with *D. fragilis*, while same structures could not be found in patients infected with *A. lumbricoides* alone. Burrows and Swerdlow reported the presence of small, ameboid, uninucleate organisms resembling *D. fragilis* inside the pinworms recovered from *Dientamoeba*-harboring appendices, but the images published were not clearly visible [10].

Several studies have reported higher coinfection rates of *D. fragilis* and *E. vermicularis* than expected, and suggested that *E. vermicularis* may act as a vector in the transmission of *D. fragilis* [3,10–14]. However, there are also some studies that involved the application of cellophane tape test for the identification of pinworms which reported no correlation between them, but it is not possible to rule out spontaneous remission of the pinworm in the presence of *D. fragilis* infection [15,16].

To assess the role of *E. vermicularis* in the transmission of *D. fragilis*, a prospective study was conducted between January

* Corresponding author. Tel.: +90 236 234 90 70–304; fax: +90 236 237 02 13.
E-mail address: nogayg@yahoo.com (N. Girginkardeşler).

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2003 and 2006 with the patients who were admitted to the Parasitology Laboratory of Celal Bayar University Medical School Hospital and were found in routine parasitological examinations to harbour *D. fragilis* or *E. vermicularis*.

2. Materials and methods

A total of 313 patients who managed to deliver both cellophane tape and fresh stool samples (discharged in the preceding 30 min) to the laboratory on three consecutive days were included in the study. Patients who failed to deliver one or more cellophane tapes or stool samples, as well as those who had received recent anti-parasitic treatment, were excluded. To rule out the possibility of a spontaneous remission of the pinworm in *D. fragilis*-positive individuals, patients were simultaneously assigned in two different groups according to their initial diagnosis: Pinworm Group (PG, $n=187$) and Dientamoeba Group (DG, $n=126$). Cases found to be infected with both parasites in the first examination were randomly assigned to the groups. All patients were referred from both in-and outpatient departments of the hospital, mostly with complaints related to the gastrointestinal tract. Their cellophane tape samples were obtained on three consecutive mornings together with their fresh stool samples, which were then examined with wet-mount, formalin ethyl acetate concentration and trichrome staining, as described [17]. All cases of *E. vermicularis* and *D. fragilis* were diagnosed with the examination of cellophane tape samples and trichrome-stained smears, respectively.

The statistical analyses of the data were performed with SPSS 11.0®, using the one-tailed significance test and chi-square test.

3. Results

The ages of the patients in DG ranged between 3 and 65 years (mean 9.70±9.93), and 57.1% were female. Almost 95% of the patients in this group were under 18 years. Examination of cellophane tape and stool samples on three consecutive days revealed a coinfection rate of 25.4% with *E. vermicularis* in DG. No significant differences were identified between the age and sex variables of these patients (Table 1).

The ages of the patients in PG ranged between 3 and 63 years (mean 13.3±9.1), and 51.9% were male, while 86% of the patients were under 18 years. Coinfection with *D. fragilis* was present in 9.6% of the patients in PG and statistical analysis of the data revealed a significant difference in rates of coinfection with *D. fragilis* among age groups ($p<0.001$) with prevalence being much higher in children under 6 years of age (Table 2).

Other intestinal parasites detected in both groups were shown in Table 3. *Blastocystis hominis* was found to be the most common parasite in both groups.

Table 1
Characteristics of patients with *E. vermicularis* in DG

Variable		Patients *n* (%)	*E. vermicularis* positive (%)	*P**
Age	≤6	45 (35.7)	33.3	0.1
	7–18	74 (58.7)	21.6	
	>18	7 (5.6)	14.3	
Sex	Male	54 (42.9)	20.4	0.1
	Female	72 (57.1)	29.2	
Total		126 (100.0)	25.4	

*Chi-square test.

Table 2
Characteristics of patients with *Dientamoeba fragilis* in PG

Variable		Patients *n* (%)	*D. fragilis* positive (%)	*P**
Age	≤6	25 (13.4)	36.0	<0.001
	7–18	135 (72.2)	5.2	
	>18	27 (14.4)	7.4	
Sex	Male	97 (51.9)	7.2	0.1
	Female	90 (48.1)	12.2	
Total		187 (100.0)	9.6	

*Chi-square test.

4. Discussion

The incidence of *D. fragilis* infection varies between 1.4% to 52% in different areas of the world [7], and the low incidence or even absence of this organism in different surveys may be due to insufficient laboratory examinations and lack of knowledge concerning this parasite [1]. Defined as a neglected cause of diarrhea, *D. fragilis* was reported to be more common than *G. lamblia* [1,2] and frequently may cause clinical symptoms related to the gastrointestinal tract [1,7].

The transmission of *D. fragilis* is still an enigma despite many studies since its discovery. Early efforts to discover a cyst stage, which would allow the survival of the parasite outside the body, and to cultivate *D. fragilis* from inside the eggs of its suggested vector, the pinworm, all failed [7,10]. However, Ockert [14] managed to infect himself, together with two other people by ingesting the eggs of *E. vermicularis* obtained from a patient coinfected with *D. fragilis*. In addition, he reported amoeboid structures inside the pinworms that had similar nuclear and cytoplasmic features to *D. fragilis* in the isoelectric point test [14].

Generally, the coincidence of *D. fragilis* and *E. vermicularis* is found to be more common than the coincidence between *D.*

Table 3
Other intestinal parasites detected in both study groups*

Parasite	Pinworm group ($n=187$) *n* (%)	Dientamoeba group ($n=126$) *n* (%)	*P*
Blastocystis hominis**	23 (12.3)	21 (16.7)	0.2†
Entamoeba histolytica/dispar	3 (1.6)	4 (3.2)	0.2δ
Giardia lamblia	6 (3.2)	7 (5.6)	0.3†
Entamoeba coli	6 (3.2)	9 (7.1)	0.1†
Iodamoeba bütschlii	8 (4.3)	7 (5.6)	0.6†
Endolimax nana	7 (3.7)	5 (4.0)	0.5δ

*No helminthes were detected in both groups, regardless of the pinworm.
**≥5 *B. hominis* in each examination area under ×400 magnification.
†Chi-square test.
δFischer's exact test.