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Research Article

The Relationship between *Helicobacter Pylori* and Intestinal Parasites in Patients with Peptic Ulcer

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Abstract

Aim: This study aimed to evaluate the frequency of *Helicobacter pylori* (*H. pylori*), risk factors, and co-infection with intestinal parasites in adult patients presenting gastrointestinal complaints.

Materials and Methods: The working group of the study consisted of 385 patients with gastrointestinal complaints. A questionnaire including questions aiming to canvass the socio-demographic features, lifestyles, and complaints of the patients was administered to the study population. Cellophane slide method, native-lugol, sedimentation and Modified kinyoun acid-fast methods were used for the diagnosis of parasites in stool, under microscope. The *H. pylori* antigen was studied in the stool sample taken for the diagnosis of *H. pylori*.

Results: *H. pylori* positivity was found to be 27.79% in the patients included in the study. 76.6% of those who are positive for *H. pylori* are women, and the positivity rate was found to be higher at the age of 40 and over (75.7%). The majority of patients with *H. pylori* positivity expressed being married (73.8%), having middle / low-income (89.7%), having a low educational background (82.2%), living in a village (55.1%), and in a nuclear family (72.2%) (p<0.001). *H. pylori* positivity was higher in those who used tap water (40.2%) and those who had a vegetable-based diet (75.7%) (p<0.001). The study found a statistically significant correlation between *Entamoeba histoloytica* and *Enterobius vermicularis* positivity and *H. pylori* positivity (p<0.05 p<0.001, respectively). The calculated odds ratio showed that *H. pylori* positivity was 1.19 times higher in *Entamoeba histoloytica* positivity and 11.27 times higher in *Enterobius vermicularis* positivity.

Conclusion: Larger and more comprehensive studies should be performed to understand better the epidemiology, clinical effects, treatment, and control of *H. pylori* co-infection.

Keywords: Peptic Ulcer, *Helicobacter pylori*, Intestinal Parasites

INTRODUCTION

Helicobacter pylori (H. pylori) is a well-known stomach bacterium for its role that triggers the development of peptic ulceration and chronic gastroenteritis predisposing to gastric cancer. It is assumed that about half of the world's population is infected with *H. pylori*, mostly in developing countries (1,2). Although the actual transmission route is not known precisely, it has been reported in several publications that it is transmitted by the fecal-oral or oral-oral route (2,3). However, it is controversial whether the human-to-human transmission route of *H. pylori* is oral-oral, fecal-oral, or otherwise (3,4). Some researchers have reported that human-to-human transmission can occur through the fecal-oral route and oral-oral route (2,3,5). Due to the uncertainties about the transmission route of *H.pylori*, transmission cannot be prevented, and its prevalence is relatively high (3).

Similarly, intestinal parasites affect millions of people worldwide and can cause general gastrointestinal symptoms such as abdominal pain, nausea, and vomiting, as well as species-specific symptoms. *Entamoeba histoloytica* is a species of the genus Entamoeba and

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anaerobic protozoa. Mature cysts of the environmentally resistant *Entamoeba histolytica* are ingested with infected food or water. A protozoa coming into the large intestine turns into trophozoites in the intestine, invades the colon, and presents with different clinical pictures ranging from asymptomatic carriage to amoebic colitis (6). *Enterobius vermicularis* is a common parasite. It is a nematode commonly found in temperate regions with tropical climates. As with *H. pylori*, its contagiousness depends on many factors such as hygiene, living environment, and socio-economic status. It is more common in places with many human-to-human contacts, such as nurseries, boarding schools, and barracks. Transmission often occurs through the fecal-oral route of egg retrieval. The parasite can also cause symptoms related to the digestive system, nervous system, urogenital system (7). All three pathogens are transmitted by the fecal-oral route and are very common in underdeveloped countries with poor hygienic conditions (2,6,7).

The prevalences of intestinal parasites and *H. pylori* infection are very close to each other (8). This suggests a strong possibility of co-infection. This study aims to evaluate the frequency of *H. pylori*, risk factors, and co-infection with intestinal parasites in adult patients presenting to a doctor with gastrointestinal complaints.

MATERIAL AND METHOD

Ethical approval

Ordu University Clinical Research Ethics Committee approved this study with date 05/02/2016 and decision number 2016/4.

Patients and study design

The working group of the study consisted of 385 patients who presented to the internal medicine outpatient clinic with digestive system complaints and agreed to bring samples to the Parasitology Department were included in the study. The data about the patients were canvassed through a questionnaire including questions about socio-demographic characteristics of the patients such as age, gender, educational background, economic status, marital status, drinking water, feeding, and companion animals people keep, lifestyles, and their complaints. The patients were informed that if parasites were not found in the first stool examination, the examination should be repeated three times at different times within ten days.

Data Collection and Examination

Stool collection containers were given to the patients, and they were informed that 3-4 tables poons of stool samples for those with diarrhea and a walnut-sized sample for those without diarrhea should be placed in a container, and the container should be tightly closed and delivered to the parasitology laboratory within 1 hour. In addition, the cellophane band method used in the diagnosis of *Enterobius vermicularis*, whose eggs are not usually seen in the stool, was administered before the toilet or bath. The cellophane tape was cut in 10-15 cm length, placed on a sticky side on a stick or a pen, and touched around the patient's anus to allow the eggs to adhere. The tape was flatly attached to a clean slide and examined under a microscope. In terms of the patients' privacy, those who want to make the application themselves were explained in detail. To say that the patient was not infected with the parasite, are-examination was performed every 3-4 days. Cellophane tape method, native-Lugol, sedimentation, and modified Kinyoun's acid-fast methods were used to diagnose parasites in stool (9-11). After the samples were prepared and stained, they were examined under a microscope.

H. pylori stool antigen was performed with the one-step *H. pylori* antigen rapid diagnostic kit (IHP-602, Acon Laboratories Inc, San Diego, USA) with 99.0% sensitivity and 98.9% specificity. The test was performed following the manufacturer's recommendations. Approximately 50 mg of stool samples were taken from at least three different stool samples with the special applicator included in the kit. Two-three drops of this mixture were dropped on the window part of the test cassette. The test result was evaluated after incubation for 10 minutes at room temperature. In cases where the control line did not appear at the end of incubation, the test was repeated for the same patient.

Data Analysis

The descriptive statistics were reported as the frequencies (n and %). Two-way contingency tables were generated, and the two-way chi-square test was used to examine the association between two categorical variables. Phi or Cramer's V coefficients were used to measure the degree of association between qualitative variables depending on the level of measurement. In the *H. pylori*-positive group, a one-way chi-square test was used to compare categorical variable frequencies. In the chi-square tests, if a cell had an expected frequency below 5, the likelihood ratio chi-square value was used instead of the Pearson chi-square value. $p<0.05$ value is accepted as significant. All statistical analyses were performed using SPSS v25.0 (IBM, Armonk, NY, USA).

RESULTS

Method Development

H.pylori positivity rate was 27.79% (n=107). Of the patients, 73% (n=281) were women and 27% (n=104) were men. The distribution of the patients by age groups was 8.1% (n=31) under the age of 25, 17.4% (67) aged 25-39 and 74.4% (n=287) aged 40 and over, respectively. While 22.6% (n=87) of the patients were single, 77.4% (n=298) were married.

The change of *H. pylori* status according to the demographic characteristics of the patients was analyzed using the two-way chi-square test (Table 1). It was observed that the presence or absence of *H. pylori* did not differ according to the demographic characteristics of the patients (p>0.05). In addition, the correlation coefficients calculated between the presence of *H. pylori* and demographic variables were also quite weak and statistically insignificant (p>0.05).

A one-way chi-square test was used to analyze whether there was a difference between the frequencies of the categories of demographic variables in *H. pylori* positive patients (Table 1). The proportion of *H. pylori*-positive women (76.6%) was significantly higher than that of men (23.4%) (p<0.05). A significant change was also found according to age groups (p<0.05). *H. pylori* positivity rate was higher in patients aged 40 and over (75.7%). The study results indicate that *H. pylori*-positive patients showed a significant change according to demographic variables such as marital status, economic status, educational background, and place of residence (village, district, city, etc.) (p<0.05). The vast majority of patients with *H. pylori* positivity expressed being married (73.8%), having middle / low income (85.7%), being illiterate or primary school graduates (89.7%), living in a village (55.1%), and living in a nuclear family (72.2%).

Table 1. *H. pylori* positivity broken down by demographic variables

		H. pylori			p‡
		Positive	p†	Negative	
Age	<25	13 (12.1%)	0.001	18 (6.5%)	0.065
	25-39	13 (12.1%)		54 (19.4%)	
	Aged 40 and over	81 (75.7%)		206 (74.1%)	
Gender	Women	82 (76.6%)	0.001	199 (71.6%)	0.317
	Men	25 (23.4%)		79 (28.4%)	
Civil Status	Single	28 (26.2%)	0.001	59 (21.2%)	0.299
	Married	79 (73.8%)		219 (78.8%)	
Economic Condititon	Good	11 (10.3%)	0.001	18 (6.5%)	0.152
	Middle and low level	96 (89.7%)		260 (93.5%)	
Educational Background	Illiterate	38 (35.5%)	0.001	79 (28.4%)	0.361
	Elementary school	50 (46.7%)		133 (47.8%)	
	High school	10 (9.3%)		42 (15.1%)	
	Higher education	9 (8.4%)		24 (8.6%)	
Residence Place	Village	59 (55.1%)	0.001	182 (65.5%)	0.147
	District / town	14 (13.1%)		24 (8.6%)	
	City	34 (31.8%)		72 (25.9%)	
Employment Status	Unemployed / trades people	88 (82.2%)	0.001	215 (77.3%)	0.292
	Worker / civil servant / retired	19 (17.8%)		63 (22.7%)	
Employment Status of Spouse	No spouse	20 (18.7%)	0.001	48 (17.3%)	0.919
	Unemployed / trades people	47 (43.9%)		116 (41.7%)	
	Worker / civil servant / retired	38 (35.5%)		107 (38.5%)	
	Private sector	2 (1.9%)		7 (2.5%)	
Life Style	Living alone	8 (7.5%)	0.001	11 (4.0%)	0.178
	With friends / dormitory	2 (1.9%)		1 (0.4%)	
	Nuclear family	77 (72.0%)		220 (79.1%)	
	Extended family	20 (18.7%)		46 (16.5%)	

†: One-way chi-square test, ‡: Two-way chi-square test

According to the patients' lifestyles, the variation of the presence or absence of *H. pylori* was analysed with the two-way chi-square test (Table 2). It was observed that the presence of *H. pylori* in the patients showed a significant change only according to the type of water used (p<0.05) but did not show a significant change according to the other lifestyles (p>0.05). While *H. pylori* was negative in most tap water users, *H. pylori*-positive rate was higher in those using spring water/water in bottles or dispensers available in the market. The correlation coefficient between *H. pylori*-positive or negative status and the type of water used was calculated as 16.7%. In addition, the correlation coefficients calculated between the presence of *H. pylori* and other lifestyles were also quite weak and statistically insignificant (p>0.05).

A one-way chi-square test was used to analyze whether there was a difference between the frequencies of lifestyle categories in *H. pylori*-positive patients (Table 2). A significant difference was found between the water types used, pets kept, feeding patterns, and knowledge about infectious diseases (p<0.05). While the rate of those using tap water was 40.2%, the rate of those who did not keep pets at home was 57.1%. While, on the other hand, the rate of the patients who ate mainly vegetables was 75.7%, and the rate of those who did not know about infectious diseases was 53.3%.

Table 2. *H. pylori* positivity broken down by patients' lifestyle

		H. pylori			p‡
		Positive	p†	Negative	
Water Type Used	Tap water	43 (40.2%)	0.001	156 (56.1%)	0.016* (r=0.167)
	Water from a well / creek / source	41 (38.3%)		89 (32%)	
	Water in bottles available in the market	23 (21.5%)		33 (11.9%)	
Keeping a Pet at Home	Yes	10 (9.3%)	0.001	31 (11.2%)	0.607
	No	97 (90.7%)		247 (88.8%)	
Type of Animals	Keeping no animals	97 (90.7%)	0.001	246 (88.5%)	0.529
	Cows	7 (6.5%)		22 (7.9%)	
	Others	3 (2.8%)		7 (2.5%)	
	Chicken	0 (0.0%)		3 (1.1%)	
Feeding Style	Meat-based diet	9 (8.4%)	0.001	13 (4.7%)	0.157
	Vegetable-sized diet	98 (91.6%)		265 (95.3%)	
Knowledge About Contagious Diseases	Good	12 (11.2%)	0.001	19 (6.8%)	0.165
	Medium	7 (6.5%)		40 (14.4%)	
	Low	31 (29.0%)		74 (26.6%)	
	No knowledge	57 (53.3%)		145 (52.2%)	

†: One-way chi-square test, ‡: Two-way chi-square test, *: p<0.05, r: Cramer's V coefficient

According to some symptoms observed in the patients, the variation of the presence or absence of *H. pylori* was analyzed with the two-way chi-square test (Table 3). *H. pylori* positivity showed a significant relationship only depending on the presence of salivation and joint pain (p<0.05). However, the degree of these relationships was measured very weakly (r=13.2% ; r=10.5%, respectively).

A one-way chi-square test was used to analyze whether or not there was a difference between the frequencies of some symptoms in *H. pylori*-positive patients (Table 3). In *H. pylori*-positive patients, there was no significant difference between the rates of decreased appetite, nausea-vomiting, and constipation symptoms (p>0.05). For other symptoms questioned, the results indicate that the rates of those with and without symptoms were significantly different (p<0.05). The proportion of *H. pylori*-positive patients with symptoms of fatigue, abdominal/stomach pain, gas pain, indigestion, and joint pain was significantly higher than the proportion of patients without symptoms. The proportion of patients with allergies, rectal itching, drooling, increased appetite, diarrhea, weight loss, and frequent urinary tract infections was significantly lower than those without these disorders. The study found no significant difference between the rates of being chronically ill or not (p>0.05).

A two-way chi-square test was performed to examine the relationship between *H. pylori* positivity and parasite positivity (Table 4). The results indicate that *H. pylori* positivity did not show a significant change compared to parasite positivity (p>0.05).

Table 3. *H. pylori* positivity broken down the symptoms observed

		H. pylori			p‡
		Positive	p†	Negative	
Allergy	Yes	24 (22.4%)		77 (27.7%)	0.293
	No	83 (77.6%)		201 (72.3%)	
Weakness	Yes	84 (78.5%)	0.001	208 (74.8%)	0.449
	No	23 (21.5%)		70 (25.2%)	
Rectal Itching	Yes	39 (36.4%)	0.001	79 (28.4%)	0.126
	No	68 (63.6%)		199 (71.6%)	
Saliva	Yes	39 (36.4%)	0.005**	65 (23.4%)	0.010* r=0.132
	No	68 (63.6%)		213 (76.6%)	
Decreased Appetite	Yes	44 (41.1%)	0.005**	98 (35.3%)	0.285
	No	63 (58.9%)		180 (64.7%)	
Increased Appetite	Yes	33 (30.8%)	0.066	66 (23.7%)	0.153
	No	74 (69.2%)		212 (76.3%)	
Diarrhoea	Yes	25 (23.4%)	0.001	57 (20.5%)	0.539
	No	82 (76.6%)		221 (79.5%)	
Abdominal Pain (Stomach Ache)	Yes	67 (62.6%)	0.001	160 (57.6%)	0.366
	No	40 (37.4%)		118 (42.4%)	
Fever	Yes	23 (21.5%)	0.009**	66 (23.7%)	0.640
	No	84 (78.5%)		212 (76.3%)	
Gas Pain	Yes	72 (67.3%)	0.001	183 (65.8%)	0.786
	No	35 (32.7%)		95 (34.2%)	
Nausea and Vomiting	Yes	56 (52.3%)	0.001	127 (45.7%)	0.242
	No	51 (47.7%)		151 (54.3%)	
Indigestion	Yes	72 (67.3%)	0.629	188 (67.6%)	0.950
	No	35 (32.7%)		90 (32.4%)	
Constipation	Yes	51 (47.7%)	0.001	111 (39.9%)	0.168
	No	56 (52.3%)		167 (60.1%)	
Weight Loss	Yes	22 (20.6%)	0.629	39 (14.0%)	0.116
	No	85 (79.4%)		239 (86.0%)	
Joint Pain	Yes	76 (71.0%)	0.001	166 (59.7%)	0.040* r=0.105
	No	31 (29.0%)		112 (40.3%)	
Urinary Tract Infection	Yes	23 (21.5%)	0.001	57 (20.5%)	0.830
	No	84 (78.5%)		221 (79.5%)	
	Yes	86 (80.4%)		231 (83.1%)	
Chronic Disease	No	44 (41.1%)	0.066	133 (47.8%)	0.236
	Yes	63 (58.9%)		145 (52.2%)	

-: Not calculated, †: One-way chi-square test, ‡: Two-way chi-square test, r: Phi coefficient, *: p<0.05, **: p<0.01

Table 4. The relationship between *H. pylori* positivity and parasite positivity

Helicobacter	**Parasite**		**Total**	**p‡**
	Negative	**Positive**		
Negative	103 (26.8)	175 (45.5)	278 (72.2)	
Positive	39 (10.1)	68 (17.7)	107 (27.8)	0.913
Total	142 (36.9)	243 (63.2)	385 (100.0)	

‡: Two-way chi-square test

Relationships between *H. pylori* positivity and parasite species were investigated by a two-way chi-square test (Table 5). The two-way chi-square test results showed a statistically significant relationship between *Entamoeba histoloytica* / dispar positivity and *H. pylori* positivity (p<0.05).

The degree of this relationship was calculated as 11.6%. The calculated odds ratio showed that *H. pylori* positivity was 1.19 times higher in *Entamoeba histoloytica* / dispar positivity. Similarly, *Enterobius vermicularis* positivity showed a significant correlation with *H. pylori* positivity (p<0.05). The correlation coefficient between *Enterobius vermicularis* positivity and *H. pylori* positivity was calculated as 19.2%. The odds ratio calculated showed that *H. pylori* positivity was 11.27 times higher in *Enterobius vermicularis* positivity. On the other hand, the other parasite species could not be statistically significantly associated with *H. pylori* positivity (p> 0.05).

Table 5. The relationship between *H. pylori* positivity and parasite species

		Helicobacter		Total	p‡
		Negative	Positive		
Blastocystis hominis	-	183 (47. %5)	73 (19.0%)	25 (66.5%)	0.655
	+	95 (24.7%)	34 (8.8%)	129 (33.5%)	
Iodamoeba buetschlii	-	270 (70.1%)	106 (27.5%)	376 (97.7%)	0.217
	+	8 (2.1%)	1 (0.3%)	9 (2.3%)	
Entamoeba coli	-	233 (60.5%)	92 (23.9%)	325 (84.4%)	0.599
	+	45 (11.7%)	15 (3.9%)	60 (15.6%)	
Entamoeba histoloytica / dispar	-	278 (72.2%)	105 (27.3%)	383 (99.5%)	0.023* r=0.116 OR=1.19
	+	0 (0.0%)	2 (0.5%)	2 (0.5%)	
Dientamoeba fragilis	-	266 (69.1%)	103 (26.8%)	369 (95.8%)	0.797
	+	12 (3.1%)	4 (1.1%)	16 (4.2%)	
Giardia intestinalis	-	262 (68.1%)	100 (26.0%)	362 (94.0%)	0.770
	+	16 (4.2%)	7 (1.8%)	23 (6.0%)	
Chilomastix mesnili	-	278 (72.4%)	105 (27.3%)	383 (99.7%)	0.108
	+	0 (0.0%)	1 (0.3%)	1 (0.3%)	
Enterobius vermicularis	-	276 (71.9%)	98 (25.5%)	374 (97.4%)	0.001 r=0.192 OR=11.27
	+	2 (0.5%)	8 (2.1%)	10 (2.6%)	
Hymenolepis nana	-	277 (72.1%)	106 (27.6%)	383 (99.7%)	0.421
	+	1 (0.3%)	0 (0.0%)	1 (0.3%)	
Cryptosporidium spp.	-	193 (50.3%)	67 (17.4%)	260 (67.7%)	0.244
	+	85 (22.1%)	39 (10.2%)	124 (32.3%)	
Cyclospora spp.	-	272 (70.8%)	103 (26.8%)	375 (97.7%)	0.703
	+	6 (1.6%)	3 (0.8%)	9 (2.3%)	
Endolimax nana	-	274 (71.4%)	104 (27.1%)	378 (98.4%)	0.756
	+	4 (1.0%)	2 (0.5%)	6 (1.6%)	
Entamoeba hartmanni	-	275 (71.6%)	106 (27.6%)	381 (99.2%)	0.163
	+	3 (0.8%)	0 (0.0%)	3 (0.8%)	
Ascaris lumbriocoides	-	277 (72.1%)	27.3%	382 (99.5%)	0.502
	+	1 (0.3%)	1 (0.3%)	2 (0.5%)	
Tænia spp.	-	276 (71.9%)	106 (27.6%)	99.5%	0.255
	+	2 (0.5%)	0 (0.0%)	2 (0.5%)	

-: not calculated, †: One-way chi-square test, ‡: two-way chi-square test, r: Phi coefficient, *: p<0.05, **: p<0.01

DISCUSSION

The study's working group consisted of 385 patients presented to the internal medicine outpatient clinic with digestive system complaints. As a result of the antigen test, the rate of *H.pylori* positivity was 27.79% (n=107). A review of the available literature on the subject showed that different findings were observed in similar studies. There may be many reasons for this. The literature review shows that the prevalence of *H. pylori* was found to be different based on several factors such as the country where the study was conducted, the study group (healthy, pregnant, general population, those with dyspeptic complaints, routine health screening, etc.), and the method used (serology, histology, urease test, PCR, culture, urea breath test, etc.). It was found to be 28.3% in a study conducted with serological analyzes in healthy individuals in Saudi Arabia (12), 93.6% in a study performed with serological analyzes in those with dyspeptic complaints in Nigeria (13), 37.9% in a study conducted with histological analyzes in indigenous people in Canada (14), and 63.4% (15) in a study performed with urea breath test in healthy individuals in China (16). In Turkey, in a study on the general population using the urea breath test, Özaydın et al. found an *H. pylori* positivity rate of 82.5% (17). In another study performed in Turkey on patients who presented for the urea breath test, Korkmaz et al. observed an *H. pylori* positivity rate of 49.5% (18). The present study performed in the province of Ordu in Turkey to investigate the *H. pylori* antigen in the stool of patients presented to the clinic involved in the study found a prevalence of 27.79%, a lower rate than expected when compared with other studies, and this may be attributed to the fact that studies' samples are composed of people from different regions and study methods.

Reviewing the socio-demographic characteristics of several past studies, we see that past research has reported different *H. pylori* prevalence rates. While some studies report no difference between women and men (19-22), some report having found no difference between young people and adults (23-25). Some studies have reported lower prevalence in young people than in adults (16). In this study, *H. pylori* positivity was found to be higher (75.7%) in patients aged 40 and over. Unlike studies in the literature, it found a higher rate in women (76.6%). It has been reported in the publications that it is more common in people with low socio-economic and educational levels, living in rural areas, living in crowded houses, and using contaminated drinking water sources (16). Korkmaz et al. (18) found no correlation between civil status and keeping pets at home. In this study, the majority of patients with higher *H. pylori* positivity were married (%73,8), had a middle/low income (85.7%), had a low educational background (89.7%), and lived in a village (55.1%) ($p<0.05$). At the same time, the rate of the *H. pylori*-positive patients using tap water was 40.2%, the rate of those who did not keep pets at home was 57.1%, the rate of those who ate mainly vegetables 75.7%, and the rate of those who did not know about infectious diseases 53.3%. The patient group in this study mostly lived in rural areas and fed farm animals such as cows at home. Therefore, unlike the results observed in previous studies, it is thought that *H. pylori* positivity may be significantly higher in those who keep pets at home.

The present study also investigated the correlation between *H. pylori* and intestinal parasites. Our study found a statistically significant relationship between the prevalence of *Entamoeba histoloytica* / dispar and *Enterobius vermicularis* parasites and *H. pylori* but found no relationship with other parasites. Similar risk factors are involved in the pathogenesis of *H. pylori* infection and parasitic infections (26-28). Many studies have been conducted in different countries and different age groups regarding the association of *H. pylori* and other protozoas, in which different results have been observed. In a study they conducted with children, Ibrahim et al. found that *H. pylori* were found together with Giardia intestinalis and Cryptosporidium (29). Seid et al. found that the prevalence of Giardia intestinalis was significantly higher in *H. pylori*-infected participants but not significantly different in *Entamoeba histoloytica* / dispar infection (1). El-Badry AA et al. found that Giardia intestinalis and H pylori co-infection is common in school-aged children (30). In a study performed with individuals receiving mental rehabilitation, Hassanein et al. showed that *H. pylori*-positive individuals were more likely to be infected with Giardia intestinalis than *H. pylori*-negative individuals (31). In their study on children with chronic abdominal pain, Goksen et al. (32) found that the incidence of Giardia intestinalis was statistically higher in the *H. pylori*-positive group (14.8%) than in the *H. pylori*-negative group (1.6%). In a study conducted on patients with chronic diarrhea, Yakoop et al. (33) showed a significant relationship between H pylori infection and Blastocystis sp. and *Entamoeba histoloytica*/dispar infection. The present study found a significant relationship between *H. pylori* and *Entamoeba histoloytica* / dispar in patients with dyspeptic complaints, and it further showed that *H. pylori* positivity was 1.19 times higher in *Entamoeba histoloytica* / dispar positivity. In the literature review, no publication was found showing a relationship between *Enterobius vermicularis* positivity and *H. pylori* positivity. In our study, *Enterobius vermicularis* positivity was also shown to be associated with *H. pylori* positivity. The correlation coefficient between *Enterobius vermicularis* positivity and *H. pylori* positivity was calculated as 19.2%. The calculated odds ratio showed that *H. pylori* positivity was 11.27 times higher in *Enterobius vermicularis* positivity.

Limitations

As it is a cross-sectional study, it does not reflect the whole universe.

CONCLUSION

Protozoas can phagocytize many bacteria and body cells and contribute to their increased pathogenicity and serve as a reservoir for potentially disease-causing bacteria.

The association of intestinal parasitism and *H. pylori* is quite complex. Different results were observed in studies conducted in different patient groups. To better understand the epidemiology, clinical effects, treatment, and control of co-infection with *H. pylori*, much more extensive and more comprehensive studies are needed than those available in the literature. The high prevalence of intestinal parasites and *H. pylori* shows that this situation should not be ignored.

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REFERENCES

1. Seid A, Tamir Z, Kasanew B, Senbetay M. Co-infection of intestinal parasites and *Helicobacter pylori* among upper gastrointestinal symptomatic adult patients attending Mekanesalem Hospital, northeast Ethiopia. BMC Research Notes. 2018;11:1-6.
2. Ugras M, Miman Ö. The prevalence of intestinal parasites in children with *Helicobacter pylori* gastritis evaluated retrospectively. Turkiye Parazitol Derg. 2013;37:245.
3. Moreira Jr ED, Nassri VB, Santos RS, et al. Association of *Helicobacter pylori* infection and giardiasis: results from a study of surrogate markers for fecal exposure among children. World J Gastroenterol. 2005;11:2759.
4. Goodman KJ, Correa P, Aux HJT, et al. *Helicobacter pylori* infection in the Colombian Andes: a population-based study of transmission pathways. Am J Epidemiol. 1996;144:290-9.
5. Brown LM. *Helicobacter pylori*: epidemiology and routes of transmission. Epidemiol Rev. 2000;22:283-97.
6. Toroglu S, Yilmaz M, Keskin D. Entamoeba histolytica's importance in terms of human and animal health. Duzce University Journal of Science and Technology. 2018;6:275-91.
7. Önlen Güneri C, Kaya ÖM, Çelik E. Inverstigation of distribution of *Enterobius vermicularis* in students of primary school in Hatay. Van Medical Journal. 26:142-5.
8. Mehraj V, Hatcher J, Akhtar S, et al. Prevalence and factors associated with intestinal parasitic infection among children in an urban slum of Karachi. PloS One. 2008;3:e3680.
9. Başkanlığı TCSBTHSK. Dışkının mikroskobik bakısı, Tricrom boyama https://hsgm.saglik.gov.tr/depo/birimler/Mikrobiyoloji_Referans_Laboratuvarlari_ve_Biyolojik_Urunler_DB/rehberler/UMS_LabTaniRehberi_Cilt_3.pdf2014.
10. Başkanlığı TCSBTHSK. Microscopic examination of feces, Condensation method https://hsgm.saglik.gov.tr/depo/birimler/Mikrobiyoloji_Referans_Laboratuvarlari_ve_Biyolojik_Urunler_DB/rehberler/UMS_LabTaniRehberi_Cilt_3.pdf2014.
11. Başkanlığı TCSBTHSK. Microscopic view of stool parasitological examination. https://hsgm.saglik.gov.tr/depo/birimler/Mikrobiyoloji_Referans_Laboratuvarlari_ve_Biyolojik_Urunler_DB/rehberler/UMS_LabTaniRehberi_Cilt_3.pdf2014.
12. Hanafi MI, Mohamed AM. *Helicobacter pylori* infection: seroprevalence and predictors among healthy individuals in Al Madinah, Saudi Arabia. J Egypt Public Health Assoc. 2013;88:40-5.
13. Olokoba A, Gashau W, Bwala S, et al. Helicabacter pylori Infection in Nigerians with Dyspepsia. Ghana Med J. 2013;47:79-81.
14. Sethi A, Chaudhuri M, Kelly L, Hopman W. Prevalence of *Helicobacter pylori* in a First Nations population in northwestern Ontario. Can Fam Physician. 2013;59:e182-e7.
15. Zhu Y, Zhou X, Wu J, et al. Risk factors and prevalence of *Helicobacter pylori* infection in persistent high incidence area of gastric carcinoma in Yangzhong city. Gastroenterol Res Pract. 2014;2014.
16. Eusebi LH ZR, Bazzoli F. . Epidemiology of *Helicobacter pylori* infection. Helicobacter. 2014;19:1-5.
17. Ozaydin N, Turkyilmaz SA, Cali S. Prevalence and risk factors of *helicobacter pylori* in Turkey: a nationally-representative, cross-sectional, screening with the 13 C-Urea breath test. BMC Public Health. 2013;13:1-12.
18. Korkmaz M, Sadıç M, Koca G, et al. The Relationship of helicobacter pylori infection with demographic, socioeconomic and environmental factors: Ankara Hospital Experience. Kafkas J Med Sci. 2013;3:74–9.
19. van Blankenstein M, van Vuuren AJ, Looman CW, et al. The prevalence of *Helicobacter pylori* infection in the Netherlands. Scand J Gastroenterol. 2013;48:794-800.
20. Vilaichone R-k, Mahachai V, Shiota S, et al. Extremely high prevalence of *Helicobacter pylori* infection in Bhutan. World J Gastroenterol. 2013;19:2806.
21. Benajah DA, Lahbabi M, Alaoui S, et al. Prevalence of *Helicobacter pylori* and its recurrence after successful eradication in a developing nation (Morocco). CClin Res Hepatol Gastroenterol. 2013;37:519-26.
22. Mathewos B, Moges B, Dagnew M. Seroprevalence and trend of *Helicobacter pylori* infection in Gondar University Hospital among dyspeptic patients, Gondar, North West Ethiopia. BMC Res Notes. 2013;6:1-4.
23. Den Hollander WJ, Holster IL, den Hoed CM, et al. Ethnicity is a strong predictor for *Helicobacter pylori* infection in young women in a multi-ethnic E uropean city. JJ Gastroenterol Hepatol. 2013;28:1705-11.
24. Benberin V, Bektayeva R, Karabayeva R, et al. Prevalence of *H. pylori* infection and atrophic gastritis among symptomatic and dyspeptic adults in Kazakhstan. A hospital-based screening study using a panel of serum biomarkers. Anticancer Res. 2013;33:4595-602.
25. Mana F, Vandebosch S, Deyi VM, et al. Prevalence of and risk factors for *H. pylori* infection in healthy children and young adults in Belgium anno 2010/2011. Acta Gastroenterol Belg. 2013;76:381-5.