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Prevalence of Cyclospora cayetanensis and Cryptosporidium spp. children according to some variables

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Abstract

In this study, the prevalence of Cyclospora cayetanensis and Cryptosporidium spp. were researched in children with parasitological investigations requested for a variety of reasons, regardless of immune status. The stool samples of 1057 pediatric patients with parasitological evaluation requested for a variety of reasons within two years were investigated under a microscopy using native-lugol, sedimentation and modified Kinyoun's acid-fast stain methods. The mean age of the 1057 pediatric patients participating in the research were 8.07±4.32 years, 11.4% were identified to have coccidian parasites (Cyclospora cayetanensis and Cryptosporidium spp.). Evaluation according to age group found the majority of children positive for Cryptosporidium spp. were in the 6-12 year interval. These parasites were observed more frequently in the spring and summer seasons compared to other seasons. There was a significant correlation between parasite positivity and spring and summer seasons ($p<0.001$). Cryptosporidium spp. was identified to be a significant risk factor in terms of growth retardation ($p<0.05$). The incidence of Cyclospora cayetanensis and Cryptosporidium spp. is high in children. It was concluded that Cryptosporidium spp. positivity was a significant risk factor for growth retardation.

Keywords: Children, cryptosporidium, cyclospora, diarrhea, growth retardation

Introduction

Around the world, especially in developing countries, infections caused by parasites continue to be a significant problem in terms of public health [1]. Among intestinal parasites, Cyclospora and Cryptosporidium are defined as coccidian parasites and are similar in terms of clinical features. They are mandatory intracellular parasites that cause diarrhea in individuals with normal immunity, though especially in those with immune failure, in all age groups [2].

Among the coccidian parasites, the species causing most disease in humans of C. parvum in Cryptosporidia (Cryptosporidium spp.) settles in the microvillus regions of intestinal epithelial cells causing short-term (nearly two weeks) self-healing diarrhea in people with sufficient immunity, but chronic and life-threatening diarrhea in hosts with suppressed immune systems [3]. In these people, the parasite may display nonintestinal involvement due to spread to the bile ducts, pancreas, stomach, respiratory system and kidneys through hematogenous routes. Cryptosporidium spp. infect humans from other humans via contaminated water and foods or from animals [4].

Cyclospora cayetanensis is the only Cyclospora causing disease in humans and is another coccidian parasite that enters the epithelial cells of the small intestine without invasion causing watery diarrhea. There are unknowns about the transmission routes of this parasite and in addition to studies emphasizing the need for more research [5], there are also articles reporting epidemics are caused by contaminated water and foods [6, 7].

This study aimed to research the prevalence of Cyclospora

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cayetanensis and Cryptosporidium spp. in children, and symptoms and findings that may be related to these parasites. In line with this, the symptoms of these parasitic infections will be determined. Additionally, the study will contribute to determining which symptoms should lead to consideration of these parasites.

Material and Methods

The approval of the ethics board of the local ethics committee was obtained, and the study was conducted in accordance with the principles of the Helsinki Declaration. Patients attending the pediatric clinic for different reasons with stool investigation requested were given information about the study and the need to repeat the examination three times at different intervals within 10 days if the parasite was not encountered on first examination and those who accepted were included in the scope of the research. Thesis data collected for Microsporidia within two years in Malatya were evaluated in terms of C. cayetanensis and Cryptosporidium spp.

Collection of material

The study included patients attending the pediatric clinic for different reasons and who accepted to bring a sample to the Parasitology Department. Patients were given stool collection containers and those with diarrhea were asked to bring 3-4 soup spoons of material, while those without diarrhea were asked to bring walnut-sized stool samples. Patients were told to tightly close the lid of the container and bring the sample to the parasitology laboratory within 1 hour. In order to state the patient was not infected with parasites, the samples were examined three times at 3-4 day intervals.

Investigation of collected material

For parasite identification in stool samples, native-lugol, sedimentation and modified Kinyoun's acid-fast stain methods were used [8-10]. After samples were prepared and stained, they were investigated with a microscope.

Statistical analysis

Descriptive statistics are reported as frequencies (n and %). To examine the association between two categorical variables, the two-way chi square test was employed. In the parasite positive group, the one-way chi-square test was used to compare the variable frequencies. Binary logistic regression analysis was used to predict the factors affecting parasite positivity. The odds ratio with 95% confidence interval was calculated to estimate risk rates. The data were examined in 95% reliability range and p-value was accepted as significant if below 0.05. All statistical analyses were performed using SPSS v26.0 (IBM, Armonk, NY, USA). This study was a retrospective cross-sectional study and was carried out in a medical faculty hospital with children patients admitted to the pediatrics department. Patients who applied to pediatric clinics for different reasons and bring samples to the Parasitology Department were included. The inclusion criteria of the study were: 1) Children under 18 years of age who agreed to participate in the study 2) Regardless of immune status, children who were requested parasitological examination for various reasons. The exclusion criteria of the study were: 1) Patients who were not agreed to participate in the study, and those who used barium, bismuth, anti-diarrheal, mineral oils, and antibiotics in the last 10 days. No sampling method was used in the study. All patients meeting the inclusion criteria within the specified date range were included to the study.

Results

The mean age of the patients were 8.07 ± 4.32 years and 11.4% (121/1057) were identified to have coccidian parasites. In 1057 pediatric patients with parasitological evaluation requested for a variety of reasons within two years in Malatya province. Of these parasites, 6.5% (69/1057) were Cryptosporidium spp. and 4.9% (52/1057) were Cyclospora cayetanensis species. Of the patients included in the study, 593 (56.1%) were male and 464 (43.6%) were female. Distribution of Cyclospora cayetanensis and Cryptosporidium spp. positivity according to season, sex and age are given in Table 1.

According to the Table 1, in terms of two both parasites were no significant differences found in general frequency distributions in sex, age groups and seasons ($p>0.05$). However, there was significant difference in frequency distribution of children positive for Cyclospora cayetanensis according to seasons ($p<0.001$). There were higher rates of positivity in spring and summer months compared to the other seasons. Also there were significant difference in frequency distribution of children positive for Cryptosporidium spp according to age groups and seasons ($p<0.001$). Most positive children were in the $<6\leq12$ age interval and spring and summer months had higher rates of positivity compared to other seasons.

Cyclospora cayetanensis was observed to have increased prevalence in March and September, while Cryptosporidium spp. had increased prevalence in the months of April and June.

Some symptoms and distribution of Cyclospora cayetanensis and Cryptosporidium spp. positivity according to disease are given in Table 2 and 3.

According to Table 2, there were no significant differences between general frequency distributions of symptoms ($p>0.05$). However, patients positive for Cyclospora cayetanensis were found to have significant differences for the frequency distribution of the symptoms of nausea-vomiting, constipation, anal itching, weakness, fever, nocturia and shortness of breath ($p<0.001$). According to the same table, there were no significant differences in general frequency distribution of diseases ($p>0.05$) but patients positive for Cyclospora cayetanensis were found to have significant differences for the frequency distributions of immunosuppression, cancer, acute urticaria and growth retardation (GR). ($p<0.001$, Table 2).

According to Table 3, there were no significant differences between general frequency distributions of symptoms and diseases except growth retardation ($p>0.05$). However, patients positive for Cryptosporidium spp were found to have significant differences for the frequency distribution of nausea-vomiting, diarrhea, constipation, anal itching, fatigue, drooling, intestinal gas, dyspepsia, nocturia, shortness of breath and general pruritus symptoms ($p<0.001$). Also, in children positive for Cryptosporidium spp were significant differences for the frequency

distributions of immunosuppression, cancer, chronic urticaria and growth retardation (p<0.001, Table 3).

In Table 4, in line with statistical analyses, it was considered that season, nausea-vomiting, diarrhea and drooling variables may affect positivity for Cyclospora cayetanensis and binary logistic regression analysis was performed. In conclusion, none of these were significant risk factors for Cyclospora cayetanensis positivity (p>0.05).

In Table 5, in line with statistical analyses, it was considered that season, age, nausea-vomiting, immunosuppression, GR and drooling variables may affect positivity for Cryptosporidium spp. and binary logistic regression analysis was performed. In conclusion, only GR was observed to be a significant risk factor for Cryptosporidium spp. positivity (p<0.05). In children positive for Cryptosporidium spp., the incidence of GR was found to be 1.92 times higher compared to children negative for Cryptosporidium spp.

Table 1. Distribution of Cyclospora cayetanensis and Cryptosporidium spp. seasonal, sex and age groups

			Positive	p1	Negative	p2
Cyclospora cayetanensis	Gender	Female	24 (46.2%)	0.579	440 (43.8%)	0.737
		Male	28 (53.8%)		565 (56.2%)	
	Age (year)	<=3	6 (12.8%)	0.103	154 (16.4%)	0.785
		<3<=6	12 (25.5%)		218 (23.2%)	
		<6<=12	18 (38.3%)		390 (41.5%)	
		>12	11 (23.4%)		177 (18.8%)	
	Season	Winter	2 (3.8%)	<0.001	37 (3.7%)	0.270
		Spring	23 (44.2%)		455 (45.3%)	
		Summer	17 (32.7%)		405 (40.3%)	
		Autumn	10 (19.2%)		108 (10.7%)	
Cryptosporidium spp	Gender	Female	29 (42.0%)	0.185	435 (44.0%)	0.746
		Male	40 (58.0%)		553 (56.0%)	
	Age (year)	<=3	7 (11.3%)	<0.001	153 (16.6%)	0.052
		<3<=6	8 (12.9%)		222 (24.0%)	
		<6<=12	35 (56.5%)		373 (40.4%)	
		>12	12 (19.4%)		176 (19.0%)	
	Season	Winter	2 (2.9%)	<0.001	37 (3.7%)	0.964
		Spring	31 (44.9%)		447 (45.2%)	
		Summer	29 (42.0%)		393 (39.8%)	
		Autumn	7 (10.1%)		111 (11.2%)	

p1:One-way chi-square test, p2:Two-way chi-square test

Table 2. Distribution of Cyclospora cayetanensis according to some symptoms and diseases

Symptoms/Diseases		Positive	p1	Negative	p2
Nausea-vomiting	Yes	48 (92.3%)	<0.001	955 (95.0%)	0.416
	No	4 (7.7%)		50 (5.0%)	
Diarrhea	Yes	36 (69.2%)	0.006**	759 (75.5%)	0.306
	No	16 (30.8%)		246 (24.5%)	
Constipation	Yes	49 (94.2%)	<0.001	933 (92.8%)	0.694
	No	3 (5.8%)		72 (7.2%)	
Anal itching	Yes	48 (92.3%)	<0.001	883 (87.9%)	0.335
	No	4 (7.7%)		122 (12.1%)	
Fatigue	Yes	52 (100.0%)	NC	979 (97.4%)	0.103
	No	0 (0.0%)		26 (2.6%)	
Drooling	Yes	38 (73.1%)	0.001**	796 (79.2%)	0.291
	No	14 (26.9%)		209 (20.8%)	
Abdominal pain	Yes	28 (53.8%)	0.579	611 (60.8%)	0.318
	No	24 (46.2%)		394 (39.2%)	
Intestinal gas	Yes	52 (100.0%)	NC	1001 (99,6%)	0.525
	No	0 (0.0%)		4 (0.4%)	
Anorexia	Yes	52 (100.0%)	NC	986 (98.1%)	0.164
	No	0 (0.0%)		19 (1.9%)	
Weakness	Yes	51 (98.1%)	<0.001	984 (97.9%)	0.934
	No	1 (1.9%)		21 (2.1%)	
Fever	Yes	50 (96.2%)	<0.001	986 (98.1%)	0.379
	No	2 (3.8%)		19 (1.9%)	
Dyspepsia	Yes	52 (100.0%)	NC	1001 (99.6%)	0.525
	No	0 (0.0%)		4 (0.4%)	
Nocturia	Yes	52 (100.0%)	NC	990 (98.5%)	0.217
	No	0 (0.0%)		15 (1.5%)	
Shortness of breath	Yes	51 (98.1%)	<0.001	990 (98.5%)	0.811
	No	1 (1.9%)		15 (1.5%)	
General pruritis	Yes	50 (96.2%)	<0.001	985 (98.0%)	0.410
	No	2 (3.8%)		20 (2.0%)	
Immunosuppression	Yes	49 (94.2%)	<0.001	937 (93.2%)	0.775
	No	3 (5.8%)		68 (6.8%)	
Diabetes	Yes	52 (100.0%)	NC	999 (99.4%)	0.436
	No	0 (0.0%)		6 (0.6%)	
Cancer	Yes	47 (90.4%)	<0.001	867 (86.3%)	0.397
	No	5 (9.6%)		138 (13.7%)	
Urınary tract infection	Yes	52 (100.0%)	NC	984 (97.9%)	0.143
	No	0 (0.0%)		21 (2.1%)	
Liver disease	Yes	52 (100.0%)	NC	1004 (99.9%)	0.751
	No	0 (0.0%)		1 (0.1%)	
Acute urticaria	Yes	51 (98.1%)	<0.001	1004 (99.9%)	0.066
	No	1 (1.9%)		1 (0.1%)	
Kronic urticaria	Yes	52 (100.0%)	NC	999 (99.4%)	0.436
	No	0 (0.0%)		6 (0.6%)	
Ulcerative colitis	Yes	52 (100.0%)	NC	1004 (99.9%)	0.751
	No	0 (0.0%)		1 (0.1%)	
Obesity	Yes	52 (100.0%)	NC	1003 (99.8%)	0.653
	No	0 (0.0%)		2 (0.2%)	
Growth retardation	Yes	45 (86.5%)	<0.001	847 (84.3%)	0.662
	No	7 (13.5%)		158 (15.7%)	

p1:One-way chi-square test, p2:Two-way chi-square test, NC: Not calculated, **: <0.01

Table 3. Distribution of Cryptosporidium spp. according to some symptoms and diseases

Symptoms/Diseases		Positive	p1	Negative	p2
Nausea-vomiting	Yes	63 (91.3%)	<0.001	940 (95.1%)	0.198
	No	6 (8.7%)		48 (4.9%)	
Diarrhea	Yes	55 (79.7%)	<0.001	740 (74.9%)	0.371
	No	14 (20.3%)		248 (25.1%)	
Constipation	Yes	67 (97.1%)	<0.001	915 (92.6%)	0,116
	No	2 (2.9%)		73 (7.4%)	
Anal itching	Yes	61 (88.4%)	<0.001	870 (88.1%)	0.931
	No	8 (11.6%)		118 (11.9%)	
Fatigue	Yes	68 (98.6%)	<0.001	963 (97.5%)	0.546
	No	1 (1.4%)		25 (2.5%)	
Drooling	Yes	53 (76.8%)	<0.001	781 (79.0%)	0.660
	No	16 (23.2%)		207 (21.0%)	
Abdominal pain	Yes	43 (62.3%)	0.041*	596 (60.3%)	0.743
	No	26 (37.7%)		392 (39.7%)	
Intestinal gas	Yes	68 (98.6%)	<0.001	985 (99.7%)	0.241
	No	1 (1.4%)		3 (0.3%)	
Anorexia	Yes	69 (100.0%)	NC	969 (98.1%)	0.108
	No	0 (0.0%)		19 (1.9%)	
Weakness	Yes	69 (100.0%)	NC	966 (97.8%)	0.083
	No	0 (0.0%)		22 (2.2%)	
Fever	Yes	69 (100.0%)	NC	967 (97.9%)	0.091
	No	0 (0.0%)		21 (2.1%)	
Dyspepsia	Yes	68 (98.6%)	<0.001	985 (99.7%)	0.241
	No	1 (1.4%)		3 (0.3%)	
Nocturia	Yes	68 (98.6%)	<0.001	973 (98.5%)	0.964
	No	1 (1.4%)		15 (1.5%)	
Shortness of breath	Yes	67 (97.1%)	<0.001	968 (98.0%)	0.641
	No	2 (2.9%)		20 (2.0%)	
General pruritis	Yes	68 (98.6%)	<0.001	974 (98.6%)	0.983
	No	1 (1.4%)		14 (1.4%)	
Immunosuppression	Yes	62 (89.9%)	<0.001	924 (93.5%)	0.269
	No	7 (10.1%)		64 (6.5%)	
Diabetes	Yes	69 (100.0%)	NC	982 (99.4%)	0.367
	No	0 (0.0%)		6 (0.6%)	
Cancer	Yes	58 (84.1%)	<0.001	856 (86.6%)	0.544
	No	11 (15.9%)		132 (13.4%)	
Urınary tract infection	Yes	69 (100.0%)	NC	967 (97.9%)	0.091
	No	0 (0.0%)		21 (2.1%)	
Liver disease	Yes	69 (100,0%)	NC	987 (99.9%)	0.713
	No	0 (0.0%)		1 (0.1%)	
Acute urticaria	Yes	69 (100.0%)	NC	986 (99.8%)	0.603
	No	0 (0.0%)		2 (0.2%)	
Kronic urticaria	Yes	68 (98.6%)	<0.001	983 (99.5%)	0.392
	No	1 (1.4%)		5 (0.5%)	
Ulcerative colitis	Yes	69 (100.0%)	NC	987 (99.9%)	0.713
	No	0 (0.0%)		1 (0.1%)	
Obesity	Yes	69 (100.0%)	NC	986 (99.8%)	0.603
	No	0 (0.0%)		2 (0.2%)	
Growth retardation	Yes	51 (73.9%)	<0.001	841 (85.1%)	0.013*
	No	18 (26.1%)		147 (14.9%)	

p1:One-way chi-square test, p2:Two-way chi-square test, NC: Not calculated, **: <0.01

Table 4. Results of binary logistic regression analysis of Cyclospora cayetanensis positivity

		b	S.E.	Wald	p	OR(95% C.I.)
Season	Winter			Reference category		
	Spring	-0.111	0.758	0.021	0.884	0.895 (0.202-3.957)
	Summer	-0.344	0.771	0.199	0.656	0.709 (0.156-3.213)
	Autumn	0.480	0.801	0.360	0.549	1.617 (0.337-7.762)
Nausea-vomiting	Yes			Reference category		
	No	0.455	0.544	0.700	0.403	1.576 (0.543-4.578)
Diarrhea	Yes			Reference category		
	No	0.417	0.326	1.641	0.200	1.518 (0.801-2.875)
Drooling	Yes			Reference category		
	No	0.437	0.334	1.709	0.191	1.548 (0.804-2.982)

OR: Odds Ratio (95% Confidence Interval)

Table 5. Results of binary logistic regression analysis of Cryptosporidium spp. positivity

		b	S.E.	Wald	p	OR(95% C.I.)
Season	Winter			Reference category		
	Spring	0.234	0.762	0.094	0.759	1.264 (0.284-5.625)
	Summer	0.408	0.761	0.288	0.592	1.504 (0.338-6.681)
	Autumn	0.238	0.831	0.082	0.775	1.268 (0.249-6.467)
Age (year)				Reference category		
	<3≤6	-0.174	0.535	0.105	0.746	0.841 (0.295-2.398)
	<6≤12	0.694	0.441	2.479	0.115	2.002 (0.844-4.749)
	>12	0.399	0.496	0.650	0.420	1.491 (0.564-3.939)
Nausea-vomiting	Yes			Reference category		
	No	0.839	0.468	3.223	0.073	2.315 (0.926-5.788)
Immunosuppression	Yes			Reference category		
	No	0.310	0.548	0.321	0.571	1.364 (0.466-3.991)
Growth retardation	Yes			Reference category		
	No	0.653	0.311	4.409	0.036*	1922 (1.044-3.535)
Drooling	Yes			Reference category		
	No	0.051	0.311	0.027	0.868	1.053 (0.573-1.937)

OR: Odds Ratio (95% Confidence Interval), *:<0.05

Discussion

Intestinal parasites are a significant public health problem especially in developing countries and are observed more frequently in pediatric populations. Among these parasites Cryptosporidium spp. and Cyclospora cayetanensis cause severe diarrhea tableau in children, the elderly, and people with suppressed immune systems, while currently they attract attention due to being a factor in diarrhea among people with stable immune systems.

The prevalence of Cryptosporidium and Cyclospora cayetanensis in children has different results in a variety of studies performed in the world in general and in Turkey. In studies performed in various countries of the world was observed the prevalence of Cryptosporidium spp varies from 2.9-22.5% [2, 11, 12]. A study in Van province performed Cryptosporidium spp was founded rates of 4.9% by enzyme-linked immunosorbent assay (ELISA) in 2000 diarrheic children, however, the oocysts were only seen in children 1.95% by microscopy. [13]. Two studies

in the world found the prevalence of Cyclospora cayetanensis in children under 15 years were 4% and 2.5%, respectively [1, 2]. Investigation of stool samples from 138 pediatric patients with gastrointestinal system complaints in the Kars province of Turkey did not encounter Cryptosporidium spp. oocysts; however, 0.7% was found to have Cyclospora cayetanensis [14]. Research in İzmir in 2005 found rates of 8.1% for Cryptosporidium spp. and 6.1% for Cyclospora cayetanensis among children from 0-14 years [15]. Again, a study evaluating 118 children with diarrhea in Ege University Faculty of Medicine identified rates of 13.5% for Cryptosporidium spp [16]. In a study performed between 2010 and 2018, the rate of Cryptosporidium spp in among children from 0-14 years was founded 3.2% [17]. A similar study in Van found 2% Cryptosporidium spp. and 5.3% Cyclospora cayetanensis [18]. In this study, rates of 6.5% and 4.9% were identified for Cryptosporidium spp. and Cyclospora cayetanensis, respectively. The different rates obtained in studies may be due to the geographic and infrastructural features of the research regions, socioeconomic status, education and cultural differences, patient groups included in the studies, methods applied and the researchers.

Just as these parasites may infection children of any age, they are more commonly observed in children under the age of 3 years due to easier transmission of parasites linked to lack of full development of the immune system, behavioral characteristics and deficient hygiene [19, 20]. Within regard to immune status, research investigating coccidian parasites in stool samples from 200 children found the mean age of children was 5.7 years [2]. Similarly, in this study, the mean age of children was 8.07 years. There was no significant difference between age groups for children positive for Cyclospora cayetanensis, while most children positive for Cryptosporidium spp. were in the 6-12 year interval. The high rate among school-age children may be due to transmission from common use locations like toilets, cafeterias and canteens in school environments. Different studies have stated there is no correlation between prevalence of parasites and sex [16, 19, 21]. In this study, similar to the literature, no significant correlation was identified between parasite prevalence and sex.

Cryptosporidium and Cyclospora cayetanensis are parasites that may be identified in humans in all seasons. In addition to studies stating they are observed more commonly between the months of February and November [19, 22], there are studies stating they are observed more frequently in summer months especially [12, 23]. In this study, Cyclospora cayetanensis was identified to have increased prevalence in March and September, while Cryptosporidium spp. had increased prevalence in April and June. Generally, it was observed that these parasites were more common during the spring when rainfall amounts in Malatya province are highest and in the summer season when aridity is highest, compared to other seasons. This situation leads to the consideration that these parasites may have water-sourced transmission and may be due to the cleaning habits in the pediatric period.

Cyclospora and Cryptosporidium infections in children are the most important vectors in protozoa-sourced diarrhea. Apart from diarrhea, they may cause many complaints related to the gastrointestinal system or nonspecific complaints [24, 25]. A study evaluating pediatric patients with diarrhea in Cuba found Cryptosporidium spp. caused vomiting, loss of appetite and fever, in order, while Cyclospora cayetanensis caused abdominal cramps and pain, vomiting, fever and loss of appetite [26]. The study by Koturoglu et al. [16] identified abdominal pain in 69% and fever in 56% of patients positive for Cryptosporidium oocysts. Research in Kenya investigated 4899 stool samples and identified a strong correlation between gastrointestinal symptoms related to persistent diarrhea, vomiting and abdominal distension in children with cryptosporidiosis [19]. Similarly in this study, cases positive for Cryptosporidium spp. were significantly associated with nausea-vomiting, diarrhea, constipation, anal itching, drooling from the mouth, abdominal pain, intestinal gas, dyspepsia, fatigue, itching on the body, growth retardation, immunosuppression, cancer, shortness of breath, nocturia and urticaria. For cases with Cyclospora cayetanensis, there were significant associations with nausea-vomiting, diarrhea, constipation, anal itching, drooling from the mouth, growth retardation, weakness, fever, immunosuppression, cancer, neutropenia, anemia, shortness of breath, nocturia and acute urticaria. This situation should be interpreted as showing that these complaints may be seen in patients infected with these parasites.

There are studies stating the growth development and cognitive functions of children infected with these parasites are negatively affected [27, 28]. Similarly, in our study, the symptom and finding of growth retardation was observed to be significant risk factor in terms of Cryptosporidium spp. ($p<0.05$). The risk of observing growth retardation in children positive for Cryptosporidium spp. is 1.92 times higher than for children negative for Cryptosporidium spp.

It is known that the most important complaint in situations where both immunosuppressed and immunocompetent people are infected with these parasites is diarrhea. However, it can be said that children with these parasities positivity may be seen high of occurrence possibility unusual symptoms such as nausea-vomiting, constipation, fatigue, shortness of breath, nocturia, urticaria, growth retardation. Therefore, in the presence of similar symptoms and finding, after other etiology reasons have been ruled out, these parasites should be remembered and stool samples should be evaluated with modified acid fast staining who a simple and relatively cheap methods. In this way, children with Cryptosporidium spp., determined to a risk in terms of growth retardation, can be identified and treated. Patients with growth retardation identified and no other factor found should be treated for Cryptosporidium spp. and will regain their health.

Conflict of interests
The authors declare that they have no competing interests.

Financial Disclosure
All authors declare no financial support.

Ethical approval
Ordu University School of Medicine Ethics Committee approved this study (KAEK no:2019/162)

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