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Çocuk Hastalarda Bağırsak Parazitlerinin Epidemiyolojisi: Ordu İli Örneği

Epidemiology of Intestinal Parasites in Pediatric Patients: Example of Ordu Province

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ÖZ

Amaç: Bu çalışmada, çocuklarda bağırsak parazitlerinin görülme sıklığının, parazit pozitifliği ile demografik, yaşam tarzı özellikleri ve eşlik eden semptomlar arasındaki ilişkinin araştırılması amaçlanmıştır.

Materyal ve Metot: Farklı semptomlarla başvuran 342 çocuğun (%49,1 kız, %50,9 erkek) dışkı örnekleri nativ, lügol, trichrome, asit fast, sedimentasyon ve selofanlı anal bant yöntemleriyle parazit tanısı için incelendi.

Bulgular: Olguların %29'u okul öncesi/1-5 yaş, % 45,6'sı 6-10 yaş ve %25,4'ü 11-18 yaş arasında idi. Bağırsak parazitlerinin görülme sıklığı %51,2 idi ve en sık Cryptosporidium spp. (%41,1), Blastocystis spp. (%40,6) ve Enterobius vermicularis (%21,1) tespit edildi. Yerleşim alanı, parazit pozitifliği açısından önemli bir yaşam tarzı özelliği olarak belirlendi ($p<0,05$).

Sonuç: Araştırmada örneklemi oluşturan çocukların yarısından fazlasında (%51,2) bağırsak parazitlerinin saptanması nedeniyle, Ordu ilinde bağırsak parazitlerinin çocuklar arasında yaygın olduğu kanaatine varılmıştır. Bu doğrultuda parazitlerin çocuklara bulaşması ve bulaşmaya karşı korunma yolları konusunda eğitimler düzenlenmelidir. Ayrıca çocukların düzenli sağlık kontrolleri yapılmalıdır.

Anahtar Kelimeler: Bağırsak parazitleri, blastocystis, cryptosporidium, çocuklar, Türkiye'nin kuzeyi

ABSTRACT

Objective: In this study, the aim was to investigate the incidence of intestinal parasites in children, demographic features related to parasite positivity, life style features and accompanying symptoms.

Materials and Methods: Fecal samples from 342 children (49.1% girls, 50.9% boys) attending with different symptoms were investigated with native, lugol, trichrome, acid fast, sedimentation and cellophane anal band methods for parasite diagnosis.

Results: All cases, 29% were preschool age of 1-5 years, 45.6% were 6-10 years and 25.4% were 11-18 years old. The incidence of intestinal parasites was 51.2% with the most commonly observed parasites identified as Cryptosporidium spp. (41.1%), Blastocystis spp. (40.6%), and Enterobius vermicularis (21.1%). Settlement area was determined to be a lifestyle feature significant for parasite positivity ($p<0.05$).

Conclusion: It was concluded that intestinal parasites were common among children in Ordu province, due to the detection of intestinal parasites (51.2%) in more than half of the children constituting the sample in the study. In line with this, educations should be organized about the transmission of parasites to children and ways of protection against transmission. Also, regular health check-ups of children must be done.

Keywords: Blastocystis, children, cryptosporidium, intestinal parasites, north of Turkey

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INTRODUCTION

Intestinal parasites affect millions of people around the world, especially children in developing countries. This universal problem is related to limitations in access to health education and diagnosis and treatment of infections, just as much as to clean drinking water and lack of sewage systems.[1,2] Children are a high-risk group for parasitic infections. These infections may affect mental and physical development, as well as causing situations like chronic diarrhea and malnutrition in this age group. Crowded environments, inadequate hygiene conditions, low socioeconomic and cultural status are factors which ease the infection of children with intestinal parasites.[3,4]

Parasitic infections are most frequently observed in children in the 0-15 year age group and are one of the common causes of hospital admissions in children from 0-5 years, especially. These infections may be asymptomatic, or frequently cause symptoms and findings like diarrhea, abdominal pain, cramps, nausea, vomiting, anemia, weight loss and loss of appetite.[5,6] Diarrhea is mostly due to viral or bacterial causes and parasitic intestinal infections are overlooked due to sufficient parasitological examinations do not have in some hospitals.[7]

This study aimed to reveal the incidence of intestinal parasites in children attending the Ministry of Health Ordu University Education-Research Hospital Pediatric Clinic with a variety of complaints and variables which may affect parasite positivity.

MATERIALS AND METHODS

Before beginning the study, Ethics Committee of Faculty of Medicine, Ordu Universitey, permission was received (Date: 17/12/2015, decision no: 2015/3). The population for the study comprised children residing in Ordu province and surroundings. All children aged 1-18 years attending Ordu University Faculty of Medicine Education-Research Hospital Pediatric Clinic for examination with various symptoms from May 2017 to May 2018 and accepting participation in the study were included. Informed consent forms were obtained from all children and/or parents who accepted participation in the study. Patients provided 20-40 g of formed feces (large walnut size) or 5-6 dessert spoons of liquid feces (~25 mL). Diaper-wearing infants had the diapers put on reversed to prevent absorption of feces and feces were placed in a fecal sample container. Patients using barium, bismuth, anti-diarrhetic, mineral oils, and antibiotics within the last 10 days and those with immune failure were excluded from the study. Samples were investigated in Ordu University Medical Parasitology Laboratory. Additionally, every participant completed a survey form created by the researchers including questions about the participant's age, sex, educational status, economic status, place of residence, home life status, type of water used, pets in the home and nutritional status.

Fecal samples were investigated with native, lugol, trichrome, acid fast, sedimentation and cellophane anal band methods for parasite detection.[8] All families were informed about parasitological diagnostic results and children with parasite identified were treated and monitored.

Statistical Analysis: A two-way chi-square test was used to examine any relationships that existed between parasite positivity and baseline characteristics or symptoms. In the parasite positive group, one-way chi-square test was used to compare categorical variable frequencies. $p<0.05$ value is accepted as significant. All statistical analyses were performed using IBM SPSS Statistics for Windows, version 26.0 (IBM, Armonk, NY, USA).

RESULTS

The study included a total of 342 patients aged from 1-18 years with 49.1% girls and 50.9% boys. All cases, 29% were preschool age from 1 to 5 years, 45.6% were 6-10 years of age and 25.4% were 11-18 years of age. The incidence of intestinal parasites in the sample was 51.2% with the most frequently observed three parasites *Cryptosporidium* spp*, Blastocystis* spp. and *Enterobius vermicularis*, respectively (41.1%, 40.6%, 21.1%) (Table 1). Among children with parasites detected, 58.9% (n=103) had only one parasite, while 41.1% (n=72) had two or more parasites observed.

When the total of 175 children with at least one parasite species identified are investigated, positivity was observed to be higher in the 6-10-year age group (48.0%), 'moderate' income level (86.9%), among 'primary school' graduates (44.6%) and those living with 'nuclear' families (73.7%). While 51.4% of patients positive for parasites were female and 48.6% were male, while 46.7% of those negative for parasites were female and 53.3% were male. However, according to the chi-square test, there was no significant variation for parasite positivity according to sex ($p>0.05$).

Additionally, no significant variation was observed for parasite positivity according to the economic and

Table 1. Frequency of identified parasites.

Parasites	**n**	**%***
Cryptosporidium spp.	72	41.1
Blastocystis spp.	71	40.6
Enterobius vermicularis	37	21.1
Entamoeba coli	29	16.6
Giardia intestinalis	20	11.4
Dientamoeba fragilis	7	4.0
Cyclospora cayetensis	5	2.9
Iadamoeba butschlli	4	2.3
Chilomastix mesnili	4	2.3
Hymenolepis nana	3	1.7
Endolimax nana	2	1.1
Ascaris lumbircoides	2	1.1
Entamoeba hartmanni	1	0.6
Entamoeba histoloytica	1	0.6
Mite	5	2.9

*: Total frequency is >100% because more than one Intestinal parasite is seen in a patient.

educational status of patients, family, type of water used, pets in the home and form of nutrition (p>0.05). While 61.7% of patients negative for parasites lived in villages, 56.6% of parasite positive patients lived in county towns or villages. The chi-square test showed parasite positivity displayed variation according to settlement type (p=0.000) (Table 2).

It was found that 73.7% of parasite positive patients lived with nuclear family, 49.1% used municipal water, 61.5% did not have pets in the home and 70.3% ate mainly vegetables. The parental education level of parasite-positive patients who do not have pets was found to be statistically significantly lower. Parasite positive patients had high rates of meat-dominant nutrition compared to negative patients.

Table 2. Variation of parasite positivity according to demographic and lifestyle characteristics of patients.

		Positive		**Negative**		**p**
		n	**%**	**n**	**%**	
Age (years)	1-5	51	29.1	48	28.8	0.660
	6-10	84	48.0	72	43.1	
	11-18	40	22.9	47	28.1	
Gender	Female	90	51.4	78	46.7	0.383
	Male	85	48.6	89	53.3	
Economic status	Good	15	8.6	18	10.8	0.435
	Moderate	152	86.9	137	82.0	
	Low	8	4.5	12	7.2	
Educational status	Illiterate	57	32.6	48	28.8	0.661
	Primary	78	44.6	72	43.1	
	Middle school and above	40	22.8	47	28.1	
Family type	Nuclear family	129	73.7	120	71.9	0.699
	Extended family	46	26.3	47	28.1	
Type of water used	Manicipal water	86	49.1	81	48.5	0.966
	Well water	6	3.4	7	4.2	
	Processed water	22	12.6	19	11.4	
	Spring water	61	34.9	60	35.9	
Animals at home	Yes	61	34.9	60	35.9	0.836
	No	114	65.1	107	64.1	
Type of nutrition	Meat dominant	17	9.7	12	7.2	0.342
	Vegetable dominant	123	70.3	129	77.2	
	Mixed	35	20.0	26	15.6	
Settlement unit	Village	76	43.4	103	61.7	**0.000***
	Town	26	14.9	7	4.2	
	City	73	41.7	457	34.1	

*: p <0.01.

However, parasite positivity did not display any variation according to these lifestyle features (p>0.05) (Table 2).

Among those with parasite positivity, 84% had allergy history, 61.1% experienced lethargy-fatigue, 58.9% had rectal itching, 60.0% had drooling, 60.0% had reduced appetite, 62.9% had diarrhea, 90.3% had fever, 74.9% had nausea and vomiting, 90.9% had indigestion, 83.4% had constipation problems, 86.9% had weight loss, 82.9% had joint pain, 93.1% had urinary tract infection and 94.9% had growth and development retardation and these were higher compared to those without positivity. The variation in having parasites or not according to the presence of some symptoms was analyzed with the chi square test. There were no significant differences in the frequency of allergy, fever, indigestion, weight loss, urinary tract infection development and growth-development retardation between the negative and positive groups (p>0.05). There were significant differences in frequencies of lethargy-fatigues, rectal itching, drooling, reduced appetite, diarrhea, abdominal pain, nausea-vomiting, constipation and joint pain between the negative and positive groups (p<0.05). Among patients positive for parasites, the frequency of patients with all symptoms apart from abdominal pain was higher compared to the frequency of patients without symptoms. A similar situation was present for negative

Table 3. Distribution of parasite positivity according to some situations.

		Positive		Negative		p
		n	%	n	%	
Allergy (Asthma, allergic rhinitis, food allergy, etc.)	No	28	16.0	20	12.0	0.284
	Yes	147	84.0	147	88.0	
Fatigue	No	68	38.9	30	18.0	**0.000*****
	Yes	107	61.1	137	82.0	
Anal itching	No	72	41.1	22	13.2	**0.000*****
	Yes	103	58.9	145	86.8	
Drooling	No	70	40.0	26	15.6	**0.000*****
	Yes	105	60.0	141	84.4	
Reduced appetite	No	70	40.0	30	18.0	**0.000*****
	Yes	105	60.0	137	82.0	
Diarrhea	No	65	37.1	22	13.2	**0.000*****
	Yes	110	62.9	145	86.8	
Abdominal pain	No	104	59.4	33	19.8	**0.000*****
	Yes	71	40.6	134	80.2	
Fever	No	17	9.7	16	9.6	0.981
	Yes	158	90.3	150	90.4	
Nausea and vomiting	No	44	25.1	18	10.8	**0.001****
	Yes	131	74.9	149	89.2	
Indigestion	No	16	9.1	9	5.4	0.188
	Yes	159	90.9	157	94.6	
Constipation	No	29	16.6	13	7.8	**0.014***
	Yes	146	83.4	153	92.2	
Weight loss	No	23	13.1	13	7.8	0.107
	Yes	152	86.9	154	92.2	
Joint pain	No	30	17.1	13	7.8	**0.009****
	Yes	145	82.9	154	92.2	
Urinary tract infection	No	12	6.9	7	4.2	0.282
	Yes	163	93.1	160	95.8	
Growth development retardation	No	9	5.1	3	1.8	0.093
	Yes	166	94.9	164	98.2	

*: p <0.05; **: p <0.01; ***: p <0.001.

patients. However, there were statistical differences for the frequencies in negative and positive groups. The majority of patients positive for parasites (94.9%) had growth-development retardation (Table 3).

With the aim of investigating whether settlement area is an important predictor (risk) factor for parasite positivity, binary logistic regression analysis was performed. Settlement area was determined to be a statistically significant factor for parasite positivity ($p<0.05$). Compared to those living in villages, those living in county towns had five times (OR: 5.034) greater parasite positivity, while those living in cities had almost two times (OR: 1.736) higher parasite positivity (Table 4).

Table 4. Logistic regression analysis predicting parasite positivity with settlement area.

Settlement unit	Negative		Positive		Total		Logistic regression analysis				
	n	%	n	%	n	%	b	S.E.	Wald	p	OR (95% CI)
Village	103	61.7	76	43.4	179	52.3	Reference category				
Town	7	4.2	26	14.9	33	9.6	1.616	0.452	12.793	**0.000**	5.034 (2.076-12.205)
City	57	34.1	73	41.7	130	38.0	0.551	0.233	5.619	**0.018***	1.736 (1.100-2.738)

b: Regression coefficient; SE: Standard error; OR: Odds ratio; CI: Confidence interval; *: $p<0.05$.

DISCUSSION AND CONCLUSION

There are many studies reporting different results related to the incidence of intestinal parasites in the world and in Turkey.[3,9-12] In three studies investigating children with similar age intervals to this study, the incidences of intestinal parasites were 10.2%, 39% and 70.9%, respectively.[9,11] The parasite incidence rate in this study was 51.2%. This difference in our study may be due to a variety of factors like the geographical features of the region, educational level of society, cultural features, economic status, hygiene, nutritional habits. In addition, the much symptom variety of the patients in the study may have been other situation affecting the result.

A study in Brazil identified the most common parasites were *Giardia intestinalis, Cryptosporidium* spp., and *Blastocystis* spp., in children under six years, while a study in Argentina about children from 1-14 years identified *Blastocystis* spp., *E. vermicularis* and *G. intestinalis*.[3,11] Two studies performed in different regions in Turkey reported the most commonly observed parasites were *Giardia intestinalis* and *Enterobius vermicularis*.[9,10] A study investigating children in primary schools in Ordu province found *Cryptosporidium* spp. and *Blastocystis* spp. were the most commonly observed parasites.[12] In this study, *Cryptosporidium* spp. (41.1%) was observed in first place followed by *Blastocystis* spp. (40.6%). In study investigating the presence of *Cryptosporidium* spp. in different seawater samples in Ordu province, the incidence of this parasite was found to be 73.7%.[13] The widespread use of swimming in the province of Ordu, the use of rivers in agricultural irrigation and the surrounding area as pasture may have been effective in the high rate of *Cryptosporidium* spp. in our study. Transmission of these frequently detected protozoa was reported to be due to water and food and via the fecal-oral route.[2] Children's not paying attention to personal care and food hygiene is also other effective factor.

Many studies have investigated the correlation between parasitic infections and socioeconomic variables. Economic status, low educational level, and living in rural regions increase the incidence of intestinal parasites. Additionally, other factors increasing parasite frequency are use of municipal water, consuming vegetables and fruit without good cleaning, lack of sewage system, and use of material like tiles, cement and bricks in the floors and walls of houses.[3,10,11,14,15] In this study, parasite positivity was found to be higher among those who used municipal water (49.1%), did not have pets at home (65.1%) and eating mainly vegetables (70.3%). In Turkey, the providing of access to municipal water by state in both urban and rural areas, and the common vegetable-dominant nutritional habits in Ordu, located in the Black Sea region north of Turkey, may have affected the study results. Additionally, low level of education in those who do not have pets, lack of attention to transmission routes such as fecal-oral route, person-to-person close contact, contaminated water, food and drink may have affected the parasite

positivity.[9,16]

Studies related to parasite epidemiology have researched the correlation between socioeconomic variables of economic status, and settlement area with parasite incidence. As the monthly income of families reduces, parasite frequency may increase;[3,10,17] but some studies reported that economic status did not affect parasite frequency.[18] In this study, parasite positivity did not display variability according to economic status. However, it was identified that settlement area may be an important predictor factor for parasite positivity. The parasite positivity risk was identified to be nearly five times higher for those living in county towns and nearly two times higher for those living in cities. The higher population in towns and cities compared to villages and additional more active social life may have caused increase in risk of infection by parasites for residents.

A study including children and adults investigated the correlation between intestinal parasites with nausea-vomiting, loss of appetite, abdominal pain, diarrhea, gas, constipation, anal itching, and abdominal distension and did not identify any significant correlation.[14] But the other study including children from 0-18 years in Turkey identified a significant correlation between abdominal pain, rectal itching, drooling, nasal itching and diarrhea with parasitosis.[10] In this study, 84% had allergy history, 61.1% had lethargy-fatigue, 58.9% had rectal itching, 60.0% had drooling, 60.0% had reduced appetite, 62.9% had diarrhea, 90.3% had fever, 74% had nausea and vomiting, 90.0% had indigestion, 83.4% had constipation, 86.9% had weight loss, 82.9% had joint pain and 93.1% had urinary tract infection identified among those positive for parasites which was very high compared to those without parasite infection identified. Differences in the study result may be due to different study populations, region and diagnostic methods used in studies.

Parasitic infections negatively affect children in terms of growth and development.[9,18] A variety of anthropometric indexes are used to monitor growth-development in children. The most practical and valid method among these indexes is accepted as weight according to age.[19] In a study, as a result of weight according to age assessment of children positive for parasites, nearly all (94.9%) were identified to have growth retardation according to criteria developed for children in Turkey by Neyzi.[20] A study by Yapıcı et al. observed children with parasite infection had low height-weight values according to age; however, this was not statistically significant.[10] These results may be interpreted as parasitosis negatively affecting growth and development.

In conclusion, in this study, 51.2% rates of intestinal parasites were encountered. This situation shows that intestinal parasites are widespread in children in Ordu province. In the childhood period, parasitic infections are still a serious public health problem and it appears parasitic infections are related to socioeconomic conditions and lifestyles in society. Additionally, intestinal parasites cause many symptoms and findings in children. It was concluded that children brought to hospital should be assessed in terms of intestinal parasites and education should be given about parasite transmission routes in children and ways to protect against these infections.

Ethics Committee Approval: Our study was approved by the Ordu University Clinical Research Ethics Committee (Date: 17/12/2015, decision no: 2015/3).

Conflict of Interest: No conflict of interest was declared by the authors.

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