RESEARCH ARTICLE / Araştırma Makalesi

Differences Between The Children Infected with Enterobius Vermicularis and Taenia Saginata

Enterobius Vermicularis ve Taenia Saginata İle Enfekte Çocuklar Arasındaki Farklar

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Abstract

Objective Intestinal parasitosis is a major health problem causing significant morbidities in children, such as malnutrition. It was aimed to investigate and compare the children with Enterobius vermicularis and Taenia saginata infections in this study. **Sakarya Med J, 2018, 8(2):272-278)**

Materials and Methods We prospectively evaluated and compared children with E.vermicularis and T.saginata infections in terms of symptoms, laboratory parameters, and anthropometric measurements.

Results Of the 183 children enrolled, 100 (54.6%) were male. Patients' ages ranged between 2 and 16 years, with a median of 8.0 (range, 2-16.2) years. E.vermicularis was present in 116 (%63.4) patients and T.saginata in 67 (36.6%). No difference was determined between the groups in terms of age, gender, or length of symptoms. Increased appetite was more prevalent in patients with T.saginata (p=0.008). Patients with E.vermicularis exhibited higher eosinophilia and IgE levels (p=0.001 and p=0.01, respectively). The mean BMI and BMI Z-score of patients with E.vermicularis were statistically significantly higher than those of the T.saginata group (15.96±2.06 vs. 14.75±2.02 and -0.44±0.98 vs. -1.45±1.35, p<0.0001 for both). Patients with T.saginata were also more underweight (p=0.003).

Conclusion Malnutrition despite increased appetite could raise suspicion of T.saginata infections, while increased levels of IgE and eosinophil count could attract physicians' attention to E.vermicularis infections even in asymptomatic patients, especially in endemic countries.

Keywords child, Enterobius vermicularis, intestinal parasitosis, malnutrition, Taenia saginata

Öz

Amaç Bağırsak parazitozu çocuklarda malnütrisyon gibi ciddi morbiditelere yol açan önemli bir sağlık sorunudur. Bu çalışmada Enterobius vermicularis ve Taenia saginata enfeksiyonu olan çocukların değerlendirilmesi ve birbirleriyle karşılaştırılması amaçlanmıştır. **(Sakarya Tıp Dergisi, 2018, 8(2):272-278).**

Gereç ve Yöntem Enterobius vermicularis ve Taenia saginata enfeksiyonu olan çocukları, semptomları, laboratuvar parametreleri ve antropometrik ölçümleri açısından prospektif olarak değerlendirip karşılaştırdık.

Bulgular Dahil edilen 183 çocuğun 100'ü (%54,6) erkekti. Yaşları 2-16 arasında değişen hastaların yaş ortancası 8,0 (aralık:2-16.2) yıldı. E.vermicularis 116 (%63,4), T.saginata 67 (%36.6) hastada mevcuttu. Gruplar arasında yaş, cinsiyet ve semptom süreleri açısından fark saptanmadı. T.saginata'lı hastalarda iştah artışı daha sıktı (p=0.008). E.vermicularis'li hastalarda eozinofili ve IgE düzeyleri daha yüksekti (sırasıyla p=0.001 ve p=0.01). E.vermicularis'li çocukların ortalama BMI ve BMI Z-skorları T.saginata'lı çocuklara göre istatistiksel anlamlı olarak daha yüksekti (15.96±2.06 vs. 14.75±2.02 ve -0.44±0.98 vs. -1.45±1.35, her ikisi için de p<0.0001). Ayrıca T.saginata'lı çocuklar daha zayıftı (p=0.003).

Sonuç Özellikle endemik ülkelerde, başka semptomu olmayan hastalarda bile, iştah artışına rağmen malnütrisyon olması T.saginata enfeksiyonunu, artmış IgE ve eozinofili düzeyleri olması ise E.vermicularis enfeksiyonunu düşündürebilir.

Anahtar Kelimeler çocuk, Enterobius vermicularis, intestinal parazitoz, malnütrisyon, Taenia saginata

Introduction

Intestinal parasitic infections are important health problems worldwide. One in four of the known infectious diseases in humans is thought to be caused by the helminth/protozoan group.[1] Although the spectrum of parasite types varies in different parts of the world, Enterobius vermicularis, commonly known as the pinworm or seatworm, is one of the most common species, with an estimated prevalence of 4–28% in children globally.[2] Infestation secondary to E. vermicularis is relatively innocuous, with symptoms arising from perineal, perianal, and vaginal irritation due to egg deposition.[3] Taenia solium, Taenia saginata, and Taenia asiatica are zoonotic tapeworms that infect humans through pigs and cattle as intermediate hosts. Despite their worldwide distribution, infections are particularly common in the developing world, such as Eastern Europe, Russia, the Middle East, East Africa, and Latin America. Approximately 50 million people are estimated to be infected with T. saginata in these regions. This is also the most commonly encountered species in Turkey, due to dietary habits and religious customs (such as Muslims avoiding pork products).[4] T. saginata is also known as the beef tapeworm. Its existence has been known since ancient times, and in contrast to T. solium and T. asiatica, it is not related to human cysticercosis, and generally causes asymptomatic infections or milder symptoms.[5]

Parasitic infections may sometimes be ignored and not treated appropriately, although they can involve numerous morbidities. There are case reports of both E. vermicularis and T. saginata even resulting in surgical or endoscopic abdominal procedures.[6] They also exhibit symptoms which may lead to progressive disorders, impairment of learning capabilities, and varying degrees of malnutrition.[7,8] Pinworms are very small and apparently benign, except for causing some minimal discomfort, while beef tapeworms are large and unpleasant in appearance. The aims of this study were to investigate children with these parasitic infestations, to determine the clinical and laboratory characteristics and anthropometric status of the affected children, and to document the differences between the study groups.

Materials and Methods

This prospective, cross-sectional study included 183 patients with T.saginata and E.vermicularis, at our tertiary hospital, Turkey, in April-October 2016. It is the largest city in the underdeveloped eastern region of Turkey and stands at an approximate altitude of 1900 m above sea level. It has a mean temperature of 5.3° C, the lowest, at -15.2° C, being seen in January and the highest, at 27.4° C, in August. The mean annual rainfall is 405.3 mm.[9] The hospital in which the study took place also serves as a referral health center for patients admitted directly or referred from other hospitals in neighboring cities, towns and villages. The study was approved by the local ethical committee (date, 05/03/2016; number, 2016/9-60).

Data were evaluated for 183 patients presenting to the Pediatric Outpatient Clinic with E. vermicularis and T. saginata infections. Data including age, sex, body weight and height, presence of symptoms, abdominal pain, anal pruritis, hypersalivation, loss of or increased appetite, constipation and diarrhea, duration of symptoms, and laboratory parameters including leukocyte and platelet counts, hemoglobin level, absolute eosinophil count, and immunoglobulin E (IgE) level were investigated.

Anthropometric parameters such as height and weight were assessed in all subjects. Weight and

height were determined using a portable digital standard digital stadiometer (Charder®, MS4900, Taichung City, Taiwan). Z-scores for weight, height, and body mass index (BMI) for age were calculated based on the general Turkish pediatric population.[10] Children were described as underweight and stunted if Z-scores of height for age and weight for age were below -2 standard deviation.[11]

As soon as stool samples were received, these were analyzed by two experienced specialists in the ERTRH microbiology laboratory. Macroscopic examination in terms of odor, consistency, and presence of mucus, blood, and adult forms of parasites was performed. Protozoal vegetative forms and cysts and helminth eggs and larvae were next investigated by light microscopic examination of fecal smears at x10 and x40 magnifications with the help of direct wet mount, native-Lugol, and Trichrome stains. Stool and serum samples from suspected symptomatic cases with an unidentified parasitic etiology were sent to the Turkish Public Health Agency microbiology laboratory. Enzyme-linked immunosorbent assay (ELISA) IgG analysis was performed for T. solium and T. saginata. For suspected pinworm infections, cellophane tape samples from perianal region were collected on three consecutive mornings immediately after the patient had got up, following parental instruction. Samples were examined for E. vermicularis eggs under light microscopy at x10 and x40 magnifications.

Patients with more than one parasite or with single parasites other than E. vermicularis and T. saginata were excluded from the study. The patients with E. vermicularis were compared with those with T. saginata in terms of demographic, anthropometric, clinical, and laboratory characteristics.

Data analysis was performed on Statistical Package for the Social Sciences version 18.0 (Chicago, IL, USA) software. The numeric variables are expressed as mean ± standard deviation. Categorical variables were compared using the chi-square test, while Fishers' exact test was used to compare percentages between the groups. Intergroup comparisons were performed using Kruskal-Wallis one-way analysis of variance (ANOVA), and the t-test. Significance was set at $p<0.05$.

Results

One hundred eighty three symptomatic children, 100 (54.6%) male, were included in the study. Patients' ages ranged between 2 and 16.2, with a median of 8.0 years. Seven (3.8%) children had a known underlying disorder (immunodeficiency [n=1, 0.5%], celiac disease [n=2, 1%], Tourette syndrome [n=1, 0.5%], Rickettsia [n=1, 0.5%], food allergy [n=1, 0.5%], or familial Mediterranean fever [n=1, 0.5%]). Symptoms had been present for a median 60 days (IQR, 21-160). E. vermicularis was identified in 116 (63.4%) children and T. saginata in 67 (36.6%). The most common symptom was abdominal pain (n=136, 74.3%) (Table 1). Only three (1.6%) patients had elevated transaminases (80-100 U/L). Forty-nine (26.8%) subjects were underweight, while the others were of normal weight. Fifty-three (29.0%) children were stunted. BMI Z-scores were below -3 in five (2.7%) children, between -2.99 and -2 in 27 (14.8%), and higher than -1.99 in 151 (82.5%). Patients with E. vermicularis and T. saginata infections were compared (Table 2). No difference was determined between the groups in terms of age, gender, or length of symptoms (Table 2). Increased appetite was a more prevalent symptom in patients with T. saginata than in those with E. vermicularis (p=0.008). Patients with E. vermicularis exhibited a higher level of eosinophilia (median absolute eosinophilia, 0.42 vs. 0.29, p=0.001) and higher levels of IgE (mean IGE level, 100 vs. 61, p=0.01). The two groups were also compared in terms of anthropometric measurements. The mean BMI and BMI Z-score of patients with E. vermicularis were statistically significantly higher

than those of the T. saginata group (15.96±2.06 vs. 14.75±2.02 and -0.44±0.98 vs. -1.45±1.35, respectively, p<0.0001 for both). Additionally, the patients with T. saginata were more underweight and had much lower BMI Z-scores (p=0.003 and p<0.0001, respectively) (Table 2). No difference was observed between the groups in terms of mean body weight and height, or Z-scores.

Table 1. Characteristics of the study population

Anthropometric measurement,	(mean±SD) (min-max)
Body weight (kg)	24.9 ± 13.6
Body weight Z-score	-1.50±1.34
Height (cm)	121.6±21.0
Height Z-score	-1.35±1.10
BMI (kg/m2)	15.52 ± 2.12 (10.9-23.1)
BMI Z-score	-0.81±1.22
Clinical Symptoms,	n (%)
Abdominal pain	136 (74.3%)
Anal pruritis	107 (58.5%)
Hypersalivation	94 (51.4%)
Loss of appetite	49 (26.8%)
Constipation	39 (21.3%)
Increased appetite	14 (7.7%)
Diarrhea	8 (4.4%)
Laboratory parameters	(mean±SD) (min-max)
Leukocyte count (x109/L)	8.93 ± 2.97 (3.4-20.30)
Hemoglobin level (g/dL)	13.9 ± 1.1 (10.7-16.7)
Platelet counts (x109/L)	360 ± 87 (174-680)
Absolute eosinophilia (x109/L)	0.37 ± 0.33 (0.0-1.9)
IgE level (mg/dL)	131 ± 192 (1-1001)

SD, standard deviation; BMI, body mass index; min, minimum; max, maximum

Table 2. Comparison of patients infected with Enterobius vermicularis and Taenia saginata

	Enterobius vermicularis n=116 (63.4%)	Taenia saginata n=67 (36.6%)	p value
Age (years) [median (min-max)]	8.0 (2-16.2)	7.6 ± 3.8	0.70
Male sex, n (%)	63 (54.3%)	37 (55.2%)	1.00
Length of symptoms (days) [median (IQR)]	60 (16-180)	60 (30-150)	0.93
Clinical Symptoms	n (%)	n (%)	
Abdominal pain	83 (71.6%)	53 (79.1%)	0.29
Anal pruritis	73 (62.9%)	34 (50.7%)	0.21
Hypersalivation	57 (49.1%)	37 (55.2%)	0.44
Loss of appetite	29 (25.0%)	20 (29.9%)	0.49
Constipation	26 (22.4%)	13 (19.4%)	0.71
Increased appetite	4 (3.4%)	10 (14.9%)	0.008*
Diarrhea	3 (2.6%)	5 (7.5%)	0.14
Anthropometric measurements	n (%)	n (%)	
Stunted	34 (29.3%)	19 (28.4%)	0.51
Underweight	22 (19.0%)	27 (40.3%)	0.003*
BMI Z-score > (-2) (-2) – (-2.99) ≤ (-3)	 107 (92.2%) 9 (7.8%) 0	 44 (65.7%) 18 (26.9%) 5 (7.5%)	<0.0001*

SD, standard deviation; BMI, body mass index; min; minimum, max; maximum, IQR, interquartile range; *, statistically significant; min, minimum; max, maximum

Discussion

This study elicited data concerning the clinical and laboratory properties and anthropometric indices of children with E. vermicularis and T. saginata infections who were living in the XXX district and surrounding area. The impact of intestinal parasitosis on children's health has been evaluated in previous studies, but no assessment and comparison specific to these parasites has been performed before.[12,13] Prior malnutrition and subsequent diminished immunity may possibly facilitate the development of parasitosis. The results from the general study population showed that 26.8% of participants were underweight, 29.0% were stunted, and 17.5% had BMI Z-scores below -2. Although malnutrition is multifactorial, and may involve such factors as poverty, socio-economic features, inadequate dietary intake, malabsorption, low birth weight, recurrent illnesses, chronic diseases, other infections, and other metabolic disorders, both groups were thought to be equally distributed in terms of confounding factors. A relationship between intestinal helminth infections and stunting in school children has been previously documented.[14] T. saginata is a meat-borne parasite which is usually acquired via ingestion of undercooked meat containing the larval stage of the parasite. Pawlowski and Schultz[15] reported that fewer than 20% of 2000 taeniasis cases also exhibited weight loss. Tembo and Craig[16] reported body weight in voluntary self-infected patients was not significantly different from normal. In contrast, in this study, children with T. saginata had lower BMI values and BMI Z-scores than those with E. vermicularis, and children with T. saginata were also more underweight. Decreased levels of magnesium and zinc, which are essential for growth and development, have been documented in children with taeniasis.[17] The better nutritional status of children with E. vermicularis may be attributed to the parasite's habitat in the intestines and lack of prominent systemic manifestations or malabsorption of nutrients. Yazgan et al.[18] observed no association between E. vermicularis infection and weight loss. Although loss of appetite or anecdotal reports of loss of weight have been reported, these symptoms have not been proved to be causally related to Enterobius infections.

Eosinophilia and IgE elevation has been proposed as a determinant of parasitic infections in children.[19] Parasitic helminth antigens induce production of IgE through cytokines such as IL-4, IL-5, and IL-13, while eosinophilia plays an important role in protective immunity against helminth parasites.[20] In a study dealing with intestinal pathology specimens of patients with intestinal parasites, eosinophilic infiltration was documented in half of the patients, and none of the patients with E. vermicularis had eosinophilic infiltration.[21] No histopathological examination was performed in that study, and the authors concluded that hyper IgE levels and eosinophilia may not always correlate with pathological tissue changes. These two parameters were above normal limits in both groups, although patients with E. vermicularis exhibited higher eosinophilia and higher levels of IgE. High IgE levels and eosinophilia have been shown to generally occur during tissue migration or the harboring of parasites, and especially when the parasite invades the bowel mucosa.[22,23] The differences in this study may be attributed to the characteristics of the parasites.

The clinical spectrum of intestinal parasitosis in children is variable and represents a challenge for clinicians. Both parasites may sometimes remain asymptomatic. Patients with taeniasis generally report passage of proglottids through the anus. However, nausea, diarrhea, abdominal pain, loss of body weight, and pruritis ani have also been reported during taeniasis.[16,24,25] Similarly, oxyuriasis due to E. vermicularis is not always symptomatic and is sometimes diagnosed incidentally, although patients may suffer from symptoms such as abdominal pain, chronic diarrhea, and anal

pruritus.[26-29] One important finding emerging from our comparison of children with E. vermicularis and T. saginata was the increase in appetite, which was more prevalent in the T. saginata group. Appetite fluctuations may arise as a consequence of both changes in bowel movements and of impaired alimentation. Leptin and neuropeptide-Y levels may also be implicated, because lower leptin and increased neuropeptide-Y plasma levels have been seen in infected mice with Taenia taeniaformis compared to uninfected subjects in one animal study.[30] Previous clinical studies have shown that E. vermicularis infestation results in loss of appetite, rather than an increase.[18,31] Increased appetite has also been reported in voluntary taeniasis patients and in an earlier Taiwanese study of Taenia spp.[16,25] No difference was observed in terms of other symptoms between the two groups, as well as of duration of symptoms, in this study.

Previous reports suggest that children, particularly those aged [5-14], generally experience the highest burden of E. vermicularis and other parasitic infections, due to their greater behavioral risks, outdoor exposure, and poor personal hygiene.[32,33] The mean ages of the children in the two groups in this study were similar. No association between patient gender and parasites was also observed, in agreement with previous reports.[34,35] In one earlier study, higher E. vermicularis infection rates were not correlated with children's gender, but were associated with lower income families.[31] Personal hygiene factors, parental educational and socioeconomic status have been reported to reflect intestinal parasitosis in previous studies.[34,36,37] However, these were beyond the scope of this study.

A number of limitations should be considered when interpreting the results of the present study. Seasonality has been reported to favor the occurrence and course of parasitic infections. Extremes of cold or heat make it more difficult for infectious stages to survive.[20] Factors such as climate and geographical conditions, and some social traditions, which were beyond the scope of the study, also appear to influence the uninterrupted transmission and spread of parasites.38 Compliance with hygiene rules, eating habits, and socioeconomic factors might also have been taken into consideration in this study.

As a conclusion, intestinal parasitic infections, which are mostly asymptomatic or ignored when their presence is realized, impose a significant burden on pediatric populations in particular. Preventable consequences such as malnutrition and other morbidities make the prompt diagnosis and appropriate treatment of parasitosis essential. Our study findings show that malnutrition despite increased appetite could raise the suspicion of T. saginata infections, while increased IgE levels and eosinophil count could direct physicians' attention toward E. Vermicularis infections, even in asymptomatic patients, especially in endemic countries.

There are no conflicts of interest to declare.

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