

# Parasitic Appendicitis in 14.797 Cases: A Retrospective Cohort Study

On Dört Bin Yedi Yüz Doksan Yedi Olguda Parazitik Apandisit:  
Retrospektif Bir Kohort Çalışması

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## ABSTRACT

**Objective:** This study aimed to determine the frequency of *Enterobius vermicularis* in appendectomy specimens and evaluate the histopathological characteristics of adult and pediatric cases with *E. vermicularis* infection.

**Methods:** Appendectomies examined from 1 January 2010, to 1 December 2020, were analysed retrospectively. Cases were divided into two groups: under 18 years (children) and 18 and over (adults). Demographic and histopathological characteristics of patients were also examined.

**Results:** Out of 14.797 patients that underwent appendectomy, 6.130 were children and 8.667 were adults. *E. vermicularis* was detected in 268 patients, wherein 64.2% were children and 35.8% were adults. In the detection of *E. vermicularis* in appendectomy specimens, the frequency was higher in children compared to that in adults (2.85%, 1.1%, respectively) ( $p < 0.001$ ). Histopathologically, acute appendicitis was defined in 31.7% ( $n=85$ ) of 268 cases, and *E. vermicularis* was found to cause a higher rate of acute appendicitis in adults ( $p < 0.001$ ).

**Conclusion:** The frequency of *E. vermicularis* in appendectomy specimens is higher in children. However, *E. vermicularis* causes acute appendicitis more frequently in adults.

**Keywords:** Appendectomy, *Enterobius vermicularis*, parasites

## ÖZ

**Amaç:** Bu çalışmada, *Enterobius vermicularis*'in apandektomi spesmenlerinde görülme sıklığını bulmayı ve *E. vermicularis* enfeksiyonu saptanan yetişkin ve çocuk olguların histopatolojik özelliklerini değerlendirmeyi amaçladık.

**Yöntemler:** 1 Ocak 2010 ile 1 Aralık 2020 tarihleri arasında yapılan apandektomiler geriye dönük olarak değerlendirildi. Olgular 18 yaş altı (çocuk) ve 18 ve üstü (yetişkin) olmak üzere iki gruba ayrıldı. Hastaların demografik ve histopatolojik özellikleri incelendi.

**Bulgular:** Apandektomi yapılan 14.797 hastanın 6.130'u çocuk, 8.667'si yetişkindi. Toplam 268 hastada *E. vermicularis* tespit edildi ve bunların %64,2'si çocuk; %35,8'i yetişkindi. Çocukların apandektomi spesmenlerinde *E. vermicularis* saptanma sıklığı yetişkinlere göre daha yüksekti (sırasıyla: %2,85, %1,1) ( $p < 0,001$ ). Histopatolojik olarak akut apandisit, 268 olgunun %31,7'sinde ( $n=85$ ) tanımlandı ve *E. vermicularis*'nin yetişkinlerde daha yüksek oranda akut apandisit neden olduğu saptandı ( $p < 0,001$ ).

**Sonuç:** Apandektomi spesmenlerinde *E. vermicularis* sıklığı çocuklarda daha yüksektir. Buna karşın *E. vermicularis* erişkinlerde daha sık akut apandisit neden olur.

**Anahtar Kelimeler:** Apandektomi, *Enterobius vermicularis*, parazit

## INTRODUCTION

Acute appendicitis is the most common disease that requires surgical intervention both in childhood and in adults. Luminal stasis and lymphoid hyperplasia often cause the pathophysiology of the disease. The

most common cause in etiology is fecaloid at all ages. Parasitic infections due to *Enterobius vermicularis* are rarely seen in the histopathological examination of appendectomy. It is a common parasite worldwide and affects about 200 million people around the world (1). It is known that it is more common, especially in



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childhood. It is transmitted by the fecal-oral route and settles in the gastrointestinal tract of the host human.

How much of the *E. vermicularis* cases are responsible for acute appendicitis is controversial and varies between geographical regions. The reason for this is that parasitic diseases are more common in socioeconomically underdeveloped countries. It has been assumed that *E. vermicularis* infection in acute appendicitis ranges from 0.2% to 41.8% worldwide (2).

In this article, parasitic infections detected in the pies of appendectomy were retrospectively reviewed. The primary aim of this study is to describe the frequency of *E. vermicularis* in appendectomies. The second is to evaluate the histopathological features of parasitic appendicitis cases in children and adults.

## METHODS

Diyarbakır Gazi Yaşargil Training and Research Hospital's pathology database was reviewed retrospectively between 1 January 2010 and 1 December 2020, and the 14.797 patients who underwent appendectomy were obtained. All pediatric and adult patients were included in the study.

The histopathological features of all patients were examined. Totally 268 cases were identified with *E. vermicularis* infection features like parasite egg, parasite larvae, or adult parasite form (Figure 1).

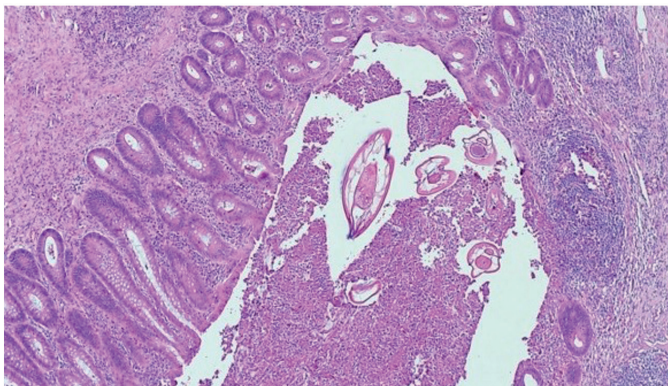
The age, gender, and operation dates of the patients were determined. The subjects were divided into two groups: under 18 years old (childhood) and 18 years and above (adult). The frequency and clinical findings of the disease were compared between the two groups.

### Statistical Analysis

All patient data were recorded in the SPSS 25 Chicago BMI database. The categorical variables were examined as minimum, maximum, and percentage values. After the normalization test was applied to the data, the chi-square test was used for group comparison, the t-test for comparison of means, and the Pearson correlation test for correlation between data. A value of  $p < 0.005$  was considered significant in all statistics.

## RESULTS

The study population is summarized in Figure 2. *E. vermicularis* was identified in 268 of 14.797 patients, 6.130 of whom were



**Figure 1.** *Enterobius vermicularis*. The parasite is seen at the appendiceal lumen (HEX100)

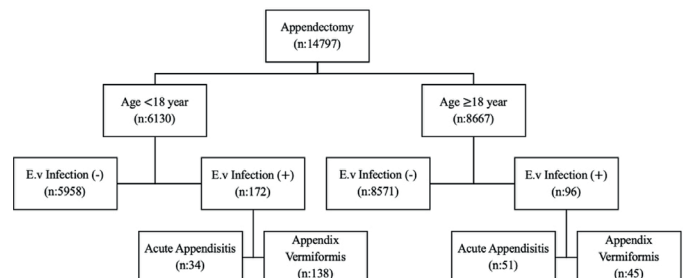
children, and 8667 were adults. The frequency of *E. vermicularis* among all appendectomies scanned for the study was 1.81% (n=268). The rate of parasite detection in children's appendectomy specimens was higher than in adults. (2.85% vs 1.1%) ( $p < 0.001$ ) (Table 1).

One hundred seventy-two of 268 cases were children (64.2%), and 96 were adults (35.8%). The mean age in childhood was  $10.77 \pm 3.82$  years; it was  $27.77 \pm 8.82$  in adults. Gender distribution was similar in both children and adults. In histopathological examination, only 85 (31.7%) of the cases were acute appendicitis, and this rate was higher in adults (53.1% vs 19.2%) ( $p < 0.001$ ). Appendix diameter was similar in adults and children, but its length was statistically significantly higher in adults ( $p = 0.008$ ). Lymphoid hyperplasia was more common in children ( $p = 0.037$ ). Perforation and fechaloid rates were similar (Table 1). When the ten-year period was examined, the number of cases seen was gradually decreasing (Figure 3).

## DISCUSSION

*Enterobius vermicularis*, also known as pinworm or oxyuris, is a nematode, and the only host is human (3). The most important route of transmission is eating foods infected with parasite eggs or drinking water. The parasite's eggs crack in the stomach and mature in the gastrointestinal system. Then frequently settle in the cecum or rectum and less regularly in the terminal ileum. This period takes about 2-4 weeks (4). This parasite can be seen in all age groups globally; however, it was reported more frequently during the school-age period (5). It has a high prevalence in developing and tropical countries and has been documented in 4-28% of children worldwide (6). Detection of *E. vermicularis* in appendectomy specimen is a rare finding, and there are data that it plays a role in the etiology of appendicitis for approximately 100 years (7).

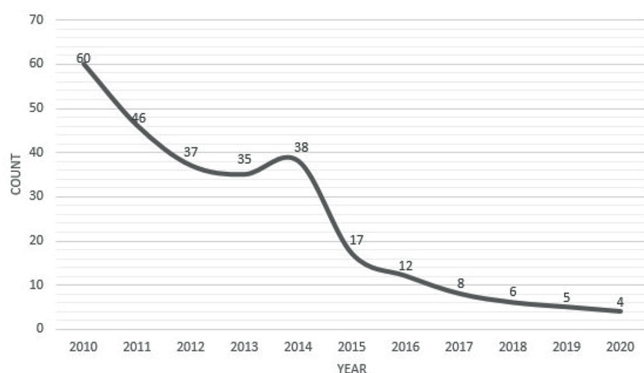
In a comprehensive literature review conducted by Zakaria et al. (6), they examined 21 articles reported between 1957 and 2002. The authors found that the frequency of *E. vermicularis* detection in appendectomies was 4.5%. In a meta-analysis by Taghipou et al. (7), 103,195 appendix tissue samples belonging to the appendicitis cases were evaluated for *E. vermicularis* infection, and 2983 (2.89%) patients were positive for the parasite. According to their study, the highest and lowest global burdens of *E. vermicularis* infection were found in the continents Africa (8%) and America (2%). Nigeria (33%) was identified as a country with the highest percentage of positive histopathological results, while the lowest prevalence (<1%) was found in Venezuela. In our study, 14,797 cases were analyzed retrospectively, and the frequency of *E. vermicularis* was 1.81%. The frequency of *E. vermicularis* in our study group is lower than most of the countries surveyed in the literature.



**Figure 2.** The study population

<b>Table 1. Clinical features</b>				
<b>Variabls</b>		<b>&lt;18 year (n=172)</b>	<b>≥18 year (n=96)</b>	<b>p</b>
<b>Frequency in all population</b>		(1.81%)		-
<b>Frequency according to age population</b>		2.85%	1.1%	<b>0.000</b>
<b>Age (year) (mean ± SD)</b>		10.77±3.82	27.77±8.82	-
<b>Sex</b>	<b>Female</b>	85 (49.5%)	50 (52%)	0.676
	<b>Male</b>	87 (50.5%)	46 (48%)	
<b>Size (mm) (mean ± SD)</b>	<b>Diameter</b>	7.35±3.41	8.23±4.90	0.088
	<b>Length</b>	64.13±16.77	69.95±71.98	<b>0.008</b>
<b>Acute appendicitis</b>	<b>No</b>	138 (80.3%)	45 (46.9%)	<b>0.000</b>
	<b>Yes</b>	34 (19.7%)	51 (53.1%)	
<b>Perforation</b>	<b>No</b>	167 (97.1%)	92 (95.8)	0.583
	<b>Yes</b>	5 (2.9%)	4 (4.2%)	
<b>Reactive lymphoid hyperplasia</b>	<b>No</b>	137 (79.7%)	86 (89.5%)	<b>0.037</b>
	<b>Yes</b>	35 (20.3%)	10 (10.5%)	
<b>Fechaloid</b>	<b>No</b>	143 (83.1%)	89 (92.7%)	0.09
	<b>Yes</b>	29 (16.9%)	7 (7.3%)	

SD: Standard deviation

**Figure 3.** Distribution of cases from 2010 to 2020 (n=268)

According to Fleming et al. (8) the annual incidence of *E. vermicularis* in appendectomy specimen from their pediatric cohort was 7.1%. Our study found this rate was 2.85% in children and that there was a statistically significantly lower rate in adults. We think this is because of the high overall incidence of *E. vermicularis* in children.

The role of *E. vermicularis* in the etiopathogenesis of acute appendicitis is controversial. According to many authors, *E. vermicularis* was more often associated with un-inflamed appendices than inflamed appendices, and mucosal invasion was not seen (9). Hasan et al. (1) suggest that *E. vermicularis* infection is an incidental finding during histopathology examination of appendectomy specimens for patients with a clinical diagnosis of acute appendicitis. However, there is no relationship between *E. vermicularis* and acute appendicitis, which is the main indication for appendectomy (1). In the study published by Karatepe et al. (10), acute inflammation was found in 18 of the 24 patients' (75%) histopathological examination. In our series, 85 cases (31.7%) had histopathological features of acute appendicitis. We also found that *E. vermicularis* causes a higher rate of acute appendicitis when seen in adults.

In our study, fecaloid, which plays a role in acute appendicitis etiology, was detected in only 36 cases. Also, perforation, which is a complication of acute appendicitis, was detected in only nine patients. In the literature, perforation rates due to acute appendicitis are range from 15% to 20% for children (11) and 16% to 40% for adults (12). However, in our study, contrary to the literature, perforation rates were lower in *E. vermicularis*-associated acute appendicitis. We can interpret this situation as *E. vermicularis* infection does not increase the possibility of perforation.

Most of the cases reported in the literature are from countries with low socio-economic development. Taghipour et al. (7) observed a geographical variation for the prevalence of *E. vermicularis* infection in appendicitis cases. They suggested that this variation in different continents could result from lifestyle, sanitation status, culture, socio-economic conditions, and climate. In the subgroup analyses of their study, they found that low-income countries with lower human development indexes had a higher prevalence of *E. vermicularis* than high-income countries with a higher human development index. In our series, the number of cases detected between 2010 and 2020 was gradually decreasing. However, it was not possible in this study to reveal what the reason for this was. We know that there has been a positive socio-economic development in the city where the research was conducted in 10 years. However, we certainly need additional demographic characteristics to evaluate whether this affects the decrease in the number of cases in our study. Our study has a limitation in this respect.

## CONCLUSION

*E. vermicularis*, which can play a role in the pathophysiology of acute appendicitis in all age groups, has a higher frequency in children. In this cohort, which has the most extensive case series in the literature, we found that *E. vermicularis* more frequently caused acute appendicitis in adults.

**\* Ethics**

**Ethics Committee Approval:** Due to the retrospective nature of our study, ethical committee approval was not taken.

**Informed Consent:** Retrospective study.

**Peer-review:** Internally peer-reviewed.

**\*\* Authorship Contributions**

Concept: S.G., N.S., Design: S.G., Data Collection or Processing: S.G., N.S., Analysis or Interpretation: S.G., N.S., Literature Search: S.G., N.S., Writing: S.G., N.S.

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

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