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Enterobiosis in Sivas, Turkey from Past to Present, Effects on Primary School Children and Potential Risk Factors

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SUMMARY: The prevalence of *Enterobius vermicularis* and potential risk factors was investigated in 2,230 pupils in Sivas between November 2006 and June 2008. A total of ten primary schools in different regions (4 located in City center, 4 in districts and 2 in villages) were classified as Region 1, Region 2 and Region 3, respectively and children completed a questionnaire about the potential risk factors. The overall egg positivity rate for *E. vermicularis* was 8.2% in Region 1, and the prevalence in the other regions was 7.0% and 14.8%, respectively. Children, aged 10–14 years, didn't show a significantly higher egg positivity rate than younger children (χ^2: 0.10, p>0.05) and the infection rate for boys was not statistically different than girls (χ^2:0.40, p>0.05). The socio-economic status of the family and personal hygiene were found to be associated with enterobiosis, (χ^2:30.83, p<0.05). Furthermore, it was found that there was a statistically important relation between parasite occurrence and school success (χ^2:39.52, p<0.05).But there is no difference between the parasitic and non-parasitic groups in terms of weight and height (t: 1.75, p>0.05, t: 1.43, p>0.05; respectively). The frequency of enterobiosis is obviously decreased in our region when the previous studies are considered.

Key Words: Enterobiosis, children, school success, socio-economical status

Geçmişten Günümüze Sivas'ta Enterobiyaz; İlköğretim Çağı Çocuklarına Etkileri ve Potansiyel Risk Faktörleri

ÖZET: Sivas'ta öğrenim gören ilköğretim çağındaki 2230 çocukta Kasım 2006 ve Haziran 2008 arasında *Enterobius vermciularis* görülme sıklığı ve potansiyel risk faktörleri selofan bant yöntemiyle araştırıldı. Farklı bölgelerdeki toplam on okul (4 şehir merkezi, 4 ilçe ve 2 köy) çalışmaya alındı ve sırasıyla grup 1,2 ve 3 olarak sınıflandırıldı. Ayrıca öğrencilere potansiyel risk faktörlerini belirlemeye yönelik bir anket uygulandı. *E.vermicularis* prevelansı grup 1'de%8.2 , grup 2 de%7,0 ve grup 3 de%14,8 olarak bulundu. Yaşları 10–14 arasında olan grup ile daha küçük olanlar arasında (χ^2: 0.10, p>0.05), erkekler ve kızlar arasında (χ^2 : 0.40, p>0.05) parazit görülme sıklığı istatistiksel olarak karşılaştırıldığında anlamlı bir fark saptanmamıştır. Ancak sosyo-ekonomik düzey ile parazit görülme sıklığı arasında anlamlı fark bulunmuştur (χ^2: 30.83, p<0.05). Ayrıca, okul başarısı (χ^2: 39.52, p<0.05) arasındaki fark önemli bulunurken, boy ve kilo açısından bir ilişki saptanmamıştır (t: 1.75, p>0.05, t: 1.43, p>0.05). Aynı bölgede daha önce yapılan çalışmalar göz önüne alındığında *Enterobius vermicularis* görülme sıklığında belirgin bir azalmanın olduğu da belirlenmiştir.

Anahtar Sözcükler: Enterobiyaz, ilköğretim çocukları, okul başarısı, sosyo-ekonomik düzey

INTRODUCTION

Enterobius vermicularis (the pinworm), which has a worldwide distribution, is the most common human intestinal parasite in children than in adults. Enterobiosis predominantly occurs in school-aged children (5–14 years), and is also highly prevalent in people living in overcrowded conditions (4, 7). Enterobiosis may remain asymptomatic or cause perianal pruritus, insomnia, restlessness, and irritability, particularly in children. It is not usually considered to be a serious disease, though it may cause serious morbidity such as appendicitis and eosinophilic enterocolitis (19). Furthermore, ectopic infections, seen most commonly in females, may result in pelvic inflammatory disease (37) or urinary tract (22). Although effective treatment has been established for decades, the control of Enterobiosis is difficult because of reinfection, incomplete treatment, and its ease of transmission (20).

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Sivas is the second largest city of Turkey in terms of area (28.488 km^2) and situated in the Upper Kızılırmak part of Inner Anatolian region in the middle of Anatolia. Summers are too hot and rainless, winters are snowy. The climatic values obtained from Institute of Meteorology, Turkey, show that the temperature ranges from –25 ^oC to 40 ^oC with an average humidity of 62%.

The overall prevelances of enterobiosis in Turkish primary schools change between 5.4- 67% (9). In the same region, the

rates of Enterobiosis have been reported between 23.5%-63.4% by different researchers. The prevalence of Enterobiosis greatly depends upon socio-economic status, education levels and personal hygiene (9).

The main objectives of the study were to determine the prevalence of *E. vermicularis* and possible risk factors of Enterobiosis among primary school children in Sivas, to inform people about the appropriate treatment of this parasitosis and also compare today's infection rate with previous studies on Enterobiosis, reported in this region between 1985-2008.

MATERIAL AND METHODS

This is a cross-sectional study to assess the prevalence of and risk factors for *E. vermicularis* among 2230 pupils in Sivas. CT samples obtained from ten different Primary Schools that were selected from socio-economically different regions. The name of these schools were 60.Yıl, Karşıyaka, Ahmet Türkseven, Kongre, Cumhuriyet, Kenan Evren, Koyulhisar, Asım Özden, Çeltek and Kurtlapa Primary Schools. The prevalence of *E. vermicularis* was established in three groups: urban area (60.Yıl, Karşıyaka, Ahmet Türkseven and Kongre Primary Schools), district region (Cumhuriyet, Kenan Evren, Koyulhisar and Asım Özden Primary Schools), and rural area (Çeltek and Kurtlapa Primary Schools).

Of all the students, 1131 students (50.7%) were living in city centre, 768 students (34.4%) were living in districts and 331 students (14.8%) were living in villages. The ages of children were varying form 6 to 15. We classified the children into two groups according to their ages. The children whose ages between 6 and 9 were collected in the first group and 10-15 were collected in the second group. CT samples were taken during education seasons between November 2006 and June 2008. The entire students in schools were told to prepare CT samples and no selection criteria were applied between students. Before sampling, the students and their teachers were informed about the parasitic diseases and demonstrated how to prepare the CT samples. Preparing the samples when get up in the morning before bath or defecation was emphasized. The parents of the students at the age of 7, 8, and 9 were also informed about the application.

After the samples reached to the laboratory Parasitology department, they were examined immediately by light microscope at 10X - 40X magnification. The CT preparations were examined either directly or by dropping 1-2 drop(s) of xylene between the cellophane tape and slide. If CT preparations could not be examined on the same day, they were kept at room temperature. After the examination, the children with enterobiosis were notified to their teacher and then they had essential medical treatment.

Additionally, before collecting the samples, a questionnaire performed among the students that involved in the study and 684 students were contributed. The questionnaire form included twenty four questions about the physical (weight, height), social-economical features of students (low, average and high), school success levels and clinical symptoms of parasitic diseases (abdominal pain, pruritus ani, enuresis nocturna, to eat into finger nail, gnashing etc.). Parents and class teachers had given support for the completion of this questionnaire. School success levels of children were notified by class teachers.

SPSS for windows (10.0 version; SPSS Inc. Chicago, IL, USA) was used for statistical analyses of the data. We used chi-square test and a significance test of differences between two independent proportions (*t*-test) for comparing the data. 'P' values of <0.05 were accepted as statistically significant.

RESULTS

In the present study, CT samples were collected from 2230 children in three regions to determine the prevalence of *E. vermicularis*. The total prevalence of parasite in the three regions was 8.8% (196 infected people). To determine the difference, the regions were compared individually, and Region 3(village) had a higher prevalence of parasites compared to the other two regions (Region 1 and Region 2) (t: 2.40, $p < 0.05$, t: 2.72 $p< 0.05$), whereas there was no statistically significant difference between Region 1 and Region 2 (t: 0.69, $p> 0.05$) (Table 1).

Table 1. Comparison of parasite numbers found in three regions

Regions	Parasite (+)		Parasite (−)		Total	
	No	%	No	%	No	%
Region 1 (City center)	93	8.2	1038	91.8	1131	50.7
Region 2 (Districts)	54	7.0	714	93.0	768	34.4
Region 3 (Village)	49	14.8	282	85.2	331	14.8
Total	196	8.8	2034	91.2	2230	100

Comparison of children with Enterobiosis and without Enterobiosis revealed that there was no significant difference in the cases of weight and height. (t: 1.75 $p> 0.05$, t: 1.43 $p>0.05$, respectively) (Table 2).

Table 2. The comparison of height and weight between enterobiosis group and non-parasitic group.

	Height Mean±SE	Weight Man±SE
Nonparasitic group (n=770)	137,95±0,47	33,37±0,33
Enterobiosis group (n= 94)	135,91±1,11	31,60±0,79
Total (n=864)	t=1,43 p>0,05	t=1,75 p>0,05

Of the 2230 children examined for Enterobiosis, the parents of 864 were responded to the questionnaire. Comparison of sex distribution in the three regions did not result in any statistically significant difference (χ^2: 0.40, $p>0.05$). The rates of

Table 3. The comparison of sex, success at school, socio-economical level and age groups between parasitic and non-parasitic group

	Parasite Positive		Parasite Negative		Total		
	n	%	n	%	n	%	
Sex							
Girl	49	46.7	547	49.9	596	49.6	χ^2=0,40
Boy	56	53.3	549	50.1	605	50.4	p>0,05
Total	105	100	1096	100	1201	100	
Success at school							
Success 1 (very low)	6	6.4	19	2.5	25	2.9	
Success 2 (low)	14	14.9	46	6.0	60	6.9	χ^2=39,52
Success 3 (medium)	35	37.2	145	18.8	180	20.8	p<0,05
Success 4 (good)	21	22.3	317	41.2	338	39.1	
Success 5 (best)	18	19.1	243	31.6	261	30.2	
Socio-economic level							
Low	83	88.3	454	59.0	537	62.2	χ^2=30,83
Average	9	9.6	227	29.5	236	27.3	p<0,05
High	2	2.1	89	11.6	91	10.5	
Ages							
between 7-9	31	33.0	250	32.5	281	32.5	χ^2=0,10
between 10-14	63	67.0	520	67.5	583	67.5	p>0,05
Total	94	100	770	100	864	100	

Table 4. Distribution of clinical symptoms between parasitic and non parasitic children

			Parasite positive		Parasite negative		Total		
			n	%	n	%	n	%	
Symptoms	**Abdominal pain**	Yes	53	56.4	342	44.4	395	45.7	χ^2=4,82
		No	41	43.6	428	55.6	469	54.3	p>0.05
	Pruritus ani	Yes	25	26.6	194	25.2	219	25.3	χ^2= 0.87
		No	69	73.4	576	74.8	645	74.7	p>0.05
	Enuresis	Yes	28	29.8	80	10.4	108	12.5	χ^2=28.80
		No	66	70.2	690	89.6	756	87.5	p<0.05
	Spittle	Yes	28	29.8	223	29.0	251	29.1	χ^2=0.28
		No	66	70.2	547	71.0	613	70.9	p>0.05
	Gnashing	Yes	16	17.0	156	20.3	172	19.9	χ^2=0,55
		No	78	83.0	614	79.7	692	80.1	p>0.05
	Total		94	100	770	100	864	100	

intestinal parasites among different age groups in the three regions are given in Table 2. No significant differences were found between the two age groups (7-9 and 10-14) according to the prevalence of *E. vermicularis* when the regions were compared (χ^2= 0.10, p>0.05) the prevalence of *E. vermicularis* was highest in region 1. The highest prevalence of parasitosis was observed in the 11 and 13 year age groups (Table 3).

In contrast, success at school was found to be closely related to parasitic incidence (χ^2: 39.52 p< 0.05). Besides, the prevalence of Enterobiosis was higher in students with low income than in students with high income (χ^2: 30.83 p<0.05) (Table 3).

Clinical symptoms like abdominal pain, pruritus ani, spittle, and gnashing were not found to be significant risk factors for Enterobiosis, nor was other factor, such as enuresis (χ^2:28.80 p<0.05) (Table 4).

A decrease in the prevalence of *E. vermicularis* infection is obvious when the previous studies are concerned (Figure 1, Table 5). As an accumulation of preformed studies, the overall rate of *E.* was observed as 45.9% among 6347 students between years 1985 and 2000 and 14.9% among 6161 students between 2000 and 2008 years. This great difference is statistically meaningful (t=28.9, p<0.05).

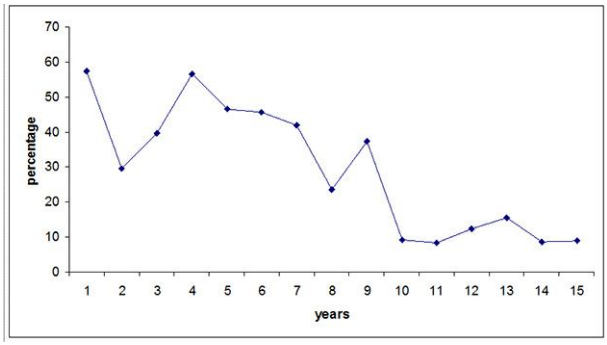

Figure 1. The observed prevalence of *E. vermicularis* between 1985 and 2008 years.

Table 5. Previous studies about the prevalence of *E. vermicularis*

Years (Reference)	Prevelans of *E. vermicularis*	
	%	n
1985 [43]	57,4	155
1986 [32]	29,6	135
1990 [30]	39,6	383
1995 [26]	56,4	101
1997 [29]	46,4	5385
1997 [10]	45,7	81
1999 [3]	42,0	107
2001 [23]	23,5	1215
2002 [35]	37.2	384
2002 [31]	9,1	91
2004 [2]	8,2	61
2005 [11]	12,3	1864
2005 [9]	15,6	316
2008*	8.8	2230

*Result of this study

DISCUSSION

E. vermicularis is a contact helminth that causes infection mainly from indoors. It is spread by infected people and is especially widespread among preschool children and younger schoolchildren, often infecting also supervisors and other members of the infected children's families. Like other helminthiases, Enterobiosis may remains asymptomatic or cause some slight indefinite symptoms: perianal pruritus, insomnia, restlessness, or irritability.

The prevalence of intestinal parasites in Turkey ranges from 11.6% to 79.2% in different cities and in different regions of those cities (classified according to socioeconomic conditions) (14, 24, 36, 38, 42).

Although Enterobiosis prevalence has decreased in Sivas, but it remains as the most common parasite among children. It is believed that there are two reasons for that outcome. First of all, the parasite has a simple and rapid life cycle without a maturation of eggs in soil like many of other helmints. Secondly, it is transmitted by person-to-person infection directly or through contaminated food or materials (11). The climate of Sivas may be taught less unfavorable for other parasitic helmints. Lack of moisture and insufficient warm for egg maturation may be the reasons. As it is mentioned in previous studies *E. vermicularis* transmission way is easy and is not effected from environmental factors (13).

In this study, the total prevalence of enterobiosis, in three different socio-economically classified districts of Sivas, was 8.8%. The findings of the present study are consistent with the findings of other studies in Sivas (1, 25, 33, 34).

The previous studies confirm the high prevalence of intestinal parasites with low socioeconomic conditions, inferior sanitary and environmental conditions, and poor personal and community hygiene in different areas of Turkey (34, 39, 42).

The present study observed a higher prevalence of intestinal parasites among the 7-14 year age groups than among the other age groups. The reason for this finding could be that the possibility of parasitic infections could be higher in primary school children than in the upper and lower-age groups because of lack of information about the prevention of parasitosis among those children.

It was assumed that *E. vermicularis* infection may cause nocturnal enuresis (12), in our study we also found a significant difference between parasitic and non parasitic group in the case of nocturnal enuresis.

A decrease in the prevalence of *E. vermicularis* infection is obvious when the previous studies are concerned. As an accumulation of preformed studies, the overall rate of *E. vermicularis* was observed as 45.9% among 6347 students, between years 1985 and 2000 and 16% among 5140 students, between 2000 and 2008 years. This great difference is statistically meaningful. First of all, that is a result of careful and frequent studies performed in this region for years. Many of the studies followed with treatment of infected children, moreover the information about parasitic infection in this regions developed so people are well educated and careful about parasitic infections. Secondly, the social-economical levels of people have increased during those years. Additionally, the studies from other countries also revealed the same decrease before and after 2000. The pinworm infection rate showed a decrease from 22.1% to 5.2% in Greece, from 14.8% to 7.9% in Korea (17, 18, 27, 40).

It has been reported that helmint infections had a negative effect on success at school (6, 21). Like the other parasites, *E. vermicularis* may have an adverse effect on school success, in present study we found a significant relation between school success and enterobiosis. It is difficult for the children with enterobiosis to concentrate on a study because of perineal itching. Furthermore, school success and *E. vermicularis* infection are both related with socioeconomic status.

The prevalence of *E. vermicularis* ranges from 5.2% to 49.7% in the world according to the data published in last six years. In our region the average rate of *E. vermicularis* is 16% for last six years. In general, the countries in the north, east and south have higher rates of enterobiosis infection than our study and western countries have lower rates. Researchers from different western countries reported the prevalence of parasite as 5.2% in Greece, 12.15% in Poland and 13.4% in Italy (5, 8, 40). Besides that, the studies from eastern countries revealed the rates were 33.8% in Iran, 35.7% in China and 41.6% in Thailand (16, 28, 41). We can also assume that the difference in pinworm prevalence between Turkey and other countries is resulted from socioeconomic levels and climate.

In conclusion, the decrease in the rate of *E. vermicularis* among primary school children is an outcome of repeated health education concerning improved personal hygiene and regular inspections and required chemotherapy with appropriate anthelmintics. In the future similar studies are essentially required to control the frequency of Enterobiosis among children living in rural areas. Moreover, people should realize that for the future global warming may cause an increase in the parasitic infections. Today two billion people have no access to sufficient water for basic sanitation. In coming years, huge mass of people will begin to suffer from this problem as a consequence of global warming.

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