

Full Length Research Paper

## Effects of *Enterobiasis* on primary school children

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Accepted 10 March, 2016

The aim of the present study was to investigate the possible adverse effects of *Enterobiasis vermicularis* infection on primary school children in Sivas, Turkey, to know whether it affects their school success, mean weight and height or not. Seven primary schools in the central region of Sivas were included in the present study. A total number of 3659 questionnaires were completed by class teachers and parents for each student. In the questionnaire, the height and weight of children, school success and other information about children were asked. The stool and cellophane tape specimens collected from the participated students were examined by light microscopy for the diagnosis of enterobiasis. The 365 (17.0%) out of 3569 of parasitic infections were *E. vermicularis* along with other parasites, and the 225 (10.5%) out of 3569 had only *E. vermicularis*. The weights and heights were found to be lower in children with enterobiasis. When school successes of the students were compared, there were statistically significant differences between the non parasitic group and the group with *E. vermicularis*. Enterobiasis is still an important problem seen among primary school children causing adverse effects on school success and physical growth especially in children from the first grades of primary schools.

**Key words:** Enterobiasis, school success, physical growth.

### INTRODUCTION

*Enterobius vermicularis* is thought to cause the world's most common human parasitic infection, enterobiasis, which is rather abundant in Turkey. The prevalence rate among the Turkish children has been reported to range between 5.1% (Muge et al., 2008) and 76.2% (Akku and Cingil, 2005). Enterobiasis is a group of infection that is more common in children than in adults. Prevalence in children could be high, a fact that has been recorded despite the difficulties in confirming the infection. The infection is more prevalent in cool and temperate zones where people tend to bath less often and change their underclothes less frequently (Garcia and Bruckner, 1993). The adult form of *E. vermicularis* inhabits the cecum, appendix and adjacent portions of the ascending colon (Beaver et al., 1984). The most common transmission is via direct anus- to -mouth by finger

contamination and by contaminated objects which their hands contacted. The most significant symptoms are produced by gravid female parasites that migrate from the anus to the perianal and perineal skin to oviposit, causing a crawling sensation and pruritus. In children, nervousness, insomnia, nightmares and even convulsion have been attributed to enterobiasis (Shoup B, 2001). In most persons, enterobiasis occurs without any symptom of infection. *E. vermicularis* problems can be reduced or prevented by encouraging habits of cleanliness in the children, by regular use of closed sleeping garments and by keeping the fingernails short and clean. Diagnosis and treatment of infected members of a household repeated as often as necessary will delay reinfection, but in usual circumstances, total prevention is not a realistic goal. A lack of personal hygiene and close contact between people encourages the spread of *E. vermicularis*. The best method for the diagnosis of enterobiasis is the cellophane tape (CT) method (Cook GC, 1994).

The aim of our study was to find out the prevalence of enterobiasis in primary schools of Sivas, Turkey; to

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**Table 1.** The comparisons of height, weight and numbers of persons in houses between the enterobiasis group and the non-parasitic group.

	Height $\bar{x} \pm Se$	Weight $\bar{x} \pm Se$	Number of person $\bar{x} \pm Se$
Non parasitic group (n: 1244)	1.37 $\pm$ 0.003	33.95 $\pm$ 0.33	5.47 $\pm$ 0.05
Enterobiasis group (n: 225)	1.26 $\pm$ 0.003	25.93 $\pm$ 0.56	5.80 $\pm$ 0.13
	t = 10.95 p < 0.05	t = 9.07 p < 0.05	t = 2.68 p < 0.05

advise students or their parents on the appropriate treatment for enterobiasis; to determine the importance of parasitic school surveys in primary health care to control parasitic diseases; to investigate the relationship between *E. vermicularis* carriage and the school success, the mean weight and height of the primary school children in the central Sivas, Turkey.

## MATERIALS AND METHODS

Sivas is situated in the middle Anatolia, a city about 450 km east of Ankara, the capital of Turkey. It is nearly 1350 m above the sea level, and has a typical continental climate with a mean temperature of -3.6°C in the coldest and 19.7°C in the hottest months.

In this study, seven primary schools (total students of 3659) from the central Sivas were randomly selected. In each selected schools, there were different number of students from different regions. The schools and number of students are as follows; Atatürk (475), Dani ment (1182), Gazi Osman Pa a (277), zzettin Keykavus (265), Kızılırmak (578), Kar ıyaka (208) and Namık Kemal (674). Children enter the school at the age of 7 and are graduated at the age of 15. Children are grouped between grade 1 and 8 which is the compulsory education time for primary schools, in Turkey.

### Examination of samples

Each student was given a clean glass container to collect the stool samples and a cellophane tape (CT) preparation. The students who agreed to participate in the study were asked to provide a fresh fecal sample and a CT preparation which had to be taken before going to the toilet in the morning. From each stool specimen, a direct preparation in saline was prepared and examined by light microscopy. The stool specimens that could not be examined on the same day were kept at 4°C. CT preparations were examined either directly or by dropping 1 - 2 drops of xylol in between the cellophane tape and slide. The stool samples that did not have any parasites on direct smears were searched with zinc sulfate flotation method. The information about the results of the present investigation and the treatments of children with parasitosis were given to parents by class teachers.

### Questionnaire

A total number of 3659 children were given a questionnaire in which the height and weight of children, school success and other information about children were asked. Parents and class teachers helped in the completion of the questionnaire. The school success levels of students in the questionnaire were determined by class teachers as Level I (very bad), Level II (bad), Level III (medium), Level IV (good) and Level V (best).

## Statistical analyses

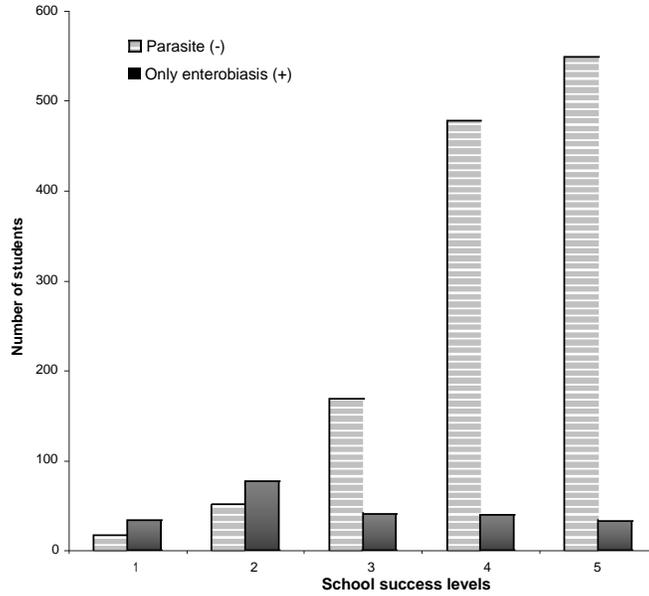
Schools included in this work were chosen by Simple Random Sampling Method. The results were analyzed using "Independent Samples t-test" and the "X<sup>2</sup>-test". All statistical analyses were performed using SPSS for Windows (version 10.0).

## RESULTS

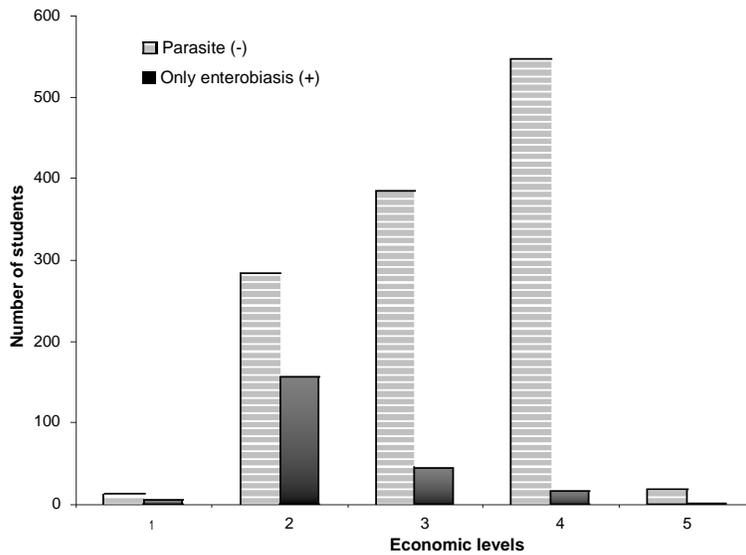
The 2144 (58.5%) out of 3659 students in seven schools participated in this study. While out of 2144 samples, 900 (42.0%) had parasitic infections, 1244 (58.0%) of them did not have any parasite. On the other hand, 365 (17.0%) had *E. vermicularis* along with other parasites, and 225 (10.5%) had only *E. vermicularis*. Comparison of the only enterobiasis and the non-parasitic groups revealed that the weights and heights were lower in the children with enterobiasis than the children without any parasite (t = 9.07 p < 0.05, t = 10.95 p < 0.05, respectively). The number of persons in the house was also determined because of the higher possibility of contamination risk in such places. Therefore, the relationship of those above mentioned parameters were compared between the enterobiasis and non-parasitic groups. Enterobiasis was found to be higher in crowded houses (t = 2.68 p < 0.05) than the houses with fewer people (Table 1).

Children with only *E. vermicularis* were 121 (53.8%) males and 104 (46.2%) females. In the mean time, students with no parasites were 630 (50.6%) males and 614 (49.4%) females. While there were no significant difference in sexes (X<sup>2</sup> = 0.74 p > 0.005) between the only enterobiasis group and the non-parasitic group; however, school success (Figure1), economical levels (Figure2) and grades (1,2,3,4, 5, 6, 7 and 8) (Figure3) were found to be significantly different (X<sup>2</sup> = 367.08, p < 0.005, X<sup>2</sup> = 217.67 p < 0.005 and X<sup>2</sup> = 38.48, p < 0.05, respectively) between those groups (Table 2).

The distribution of children with enterobiasis in schools was as follows: Atatürk, 17 (8.8%); Dani ment, 53 (17.1%); Gazi Osman Pa a, 12 (10.4%); zzettin Keykaus, 29 (26.9%); Kızılırmak, 28 (11.2%); Kar ıyaka, 19 (18.1) and Namık Kemal, 67 (17.3). The ratio of enterobiasis shown in Figure 4 between schools was found to be statistically significant (X<sup>2</sup> = 25.32, p < 0.05). Enterobiasis ratio was higher in Dani ment, Kar ıyaka and Namık Kemal primary schools than in the others.



**Figure 1.** Distribution of enterobiasis according to school success levels.

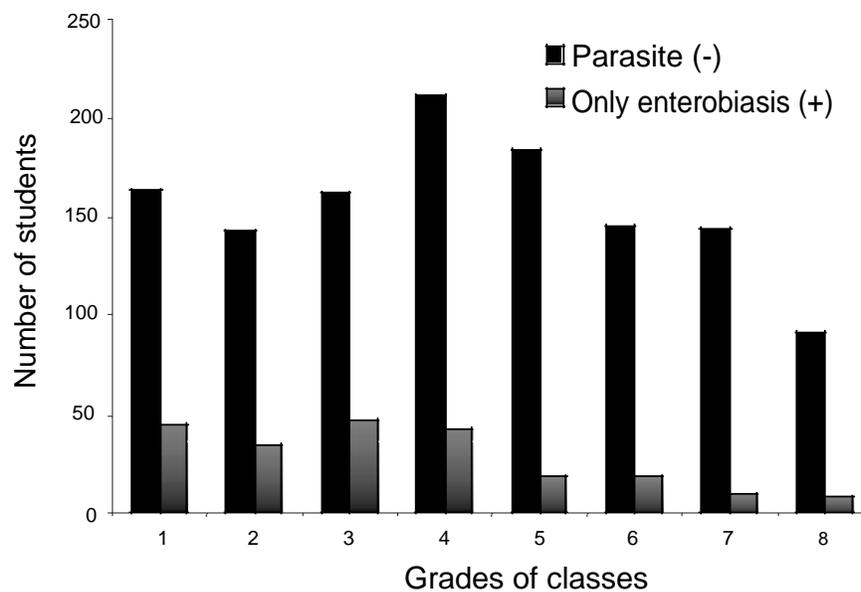


**Figure 2.** Distribution of enterobiasis according to economic levels.

## DISCUSSION

The prevalence of enterobiasis in Turkey is about 5.1 - 76.2% in the primary schools according to different reports (Akku and Cingil, 2005; Hazir et al., 2009; Malatyali et al., 2008; Muge et al., 2008; Otkun et al., 2000). However, in Sivas where this investigation was performed, rates of enterobiasis were variously reported to be 23.5 - 63.4% according to the previous studies performed at different times (Yilmaz and Saygi, 1984; Saygi, 1986; Özçelik et al., 2001; Saygi et al., 1991, 2002). In this study, it has been found that the

enterobiasis prevalence was 17.0% among the primary school children of Sivas. Enterobiasis prevalence greatly depends upon a lack of personal hygiene and close contact between people (Beaver et al., 1984). Findings of the present study indicated that the rates of enterobiasis were lower than the rates suggested by previous studies performed in the same region, whereas the rates were similar to those seen in the other regions of Turkey. The reason for the decrease in enterobiasis rates in Sivas primary school children could be attributed to the increase in education in all level of people on transmission ways of intestinal parasites along with often



**Figure 3.** Distribution of enterobiasis according to grades of classes.

**Table 2.** The comparison of sex, school success, economic levels and grades between the enterobiasis group and the non-parasitic group.

	Only <i>E. vermicularis</i> positive		Parasite negative		Total		
	n	%	n	%	n	%	
<b>Sex</b>							
Girl	104	46.2	614	49.4	718	48.9	$\chi^2 = 0.74$ $p > 0.05$
Boy	121	53.8	630	50.6	751	51.1	
Total	225	100.0	1244	100.0	1469	100.0	
<b>According to school success</b>							
Success 1 (very low)	34	15.1	17	1.4	51	3.5	$\chi^2 = 367.08$ $p < 0.05$
Success 2 (low)	77	34.2	51	4.1	128	8.7	
Success 3 (medium)	41	18.2	169	33.6	210	14.3	
Success 4 (good)	40	17.8	458	38.8	498	33.9	
Success 5 (best)	33	14.7	549	44.1	582	39.6	
Total	225	100.0	1244	100.0	1469	100.0	
<b>According to economic level</b>							
level (very bad)	5	2.2	13	1.0	18	1.2	$\chi^2 = 217.67$ $p < 0.05$
level (bad)	157	69.8	283	22.7	440	30.0	
level (medium)	45	20.0	384	30.9	429	29.2	
level (good)	17	7.6	546	43.9	563	38.3	
level (best)	1	0.4	18	1.4	19	1.3	
Total	225	100.0	100.0	1244	1469	100.0	
<b>Classes</b>							
Grade 1	45	21.6	163	78.4	208	100.0	$\chi^2 = 38.48$ $p < 0.05$
Grade 2	35	19.8	142	80.2	177	100.0	
Grade 3	47	22.5	162	77.5	209	100.0	
Grade 4	42	16.6	211	83.4	253	100.0	

Table 2. Cont.

Grade 5	19	9.4	184	90.6	203	100.0
Grade 6	19	11.5	146	88.5	165	100.0
Grade 7	10	6.5	144	93.5	154	100.0
Grade 8	8	8.0	92	92.0	100	100.0
Total	225	15.3	1244	84.7	1489	100.0

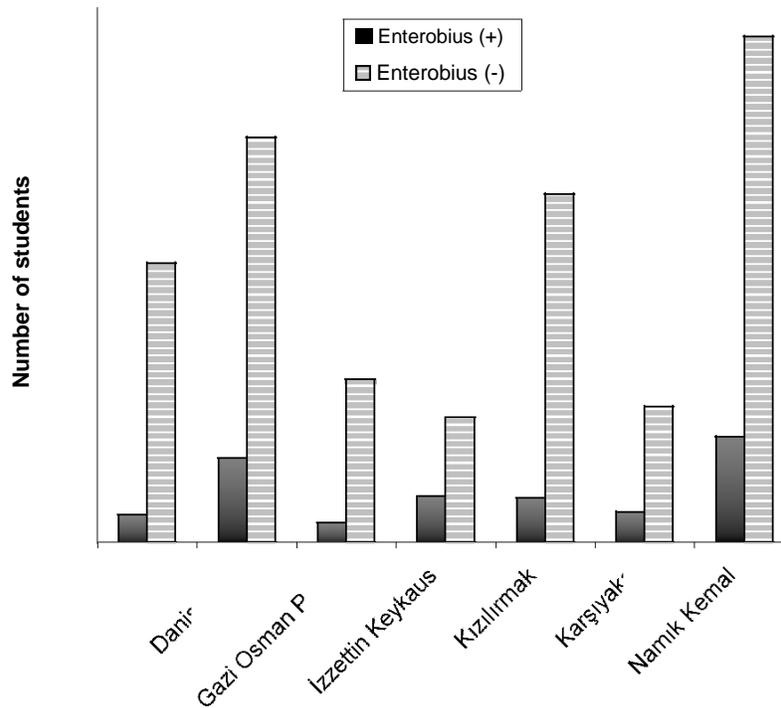


Figure 4. Distribution of enterobiasis in schools.

performed parasite surveys in this region.

Enterobiasis usually follows a less acute course than the bacterial and/or viral infections and has less lethality. It is highly common among the primary school children but it has generally been neglected and not been considered at length. Patients with enterobiasis are often asymptomatic, and their growths are affected by *E. vermicularis* infection (Beaver et al., 1984; Saygı and Kiriçi, 1990). Data from the questionnaires in the present study demonstrated that the number of children with enterobiasis was found to be higher in crowded houses ( $t = 2.68$   $p < 0.05$ ). On the other hand, the weight for age and the height for age were found to be lower in the infected children than the non-infected group ( $t = 9.07$   $p < 0.05$ ,  $t = 10.95$   $p < 0.05$ , respectively). Periodical school surveys and education of children along with their parents on the adverse effects of enterobiasis could help to decrease the ratio of such parasitic infection.

While there was significant difference in the incidence of enterobiasis between males and females in certain previous studies (Hö and Park, 1984; Kim et al., 2003;

Guignard et al., 2000), no difference has been found in the others (Kang et al., 1998; Sutisna et al., 1999; Yoon et al., 2000; Sung et al., 2001). On the other hand, in the present study, there were no significant difference ( $X^2 = 0.74$   $p > 0.005$ ) between the only enterobiasis group and the non-parasitic group when the sexes were compared.

There were no previous reports on the effect of enterobiasis on school success of children; however, it has been reported that some helminth infections had negative effects on school success and cognitive functions of children (Nokes et al., 1992; Simeon et al., 1994; de Clercq et al., 1998; Hadidjaja et al., 1998). In the present study, school success was lower in the enterobiasis group than the non-parasitic group ( $X^2 = 367.08$   $p < 0.05$ ).

Enterobiasis is an infection group that is more common in children than in adults. Prevalence in children could be high, a fact that has been recorded despite the difficulties in confirming the infection. It is said that "You had this infection as a child; you have it now; or you will get it again when you have children" (Garcia and Bruckner,

1993). The rates of enterobiasis, in this study, were significantly higher in the lower grades (1st, 2nd, 3rd and 4th) and lower in the higher grades (5th, 6th, 7th and 8th) among students in 7 primary schools ( $X^2 = 38.48$ ,  $p < 0.05$ ).

In conclusion, *E. vermicularis* infection rates in Sivas seemed to be decreased when compared to the findings of the previous studies; however, it is still a problem among the primary school children. Enterobiasis adversely affects the growth and school success of school children. Therefore continuous education on enterobiasis should be given both to parents and children along with periodic school surveys and treatment of enterobiasis cases among children in order to prevent *E. vermicularis* infections, thus, to increase their school success and growth.

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