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Prevalence of Intestinal Parasites in Three Socioeconomically-different Regions of Sivas, Turkey

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ABSTRACT

The study was carried out to determine the prevalence of parasites in three socioeconomically-different regions (Alibaba, Esentepe, and Çayboyu) of Sivas, Turkey, to determine the most accurate method for the diagnosis of taeniasis and enterobiasis, to determine the importance of household visits in primary healthcare to control parasitic diseases, and to treat intestinal parasitic diseases in those regions. Both stool specimens and cellophane tape (CT) samples were taken from 1,864 participants during 641 household visits in the three regions. The age groups included were pre-school [(0-6 year(s)], primary school (7-15 years), and the upper age group (16 years and above). The total prevalence of intestinal parasites in the three regions was 37.2%. Eleven intestinal parasite species were detected in both stool specimens and CT samples. *Giardia intestinalis* and *Enterobius vermicularis* were the most frequent species identified in all the three regions. Region I (Alibaba) had a higher prevalence of parasites compared to the other two regions. There was no significant difference between Region II (Esentepe) and Region III (Çayboyu) in isolation of intestinal parasites. There were statistically significant differences between the age groups when the rates of parasitic infection were compared. The highest prevalence of parasitosis was observed among the age group of 7-15 years and in the socioeconomically lowest one of the three regions. While the most accurate way of diagnosis for taeniasis was the combined usage of the CT and direct preparation methods, the CT method was the best method for the diagnosis of enterobiasis. Thus, the local administrators in cities need to pay more attention to the prevention of parasitic infections along with improvements in educational, environmental and sanitary conditions.

Key words: Parasites; Intestinal diseases, Parasitic; Diagnosis, Laboratory; Cellophane tape test; Turkey

INTRODUCTION

Intestinal parasitic diseases are among the most common infections worldwide and are more prevalent in the poorest communities of the developing world (1-3). It is estimated that some 3.5 billion people are affected and that 450 million become ill as a result of these infections, the majority being children (4). These infections are regarded as a serious public-health problem, as they cause iron-deficiency anaemia (5-7), growth retardation in children, and other physical and mental health problems but they are also relatively easy to control: evidence suggests that treating school children increases their height and weight, improves iron stores, and reduces iron-deficiency anaemia (8-10). To control parasitic infections in the community, the guidelines developed by the World Health Organization (WHO) suggest

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consideration of three coordinated actions: improved sanitation, chemotherapy, and health education (11).

Home visits by nurses have been an important component of public health for over 100 years (12). Recent reports of large clinical trials have provided a convincing evidence of the cost-effectiveness of home visits (13,14). Public-health nurses are gaining experience in strengthening and supporting the ability of communities to grow and change (15).

region in the middle of Anatolia. The climatic values, obtained from the Institute of Meteorology, Turkey, show that the temperature ranges from -25 ºC (-13 ºF) to 40 ºC (104 ºF), with rainfall of only 382 mm (15 inches) per year along with an average humidity of 62%.

The study was performed by means of a household survey of people with different socioeconomic conditions in 3 of 62 regions in Central Sivas. A simple random-sampling method was used for choosing these three

Fig. Location of Sivas on the map of Turkey

The main objectives of the study were to determine the prevalence of parasites in three regions of Sivas, Turkey, to advise people on the appropriate treatment of intestinal parasitic infections, to determine the importance of household visits in primary healthcare to control parasitic diseases, and to assess the role of the cellophane tape (CT) test in the diagnosis of taeniasis and enterobiasis.

MATERIALS AND METHODS

The study was carried out in three regions of Sivas, Turkey. Sivas, the second largest city of Turkey in terms of area (28.488 km^2) (Fig. 1), has 17 districts (Akincilar, Altinyayla, Divrigi, Dogansar, Gemerek, Gürün, Gölova, Hafik, Imranli, Kangal, Koyulhisar, Susehri, Sarkisla, Ulas, Yildizeli, Zara, and the City Centre), 38 municipalities, 1,246 villages, and 721 sub-village settlements. It is located in the Upper Kizilirmak part of Inner Anatolian

areas—Alibaba (Region I, total population–26,821), Esentepe (Region II, total population–28,904), and Çayboyu (Region III, total population–576). According to the data of the Regional Health Centres, the socioeconomic conditions of the people living in Region I were lower compared to those living in the other two regions when the educational levels, the number of persons living in the house, the type of toilet used, and the type of heater used in the house were considered. There were no statistically significant differences between the other two regions (Region II and Region III) when the above criteria were compared (Data were obtained from the Statistical and Computing Branch of the Health Ministry, Turkey). During May-July 2002, 1,864 of 3,057 persons living in 641 houses were invited to take part in the study aiming at recruiting subjects for the study and treating their parasitic infections as much as possible in three months.

Household visits

Household visits in such field studies are crucially important since people, unaware of parasitic infections and their treatment, can be informed about these infections and can also be given advice on how to handle such problems.

Public-health nursing students visited the 641 households (250 in Region I, 250 in Region II, and 141 in Region III) selected following the simple random-sampling method. These households were given information about the aim of the study, the possible adverse effects of intestinal parasites on humans, and the method of taking specimens from the people. Consent of the guardians of each participant was obtained before taking samples, and the public-health nursing students also gave information about parasitic infections to all the participants. They obtained information on economic conditions, jobs, health insurance, waste and toilet conditions, contraception methods used, etc. of people during their household visits.

Stool examination

In the three regions, 1,864 people participated in the study. People who had been treated with antiparasitic drugs during the last three months were excluded. Table 1 shows the distribution of sex and age groups of the participants according to regions. The age groups were pre-school [(0-6 year(s)], primary school (7-15 years), and the upper age group (16 years and above). The participants were aged between 0 and 65 years. Their median age was 26 years.

Each person in the house was given a clean plastic container to collect stool samples and a cellophane tape (CT) preparation. Those who agreed to participate in the study were asked to provide a fresh faecal sample and CT preparation which had to be taken before going to the toilet in the morning. From each of stool specimens, a direct saline smear preparation (DP) was made and examined by light microscopy. For differential diagnosis of protozoa cysts, either Lugol's solution was added to the same preparation or another preparation was made using Lugol's solution. The samples which did not reveal any intestinal parasite on the direct smear were searched with the zinc sulphate flotation method. Stool specimens that could not be examined on the same day were kept at 4 ^{o}C. The CT preparations were examined either directly or by dropping 1-2 drop(s) of xylene in between the cellophane tape and slide. CT preparations that could not be examined on the same day were kept at room temperature.

Participants infected by parasites were given advice on how to treat the infections.

Statistical analyses

In the regions where our research was to be carried out, the number of houses (n=641), which could be visited by the public-health nursing students, was determined. The houses to be visited were determined using a simple random-sampling method according to the numbers of houses in Region I and Region II, whereas all houses in Region III were visited.

The chi-square test was used for comparing data, and a significance test of differences between two independent proportions (*t*-test) was carried out. The level of significance was set at $p<0.05$.

Table 1. Distribution of sex and age groups according to regions

Region	Sex				Age (years) group						Total
	Female		Male		0-6		7-15		16 and above		
	No.	%	No.	%	No.	%	No.	%	No.	%	
Alibaba (Region I)	483	53.3	423	46.7	142	15.7	154	17.0	610	67.3	906
Esentepe (Region II)	379	54.1	322	45.9	93	13.3	206	29.4	402	57.3	701
Çayboyu (Region III)	149	60.0	108	42.0	29	11.3	45	17.5	183	71.2	257
Total	1,011	54.2	853	45.8	259	13.9	404	21.7	1,200	64.4	1,864

RESULTS

In the present study, stool specimens and CT samples were collected from 1,864 persons during visits to 641 households in three regions to determine the prevalence of intestinal parasites. The total prevalence of intestinal parasites in the three regions was 37.2% (694 infected people). Eleven intestinal parasite species were detected from both stool specimens and CT samples. Table 2 shows the parasite species detected and the sex distribution of the people who had those parasite species. *Giardia*

Table 2. Parasite species detected by both cellophane tape and direct preparation methods and sex distribution of patients in three regions

Parasite	Region I (n=906)				Region II (n=701)				Region III (n=257)				Total (n=1,864)			
	Female	Male	No.	%	Female	Male	No.	%	Female	Male	No.	%	Female	Male	No.	%
Giardia intestinalis	84	76	160	17.7	61	56	117	16.7	16	14	30	11.7	161	146	307	16.5
Entamoeba histolytica/dispar	13	11	24	2.6	10	8	18	2.6	2	1	3	1.2	25	20	45	2.4
Entamoeba coli	24	21	45	5	18	15	33	4.7	9	7	16	6.2	51	43	94	5
Endolimax nana	22	18	40	4.4	13	11	24	3.4	3	4	7	2.7	38	33	71	3.8
Iodamoeba buetschili	5	3	8	0.9	5	4	9	1.3	4	4	8	3.1	14	11	25	1.3
Blastocystis hominis	4	4	8	3.6	2	1	3	0.4	3	3	6	2.3	9	8	17	0.9
Hymenolepis nana	7	6	13	6.2	5	4	9	1.3	3	1	4	1.6	15	11	26	1.4
Taenia spp.	29	27	56	10.2	19	14	33	4.7	6	5	11	4.3	54	46	100	5.4
Enterobius vermicularis	47	45	92	0.9	58	54	112	16	13	12	25	9.7	118	111	229	12.3
Ascaris lumbricoides	5	3	8	0.2	4	3	7	1	-	1	1	0.4	9	7	16	0.9
Trichuris trichiura	2	0	2	-	2	3	5	0.7	-	-	-	-	4	3	7	0.4
Total no. of parasites	242	214	456	40.7	197	173	370	-	59	52	111	-	498	439	937	-
Total no. of infected persons	194*	175*	369	126*	109*	235	33.5	49*	41*	90	35	369*	325*	694	37.2	
Parasite species/infected persons		1.24				1.57				1.23				1.35		
	χ^2=610.17 p<0.05				χ^2=499.39 p<0.05				χ^2=66.76 p<0.05							

* The number of infected persons by one or more intestinal parasite(s); CT=Cellophane tape; DP-Direct preparation

intestinalis and *Enterobius vermicularis* were the most frequently-isolated species in all the three regions. The numbers of parasites were compared in the three regions, and there were statistically significant differences between regions (Table 3). To determine the difference, the regions were compared individually, and Alibaba region had a higher prevalence of parasites compared to the other two regions (Esentepe and Çayboyu), whereas there was no significant difference between Esentepe and Çayboyu. *G. intestinalis* and *E. vermicularis* were the most common parasites detected in all the three regions.

Comparison of sex distribution in the three regions did not result in any statistically significant difference (Table 4).

The rates of intestinal parasites among different age groups in the three regions are given in Table 5. No significant differences were found between the three age groups according to the prevalence of intestinal parasites when the regions were compared (χ^2=3.11, p>0.05). There were statistically significant differences (χ^2=89.99, p<0.005) between the age groups when the rates of parasitic infections were compared. The prevalence of intestinal parasites among each age group was as follows: 0-6-year age group–22.1%, 7-15-year age group–49.2%, and 16-year or above age group–28.7%. Therefore, the highest prevalence of parasitosis was observed in the 7-15-year age group.

To test the accuracy of the CT and DP methods, the number of helminth eggs found by the CT method was compared with the number of eggs found by the DP method. Results are given in Table 6. When the results were compared in each region, there were statistically significant differences between the DP method and the CT method (Table 7). It was determined that the CT method was more accurate than the DP method in the diagnosis of enterobiasis and taeniasis.

DISCUSSION

About a third of the urban population of developing countries live in slums and shantytowns, and by 2025, about 57% will be in urban areas. Urgent consideration should, thus, be given to improving sanitation in deprived urban areas, and these people should periodically be investigated from the parasitical point of view (16). Parasitic infections affect urban people severely, especially in the underdeveloped areas of the cities. Therefore, the present study was designed to determine the prevalence of intestinal parasites in three different regions of Sivas

to compare the DP and CT methods in the diagnosis of enterobiasis nd taeniasis.

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 socio-economic conditions) (17-21). The total prevalence of intestinal parasites in three different socioeconomically-classified districts of Sivas was 37.2%. The findings of the present study are consistent with the findings of other studies in Sivas (22-25).

present work was that the underdeveloped Alibaba district demonstrated a higher prevalence of intestinal parasites than the two other more-developed districts (Esentepe and Çayboyu) ($p<0.05$).

Intestinal parasites generally cause asymptomatic, atypical, and non-specific symptoms in hosts (27). People infected with such parasites can only be determined through population surveys. Therefore, untraced people carrying such parasites live with those parasites without any symptoms. Six hundred and ninety-four asymp-

Table 3. Comparison of parasite numbers found in three regions

Region	Parasite (+) (n=694)		Parasite (-) (n=1,170)		Total no. of persons investigated (n=1,864)
	No.	%	No.	%	
Alibaba (Region I)	369	40.7	537	59.3	906
Kümbet (Region II)	235	33.5	466	66.5	701
Çayboyu (Region III)	90	35.0	167	65.0	257
$\chi^2=9.26$, $p<0.05$					

Table 4. Comparison of sex distribution among infected persons in three regions

Region	Female (n=369)		Male (n=325)		Total no. of infected persons (n=694)
	No.	%	No.	%	
Region I	194	52.5	175	47.5	369
Region II	126	53.6	109	46.4	235
Region III	49	54.4	41	45.6	90
$\chi^2=0.12$, $p>0.05$					

Table 5. Prevalence of intestinal parasites among various age groups in three regions

Age (years) group	Region I (n=369)		Region II (n=235)		Region III (n=90)		Total no. of infected persons (n=694)
	No.	%	No.	%	No.	%	
0-6	78	50.9	58	37.9	17	11.2	153
7-15	191	55.8	106	30.9	45	13.1	342
16 and above	100	50.2	71	35.6	28	14.2	199
$\chi^2=3.11$, $p>0.05$							

Depending on the climatic conditions and location characteristics, some parasites had a higher prevalence as revealed from some surveys. 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 (18,25,26). Reports from the public-health nurses who completed the sample-collection procedure in the present study indicated poor environmental conditions, low personal hygiene, lack of public water supplies and waste removal services accompanied with low socioeconomic conditions in the areas studied. The main outcome of the

tomatic people from three different districts were identified and sent to the health centres for treatment. The public-health nurses played a crucial role in surveying people to inform them about parasitic diseases, to collect the CT and stool samples, and also to convey the results to the study subjects. Experiences from household visits made by them showed that they had more advantages than our previous similar studies on the number of people participating in this investigation and to educate the members of households on public-health matters (28). Household visits for surveys of parasitic infections are crucially important in underdeveloped areas of the cities. Therefore, in the present study, people, unaware of their

Table 6. Frequency of intestinal helminths detected by the cellophane tape and direct preparation methods in three regions

Parasite	Region I (n=906)		Region II (n=701)		Region III (n=257)		Total (n=1,864)				
	DP	CT	DP	CT	DP	CT	DP (+) only	CT (+) only	+ (by either)	DP (-) CT (+)	DP (+) CT (-)
Enterobius vermicularis	-	92 (10.2)	2 (0.3)	112 (16)	1 (0.4)	25 (9.7)	3	229	229	226	0
Taenia spp.	16 (1.8)	46 (5.1)	13 (1.9)	26 (3.7)	3 (1.7)	10 (3.9)	32	82	100	68	18
Ascaris lumbricoides	8 (0.9)	1 (0.1)	7 (1)	1 (0.1)	1 (0.4)	-	16	2	16	0	14
Trichuris trichiura	2 (0.2)	-	5 (0.7)	1 (0.1)	-	-	7	1	7	0	6
Total	25* (2.8)	103* (11.4)	26* (3.7)	118* (16.8)	4* (1.6)	34* (13.2)	55*	255*	352*	294*	38*

* The number of infected persons by one or more intestinal helminthic parasite(s)
Figures in parentheses indicate percentages
CT=Cellophane tape
DP=Direct preparation

parasitic infections, were given information about and treatment of such infections.

The high prevalence of intestinal parasites in any population is related to parasitic contamination of the soil and water sources in addition to deficient sanitary and sociocultural conditions (29). The implementation of programmes on health education, personal hygiene, communal sanitation, and eventual treatment of infected people would contribute to the control of this health problem. Management practices in accordance with the specific characteristics of an urban environmental and sociocultural ecosystem are, thus, important for the control of intestinal parasitic infections among municipal populations (30). The findings of our study suggest that there is a high prevalence of parasitic infections in the community, and an intervention strategy, including a health-education programme, should, thus, be designed and implemented to control parasitic infections.

The present study observed a higher prevalence of intestinal parasites among the 7-15-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 (31).

G. intestinalis was the species most frequently detected in the three regions. The higher prevalence of *G. intestinalis* and the other protozoan infections than helminth infections might indicate contamination of the water supply. In addition, the lower prevalence of helminth infections spread through the soil could be related to better sanitary conditions apart from water supplies.

In this study, *E. vermicularis* was the second most common parasite (12.3%) determined by the CT method. However, only three (0.2%) *E. vermicularis* were determined by the DP method. There was a significant statistical difference between the results of the DP and the CT method in detecting the frequency rates of enterobiasis in each population of the three regions. According to the results of the present study, it could be postulated that, of the two methods, the CT test was the most accurate method for the diagnosis of *Enterobius*-associated infection. A previous study also reported that the CT method was the gold standard for the diagnosis of enterobiasis (32).

Taeniasis (*T. saginata and T. solium*) occurs mainly as a result of consumption of raw meat by populations.

Table 7. Comparison of *Enterobius vermicularis* and *Taenia saginata* by DP and CT methods in each region using a "significance test of differences between two independent proportions"

Region	*Enterobius vermicularis*				*Taenia saginata*			
	DP	CT	*t*-test value	p value	DP	CT	*t*-test value	p value
Region I	-	92	9.61	<0.05	16	46	10.28	<0.05
Region II	2	112	10.92	<0.05	13	26	4.69	<0.05
Region III	1	25	5.05	<0.05	3	10	2.92	<0.05

CT=Cellophane tape; DP=Direct preparation

However, *T. saginata*-associated infection was the only type of taeniasis observed in the present study since no pig meat was consumed in Sivas. The present study also applied the two methods for the diagnosis of human taeniasis as used in the detection of enterobiasis. While the DP method and the CT preparation showed 32% and 82% reliability respectively, the combined usage of the DP and CT tests was almost 100% reliable to detect taeniasis. The CT method was not always 100% reliable because the subjects either could not perform the method properly or might have cleaned their anal region well enough after the toilet use just before performing the sample-taking procedure to result in non-detection of taeniasis. Therefore, subjects must always be asked to perform the CT method before they go to the toilet and whether they had proglottid expulsion or not before the CT method. Kaminsky showed that the results of the Kato cellophane thick smear method, a combination of Kato and 'Scotch' tape per anal swab and clinical history of proglottid expulsion, was 80%, 88%, and 50% respectively (33). The statistically significant differences between the DP and the CT method were determined in the present study in detecting taeniasis in all the three regions. The CT method was more effective in diagnosis compared to the DP method; however, the combined use of the DP and CT methods was the most reliable of all for the diagnosis of taeniasis.

In conclusion, the findings of the present study showed that the 7-15-year age group had the highest parasitic infection, indicating the lack of education on parasitic infections, along with the deficiency of environmental and sanitary conditions and personal hygiene. It has also been determined that, while the most accurate way of diagnosis for taeniasis was the combined usage of the CT and DP methods, the CT method was the best method for the diagnosis of enterobiasis. The findings of this study suggest that the city administrators need to pay more attention in the prevention of parasitic infections, along with the improvements in educational, environmental and sanitary conditions.

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