

Prevalence and associated risk factors of intestinal parasites among children of farm workers in the southeastern Anatolian region of Turkey

Nebiye Yentür Doni¹, Gülcan Gürses¹, Zeynep Şimşek², Fadile Yıldız Zeyrek³

¹ Vocational School of Health Services Medical Microbiology, Harran University, Sanliurfa, Turkey

² Faculty of Medicine Public Health, Harran University, Sanliurfa, Turkey

³ Faculty of Medicine Medical Microbiology, Harran University, Sanliurfa, Turkey

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Abstract

Objective. To determine the species, prevalence, and associated risk factors of intestinal parasites in farm workers' children in a representative sample in the southeastern Anatolian region of Turkey.

Materials and method. A total of 333 farm workers' children, under the age of six years, were selected using the probability sampling method. Mean age of the children was 3.63 ± 0.5 ; 55.5% were female. Data were collected using a structured questionnaire and laboratory analysis of faecal samples.

Results. The overall prevalence was 44.6% and the infected children had single, double, and triple parasitic infections at 72.3%, 23.0%, and 4.7%, respectively. The most common parasite was *G. intestinalis* (47.97%), followed by *E. vermicularis* (37.84%), *T. saginata* (27.03%), *H. nana* (12.16%), and *A. lumbricoides* (7.43%), respectively. Age, gender, illiteracy of the households, poverty, absence of toilets, bathrooms, and kitchens at the place of residence, lack of safe potable water, geophagia (soil eating habit), and being a child of a seasonal farmworker were the most significant factors associated with intestinal parasitic infection ($P < 0.05$). *G. intestinalis* and *E. vermicularis* were found as the most common parasites that cause salivation, abdominal pain, and tiredness ($P < 0.05$).

Conclusion. The study revealed that health education programmes for farm workers and farmers should be improved to increase awareness about living and working conditions, in order to control intestinal parasites. However, early diagnosis and treatment services for intestinal parasites should be provided by primary health care staff in the national child screening programme in agricultural populations.

Key words

Children under 6 years of age, intestinal parasites, agricultural area, seasonal farm workers

INTRODUCTION

According to the International Labour Organization, agriculture is the second greatest source of employment worldwide, with over one-third of the world's workforce (1.3 billion people) depending on agriculture. In most industrialized countries, agricultural workers comprise 9% of the workforce, and this rate reaches 60% in developing countries. In Eastern Europe, 20% and in Latin America, 25% of all workers are employed in agriculture. About 63% of all workers in Africa and 62% of all workers in Asia are employed in agriculture, compared to only 5.2% in the European Union [1]. Similarly, in Turkey, 24.6% (6,143,000 people) of the labour force are employed in the agriculture sector [2]. Agricultural work is different from other sectors from the point of view of the working environment and facilities. While working in fields, agricultural workers are infected with many waterborne and foodborne pathogenic agents, including bacteria, viruses, and protozoa, which may cause diseases that vary in severity from mild gastroenteritis to severe, and

sometimes fatal, diarrhoea related to the lack of sustainability of water supply and sanitation services, poor hygiene behaviours, and lack of priority given to the agricultural sector's healthy living arrangements. The World Health Organization reported that approximately 2 billion people are infected with soil-transmitted helminths and 1.1 billion people globally do not have access to improved water supply sources, whereas 2.4 billion people worldwide do not have access to any type of improved sanitation facility. Therefore, about 2 million people die every year due to diarrhoeal diseases, most of whom are children younger than 5 years of age. The most affected are the populations in developing countries, living in poor health conditions, poverty, and periurban dwellers or rural populations [3].

The farm workers' children walk on the ground without shoes and play on soil that contains parasite cysts and mature forms. The infectious stages of parasites have the ability to easily enter their host, usually through the mouth as a contaminant of food, water, or fingers, while the next generation leaves the body in faeces through the anus in the form of spores, cysts, eggs, or larvae. There are exceptions: a few parasites of the gut enter the body through the skin, notably the larvae of hookworms and *Strongyloides stercoralis*. Sometimes, infected people put others at risk of infection, such as by defecating in the open, so that the infectious stages are spread through the environment [4].

Address for correspondence: Nebiye Yentür Doni, Harran University Vocational School of Health Services Medical Microbiology, İpekyol Bulvarı. No:1 63050 Sanliurfa/Turkey
E-mail: n_doni@hotmail.com

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Helminths and protozoans are in endemic areas for children. Infections that are of major public health importance are widely distributed in tropical and subtropical areas, with the greatest numbers occurring in sub-Saharan Africa, the Americas, China, and East Asia. Infected children are physically, nutritionally, and cognitively impaired because of the malabsorption of nutrients. In addition, some protozoan and helminths also cause loss of appetite, and therefore a reduction in nutritional intake and physical fitness.

The Southeastern Anatolia Project (GAP=SEAP) is one of the most ambitious of all regional development efforts worldwide, and the largest and most comprehensive development effort ever launched by the Republic of Turkey. GAP is a multisector, integrated regional development project launched in the region of southeastern Anatolia, one of the relatively less developed regions of the country, comprising nine administrative provinces (Adıyaman, Batman, Diyarbakır, Gaziantep, Kilis, Mardin, Siirt, Şanlıurfa, and Şırnak). Agricultural output and raw materials, as well as a rural labour force and capital, are the basis for agro-industries, other industrial sectors, and services to contribute to the further development of the national and global economy [5]. In addition, the influence of the formation of dam lakes and the enlargement of irrigation areas will change the health problem profile.

The objective of this study was to determine the species and prevalence of intestinal parasites in a representative sample in this GAP region.

MATERIALS AND METHOD

This study was conducted between January – April 2013 in nine provinces (Adıyaman, Batman, Diyarbakır, Gaziantep, Kilis, Mardin, Siirt, Şanlıurfa, and Şırnak) of the southeastern Anatolia region in Turkey, and approved by the Ethics Committee of the Faculty of Medicine at Harran University. The optimum sample size was calculated as 400 farm workers' children under the age of six years. A total of 333 children were divided into 110 clusters (a cluster size was 10 households), and one child enrolled from every household had random complaints and symptoms of intestinal parasitic infection (response rate – 83.3%). During home visits, after explaining the aim of the study, informed consent was obtained from the children's parents. Data were collected using a structured questionnaire and laboratory analysis of faecal samples. An adhesive cellophane tape with a glass slide and a faecal specimen container were distributed to the parents during house-to-house visits. The next morning, the cellophane tape and a single faecal specimen from each participant were collected and the faecal specimens transferred into a container with 10% formaldehyde for preservation of helminth eggs, protozoan cysts, and trophozoites in the faecal specimens. All of the specimens were transferred to the Şanlıurfa Harran University Microbiology Laboratory under suitable conditions. In the laboratory, the faecal specimens were examined macroscopically. Next, the faecal specimens were examined for the presence of parasites, helminth eggs, larvae, and protozoan cysts using a direct wet mount, native-Lugol (saline and Lugol's iodine solution), modified formalin-ethyl acetate sedimentation, and acid-fast stained preparations. The cellophane tapes were examined for the presence of *Taenia saginata* and *Enterobius vermicularis*.

Children who had at least one faecal sample in which an intestinal parasite was identified were classified as positive for that parasite.

The children's mothers were asked to fill out a standardized questionnaire that included sociodemographics, living conditions, and children's complaints: abdominal pain, nausea/vomiting, lack of appetite, abdominal pain, salivation during sleeping, perianal itching, geophagia, and eating raw meat. All of the complaints caused by intestinal parasites were answered by the mothers as 'yes', 'no', or 'I don't know'.

Statistical analysis. Data entry and analyses were performed using the Statistical Package for the Social Sciences version 11.5. Associations among the variables were assessed using either parametric (student's t-test, chi square test) or non-parametric tests (Mann-Whitney U test, chi-square), depending on the distribution of the variables. The level of statistical significance was set as $P \leq 0.05$ and for each statistically significant factor.

RESULTS

The study sample comprised 333 participants, aged between 0–72 months, from the nine GAP provinces. Their mean age was 3.63 ± 0.5 and 55.5% were female. The mean household size with infected children was 9.2 ± 3.83 and the mean household size with not infected children was 8.42 ± 3.34 . The mean difference was statistically significant ($t = -2.049$; $P = 0.041$).

Intestinal parasitic infection according to the sociodemographic factors are presented in Table 1. The prevalence of the intestinal parasites among farm workers' children was 44.6%. Gender, age, education of the household members, poverty, type of work, geophagia (soil eating habit), and the hygienic condition of the houses, including water, kitchen, and bathroom, were significantly associated with parasitic infection. Males, children above three years old, the low educational level of the households, poverty, absence of separate kitchen and bathroom, inside or outside toilet, lack of safer potable water, geophagia, and seasonal migratory workers' children had a higher prevalence of intestinal parasites ($P < 0.05$) (Tab. 1). There was no association between the type of settlement and the regional development level ($P > 0.05$).

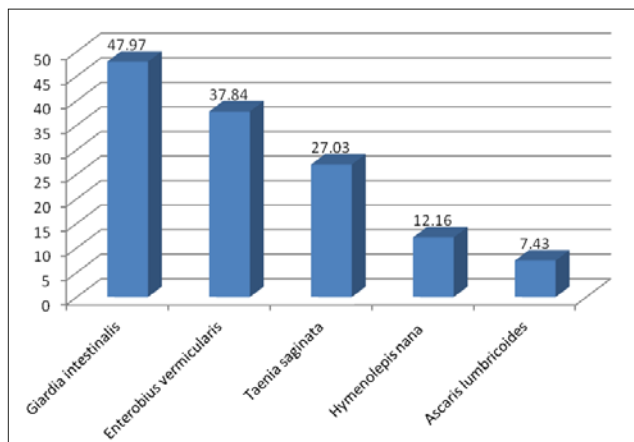
The most common parasite was *G. intestinalis* (47.97%), followed by *E. vermicularis* (37.84%), *T. saginata* (27.03%), *H. nana* (12.16%), and *A. lumbricoides* (7.43%), respectively. Single, double, and triple parasitic infections of 72.3%, 23.0%, 4.7%, respectively, were found (Fig. 1).

The most frequent symptoms associated with any parasite was salivation during sleep – 50.0%, abdominal pain – 47.9%, severe itching of the nose or anus – 43.8%, nausea – 42.6%, lack of appetite – 42.6%, weight loss – 45.9%, tiredness – 33.6%, presence of helminth in the faeces – 21.7%, and geophagia – 7.6%.

G. intestinalis and *E. vermicularis* were the most common parasites that caused salivation, abdominal pain, and tiredness ($P < 0.05$).

Table 1. Distribution of intestinal parasitic infection according to sociodemographic factors

Variables	Infected		Not infected		Total		X ² ; P
	n	%	n	%	n	%	
Gender							
Female	73	39.9	110	60.1	183	55.0	X ² = 3.87;
Male	75	50.0	75	50.0	150	45.0	P= 0.049*
Age groups							
2 years and below	32	35.2	59	64.8	91	27.3	X ² = 4.36;
3 years and above	116	47.9	126	52.1	242	72.7	P= 0.037*
Education of the household							
Illiterate	621	50.0	620	50.0	1241	53.0	X ² = 10.08;
Primary school	293	45.0	358	55.0	651	27.8	P= 0.018*
Secondary school	165	48.2	177	51.8	342	14.6	
≥High school	39	36.4	68	63.6	107	4.6	
Poverty							
Yes	61	50.4	60	49.6	121	37.1	X ² = 214.4;
No	84	41.0	121	59.0	205	62.9	P= 0.00*
Type of work							
Family farmer	786	45.5	940	54.5	1726	60.8	X ² = 11.39;
Seasonal migratory worker	578	52.0	533	48.0	1111	39.2	P= 0.001*
Type of settlement							
Province	19	45.2	23	54.8	42	12.6	X ² = 0.81;
Town	39	40.6	57	59.4	96	28.8	P= 0.067
Village	90	46.2	105	53.8	195	58.6	
Regional development level							
Developed	29	37.7	48	62.3	77	23.1	X ² = 2.18;
Middle developed	77	47.8	84	52.2	161	48.3	P= 0.33
Underdeveloped	42	44.2	53	55.8	95	28.5	
Kitchen at home							
Yes	111	42.7	149	57.3	260	78.3	X ² = 1012.47;
No	37	51.4	35	48.6	72	21.7	P= 0.00*
Bathroom at home							
Yes	116	43.4	151	56.6	267	80.4	X ² = 1138.98;
No	32	49.2	33	50.8	65	19.6	P= 0.00*
Toilet							
Inside	64	48.9	67	51.1	131	39.6	X ² = 707.49;
Outside	75	44.9	92	55.1	167	50.5	P= 0.00*
Inside & outside	9	27.3	24	72.7	33	10.0	
Access to water							
Safe	35	28.5	88	71.5	123	58.3	X ² = 528.797;
Unsafe	34	38.6	54	61.4	88	41.7	P= 0.00*
Geophagia							
Yes	12	57.1	9	42.9	21	6.7	X ² = 235.62;
No	126	43.3	165	56.7	291	93.3	P= 0.00*
Total	148	44.6	185	55.4	333	100.0	

**Figure 1.** Distribution of intestinal parasites, detected by species

DISCUSSION

Epidemiological studies on the prevalence of infection by intestinal parasites in different localities were conducted to identify high-risk communities and improve appropriate interventions. In line with this view, the present study attempted to assess the prevalence and associated risk factors of different intestinal parasitic infections in farm workers' children under six years of age, who lived in the nine GAP provinces in the southeastern Anatolia region of Turkey. Approximately one out of every two farm workers' children

was infected. This prevalence (44.6%) was consistent with those reported in other studies conducted on agricultural populations [6, 7, 8, 9, 10, 11, 12, 13].

Regarding the parasite prevalences in the current study, the most common protozoon was *G. intestinalis*, with a prevalence of 47.97%, and the most common helminth was *E. vermicularis*, with a prevalence of 37.84% among all of the intestinal parasites. This finding was consistent with those reported in other studies conducted in the GAP region, in both underdeveloped and developed countries [7, 9, 10, 11, 14, 15, 16, 17]. This higher prevalence might be attributed to the many factors reported by the farm workers' children, such as close physical contact with other children, poverty, unsanitary conditions, overcrowded families, having poor personal hygiene habits, the common handling of children's clothing or bedding, and breathing in dust infested with parasite eggs.

In the presented study, some risk factors associated with intestinal parasitic infections and age were found: gender, illiteracy of the household, being a member of a seasonal migratory farmworker's family, poverty, the absence of a toilet, bathroom, or kitchen at home, shanty house, or tent, lack of safe potable water, and geophagia were the most significant factors for intestinal parasitic infection.

- 1) Children aged three and above were significantly more infected with intestinal parasites, similar to that reported in other studies [15, 18, 19]. This could be due to farmworker's children aged two and below mostly remain indoors and are breast fed.
- 2) Males had a significantly higher prevalence of intestinal parasites than females, as reported elsewhere [17, 20, 21]; this could be caused by males playing with soil or contaminated water, where their hands could be contaminated with the eggs of soil-transmitted parasites or they could be infected by waterborne parasites.
- 3) The education level of all of the family members, not only the mothers, was significantly associated with the intestinal parasitic infections. Other studies have also emphasised that the lack of maternal education is the most important risk factor [11, 12, 22, 23]. Children whose households were illiterate had a higher prevalence of intestinal parasitic infection (50.0%). Individuals with higher levels of education could positively affect the health behaviours of their family members.
- 4) Poverty: the effect of poverty on the intestinal parasitic infection was complex and could be attributed to many factors, such as an unhygienic environment, lack of safer potable water, safer clothes, and poor nutrition. Studies conducted in different countries showed that parasitic infections were higher in those with a low socioeconomic status and was more common among immigrants [16, 24, 25].
- 5) The children of seasonal migratory farm workers were more infected with intestinal parasites than farmers' children because of the unhealthy and poor hygienic living conditions in the fields. The prevalence of intestinal parasites conducted on migratory farm workers ranged from 20% – 80% [6, 8, 9, 10, 11, 12, 13]. Farm workers' children living in a home or shanty house without a kitchen, bathroom, or toilet had a higher prevalence of intestinal parasitic infection – 51.4%, 49.2%, and 48.9%, respectively. As a result of having an irregular toilet, unsupervised migratory farm workers' children might be

more prone to defecating in open fields on farms that are already polluted by faeces, and therefore might be infected with intestinal parasites.

- 6) Farm workers' children who used drinking water from rivers, streams, springs, and wells had a significantly higher prevalence of intestinal parasitic infection (38.6%), compared to those who had access to tap water (28.5%). This result was in line with the prevalences reported in other studies [24, 26]. This might be explained as reported in a previous study, where the common use of water reservoirs by humans and animals may contribute to the transmission of pathogenic species of microorganisms [27].
- 7) The mean household size was associated with parasitic infection. When the mean of the households increased, the significance of the association with parasitic infection could be determined. Overcrowded families were more infected with intestinal parasitic infection.
- 8) Geophagia: the prevalence of parasitic infection among children having geophagia was significantly higher (57.1%) than those without geophagia (43.3%). This result was similar to that reported in another study [20].

An association could not be determined between intestinal parasites and type of settlement (village-town-province) and the regional development level of the provinces. The climate and geographic conditions of the nine GAP provinces presented similar features, such as moisture, optimum temperature, and proper soil, for the development of the oval and larval stages of parasites.

In the presented study, salivation, abdominal pain, weight loss, severe itching, vomiting, nausea, and loss of appetite were significantly related to parasite-positive children. More specifically, *G. intestinalis* and *E. vermicularis* were the most common parasites causing salivation, abdominal pain, and tiredness.

Strengths and limitations of the study. This study was the first investigation of intestinal parasite prevalence among farm workers' children under six years of age, in a large region consisting of nine GAP cities in Turkey. As a result of the method employed, it was possible to generalize the results of all of the farm workers' children in the southeastern Anatolia region. The limitation of this study was that only a single faecal sample was collected from each participant. Helminth egg output varies from day-to-day and within each stool specimen; hence, it is probable that the 'true' prevalence was underestimated. Although recent studies have suggested that one or two stool samples will detect up to 90% of the protozoa present [16], the authors believe that if three serial faecal samples were taken from the children, the sensitivity of the study would have been increased. Unfortunately, this could not be performed because of the large study region. Another limitation of this study was that the Trichrome stain and an antigen test were not used, which may have resulted in unreported *Entamoeba histolytica/Entamoeba dispar*.

CONCLUSIONS

The present study reveals that intestinal parasites were abundant among farm workers' children in the southeastern Anatolia region of Turkey. As a result of the findings, national

awareness should result in the provision of improvement in the living and working conditions of farm workers who are obliged to migrate and live with their children under six years of age. Because of this, priority should be given to the agricultural sector's healthy living arrangements (providing safer potable water, constructing toilets on farms) must be legislated. However, early diagnosis and treatment services for intestinal parasites should be given by the primary health care staff in national child screening programmes in agricultural populations.

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