Original Article

A Study on the Prevalence of *Enterobius vermicularis* in Kindergartens of Dezful City (Khuzestan Province, Iran), 2013

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Introduction: Intestinal parasitic infections are of a major public health problem in many societies. *Enterobius vermicularis* is particularly more persistent in places such as kindergartens, dormitories, and barracks, where people live and work together. This study aimed to investigate the prevalence and risk factors of infection with *E. vermicularis* in the kindergartens of Dezful City, 2013. **Methods**: In this cross-sectional study, a total number of 254 children aged 3-7 years, were randomly selected from private kindergartens in different parts of the city based on population density. Data collection tool was a questionnaire including demographic characteristics. The children were examined using Graham method (Scotch tape) to determine the prevalence rate of *E. vermicularis* infection. Non-parametric statistical χ^2 test was used to evaluate the objectives. All statistical tests were done at a confidence level of 95% and a *p*-value<0.05. **Results:** A total of 254 children were examined for the prevalence of *E. vermicularis,* of whom 127 cases (50%) were males and 127 (50%) were female. Out of the total number of examined children, 20 cases (7.8%) were observed to be infected with *E. vermicularis*. Of these patients, 11 (4.3%) were female and 9 (3.5%) were male. The highest rate of infection was observed in children aged 5-6 years. The highest prevalence of *E. vermicularis* infection (19 cases, 7.5%) was observed in children of parents with preliminary education. However, one positive case (0.3%) was documented for a family with parents having higher education level. In general, this study showed 19 out of 20 *E. vermicularis* positive cases were from Dezful's kindergartens located in poor socio-economic areas. Another factor for the prevalence of *E. vermicularis* was presence of health trainers in the kindergartens. A considerable number of *E. vermicularis* cases (95%) were recorded for kindergartens with no health trainer. **Conclusion**: With respect to the obtained *p*-value of 0.6 for age and gender of children, as well as having equal gender distribution and according to the findings of this study, the age and gender did not have significant effects on the prevalence of *E. vermicularis* infection in kindergartens. In addition, the infection rate was recorded to be 5.8% for the age group of 5-6 years. In fact, the prevalence of *E. vermicularis* infection was increased with increasing age, probably due to increased social communication in this age. *J Med Microbiol Infec Dis, 2014, 2 (2): 76-79.*

Keywords: *Enterobius vermicularis*, Kindergarten, Dezful, Iran.

INTRODUCTION

Oxyuriasis is a common parasitic disease among children, which is caused by nematode worm *Enterobius vermicularis* [1]. *E. vermicularis* has the widest geographical distribution among worms due to its close relationship with man and environment [2]. The parasite is not transmitted by insects or intermediate hosts but directly from an infected person to a healthy one through hand contact and contaminated food and supplies. It has been shown that there is also an airborne route of transmission for *E. vermicularis*, in which parasite eggs can be released in the air and inhaled [3]. Although, *E. vermicularis* do not reproduce inside the body of their human host [4], sometimes eggs may hatch on the anal mucosa, and larva migrate back into the gastrointestinal tract of the original host [4, 5] in a process known as retroinfection [5, 6]. When retroinfection occurs, it can directly cause an intense parasitic load and ensure continuous *E. vermicularis* infestation [5]. Regardless of the limited 13-week lifetime of *E. vermicularis* [7], autoinfection (infection from the original host to itself), either via the anus-to-mouth route or via retroinfection, enables *E. vermicularis* to inhabit the same host for an unlimited period of time [5].

E. vermicularis is a symbiotic worm, but in many cases, it causes symptoms (especially in children), such as anal itching, nausea and vomiting, abdominal pain, insomnia, weight loss, irritability and teeth grinding [8]. The other serious complications are appendicitis, bowel impediment, severe diarrhea, eosinophilic colitis, and urinary tract infections [9]. Due to anal itching, eggs are particularly placed under fingernails and thereby can be transmitted to the original host (autoinfection) or to others [1]. Definite diagnosis of *E. vermicularis* is made based on detecting mature parasites in stool or their eggs by Scotch tape technique [10].

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However, in more than 10% of samples, parasite eggs are not detectable by stool examination method. Graham method, also known as Scotch tape, is the most reliable way to detect parasite eggs, and the best time for sample collection is in the morning before defecation or bathing [1]. Regardless of protective hygienic measures for the most at-risk age groups and separation of healthy children from infected ones, there is a high potential risk of *E. vermicularis* transmission due to autoinfection and direct spread of parasite eggs [11]. Previous studies showed that *E. vermicularis* infection can be seen in large quantities in many parts of our country, especially among children in orphanages, preschool, and elementary schools [12]. According to the World Health Organization, it is estimated that 200 million people are infected worldwide [13]. Due to being autoecious and having autoinfection ability, *E. vermicularis* has a high prevalence rate, even in developed countries. This study aimed to determine the prevalence of *E. vermicularis* in children of Dezful kindergartens through collecting samples from different parts of the city during the year 2013.

MATERIAL AND METHODS

In this descriptive study, Dezful City was divided into 7 districts based on urban areas. After coordination with the Social Welfare Department, the samples were collected from 10 private kindergartens using a random sample method. The samples were examined by light microscopy in the Parasitology Laboratory of School of Medicine, Ahvaz Jundishapur University of Medical Sciences. To carry out this study, instruction sessions were first held to train parents on how to recognize the disease, how samples would be provided using Graham method, and how parents could protect their children from the disease. After explaining the study procedure to the parents, the questionnaires including demographic characteristics as well as family and health status, were presented to the parents. After completion of the questionnaires, children were selected, of whom a total number of 254 were randomly selected using a random cluster sampling method. The Scotch tape samples were collected and examined microscopically. The obtained data were analyzed using SPSS software version 15.

RESULTS

In general, 254 children from 10 private kindergartens of Dezful City, were examined based on density population. Then, a random sampling method was used to take samples from the 7 selected parts of the city. The gender distribution was similar; 127 cases (50%) were female and 127 (50%) were male. After all, a total 20 (7.8%) children were diagnosed with *E. vermicularis* infection, of whom 11 (4.3%) were female and 9 (3.5%) were male (Figure 1). The subjects were classified into age groups of 3-4, 4-5, 5-6, and 6-7, respectively (Table 1) (Figure 2). The highest rate of infection (5.8%) was observed in children aged 5-6 years. The highest disease prevalence was seen in children of families with preliminary education and lower socioeconomic status. In field studies, it has been found that family environment hygiene was poor. Moreover, most cases were documented in children of the kindergartens located in districts with lower social class (Table 2). Four out of the 10 kindergartens had health trainers to teach children about personal hygiene. Interestingly, the obtained results indicated that a considerable amount of children with *E. vermicularis* infection, *i.e.*, 19 cases (95%) were recorded for kindergartens with no health trainer. However, despite of the presence of health trainer, one positive case (5%) of *E. vermicularis* infection was observed in one of the kindergartens.

Table 1. Age and gender distribution of *E. vermicularis* egg positive cases in children of kindergartens in Dezful City, 2013

Age group	No. Infected children		Infected Children (%)
	Boy	Girl	
3-4	0	1	0.3
4-5	1	3	1.4
5-6	7	7	5.8
6-7	1	0	0.3
Total	9	11	7.8

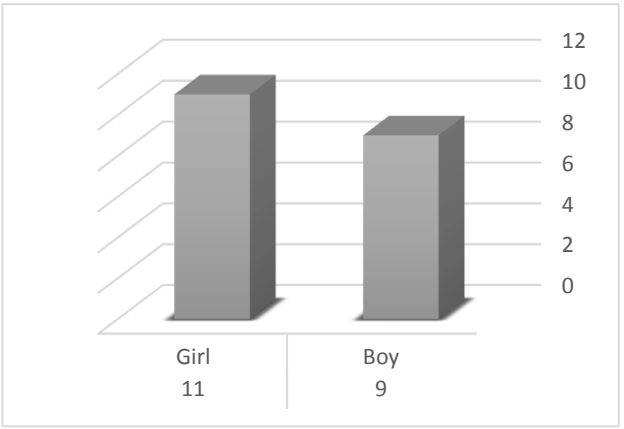


Fig. 1. Prevalence of *E. vermicularis* infection according to gender

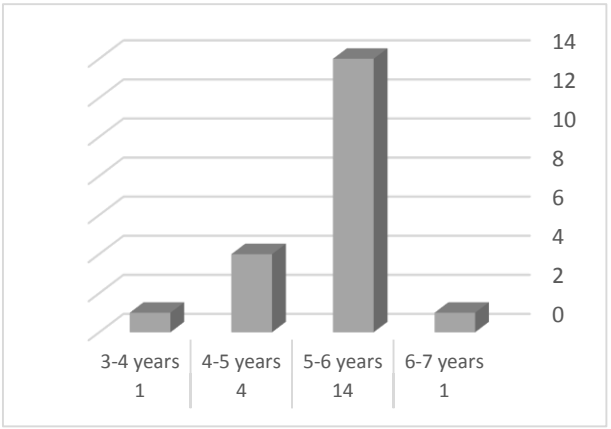


Fig. 2. Prevalence of *E. vermicularis* infection according to age

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Table 2. Studied variables of distribution of *E. vermicularis* egg positive cases in children of kindergartens in Dezful City, 2013

	Economic status *p*-value = 0			**Social status** *p*-value = 0			**Parental education level** *p*-value = 0			**Health trainer** *p*-value = 0.002	
	Low	Medium	High	Lower	Middle	Upper	Middle school	High school	High education	With	Without
No. Children	176	49	29	130	86	38	117	79	58	63	191
%	69.3	19.3	11.4	51	33.4	14.5	69.3	19.3	11.4	24.8	75.2
No. Infected children	19	1	0	19	1	0	19	1	0	1	19

DISCUSSION

Parasitic infections can occur with different prevalence rates in many parts of the world. Prevalence distributions of these infections are related to standard principles of public health, economic, and climatic regions [14]. The present study confirmed the prevalence of *E. vermicularis* in children of 10 kindergartens in 7 different districts of Dezful City during 2013. A total number of 254 children were examined using Graham method, and it was evidenced that 20 children were infected with *E. vermicularis*. Eleven of them were female and 9 were male. The high prevalence of *E. vermicularis* was documented in areas with low socioeconomic status, indicating the existence of a relationship between the infection of children and families' social class. Since the data were qualitative, a nonparametric test (Chi-square) was used to investigate association of socioeconomic status and prevalence of *E. vermicularis* infection. The Chi-square test statistic value was found to be 7.981, with 2 degrees of freedom and a *p*-value of 0. Therefore, a significant relationship was observed between socioeconomic status and the prevalence of the disease. Our results were consistent with those of Noruzian and Youssefi study on *E. vermicularis* prevalence in kindergarten and primary school children in Babol City, Mazandaran, Iran, 2013 [14].

In terms of the parental education level, most infected children were recorded for families with middle and high school education level. In addition to above, our field observation revealed that another reason for the high infection rate was poor family environment hygiene. In terms of the effect of parental education level on the prevalence of *E. vermicularis* infection, the Chi-square test value was found to be 25.648, with 3 degrees of freedom and a *p*-value of 0. Therefore, the statistical figures of this study show a significant correlation between the incidence of *E. vermicularis* infection and parental education level (Table 2), which is consistent with Hazratitapeh *et al*. study on *E. vermicularis* prevalence and effective factors involved in its spread in kindergartens of Urumieh, 2006 [15]. As a result, a personal and environmental hygiene training course should be in place, especially for parents with low education and social class in order to prevent and reduce the incidence of *E. vermicularis* in children.

The highest rate of infection was observed in children of both genders aged 5-6 years. Easy transmission of the parasite as well as high social communication in children of this age group could be the reasons for higher prevalence rate of *E. vermicularis* infection. With respect to the obtained qualitative data a non-parametric (Chi-square) test was used to examine the relationship between gender and prevalence of *E. vermicularis* infection. According to the present data, Chi-square test statistic value was 0.2. Therefore, hypothesis H_1 (There is a significant relationship between gender and disease outbreaks) was rejected with a confidence of 0.346. As a result, no significant relationship was observed between gender and disease prevalence among children. Alternatively, since the *p*-value calculated by Mann-Whitney test was more than 0.05, no significant association was found between the prevalence of *E. vermicularis* and age and gender of children. Therefore, hypothesis H_0 (There is no significant relationship between gender and the disease prevalence) was accepted. The statistical test of Mann-Whitney was used, because data on age and gender did not follow a normal distribution. The variable of health trainer presence could influence kindergartens in terms of the prevalence of *E. vermicularis*. The achieved results showed that most positive cases were found in kindergartens with no health trainers. Based on the obtained results a Chi-square value of 10.01 and a *p*-value of 0.002 were achieved. In our study, a significant correlation was found between the presence of health trainer in kindergartens and prevalence of *E. vermicularis* in the children (Table 2), which was in agreement with the study of Hazratitapeh *et al*. in 2006.

In a study on children (aged 4-7 years) of kindergartens and elementary schools in Babol City, 2009, a total number of 702 samples were collected using Scotch tape, and *E. vermicularis* prevalence was found to be 33.3% [14]. In the above study, factors including hygiene, climate, and economic status were found to be effective in the prevalence of *E. vermicularis*. In addition, in a study on kindergarten and primary school children of Semnan Province (2005), a total number of 688 children were tested using Scotch tape, and *E. vermicularis* prevalence was estimated to be 5.2% [16]. In that study, a significant relationship was found between the prevalence of *E. vermicularis* and the lack of frequent hand washing, fatigue, maternal education, and urban residence [16]. Another study (2002) was conducted in Urmia using the same method, and 393 samples were collected from children aged 1 to 6. Most cases of infection were observed in ages 5-6 years. Furthermore, in terms of parental education level, the prevalence of *E. vermicularis* in children of mothers with low education was higher than children of mothers with higher education [15]. In that study a significant relationship was found between the presence of health trainers in kindergartens and prevalence of *E. vermicularis*. However, the difference in the prevalence of *E. vermicularis* was found to be due to existence of differences in climate, household sanitation, presence of health trainer in kindergarten, and population density.

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According to the results of the present study and their comparison with those of other investigations, it can be said that teaching principles and standards of health care to parents with low education, promotion of personal hygiene and family environment hygiene, necessity of observance of hygiene recommendations by kindergarten teachers, and familiarization of children with concepts of personal hygiene, are the best strategies to prevent parasitic diseases such as oxyuris.

According to the results of this study, we conclude that age and gender of children have no influence on the prevalence of *E. vermicularis*. However, socioeconomic classes, parental education level, and presence of health trainers in kindergartens have significant effects on the prevalence of *E. vermicularis*.

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CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest associated with this manuscript.

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