

## Prevalence of *Enterobius vermicularis* infection among preschool children, Babol, North of Iran

Seyed Ali Norbakhsh Amiri<sup>1</sup> · Mohammad Taghi Rahimi<sup>2</sup> · Seif Ali Mahdavi<sup>3</sup> · Mahmood Moosazadeh<sup>4</sup> · Omid Ramzani<sup>1</sup> · Ali Farrokhi Koshk<sup>1</sup> · Reza Rosbehan<sup>1</sup> · Seyed Abolghasem Siyadatpanah<sup>1</sup>

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**Abstract** *Enterobius vermicularis* or pinworm, is considered as one of the most frequently encountered intestinal nematodes and infects millions of people throughout the world particularly children. Some symptoms of the infection including Anal itching, restlessness, insomnia, endometritis, abdominal cramps, diarrhea and etc. The purpose of the present study was to determine the status of enterobiasis in kindergarten and preschool children of kindergartens from Amir Kola, Babol Mazandaran Province, North of Iran. A total number of 126 (70 boys and 56 girls) children from four kindergartens from Amir Kola, Babol, Mazandaran Province, North of Iran were examined for the prevalence of *E. vermicularis* infection, 2013. Adhesive cello-tape anal swab method was trained to parents for sampling. In addition, a questionnaire was designed and filled out to collect demographic information for each individual. Data were analyzed using Chi square test and multivariate logistic regression for each risk factor. The overall prevalence of *E. vermicularis* infection was 22.2 % (28). Infection with *E. vermicularis* in girls 23.2 % was higher compared to boys 21.4 %. Regarding age of examined individuals, infection was seen more both in boys and girls with the age of 6 years old compared to

other age groups. There was no significant difference between gender and age ( $p < 0.05$ ). Based on the results of current study, prevalence of *E. vermicularis* in kindergarten and preschool children is high and still is an important public health matter in the north of Iran and should not be underestimated due to being highly contagious infection. Therefore, a systematic control and preventive measures should be adopted to reduce morbidity associated with enterobiasis.

**Keywords** Children · Intestinal parasite · Primary schools · Public health

### Introduction

Intestinal parasitic infections are considered amongst the most common infections throughout the world and it is estimated that 3.5 billion subjects are suffered (WHO 1998). Among them *Enterobius vermicularis* is public health problem. The helminth parasite, *E. vermicularis* (oxyuris), is an intestinal nematode and commonly is known as the pinworm (Roberts and Janovy 2009). Enterobius infection is the representative contact-borne contagious helminth. Enterobiasis usually occurs by ingestion of eggs via contaminated hands or food. Mature threadworms dwell in the lumen of terminal ileum or caecum. It is especially more prevalent amongst children in crowded communities and unsanitary conditions. One estimate puts the total number of infected people at one billion (Nagar 1987; Cook 1994).

The majority of cases are symptomless; sometimes children suffer from irritability and loss of appetite, nausea, insomnia, bed-wetting, nightmares, grinding of the teeth, diarrhea, pruritus ani, catarrhal inflammation, pruritus vulvae, recurrent cellulitis and endometritis. In addition, anal

✉ Seif Ali Mahdavi  
SA.Mahdavi@mazums.ac.ir; seifali.mahdavi@gmail.com

<sup>1</sup> Student Research Committee, School of Medicine, Mazandaran University of Medical Sciences, Sari, Iran  
<sup>2</sup> Toxoplasmosis Research Centre, Mazandaran University of Medical Sciences, Sari, Iran  
<sup>3</sup> Amol Faculty of Paramedics, Mazandaran University of Medical Sciences, Sari, Iran  
<sup>4</sup> Health Sciences Research Center, Faculty of Health, Mazandaran University of Medical Sciences, Sari, Iran

**Fig. 1** Map of Iran, orange area shows position of Babol, Mazandaran Province, North of Iran (color figure online)



itching is a major symptom of the infection. Rarely, pinworms penetrate into submucosa that can be fatal (Lee et al. 2011). Besides, enterobiasis adversely affects school success and physical growth, particularly among young children (Celiksoz et al. 2010). Prevalence of enterobiasis in Iran was reported 25–29 %. Prevention of infection is complicated and difficult, due to the parasite's rapid spread and high reinfection and autoinfection rate (Shoup 2001). Continuous monitoring of infection rates is key to successful disease control (Kang et al. 2006). Therefore, the present study was undertaken to evaluate the prevalence of *E. vermicularis* infection among kindergarten and preschool children of Mazandaran Province, North of Iran, 2013.

## Materials and methods

### Sampling and parasitological procedure

The subjects in the study were between 2 and 6 years of age and were from four kindergartens from Amir Kola,

Babol, Mazandaran Province, North of Iran (Fig. 1). The selection of subjects was by randomized cluster sampling. A total number of 126 children (70 boys and 56 girls) was examined for the prevalence of *E. vermicularis* infection from October to December, 2013. The diagnosis was made by the transparent tape technique using a 2 × 6 cm rectangle of transparent tape. The adhesive side of the transparent tape swab is placed on the perianal skin, pulled off and placed, adhesive side down, on the labeled slide. The slides are collected and taken to the laboratory for examination. The slides are then observed under the light microscope for the presence of *E. vermicularis* eggs. Furthermore, a questionnaire was designed and filled out for each individual to collect demographic and clinical information which seem to be related with enterobiasis. Finally, the results were presented to kindergartens and prevention and control methods were educated.

The data were analyzed using SPSS 16 and EpiInfo 6 programs. Odds ratios for risk factors analysis were calculated by multivariate logistic regression model. *p* value <0.05 was considered as significant.

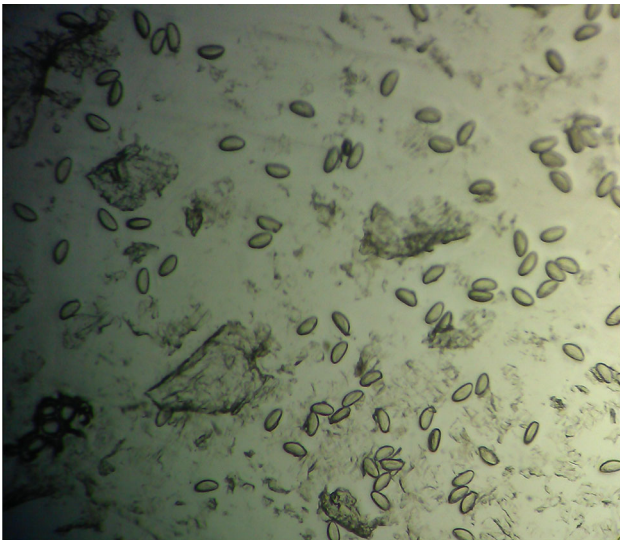
**Table 1** Univariate and multiple logistic regression analysis on different risk factor for enterobiasis

Risk factor	Frequency		Enterobiasis		<i>p</i> value
	No.	%	Yes (%)	No (%)	
<b>Sex</b>					
Boy	70	55.6	15 (21.4)	55 (78.6)	0.489
Girl	56	44.4	13 (23.2)	43 (76.8)	
<b>Age (years)</b>					
2–3	14	11.1	1 (7.1)	13 (92.9)	0.161
4–5	77	61.1	16 (20.8)	61 (79.2)	
6	35	27.8	11 (31.4)	24 (68.6)	
<b>Area</b>					
Urban	113	89.7	24 (21.2)	89 (78.8)	0.319
Rural	13	10.3	4 (30.8)	9 (69.2)	
<b>Family members</b>					
3	86	68.3	17 (19.8)	69 (80.2)	0.227
4–5	40	31.7	11 (27.5)	29 (72.5)	
<b>Anal itching</b>					
Yes	33	26.2	7 (21.2)	26 (78.8)	0.541
No	93	73.8	21 (22.6)	72 (77.4)	
<b>Teeth grinding</b>					
Yes	36	28.6	7 (19.4)	29 (80.6)	0.414
No	90	71.4	21 (23.3)	69 (76.7)	
<b>Finger sucking</b>					
Yes	34	27	9 (26.5)	25 (73.5)	0.319
No	92	73	19 (20.7)	73 (79.3)	
<b>Restlessness</b>					
Yes	28	22.2	4 (14.3)	24 (85.7)	0.189
No	98	77.8	24 (24.5)	74 (75.5)	
<b>Insomnia</b>					
Yes	9	7.1	3 (33.3)	6 (66.7)	0.319
No	117	92.9	25 (21.4)	92 (78.6)	
<b>High level of parental care</b>					
Yes	110	87.3	25 (22.7)	85 (77.3)	0.504
No	16	12.7	3 (18.8)	13 (81.2)	
<b>Infection of family with enterobius</b>					
Yes	9	7.1	3 (33.3)	6 (66.7)	0.319
No	117	92.9	25 (21.4)	92 (78.6)	
<b>Infection with other parasites</b>					
Yes	27	21.4	8 (29.6)	19 (70.4)	0.214
No	99	78.6	20 (20.2)	79 (79.8)	

## Results

The overall prevalence of enterobiasis among examined individuals was determined 22.2 % (28). Infection with *E. vermicularis* in girls 23.2 % was higher compared to boys 21.4 %. Regarding age of examined individuals, infection was seen more both in boys and girls with the age of 6 years old compared to other age groups. There was no

significant difference between gender and age ( $p < 0.05$ ). Enterobiasis was more prevalent in age of 6 years old (31.4 %) compared to other groups. Infection in rural areas (30.8 %) was seen more than urban areas (21.2 %). Table 1 indicates demographic and clinical factors of examined individuals. In addition, there was no significant association between enterobiasis and the listed demographic and clinical factors presented in Table 1. Figure 2



**Fig. 2** Light microscopy showing a large number of *E. vermicularis* eggs detected by Scotch-tape technique (40X)

shows the collected *E. vermicularis* eggs from patient under light microscopy.

## Discussion

The results of the present study demonstrate a high prevalence (22.2 %) of *E. vermicularis* infection among children attending kindergartens and primary schools on Amir Kola, Babol, Mazandaran Province, North of Iran. According to literature review many efforts have been conducted in different areas of Iran including Alborz, Isfahan, Urmia, Amol, Sari and Babol, Semnan, Kermanshah, Ardebil, Zahedan, Babol, Ahwaz and Tehran were 0.028, 2.38, 4.6, 7.1, 7.3, 8.1, 14.7, 18.3, 31.8, 33.3, 34.6 and 40 %, respectively (Nourozian and Youssefi 2013; Sharifi and Abd 2000; Sha-Mohammadi et al. 2014; Maraghi 1997; Daryani et al. 2003; Afrakhteh et al. 2015).

The prevalence of *E. vermicularis* amongst children has been reported in many parts of the globe, and varies considerably, depending on the age groups and areas (WHO 1998; Kang et al. 2006). *E. vermicularis* infection using cellophane tape among children of Turkey, the Republic of Korea, Thailand, Romania and Argentina were reported 9, 18.5, 25, 42.8 and 43.4 %, respectively (Park et al. 2005; Bunchu et al. 2011; Neghina et al. 2011; Guignard and Freye 2000; Köksal et al. 2010).

In this work, no significant difference was seen between prevalence of enterobiasis and gender that is in agreement with some studies (Nourozian and Youssefi 2013; Haghi et al. 2013). It is important to bear in mind that climate plays a prominent role in prevalence of *E. vermicularis* infection and Mazandaran Province has favorable

conditions for survival of *E. vermicularis* eggs. This province enjoys a moderate, semitropical climate with an average temperature of 25 °C in summer and about 8 °C in winter. The province also has a quasi-Mediterranean climate, and the annual rainfall averages 650 mm in the eastern part of Mazandaran province and more than 1300 mm in the western part. Considering this point control of *E. vermicularis* infection is relatively difficult and complicated in this area (Youssefi et al. 2014).

A valuable point is that inadequate personal hygiene increases the risk for pinworm infection and there is a significant relationship between level of personal hygiene and rate of enterobiasis (Noor Hayati and Rajeswari 1991). Usually, children are considered as the main targets, because of this fact that children's behaviors contribute more to the development of *E. vermicularis* infection compared to adults (Afrakhteh et al. 2015). Some important factors may increase risk of acquiring enterobiasis in children including being in overcrowded places, playing on the floor, nail biting, failure to wash hands before meals and living in non-apartment dwellings.

Authors from the current investigation draw a conclusion that the prevalence rate of *E. vermicularis* in kindergarten and preschool children is high and should not be neglected due to being highly contagious infection. Therefore, educational programs and mass treatment should be carried out in order to reduce infection incidence in this area and hygiene measures can help to reduce the chances of pinworm reinfection or new infections in other people. In addition, continuous epidemiological researches and preventive measures should be taken into consideration owing to the significance of the disease in children.

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## Compliance with ethical standards

**Conflict of interest** The authors declare that they have no conflicts of interest.

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