

Epidemiological Study of Enterobiasis in the Preschool Children during April 2013 to Feb 2014 in Mazandaran Province, Northern Iran

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Abstract

Background: *Enterobius vermicularis* (*E. vermicularis*) is one of the most common parasitic infections among children. The present study aimed to determine the prevalence rate of enterobiasis among preschool children in Mazandaran province, northern Iran.

Materials and Methods: In this cross-sectional study, 653 preschool children were recruited via the cluster sampling method during April 2013 to Feb 2014. A questionnaire was administered to parents by an interviewer and determined children's socio-demographic characteristics, personal hygiene, and healthy behaviors. The Graham technique was applied for diagnosis. Data were analyzed using logistic regression model and chi-square test.

Results: In a total of 653 examined subjects, the prevalence rate of *E. vermicularis* was 19.4%, among which 40.9% were male, and 59.1% were female. The highest and lowest prevalence rates of *E. vermicularis* were found in Neka (61.4%) and Tonekabon (1.6%) districts, respectively. A significant association was found between infection and residency, parental occupations, parental education, number of family members, changing underwear, sterilization of linen clothing, taking daily bath, boiling or ironing clothes.

Conclusions: The high prevalence rate of *E. vermicularis* infection in this study proves the stability status of enterobiasis in this area, posing a risk for children there. Systematic control of infection in children is proposed.

Keywords: *Enterobius vermicularis*, Epidemiology, Preschool children, IR Iran

1. Background

Enterobius vermicularis (*E. vermicularis*) is commonly known as a pinworm, which is from nematode phylum with a widespread geographical distribution. The only known host of parasite is human with over 209 million infected people worldwide (1). In USA and some parts of Europe, the prevalence rate of enterobiasis is high (30-50%) (2). Infection rate among children was found to be 12.6% (3). Limited studies conducted in Iran have reported the prevalence rate of infection to be between 10.79 to 85% (4-5).

Due to biological characteristics of the parasite, all groups with different levels of socio-economic status and hygiene are at risk for infection (6-7). It was found that the most at-risk group is the group of school-age children, especially those living in crowded environments with poor sanitation (8-11).

E. vermicularis is directly transmitted via anus-to-mouth transmission by finger contamination, causing re-infection. Therefore, due to simple transmission infection is frequently occurred in individual and homecare (12). Although *E. vermicularis* is usually asymptomatic and non-dangerous, but it may be the cause of significant morbidities due to some consequences of infection, including perianal pruritus, restlessness, loss of appetite, eosinophilic colitis, insomnia, and

irritability mainly in children. In rare cases, *E. vermicularis* can cause serious gastrointestinal problems and ectopic infections such as vaginitis, appendicitis (13-16). The high rate of *E. vermicularis* infection among Iranian children population is unavoidable due to risky behaviors in children such as sucking habits, crowded kindergartens with low health status, caregivers' unhealthy life style.

Previous studies conducted in Mazandaran province reported relatively high prevalence rates of *E. vermicularis* among general population (1.52%) (17) and 2 to 5-year-old girls (29.5%) (5); no study has been conducted on 6-year-old children. Given the educability of this group of children and caregivers' continued contact with parents, this study investigated the prevalence rate and some related risk factors of *E. vermicularis* among preschool children in Mazandaran province. The results of this project could be used to design health program for teachers, parents, and children.

2. Objectives

The objective of this study was to determine the prevalence rate of enterobiasis among preschool children in Mazandaran province, northern Iran and including the evaluation of children's socio-

demographic characteristics such as age, sex, parents' education level and occupation, family size; and healthy behaviors.

3. Materials and Methods

In this cross-sectional study conducted in northern Iran, 6-year-old children were selected during 2013-2014. Using descriptive statistics and considering the prevalence rate of 29.5% obtained in the previous study (5) and 0.05% alpha and 95% confidence interval, the minimum sample size required was 685 participants. Cluster sampling method was used to select the required schools located in five parts (north, south, west, east and center) of the seven cities. All of the children were approached weightily to the Poisson random method. Data were collected via a researcher-designed questionnaire including children's socio-demographic characteristics such as age, sex, parents' education level and occupation, family size; and healthy behaviors such as washing hands before eating, frequency of hand washing, changing daily underwear, genital washing style, shortening the nails, and taking daily bathing. Two questions were also asked about boiling and ironing the underwear and sterilization of linen clothing. *E. vermicularis* specific method of Graham and scotch tape were used for detection (18). Training points for test and packed slides were given to parents. Two slides with attached tape were given to parents for each child. Parents were trained to attach 3-4 cm from the tape into the babies' anal area for one minute once in the morning before defecation, to remove and attach it on the slide, and to pack and deliver the slides in the same day to the co-researchers. Samples were examined in the Parasitology laboratory at Mazandaran University of Medical Sciences for examining parasites using light microscopes with 10 and 40X objective lenses. The sensitivity of this technique is about 90% (1). In this study, chi-square test was used to determine the significance of the variables using SPSS software version 16.

4. Results

Of 665 participants, 12 samples (1.8%) were excluded due to sampling errors made by parents and incomplete information, resulted in 653 (98.20%) 6-year-old children participating in this study. Among them, 57.3% (n=374) cases were female, and 42.7% (n=279) cases were male, living with their parents mostly educated at upper secondary level (Table 1).

The prevalence rate of *E. vermicularis* infection was 19.43% (127). From which 40.9% (52) were observed in males and 59.1% (n=75) in females with no significant difference between the two groups.

As shown in Table 1, chi square test and odds ratio by logistic regression analysis showed that although the risk of infection was higher in girls than in boys, but the relation between the infection rate and gender was not statistically significant ($p>.05$) so that it can be assumed that the risk of infection among girls and boys is statistically the same.

Regarding the education level, about 78% (n=99) of the fathers and 82% (104) of the mothers were illiterate or under diploma. Investigate the role of parents' education level showed that there is a significant relationship between the rate of *E. vermicularis* infection and parents' education level ($p<.05$). The odds ratio for infection in students with undergraduate fathers was 4.4 times more likely than in students with educated fathers (OR=2.394; 95% CI=1.11-2.76).

The results showed that 78.70% of the fathers were self-employed, and 92.1% of the mothers were housewives. Also, the association between *E. vermicularis* infection and parents' occupation was significant ($p<.05$). The results showed that *E. vermicularis* infection in students whose fathers were self-employed was 2 times more likely than in students whose fathers were employed in governmental sector (OR=2.0465; 95% CI=1.2734-3.2889). Moreover, the odds ratio of *E. vermicularis* infection in students whose mothers were housewives was 2.39 times more likely than in students whose mothers worked in governmental sector (OR =2.3957; 95% CI= 1.2063-4.7580).

Regarding the residency, the results showed that there is a significant correlation between *E. vermicularis* infection and samples' residency ($p<.05$). Most of the positive results belonged to children living in east districts (61.4%). The results showed that subjects living in east of the province were 70 (OR=70.4762; 95% CI=33.160-149.784) and 74.87 (OR=74.8718; 95% CI=36.177-154.955) times more at risk to be infected than those living in the west or capital city (Sari) of the province, respectively.

Table 1. Prevalence of Enterobius vermicularis infection among preschool children (n=653) in Mazandaran Province, northern Iran

Variables		No. Infected (%)	No. non-infected (%)	P-value χ^2	p-value OR	OR	95% CI
Gender	female	75 (59.1)	299 (56.80)	0.651	-	-	-
	male	52 (40.9)	227 (43.20)		0.651	-	-
Father's educational level	under graduate	99 (78)	352 (67)	0.016	-	-	-
	graduate	28 (22)	174 (33)		0.016	2.394	1.11-2.761
Mother's educational level	under graduate	104 (82)	325 (62)	P<0.0001	-	-	-
	graduate	23 (18)	201 (38)		P<0.0001	4.159	1.72-4.54
Number of household members	≤4	106 (84)	464 (88)	P<0.0001	P<0.0001	5.8365	2.6817-12.7023
	>4	16 (21)	12 (62)		-	-	-
Father's employed	self employed	100 (78.70)	344 (65.40)	0.01	-	-	-
	Workless	2 (1.60)	6 (1.10)		0.8681	-	-
	Government Servants	25 (19.70)	176 (33.50)		0.0031	2.0465	1.2734-3.2889
Mother's employed	self employed	0	20 (3.80)	0.001	0.0893	-	-
	housekeeper	117 (92.1)	420 (79.80)		-	-	-
	government servants	10 (7.9)	86 (16.30)		0.0126	2.3957	1.2063-4.7580
Resident	EAST	80 (63)	12 (2.3)	P<0.0001	-	-	33.160-
	WEST	21 (16.5)	222 (42.2)		P<0.0001	70.4762	149.784
	CAPITAL	26 (20.5)	292 (55.5)		P<0.0001	74.8718	36.177-154.955

OR: Odds Ratio

As Table 2 shows, there is not a significant relationship between the rates of *E. vermicularis* infection and the children's genital washing style ($p>.05$). But the relationship was at significant level in some basic sanitation such as sterilization of linen clothing and boiling

or ironing clothes ($p<.05$).

The risk of infection in children changing daily underwear was less than those changing it weekly or later (OR =0.2877; 95% CI=0.1321-0.6265) (Table3).

Table 2. Distribution of *Enterobius vermicularis* infection according to basic sanitation behaviors among preschool children (n=653) in Mazandaran Province, northern Iran.

Variables		Infected (N) %	Non-infected (N) %	P-value χ^2	P-valueOR	OR	0.95% CI
Style of washing genital	Sitting	87(68.5)	387 (73.6)	0.25	-	-	-
	Standing	40 (31.5)	139 (26.40)		0.25	-	-
Boil or ironing clothes	Daily	9(7.1)	21(4)	0.028	-	-	-
	2 to 3 times a week	61 (48)	204 (33.8)		0.3962	-	-
	Weekly and more	57 (44.9)	301 (57.2)		0.0539	-	-
Sterilization linen clothing	Daily	5 (3.9)	15 (2.9)	0.001	-	-	-
	2 to 3 times a week	78 (61.4)	214 (40.7)		0.866	-	-
	Weekly and more	44(34.6)	297(56.7)		0.1339	-	-

OR: Odds Ratio

Table 3. Distribution of *Enterobius vermicularis* infection according to healthy habits among preschool children (n=653) in Mazandaran Province, northern Iran.

Variables		Infected (N) %	Non-infected (N) %	P-value χ^2	P-value	OR	0.95% CI
Washing hands before eating	Yes	123 (96.9)	492 (93.5)	0.15	-	-	-
	No	4 (3.1)	34(6.5)		0.1613	-	-
Changing daily underwear	Daily	48(37.8)	231 (43.9)	0.004	-	-	-
	2 to 3 times a week	66 (52)	277 (52.7)		0.5138	-	-
	Weekly and more	13 (10.2)	18 (3.4)		0.0017	.2877	0.1321-0.6265
Shorting nails	Yes	123 (96.9)	509(96.8)	0.96	-	-	-
	No	4 (3.1)	17(3.2)		0.9624	-	-
Bathing daily	Morning	9(7.1)	43(8.2)	0.138	-	-	-
	Noon	49(38.6)	155(29.5)		0.3044	-	-
	Night	69(54.3)	328(62.4)		0.9896	-	-

OR: Odds Ratio

CI: confidence interval

5. Discussion

The infection of *E. vermicularis* was common among children of this study (19.4%). In agreement with universal studies, this result indicated that infection with parasites is a worldwide problem in children aged less than 6 years, and this group is mostly the main target of infection, rather than the adults.

Previous studies conducted in different parts of Iran showed that this parasite is a common infection among children (29.50%) and general population (10.79% to 85.00%) (4-5, 10). This result is consistent with the prevalence rates reported in other studies conducted on children around the world such as Venezuela (19.1%) (19) and Sweden (21.10%) (20); however, the result is higher than the prevalence rates reported among Chinese (0.50%) (21), American (4.5%) (22), Korean (9.20%) (23), Turkish (10.50%) (24), and Taiwanese children (11.00%) (25). A review study on geographical distribution of enterobiasis in Mazandaran province during 1981 to 2013 years showed that the most prevalence rate of enterobiasis was observed in Babol kindergartens in 1998 (33.6%) (26) and in girls attending Sari kindergarten in 1999 (29.5%) (5).

In this study the highest prevalence rate of infection was observed in Neka city (61.4%) while in the previous study this rate was low (1%) in this area (27). Moreover, children living in east of the state were more infected than those living in west of the state.

Results of this study highlight the fact that *E. vermicularis* infection is not a geographical problem, and to which all children around the world would be at risk. However, the important issues that make the comparison difficult are the variation in the age of children under study and difference in studies methods such as different sampling methods and sample size and different diagnostic methods.

When socio-demographic characteristics of the samples were considered as the determinates of *E. vermicularis* infection, high levels of infection can be attributed to parents' occupation because when parents are busy, less attention is paid to children's health and also to kindergarten teachers' lack of commitment to this issue. In some studies, greater frequency of infection was found in children whose parents were in low level of educational status, and their mothers' and fathers' occupations were homemaker and self-employed, respectively.

It can be concluded that when children live in impoverished areas, if parents and kindergarten educators pay adequate attention to children's hygiene, catching oxyuriasis is not simply possible [27].

Moreover, *E. vermicularis* infection in students whose mothers are housewives is 2.39 times more likely than in students whose mothers have government jobs.

Consistent with some other studies [28], in this study, gender of children was not a significant factor for *E. vermicularis* infection; therefore, our result indicated that all children regardless of their gender are at risk to this infection.

In this study, there was a significant relationship between the rate of infection and the number of family members. The risk of infection in families with a population of more than 4 people was 5.8 times more likely than in families with a population of lower than or equal to four people.

The results showed that the infection prevalence in children living in crowded population is more common.

The role of basic sanitation in prevention of *E. vermicularis* infection is unavoidable. When personal hygiene and healthy behaviors of the children were analyzed as the determinants of *E. vermicularis* infection, it was found that greater frequency of infection occurred among children who did not boil, iron or sterile their clothes; this finding is in agreement with Talari et al.'s (1998) report. These results strengthen the need for

providing regular education for children, parents, and caregiver about preventive behavior. Moreover, sanitary measures are needed to control *E. vermicularis* infection in pre-school children. Moosazadeh et al. (2017) in a meta-analysis study on enterobiasis in Iranian children reported that the prevalence rates of infection were between 1.2 to 66.1%, which are near to our results (1.6 to 61.4%) (29).

Contrary to what was expected, in this study, the risk of getting infection was not related to washing hands before eating, shortening nails, and taking daily bathing. Instead of personal hygiene principles, these results may highlight the role of environmental hygiene in the transmission of infection, which need deep investigations.

6. Conclusion

In conclusion, both parents' socio-economic status and basic sanitation had important role in the prevalence rate of this infection among pre-school children. Therefore, in order to reduce the frequency of infection and morbidity associated with it, some steps should be taken such as providing educational program for children, parents, and caregivers; observing hygiene and care toward children; regularly controlling them, and providing sanitary facilities. As a whole, in developing countries, *E. vermicularis* infection is an indicator of sub-standard sanitation and poor personal hygiene. Therefore, all these factors should be considered in these societies parasite prevention programs. Our results showed valuable information about the frequency of enterobiasis among children in the north parts of Iran, which would likely be very important for the disease control programs.

Our results provided valuable information regarding the epidemiology of enterobiasis among children in the northern region of Iran.

Conflict of interest

All authors declare that they have no conflicts of interest.

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Authors' Contribution

Hajar Ziaei Hezarjaribi designed the project and the others have collaborated on collecting and examining the samples.

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