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RISK FACTORS OF *ENTEROBIUS VERMICULARIS* INFECTION WITH SYMPTOMS AMONG CHILDREN IN ERBIL GOVERNORATE

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Abstract

Enterobiasis is a gastrointestinal helminthic infection caused by Enterobius vermicularis. An adult human is less susceptible to infection than children. This study aimed to discover the rate of infection in Erbil Governorate children with E. vermicularis. This study was conducted among 400 children (1-15 years of age). Cellophane tape samples were taken from participants and examined microscopically. Using SPSS version 23 for statistical analysis the total rate of infection with E. vermicularis was 10.5%. The infection was recorded higher in males (11.05%) than in females (10%), despite this difference statistically was non-significant. The highest infection was observed in the 6-10 years age group as 12.9% with a significant difference observation between the age groups concerning enterobiasis. According to place significant difference was observed with a higher rate of infection in the urban region (16%). Statistically, the analysis showed a significant relationship between enterobiasis and mother's occupation. The incidence was higher as 18.52% among children having employed mothers and was lower as 9.25% among children having unemployed mothers. A significant difference was observed between enterobiasis and study months. The highest prevalence of infection was 16% reported in March 2019 than prevalence 3.08% reported in December 2018. 35% of children who did not wash their hands were affected by E. vermicularis and high significant difference was observed with hand washing. Significant difference was detected between enterobiasis and finger sucking, as 25.58% of children who sucked their fingers were affected by E. vermicularis. No significant difference between enterobiasis and enuresis was reported in this study. The statistically significant relationship among children with anal itching was 17.95% detected. Till now E. vermicularis infection is common among children in Erbil Governorate.

Keywords: *Enterobius vermicularis, Enterobiasis, Prevalence, Erbil, Cellophane tape method.*

INTRODUCTION

Enterobius vermicularis is the most common helminthic parasite of temperate regions as compared to tropics (1). This parasite is highly spreadable in crowded institutions (such as kindergarten, schools, orphanage and mental institutions) and among low socioeconomic status families, especially where sanitation measures are relatively low (2). At least there are 200 million people infected in the world by *E. vermicularis* especially kids (3).

Adult *E. vermicularis* is a short, white fusiform worm with pointed ends (4). The pinworm life cycle is simple and occurs in the lumen of the digestive system and completes in a single host. The human is natural host, after ingestion, in the small intestine the mature eggs hatch and produce the larvae which travel to the caecum and fusiform appendix where they develop to adults within 15-30 days of infection (5). Adult worms congregate mainly in the cecal region of intestine, but they commonly wander throughout the gastrointestinal tract from the stomach to the anus, they attach themselves to the mucosa where they feed on epithelial cells and bacteria (6).

Enterobiasis is frequently asymptomatic (7). In symptomatic cases, the most common complaint is pruritus ani (itching or irritation of perianal and perineal region), usually worse at night (8). When the gravid female worm crawls to lay eggs in the perineal region cause nocturnal enuresis, perianal excoriation, insomnia, abdominal pain, anorexia, loss of weight, nervousness and nail-biting (9). The bed-wetting in children more than 4 years old at least one time a week is called nocturnal enuresis (10). A variety of other symptoms have been attributed to pinworm infection in children including impaired concentration and lower intelligence quotient (IO) level in children (5, 11). Furthermore, *E. vermicularis* is also related to acute appendicitis (12).

Infected people are the chief source of *E. vermicularis* infection for the community (13). The infection is transmitted by direct contact from an infected child to susceptible children (3). However, the infection can transmit by touching contaminated things like bed linen, clothes and bathroom materials then ingested these eggs through the mouth, or even through inhalation of eggs containing dust of pinworm (14). Eggs of pinworm may spread among children with their bad personal hygiene such as sucking of solid fingers or nail-biting. Additionally, the infected child can easily bring the infection from outside and spread it to the family members (15). Humans acquire enterobiasis by ingestion of contaminated food and water or through direct contact with infected children, and rarely through inhalation of airborne eggs (16). Autoinfection is one of the ways in which the infection transfers to the same child, by scratch the perianal region. This leads to transfer of eggs to the finger under the nail then to the mouth and so this behavior assists in the transmission of infection (17). Retro-infection is the unusual mode of infection, in which the eggs on perianal or perineal fold hatch out to larvae which migrate back to the rectum then to the intestine where they mature into adult male and female worms. Retro-infection occurrs mainly in adult humans (5).

This study was aimed to find the rate of *E. vermicularis* infection in children, and to study the effect of some demographic parameters on the prevalence of *E. vermicularis*, further to find the relationship between pinworm and some symptoms of infection.

MATERIAL AND METHODS

STUDY POPULATION

This study was performed in Erbil Governorate from 1st November, 2018 to March, 2019. A total of 400 children participated in this study; the ages ranged between 1 to 15

years, including 210 females and 190 males, from different socio-economic levels to know the true prevalence of the infection in children.

SAMPLE COLLECTION

The cellophane tape method (Scotch tape method, Graham stick method) is the best method for diagnosis of *E. vermicularis* (1), and this procedure was performed by pressing sticky side of the tape more than one times to anal and perianal region of the child then sticking the tape on the glass slide and putting it into the sterile clean nylon envelope and labeled (18). This procedure was conducted early in the morning before taking bath with help of child's mother and asked the parents to fill a special questionnaire about the study. The collected samples transported to the Microbiology Laboratory/ Health Science Collage/ Hawler Medical University and examined under the microscope.

MICROSCOPIC EXAMINATION

The collected cellophane tape samples were examined on the same day under a microscope for the detection of *E. vermicularis* eggs, and after observation samples were preserved in the refrigerator and examined the next day (19).

STATISTICAL ANALYSIS

The Statistical Package for the Social Sciences (SPSS v.23) program was used to study the statistical analysis, by using ''Independent t-test'' and ''chi-square. The participants included in our study were chosen randomly.

RESULTS AND DISCUSSION

Our study was done to find the risk factors of *E. vermicularis* infection among children. Children make a group, the most prone to such worm infection in the community that can be the main focus for transmitting the infection. As children are in direct contact with family members, can transmit the infection to elder members of the family. Moreover, asymptomatic carriers of *E. vermicularis* are also potential source of transmission to elders and responsible for particular public health problem (20).

DISSTRIBUTION OF *E.VERMICULARIS* INFECTION AMONG CHILDREN CONCERNING RISK FACTORS

The finding of present study (Table I) showed that the prevalence of *E. vermicularis* infection among 400 children was 10.5% (42/400). The total frequency of infection among children who infected with *E. vermicularis* was higher in males than females with 11.05% (21/190) and 10% (21/210) respectively. Statistically non-significant difference (p = 0.73) was observed in *E. vermicularis* infection with the sex of children. Our result was in agreement with Osada etal., 2015 (21), whereas in dis-agreement with Lee et al., 1999 (22). The reason for the high percentage of infection in the males maybe due to the fact that they spend more time playing outside with their friends and are more exposed to contaminated soil or materials.

Current study detected that the highest rate of infection was 12.9% (12/93) in the age group (6-10) (Table I) and the lowest was 2.27% (1/44) recorded in children of eleven years and above ages. Statistically, a significant difference (p = 0.00) was observed in the age group with *E. vermicularis* infection. Our result is in agreement with Kadhim 2007 (23), while in disagreement with Sang et al., 2011 (24). The higher rate of infection among younger children may be due to the fact that they are more likely to play on the floor, suck their fingers, and fail to wash their hands before meals than older children.

Table I. Distribution of *E. vermicularis* infection among children concerning to risk factors

Variables	Total no. of examination	No. +ve (%)	No.-ve (%)	*p*-value
Gender				
Male	190	21 (11.05)	169 (88.95)	
Female	210	21 (10.00)	189 (90.00)	0.73
Total	400	42 (10.50)	358 (89.50)	
Age groups				
1-5	263	29 (11.03)	234 (88.97)	
6-10	93	12 (12.90)	81 (87.10)	0.00
11-15	44	1 (2.27)	43 (97.73)	
Total	400	42(10.50)	358(89.50)	
Residency				
Rural	300	26 (8.7)	274(91.3)	
Urban	100	16 (16.0)	84(84.0)	0.03
Total	400	42 (10.5)	358(89.50)	
Mother's job				
Unemployed	346	32 (9.25)	314 (90.75)	
Employed	54	10 (18.52)	44 (81.48)	0.005
Total	400	42 (10.50)	358 (89.50)	
Months study				
November 2018	118	9 (7.63)	109 (92.37)	
December 2018	65	2 (3.08)	63 (96.92)	
February 2019	117	15 (12.82)	102 (87.18)	0.03
March 2019	100	16 (16.00)	84 (84.00)	
Total	400	42 (10.5)	358 (89.50)	
Hand washing				
Yes	380	35 (9.21)	345 (90.79)	
No	20	7 (35.00)	13 (65.00)	0.00
Total	400	42 (10.5)	358 (89.50)	

*p<0.050 (Significant)

Concerning the residence the highest rate of infection recorded in urban areas that was 16.0% (16/100) and the lowest in rural areas as 8.7% (26/300). Statistically (P. value = 0.03) significant difference recorded among children in different residency. Distribution of the infection rate differs with the regions, and this may be related to the crowded areas, low educational levels of population, poor sanitary disposal and poor hygiene. Current results were observed in high agreement with Maulood et al., 1995 (25).

According to the mother's job, the prevalence of *E. vermicularis* infection was high in children who have employed mothers 18.52% (10/54) and the lowest rate was 9.25%

(32/346) in children with unemployed mothers. We observed a significant relationship (p = 0.005) between enterobiasis and mother's jobs (Table I). This infection and difference may because of the fact that parents are busy and cannot give proper attention to their children's health. This finding is in agreement with (26), while in disagreements with the studies done by Artan et al., 2008; Wang et al., 2010 and Kaidane et al., 2014 (27 - 29) in which researchers suggested that employed persons are educated who wander and encounter people more than unemployed person, thus become enlightened and informative than an unemployed person. That's why educated mothers are more concerning to their children health.

Whereas the rate of *E. vermicularis* infection concerning months of study (Table I), showed that the highest percentage of infection was 16% (16/100) recorded in march-2019 and the lowest rate of infection 3.08% (2/65) recorded in December-2018. We observed a significant difference (p = 0.03) between enterobiasis and months of study. This difference may be due to the eggs cannot survive in very low temperature, while our result did not agree with Mustafa & Awad 2010 (30) who found the highest rate of enterobiasis in winter months, this could be due to decreasing of temperature and increasing of humidity in the winter season. Furthermore, in cold weather people try to huddle together in warm and closed places (rooms) that favors the easy transmission of the infective stage (eggs) between members. In cold weathers people wear close-fitting garments and use many layers of clothes, this facilitates the transmission of the infection.

However, the infection rate of *E. vermicularis* concerning hand washing of children (Table 1), showed that the higher rate of infection 35% (7/20) recorded in those children who did not wash their hands, whereas children who were habitual in washing their hands were less infected with *E. vermicularis*, as 9.21% (35/385). There was observed high significant difference (P. value = 0.00) between enterobiasis with hand washing in children. This difference may be due to contaminated hands being easily transmit infection to other children and also cause autoinfection, these observed results were in agreement with Lee et al., 1999 (21).

PREVELENCE OF *E. VERMICULARIS* INFECTION ACCORDING TO SYMPTOMS

A significant difference (P. value = 0.001) was recorded between enterobiasis with finger sucking (Table II). 25.58% (11/43) of children who sucked their fingers were infected by *E. vermicularis* whereas 8.68% (31/357) of children who did not suck their fingers were infected by *E. vermicularis*. This difference may be due to the fact that a person who harbors such infection feels severe itching in the anal area, so itchy anal skin leads to the contaminated fingers and nails with pinworm eggs. Current study findings were observed in agreement with Jones 1988 (31). While in disagreement with Lee et al., 1999 (21) who suggested no significant difference between enterobiasis and sucking fingers.

From 400 sampled children, 30 children were having enuresis and 5 (16.67%) of them had enterobiasis (Table II), whereas 37 (10.0%) of children not have enuresis are infected by *E. vermicularis.* We observed there was no significant difference (P. value = 0.25) between enterobiasis and enuresis. These results were agreed with Berry 2006 and Genus et al., 2009 (32, 33), but disagree with Al-Esavi 2010 (34). Enuresis may be due to many factors in children such as in physiological and emotional disturbances (33).

Finally, we recorded a statistically significant relationship (p = 0.02) between infection in children and anal itching. 17.95% (14/78) of children who had itching in anus were affected by *E. vermicularis* while 8.70% (28/322) of children who did not have anal itching were affected by *E. vermicularis*. A similar result was obtained by Out-Bassey et al., 2011(35). Crawling of *E. vermicularis* female worm around the perianal region to deposit eggs during the night time leads to itching and irritation of the anal region.

Table II. Prevalence of *E. vermicularis* infection among children according symptoms

Symptoms	Total no. of examination	No. +ve (%)	No.-ve (%)	*p*-value
Sucking fingers				
Yes	43	11 (25.58)	32 (74.42)	
No	357	31 (8.68)	326 (91.32)	0.001
Total	400	42 (10.50)	358 (89.50)	
Enuresis				
Yes	30	5 (16.67)	25 (83.33)	
No	370	37 (10.00)	333 (90.00)	0.25
Total	400	42(10.50)	358(89.50)	
Anal Itching				
Yes	78	14 (17.95)	64 (82.05)	
No	322	28 (8.70)	294 (91.30)	0.02
Total	400	42 (10.5)	358(89.50)	

*p<0.050 (Significant)

CONCLUSION

Enterobius vermicularis infection observed was high in children of Erbil Governorate. Significant relationships were observed between *E. vermicularis* infection and residency, age group, mother's job, hand washing, sucking fingers and anal itching in children. But non-significant relationships were recorded between *E. vermicularis* infection and gender. Furthermore, no significance was observed between infection and enuresis in children.

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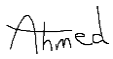
1	**Ahmed Akil Khudhair Al-Daoody** Department of Medical Microbiology, College of Health Sciences, Hawler Medical University,	**009647504307129 Ahmed.akil@hmu.edu.krd**		Participated in conceiving and designing the study, carried out data analysis and participated in reviewing the initial and final drafts of the manuscript. All authors read and approved the final manuscript.
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