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Original Article

Pinworm infection in school children of four districts of Malakand region, Khyber Pakhtunkhwa, Pakistan

Infecção por Pinworm em crianças em idade escolar de quatro distritos da região de Malakand, Khyber Pakhtunkhwa, Paquistão

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Abstract

Illnesses caused by human pinworm remains a pediatric health problem in developing nations including Pakistan. This study aimed to investigate the prevalence of *Enterobius vermicularis* in school children of four districts in Malakand region, Pakistan. Four hundred faecal specimens were screened from May 2014 to July 2017 using normal saline and Lugol Iodine solution. Twenty three (5.75%) individuals were found infected with *E. vermicularis*. Five children (1.25%) were infected with only *E. vermicularis* and eighteen (4.5%) were mixed with other helminths. *E. vermicularis* 23 (5.75%), hookworm 11 (2.75%), *Ascaris lumbricoides* 5 (1.25%), *Taenia saginata* 2 (0.5%) and *Trichuris trichuira* 4 (1%) were detected. Age wise 5-8 years were more parasitized followed by 13-15 and 9-12 years of age (0.0296, P<0.05). Male children were highly (0.06700, P<0.05) infected than female. Children in Malakand district were found more infected followed by Dir Upper, similar infection rate was noted in children of districts Lower Dir and Swat (0.0192, P<0.05). Children in primary level were highly (0.0013, P<0.05) infected than those of middle and high levels. Enterobiosis is still the most common parasitic diseases in children. Studies on enterobiosis should be conducted time by time to recognize the hazardous of such parasitic infection in remote areas of the country.

Keywords: enterobiosis, oxyuriasis, human pinworms, child health, intestinal nematode.

Resumo

As doenças causadas pela traça humana continuam sendo um problema de saúde pediátrica nos países em desenvolvimento, incluindo o Paquistão. Este estudo teve como objetivo investigar a prevalência de Enterobius vermicularis em escolares de quatro distritos na região de Malakand, Paquistão. Quatrocentos espécimes fecais foram selecionados de maio de 2014 a julho de 2017, usando solução salina normal e solução de lugol iodo. Vinte e três (5,75%) indivíduos foram encontrados infectados por E. vermicularis. Cinco crianças (1,25%) foram infectadas apenas com E. vermicularis e dezoito (4,5%) foram misturadas com outros helmintos. Foram detectados E. vermicularis 23 (5,75%), ancilóstomo 11 (2,75%), Ascaris lumbricoides 5 (1,25%), Taenia saginata 2 (0,5%) e Trichuris trichuira 4 (1%). Com relação à idade, 5-8 anos foram mais parasitados, seguidos por 13-15 e 9-12 anos de idade (0,0296, P <0,05). Crianças do sexo masculino foram altamente (0,06700, P <0,05) infectadas do que as do sexo feminino. As crianças no distrito de Malakand foram encontradas mais infectadas, seguidas por Dir Upper, taxa de infecção semelhante foi observada em crianças dos distritos Lower Dir e Swat (0,0192, P <0,05). As crianças do nível primário foram altamente (0,0013, P <0,05) infectadas do que as dos níveis médio e alto. A enterobiose ainda é a doença parasitária mais comum em crianças. Os estudos sobre enterobiose devem ser conduzidos periodicamente para reconhecer a periculosidade dessa infecção parasitária em áreas remotas do país.

Palavras-chave: enterobiose, oxiuríase, oxiúros humanos, saúde infantil, nematóide intestinal.

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1. Introduction

Enterobiosis has a wide range of geographic distribution and is prevalent in developing and even in developed nations. Intestinal enterobiosis affects more than 400 million people throughout the world. It rarely affects tropical people because its eggs cannot survive in hot dry conditions for long time (Afrakhteh et al., 2016). Though most parasitic infections have been eradicated in developed nations, *E. vermicularis* infection is still often reported in many developed nations. In Pakistan the prevalence of enterobiosis has sharply increased from 0.2% in 1964 to 14.1% in 2017 (Farooqi, 1964; Khan et al., 2017a).

Enterobiosis is acquired by eating of eggs having the 3rd stage larvae and infection is often directly transmitted from anus to mouth via hands, water or food contaminated by the eggs. Larvae emerges from the ingested eggs in the duodenum and travel to the caecum to become sexually mature (Freedman et al., 1994). Males die after copulation, while egg-bearing females travel to the perianal and perineal regions, where they lay up to 11,000 eggs. The female usually return to the colon or die after laying eggs (Bogitsh et al., 2013). Eggs may also be deposited on clothing and bed linen, and are subsequently either ingested or inhaled (Park et al., 2005).

Enterobiosis is often described as a childhood infection caused by *E. vermicularis* (human pinworm), also known as oxyuriasis (Roberts and Janovy Junior, 2009). *Enterobius vermicularis* is the pinworm of the large intestine of man, which causes perianal itching and irritability, abdominal discomfort, loss of appetite, weight loss, insomnia, restlessness, enuresis (Kubiak et al., 2017), recurrent urinary tract infections (Choudhury et al., 2017) and appendicitis (Ahmed et al., 2015). Occasionally, pinworms penetrate into the submucosa resulting to a fatal diseases. They may also, penetrate extraintestinal sites like vulva, vagina, uterus, fallopian tubes, ovary, peritoneum, lung, liver, breast, spleen (Ng et al., 2011), male urinary tract (Zahariou et al., 2007) nose (Kaniyur et al., 2005) and conjunctival sacs (Dutta and Kalita, 1976) and leads to ectopian enterobiosis.

Studies from different parts of Pakistan in the last two decades report prevalence rates of enterobiosis, as 13.8% Jamil (1999); 2.61% Shaikh et al. (2003); 1.3% Chaudhry et al. (2004); 16.3% Maqbool et al. (2007); 1.8% Sajjad et al. (2009); 10.3% (Nisa et al., 2011); 12% (Khan et al., 2012); 8% (Khan et al., 2015); 9.73% (Khan et al., 2017a) and 9.52% (Khan et al., 2018a) and 6.48 (Khan et al., 2018b). Recently, most studies have focused on intestinal parasitic infections among the human population of Pakistan with little on the prevalence of human pinworm infection. This paper presents observation on the prevalence of pinworm infection among school children in four districts of Malakand region, Pakistan.

2. Materials and Methods

2.1. Study area

A cross-sectional study was conducted in Malakand Division (the northwest of Pakistan) which covers nearly 40% of the area of Khyber Pakhtunkhwa province Pakistan. It covers an area of nearly 29,800 km^2 and has a population of about 6.0 million people. Malakand Division is situated between latitudes of 35° 29' 59.99" North and longitudes of 72° 00' 0.00" East with 1420m in elevation. Of the 7 districts in Malakand division four namely Malakand, Lower Dir, Upper Dir and Swat were selected for the current study. These districts were selected due to the reasons that most of the studies on human intestinal parasitic infections were conducted previously.

2.2. Data collection

The study was conducted from May 2014 to July 2017. A total of 400 stool samples from children (324 boys and 76 girls) of 5 to 15 years of age attending government schools, were collected. Prior to initiation of the study, a structured questionnaire to collect demographic data (age, sex, date of collection, locality, intestinal complaints, and previous anti- parasitic therapy) was developed. A meeting was held with school authorities and guardians of the children to discuss the purpose of the study and to take permission to carry out the study. A day before specimen collection, all the children (participants) were given verbal instructions on handling and collection of fecal samples with provided clean, dry, screw capped, wide-mouth plastic bottles containing 10% M.I.F (Merthiolate, Iodine, Formaldehyde) preservatives and wooden spatula. The children were instructed to collect about 10 grams of feces. All the samples were then brought to the Laboratory of Parasitology, Zoology Department, University Of Malakand for further processing. We excluded from the study, children who were either treated with anti-helminths or were allowed by parents to participate in the study.

2.3. Microscopic examination

The laboratory investigation was carried out through Wet Mount Techniques, of normal saline and Lugol, iodine solution. Sedimentation, floatation and centrifugation procedures and techniques, were also used for confirmation of the results.

2.4. Statistical analysis

Data were analyzed descriptively using Graph Pad version 5. Probability values less than or equal to 0.05 were considered significant ($P \leq 0.05$).

3. Results

The overall prevalence of *E. vermicularis* among school children was 5.75% (23/400) with boys 6.48% (21/324) showing more prevalence than girls 2.63% (2/76) (0.6700, P>0.05). Children aged 5-8 years showed the highest prevalence (8.18%; 9/110) compared to other age groups (0.0296, P<0.05). Children in Malakand district were found more infected followed by those in Dir Upper. Similar infection rate was noted in children of districts Lower Dir and Swat (0.0192, P<0.05). Children in primary

level were highly infected than those of middle and high level (0.0013, P<0.05) (Table 1).

Most positive children had multiple gastrointestinal helminth infections (double and triple) rather than single infections. The total number of single, double and triple infected cases were 5, 14 and 4 respectively, making 1.25%, 3.5% and 1% of the total examined individuals and 21.73%, 60.86% and 17.39% of the total infected persons, respectively. It was found that in double parasitic infection, *E.cvermicularis* was more likely to associate with hookworm, followed by *T. saginata* and *A. lumbricoides*. Double infections were higher in Malakand District as compared to others. In Lower Dir, association was with hookworm only. In Malakand, association was with hookworm and *T. saginatta*. In Upper Dir, there was no double association while in Swat, double association was with *A.lumbricoides* (Table 2).

Table 3 indicates the parasites which are in association with *E. vermicularis* in the current study. Total number of infections was reported as 11.2% (n=45) including

Table 1. Prevalence of *E. vermicularis* by sex and age among school children in Malakand region, Pakistan.

categories	No. of children positive/ No. of children examined (%)						P value
	Dir lower	Dir upper	Swat	Malakand	Total	Prevalence	
Age							
5-8	0/35	2/32	2/33	5/10	9/110	8.18%	
9-12	1/28	4/48	0/35	2/47	7/158	4.43%	0.0296
13-15	1/37	2/20	0/32	4/43	7/132	5.30%	
	2/100 (2%)	8/100 (8%)	2/100 (2%)	11/100 (11%)	23/400		
Sex							
Male	2/81	6/73	2/85	11/85	21/324	6.48%	
female	0/19	2/27	0/15	0/15	2/76	2.63%	0.6700
	2/100	8/100	2/100	11/100	23/400	5.75%	

Table 2. Prevalence and pattern of single and mixed intestinal parasitic helminth infections in relation to *E. vermicularis* among school children in Malakand region, Pakistan.

Pattern of infection	Districts					P value
	Dir lower	Dir upper	Swat	Malakand	Total (%)	
Single						
Enterobius vermicularis	0	4	1	0	5(1.25)	
Double						
E.vermicularis +hookworm	2	0	0	9	11(2.75)	0.5287
E.vermicularis+A.lumbricoides	0	0	1	0	1(0.25)	
E.vermicularis + T.saginata	0	0	0	2	2(0.5)	
Triple						
E.vermicularis + A.lumbricoides + T.trichura	0	4	0	0	4(1)	
Total infected individuals	2	8	2	11	23(5.75)	
Total number of sample examined	100	100	100	100	400	

Table 3. Prevalence of *E. vermicularis* in combination with other helminth infections among school children in Malakand region, Pakistan.

Parasite	Number infected	Prevalence (%)
Enterobius vermicularis	23	5.75%
Hook worm	11	2.75%
Ascaris lumbricoides	5	‘1.25%
Taenia saginata	2	0.5%
Trichuris trichura	4	1%
Total No. of infection	45	11.25%

5.75% (n=23) *E. vermicularis*, 2.75% (n=11) hookworm, 1.25% (n=5) *A. lumbricoides*, 0.5% (n=2) *T. saginata* and 1% (n=4) *T. trichura*.

4. Discussion

In Pakistan the prevalence of human pinworm ranges from 2% (Farooqi, 1964) to 16.3% (Maqbool et al., 2007). This nematode remains as the most important intestinal pathogenic parasite specifically in children. The transmission of this pinworm occurs via ingestion of infectious eggs by direct anus-to-mouth transfer by fingers. This is facilitated by the perianal itch (pruritis ani) induced by the presence of pinworm eggs in the perianal folds, and commonly occurs as a result of nail biting, poor hygiene, or inadequate hand-washing.

We determined the prevalence of pinworm infection among school children of 5 to 15 years age in four districts of Malakand Division, Pakistan. In the current study, prevalence of *E. vermicularis* is 5.75%, which is comparable to Bilqees et al. (1982) in mixed population of Karachi. Siddiqi and Bano (1979) described 3.5% of the infection in school children of Peshawar district. According to the study conducted by Pal and Subhani (1989), 3.03% of the infection rate was reported in school children of Dir, district. Findings of the current study was comparatively low, when compared to the study conducted by Maqbool et al. (2007), who reported 16.3% of the infection in urban and rural population of Lahore. Jamil (1999) also reported high infection rate (13.8%) in urban and suburban areas of Islamabad . Khan et al., 2012 reported 12% prevalence. Pal and Malik (1979) noted 9.1% prevalence rate in school children of Islamabad. A high prevalence of 8% was noted by Khan et al., 2015 in education sectors of Swat, Pakistan. Khan et al. (2017b) reported 9.73% prevalence among food handlers of Swat Pakistan . The highest prevalence rate (14.1%) of pinworm was reported in different occupational groups of district Swat, Pakistan (Khan et al., 2017a).

District wise, prevalence rates were 11, 8, 2, and 2% in Malakand, Dir Upper, Swat and Dir lower respectively. Malakand was found to be more affected than others. In the present study, Swat showed decrease in prevalence as compared to previous study (7.56%) reported by Khan et al (2012). reported 1.35% infection rate in Dir Upper which increased in our study to 8%.

Higher infection rate in boys (6.48%) was observed than in girls (2.63%). This is in accordance with Park et al (2005), Hazratitappeh et al (2002) and Requena et al (2007). However, some studies like Afrakhteh et al. (2016), Amiri et al. (2016), Li et al (2015), Suraweera et al. (2017), Chai et al. (2015), Nourozian and Youssefi (2013), Haghi et al. (2013), and Chang et al. (2009) reported no significant association between prevalence of pinworm infection and sex of infected individuals.

According to Afrakhteh et al. (2016), Nithikathkul et al. (2001) and Bunchu et al. (2011) there is association between prevalence of *Enterobius vermicularis* infection with age of the host. Amiri et al (2016), Suraweera et al. (2017) and Park et al. (2005), reported no significant difference between age while Li et al. (2015) reported significant difference between age and infection prevalence. In the present study, most infected children were 5-8 years in age which is consistent with many other studies such as Taylor et al. (2018) and Nithikathkul et al. (2001). In present study also, we found that *E.vermicularis* was likely to occur in co-infection with other intestinal parasites like hookworm, *A. lumricoides*, *T. saginatta* and *T. trichura*. These association were also reported by Khan et al. (2012).

E.vermicularis is also present in variable rate of prevalence in human population of Pakistan as: 0.6%, 0.2% and 0.2% Farooqi (1964); 0.5%; 1.5% Baqai and Zuberi (1986); 2.3% Ali (1993); 2.61% Shaikh et al. (2003); 1.3% Chaudhry et al. (2004); 1.8% Sajjad et al., (2009). Variations in prevalence of pinworm in the different parts, might be due to the variable climatic conditions, personal habits, cultural and geographical limitations.

Conclusions

The current study offers new vision on prevalence of pinworm infection among school children in four districts of Malakand region, Pakistan. This research findings highlight the need for children health and rural communities' improvement in the remote parts of Pakistan. Intervention of health awareness programs should be compulsory to minimize spread and reinfection of such infections in the population.

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