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Original Article

Prevalence of intestinal nematodes infection in school children of urban areas of district Lower Dir, Pakistan

Prevalência de infecção por nematoides intestinais em escolares de áreas urbanas do distrito de Lower Dir, Paquistão

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Abstract

Intestinal parasitism is the main cause of disease all over the world and described as a significant community health problem. The current study intended to find out the occurrence and identification of hazard factors linked with IPIs among 4-12 years aged shool-age children residing in Lower Dir district, Pakistan during 2019 - 2020. A cross-sectional school-based study was conducted using a pre-arranged pre-tested survey. Anthropometric data and stool collection were done to obtain the findings. The direct wet mount preparation in saline/iodine/methods was used for stool examination. Data were investigated using the GraphPad Prism 5. A total of 400 children studied (mean age of 8.6±3.6 years) the total incidence rate for the intestinal parasitic disease was established to be 71.75%. Of the 400 children studied, the overall prevalence rate for intestinal parasitic infections was found to 71.75% *Ascaris lumbricoides* (33.1%), *Trichuris trichiura* (1.04%), *E. vermicularis* (1.39%), Hookworm (19.86%) were identified in children living in the study area. We concluded that there is a mass scale campaigns were required to generate alertness about health and sanitation in children and the need for the development of effective poverty control programs because deworming (killing of worm with drugs) alone is not adequate to control parasitic infections.

Keywords: nematodes infection, poly-parasitism, urban life, unhygienic, poor nutrition.

Resumo

O parasitismo intestinal é a principal causa de doença em todo o mundo e descrito como um importante problema de saúde comunitária. O presente estudo buscou descobrir a ocorrência e identificação de fatores de risco relacionados a infecções parasitárias intestinais (IPIs) entre crianças em idade escolar de 4 a 12 anos residentes no distrito de Lower Dir, Paquistão durante 2019-2020. Um estudo transversal baseado em escola foi realizado usando uma pesquisa preestabelecida e pré-testada. Dados antropométricos e coleta de fezes foram feitos para obtenção dos achados. A preparação de montagem úmida direta em solução salina/iodo/métodos foi usada para exame de fezes. Os dados foram investigados usando o GraphPad Prism 5. Em um total de 400 crianças estudadas (idade média de 8,6±3,6 anos), a taxa de incidência total da parasitose intestinal foi estabelecida em 71,75%. Das 400 crianças estudadas, a taxa de prevalência global de infecções parasitárias intestinais foi de 71,75%. *Ascaris lumbricoides* (33,1%), *Trichuris trichiura* (1,04%), *E. vermicularis* (1,39%), Ancilostomíase (19,86%) foram identificados em crianças morando na área de estudo. Concluímos que há necessidade de campanhas em massa para gerar alerta sobre saúde e saneamento nas crianças, e a necessidade do desenvolvimento de programas efetivos de controle da pobreza, pois a desparasitação por si só não é adequada para controlar as infecções parasitárias.

Palavras-chave: infecção por nematoides, poliparasitismo, vida rural, anti-higiênico, má nutrição.

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1. Introduction

Intestinal Helminths are prevalent in those parts of the world where high temperature, poor cleanness, impure water, and imperfect and crowded accommodation exist. The disease rate is maximum in family existing in Sub-Saharan parts of Africa, after that Asia and next Caribbean and Latin America (Silva et al., 2003; Brooker et al., 2006). There is large number of nematode worms, but a small number for human infection. Among them, some are the soil-transmitted helminths *Ancylostoma duodenale*, *Necator americanus*, *Ascaris lumbricoides* and *Trichuris trichiura* are most prevalent organisms on the earth, estimated to infect almost one-sixth of the global population. *Ascaris lumbricoides*, *Trichuris trichiura* and hookworm of human origin are a group of nematode parasites infecting human alimentary canal when ingested eggs or larva (Khan et al., 2019b).

The overall weight of STHs infection shown about 70% of infection happened in Asia (Pullan et al., 2014) as well as 26.4% of Asian study inhabitants hosted as a minimum one STP species. In Pakistan, *Ascaris lumbricoides* infection is broadly common, with changeable division in all regions of the country. Different species of human intestinal worms have been recorded previous workers in different parts of the Malakand region and Pakistan as well (Arshad et al., 2019). Three and 3.5 Billion individuals are approximately contaminated through intestinal parasites including 1.47 Billion with *A.lumbricoides*, 13 million with *A.duodenale*/*N.americanus* and 1.05 billion with *T.trichura*. More than 40 million school-going children are expected to be contaminated with STHs. Children range from 5 to 15 years in age are commonly polluted, though the occurrence of *A.duodenale*/*N.americanus* disease tends to increase by growing time. Therefore, young girls and women during delivery are mainly infected with *A.duodenale*/*N. americanus* (Luong, 2003). *A. lumbricoides* go after extremely equivalent lines with a stable increase initial childhood to mean youth, and then turn down into the mature period program. This is dissimilar as of the hookworms when they able to initiate in near the beginning childhood and childhood but after that go up during fully developed life moreover attainment to upland or merely go down from 40 years or so. There were no information on age- correlated frequency or power designed for human *Strongyloides stercoralis* in the writing, and all STHs existed confront of understanding worm mass as of the investigative tests used (Olsen et al., 2009).

One characteristic of nematodes are calculated known their predictable global occurrence was the relationship aimed at the incidence and power of illness. Whereas occurrence stand for the population exaggerated by something as of one to thousands (huge infection) of worms, the quantity of fake negatives depends on the investigative method used. However, the disease is disadvantaged on illness intensity and the greater part of worm load is greatly over-dispersed by a hypothetical quantity of 80% of every worm below 20% of those contaminated. The majority exploratory procedure suggests not direct actions of illness, depending on the existence of eggs within the faces, and by greatest are merely semi-quantitative, because the affiliation amid egg yield and the figure of fully developed worms is composite. In Pakistan *Ascaris lumbricoides* illness is broadly common, with changeable division in all regions of the country. Therefore, accurate analysis of soil transmitted helminthiasis play a key role in human being patient organization, drug efficiency assessment, organization of contaminated human being, detecting manage programs and removal (McCarthy et al., 2012; Speich et al., 2014).

In recent past decade various studies have been published on intestinal parasites infecting different sectors of human population in the region as Khan et al. (2011, 2012, 2014, 2016, 2017c,b, 2018a, b, 2019a, b), Arshad et al. (2019), Khan and Khan (2015), Noor un Nisa et al. (2011), Khan et al. (2020, 2021a,b, 2022), Iqbal et al. (2021), Rahman et al. (2022), Ulhaq et al. (2022).

2. Materials and Methods

2.1. Study sites

2.1.1. Location and boundary

Lower Dir is the is a part of old district Dir of Malakand division. It is located in Hindu Kush range and the area occupied is 5,284 km^2. These days it forms two districts of Pakistan - Upper Dir and Lower Dir (1,585km^2). In the Northside of Dir Lower the rocky mountainous peaks raise from 1100 to 3119 meters. About every of it connects in the basin of the Panjkora which rise in the Hindu Kush at Lat. 35.45 and connect the River Swat close to Chakdara, where the district is naturally penetrated, at Lat. 34.40 (Figure 1).

3. Data Collection

The questionnaire was organized on the demographic data (age and gender) as well as socioeconomic profile of the inhabitants.

4. Laboratory Examination

The stool sample was examined by naked eyes to find out of mature or some immature stage of parasites. Then stool samples were faced to microscopic examination, with the help of wet-mount procedure (Lugol's iodine solutions and Salt solution). The formol-ether concentration was also planned for the verification of negative cases selected to positive. Three 3 g of stool were emulsified in 3 drops of salt solution (0.9%) or Lugol'siodine solution (WHO, 1991). Only one drop of the suspension was placed on the centre of the slide with the help of wooden stirrer and after that, a cover-slip was sited. The slides with sample suspension were studied with help of the sample microscope first below low 10× power and after that high 40× power objectives. Salines direct smear was used for the identification of *tapeworm* eggs. At the top of direct stool microscopic assessment, one 1 gram 125 of each stool sample was emulsified in 10% formol-ether and formalin solution concentration technique was carry out as to elevate the opportunity of scrutinized parasites (WHO, 1991).

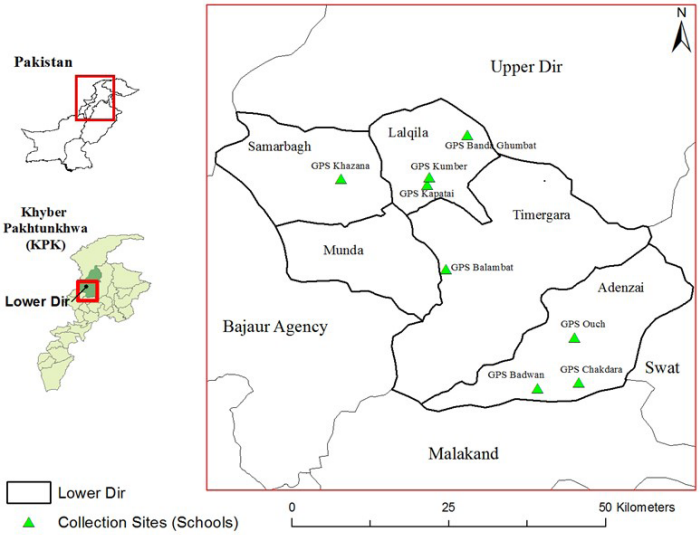

Figure 1. Location Sites of the study area in lower Dir region (Khyber, Pakhtunkhwa).

5. Parasite Identification

Intestinal parasites were examined under the microscope and recognized based on morphological characteristics of eggs, larvae and adult stages through valid and standard keys.

6. Statistical Analysis

SPSS, Graph Pad Prism and Minitab were use to calculate the results. If P-value is less than 0.05, it will be considered as statistically important.

7. Result

The prevalence of intestinal parasites is at least a single infection was 195 (61.73%). Mixed infection was observed in 92 (46.93%) among school children who had an intestinal parasitic infection. Of these proportion, 36 (18.36%) are double, 27 (13.77%) triple and 12 (6.12%) quadruple infections were observed (Table 1).

The overall prevalence of intestinal parasite was 71.75% (n=287/400). Multiple parasitic infections were identified in 32.05% (n=92/400) individuals (Table 1). The most common prevalent parasite is *A. lumbricoides* (34.49%) hookworm (19.86%), *E. vermicularis* (1.39%), *T. trichiura* (1.04%) (Table 2).

Table 3 demonstrated over all infection if A.lumbriciodes, A.duodenale, E.vermicularis, T.saginata, H.nana and H.diminuta as 33.1%, 19.8%, 1.39%, 1.04%, 22.6% 18.8% and 1.39%. of the children below age 8 years were more infected than above 8 years, however males were highly infected than females. Regarding the prevalence of Toxocara spp which showed same percent prevalence in both the genders and ages as well.

7.1. Plaetes

Figure 2 to 7.

Figure 2. *A. lumbricoides* unfertile egg.

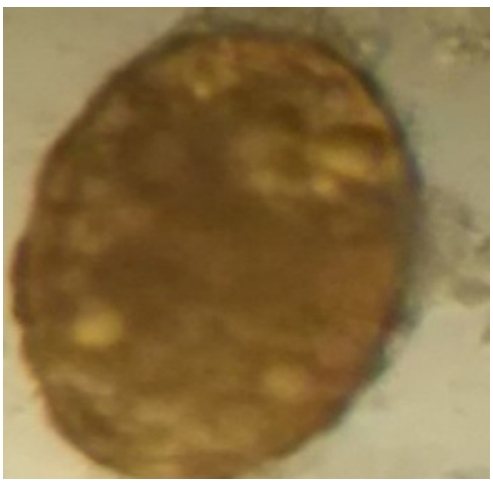

Figure 3. *A. lumbricoides* fertile egg.

Table 1. Proportion of mono-parasitism and poly parasitism of intestinal parasitic infections in school children of Lower Dir, Pakistan.

Type of infection	No. of species	Species associated	Cases (%)
Mono-parasitism	1species (n=121)	hookworm	27 (13.77)
		Ascaris lumbricoides	70 (35.71)
		Enterobius vermicularis	15 (7.65)
		Trichuris trichiura	9 (4.59)
Total mono -parasitism			121 (61.73)
poly-parasitism	2 species (n=36)	*A. lumbricoides, hookworm*	11 (5.61)
		A. lumbricoides, H. nana	10 (5.10)
		T. saginata, hookworm ,	12 (6.12)
		H. nana, T. trichura	1 (0.5)
		A. lumbricoides, Taxocara spp	2 (1.02)
			36 (18.36)
	3 species (n=27)	*T. saginata, A. lumbricoides, hookworm*	5 (2.5)
		H. nana, E.vermicularis,T. saginata	4 (2.04)
		A.lumbricoides, H. nana, E. vermicularis	4 (0.04)
		H. nana, T. saginata, hookworm	2 (1.02)
		A. lumbricoides, H.dimanuta, hookworm	5 (2.5)
		H.nana, T.saginata, A.lumbricoides	7 (3.57)
			27 (13.77)
	4 species (n=12)	*A.lumbricoides*, hookworm, *T.saginata*, *H. dimunuta*	2 (1.02)
		A.lumbricoides, E.vermicularis, H. nana, hookworm	3 (1.53)
		H.nana, T. saginata, hookworm, *E.vermicularis*	7 (3.57)
			12 (6.12)
Total poly parasitism			92 (46.93)
Total of infected individuals			196 (49)
Total No. Examined			400

Table 2. Frequency distribution of intestinal parasites identified from school children stools.

Group	Parasite species	Population infected	Prevalence (%)
Helminth	*Ascaris lumbricoides*	95	33.1
	Taenia saginata	65	22.64
	Hook worms	57	19.86
	Hymenolepis nana	54	18.81
	Enterobius vermiculari	4	1.39
	Hymenolepis.diminuta	4	1.39
	Trichuris trichura	3	1.04
	Taxocara spp	2	0.69
Total helminth infection		284	99.3
Total number of infection		287	71.75
Total number of individual infected		400	

Table 3. Prevalence of intestinal tapeworms and nematodes parasitic infections among school children in Lower Dir KP, Pakistan.

Parasite	Ages		Sex		Over all	%
	<8	>8	Male	Female		
Nematodes						
Ascaris lumbricoides	57	38	77	18	95	33.1
Ancylostoma duodenale	30	27	41	16	57	19.86
Enterobius vermicularis	3	1	3	1	4	1.39
Trichuris trichura	3	-	3	-	3	1.04
Taxocara spp	1	1	1	1	2	0.69
Cestodes						
Taenia saginata	45	20	48	17	65	22.64
Hymenolepis nana	36	18	45	9	54	18.81
Hymenolepis diminuta	3	1	2	2	4	1.39
Total No. of infection					287	71.75
Total No. of samples					400	

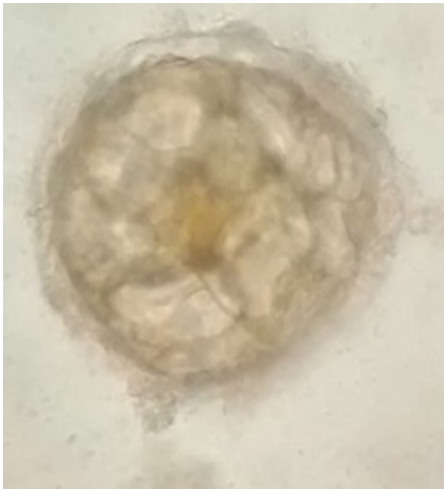

Figure 4. Hookworm egg.

Figure 6. *Trichuris trichiura*.

Figure 5. *Trichuris trichiura*.

Figure 7. *E. vermicularis* egg.

8. Discussion

Parasitic infection of helminths is generally prevalent all over the world. These parasites were changeable according to the environmental conditions, customs climatic, local behaviour, in the urban and rural region the globe. Therefore, we planned to throw some light on parasitic infections in schoolchildren. Parasitism is one of the greatest problems in developing and underdeveloped countries including Pakistan where population increase day by day, low per capita income, smallest health facilities, reduced nutrition in the joint family system particularly in rural localities with maximum chances of contact, provide ideal conditions for intestinal helminthic infections. In the current study overall prevalence of intestinal parasites infection among school children of urban areas of Lower Dir, Pakistan was 49% (n=196/400). The highest prevalence was recorded in Islamabad 94.4%, while the lowest in other studies.

Ascaris lumbricoides (roundworm) is the most common parasite, infecting over 1/5 of the world population. The eggs are getting out in the faces and expose in the surroundings, afterwards establish in water, soil, impure fruit and vegetables. Leave the eggshell out and infective embryonated eggs swallowed, and exceed through the liver to the blood stream, lungs, and then returned to small intestine departure the respiratory tract and after that swallowed. In the current study *A. lumbricoides* was the most prevalent parasite 33.1% (n=95) in urban locality of Lower Dir, which is comparable with 30.1% in District Swat (Noor-un-Nisa et al., 2011), 39.8% in district Swat (Khan et al., 2011), 39.8%in District Swat (Khan and Khan, 2015), 31.7% in district Swat (Khan et al., 2019b) and 33.3% in Panjab (Dar et al., 2013). But the present prevalence rate is high when compared with, 15% in Banu (Khan and Khan, 2015), 17%,20.3% in Swat (Khan et al., 2018a), 1.4% in Peshawar (Ilyas et al., 2018), 7.76% in Swat (Khan et al., 2019a), 4.0% in Quetta % (Arshad et al., 2019), 17.5% in Punjab (Kosar et al., 2017), 1.1% in Larkana, 5.5%in Karachi (Arshad et al., 2019), 12% in AJK (Khan et al., 2017a).The present prevalence rate is low when compared, 55.8% in Swat (Khan et al., 2017c), 53.0% in Swat (Khan et al.,

2017b), 66.4 in district Swat, Upper Dir and Lower Dir (Khan et al., 2019b).

Ancylostoma duodenale (hookworm) incidence rate is 19.86% in the present study. This nematode infection is nearly comparable with 20% in Azad Jammu and Kasmir (Khan et al., 2018b), 7.58% in Islamabad, 6.70%in district Swat (Noor-un-Nisa et al., 2011), 6.91% in district Swat, Lower and Upper Dir (Khan et al., 2019a), 6.45% in district Swat (Khan et al., 2017b) and 5.99% in district Swat (Khan et al., 2017c). The infection rate was high then other studies, 3.64% in Swat (Noor-un-Nisa et al., 2011), 3.64% in district Swat (Khan and Khan, 2015), 2.90% in Swat (Khan et al., 2018b), 3.96% (Khan et al., 2018a), 1.08% in district Swat (Khan et al., 2019b), 0.85% in Peshawar (Ilyas et al., 2018);m0.4% in Karachi (Arshad et al., 2019); 33.4% was found in school children of Lower district Lower Dir, Pakistan (Khan et al., 2022) and 41.9% of prevalence was noted by Ulhaq et al. (2022). The infection rate was low 41.7% study conducted in Punjab (Dar et al., 2013).

Enterobius vermicularis (pinworm) is an intestinal nematode parasite that infection is the main agent for contact-borne infectious helminth. The present survey established the prevalence of *E.vermicularis* (1.39%), in children of district Dir is greater than previous studies .*E. vermicularis* infection among children are lower than studies conducted 22.75% in Islamabad, 10.7% Swat (Khan et al., 2011), 10.3% in district Swat (Noor-un-Nisa et al., 2011), 10% in AJK (Khan et al., 2017a), 9.52% in Swat (Khan et al., 2018a), 8.25% Swat (Noor-un-Nisa et al., 2011), 8.25% Swat (Khan and Khan, 2015), 5.05% in Swat (Khan et al., 2019b), and 14.4% Swat (Khan et al., 2017b). The prevalence rate of *E. vermicularis* in children of the district Lower Dir is high and not negligible due to highly transmittable infection.

The current prevalence rate of *Trichuris trichiura* is 1.04% in district Lower Dir. This is comparable, with 1.3% in Punjab (Kosar et al., 2017), 1.3% in Quetta (Arshad et al., 2019) and 0.42% in Lahore (Anwar et al., 2018). The prevalence rate of the present study is low when compared with, 26.2% Swat (Khan et al., 2017b), 19.1% Swat (Khan and Khan, 2015), 19.1% Swat (Khan et al., 2012), 19.0% in Swat (Khan et al., 2011), 15.9% in Swat (Noor-un-Nisa et al., 2011), 14.9% Swat (Khan and Khan, 2015), 14.3% Swat (Khan et al., 2018a), 11% in AJK (Khan et al., 2017b), 8.73% Swat (Khan et al., 2019a) and 8.30% in Swat (Khan et al., 2019b). The above nematodes were found share with cestodes infection in 19.7% of the study population (Rahman et al., 2022).

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