

Original Article

Prevalence of cestodes infection among school children of urban parts of Lower Dir district, Pakistan

Prevalência de infecção de cestóides entre crianças em idade escolar de partes urbanas do distrito de Lower Dir, Paquistão

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Abstract

Tapeworms of zoonotic importance have been described as a leading public health problem. Current research was aim to assess the prevalence of tapeworms among 5-12years school children residing in district Lower Dir, Pakistan from January 2019-December 2019. The wet mount preparation in saline/iodine/methods were used for stool examination. Data was analyzed using appropriate descriptive, static methods. Of the 400 children studied 71.7% were infected with one or more species of intestinal parasites. Single infection of cestode species was found in 69 individuals with 17.2% prevalence and multiple parasitic infections were identified in 19.7% (n=79/400) individuals. The multiple infection were comprised as 10% (n=40) double, 6.75% (n=27) triple and 3% (n=12) quadruple. A total of 9 species of helminths and one species of protozoan infection. Among the helminths *Ascaris lumbricoides* was the most prevalent 33.1% (n=95), *Taenia saginata* 22.6% (n=65), hookworm 19.8% (n=57), *Hymenolepis nana* 18.8% (n=54), *Enterobius vermicularis* and *Hymenolepis diminuta* 1.39% (n=4each), *Trichuris trichura* 1.04% (n=3), *Toxocara* spp 0.69% (n=2) and *Schistosoma japonicum* 0.34% (n=1) were reported. One protozoan species was *Cryptosporidium* spp 0.69% (n=2) in current study. In case of *A.lumbricoides*, hookworm, *E.vermicularis*, *T.trichura*, *T.saginata*, *H.nana* and *H.diminuta* the male children of below 8 years of age were highly infected. Other infections are reported in the same prevalence with slight difference if any. We conclude that there is a need for mass scale campaigns to create awareness regarding health and hygiene in children and the need for development of effective poverty control programs because deworming alone is not adequate to control parasitic infections.

Keywords: intestinal parasitosis, tapeworm infection, zoonosis, school children, poor sanitation.

Resumo

As tênias de importância zoonótica têm sido descritas como um dos principais problemas de saúde pública. A pesquisa atual teve como objetivo avaliar a prevalência de tênias entre crianças em idade escolar de 5 a 12 anos que residem no distrito de Lower Dir, Paquistão, de janeiro de 2019 a dezembro de 2019. Os métodos de preparação para montagem úmida em solução salina/iodo foram usados para exame de fezes. Os dados foram analisados usando métodos descritivos e estáticos apropriados. Das 400 crianças estudadas, 71,7% estavam infectadas com uma ou mais espécies de parasitas intestinais. Infecção única de espécies de cestóides foi encontrada em 69 indivíduos com prevalência de 17,2% e infecções parasitárias múltiplas foram identificadas em 19,7% (n = 79/400) indivíduos. As infecções múltiplas foram compostas por 10% (n = 40) dupla, 6,75% (n = 27) tripla e 3% (n = 12) quádrupla. Um total de 9 espécies de helmintos e uma espécie de infecção por protozoários. Entre os helmintos, *Ascaris lumbricoides* foi o mais prevalente 33,1% (n = 95), *Taenia saginata* 22,6% (n = 65), ancilóstomo 19,8% (n = 57), *Hymenolepis nana* 18,8% (n = 54), *Enterobius vermicularis* e *Hymenolepis diminuta* 1,39% (n = 4cada), *Trichuris trichura* 1,04% (n = 3), *Toxocara* spp 0,69% (n = 2) e *Schistosoma japonicum* 0,34% (n = 1). Uma espécie de protozoário foi *Cryptosporidium* spp 0,69% (n = 2) no estudo atual. No caso de *A.lumbricoides*, ancilostomíase, *E.vermicularis*, *T.trichura*, *T.saginata*, *H.nana* e *H.diminuta*, as crianças do sexo masculino com menos de 8 anos de idade estavam altamente infectadas. Outras infecções são relatadas na mesma prevalência, com ligeira diferença, se houver. Concluímos que há uma necessidade de campanhas em massa para criar consciência sobre saúde e higiene em crianças e a necessidade de desenvolvimento de programas eficazes de controle da pobreza, porque a desparasitação por si só não é adequada para controlar infecções parasitárias.

Palavras-chave: parasitose intestinal, infecção por tênia, zoonose, escolares, saneamento deficiente.

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1. Introduction

The tapeworm infections are low in big Muslim communities in areas of Asia and Africa. The information from those communities in Africa and South Asia, telling to intestinal cestode infectivity is uncommon in these areas. The overall weight of STHs (soil transmitted helminths) infection shown to 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. Information on epidemiology and clinical spectrum of tapeworms is scarce in the world. It is believed that tapeworm diseases are not common in people of tropical region due to lacking of access to meats of the hosts which serves as source of infection.

Although muslim communities in most parts of the world having low rates of tapeworm diseases. Due to the mode of nutrition most of the studies from Africa and South Asian communities indicates that diseases caused by intestinal tapeworm are mainly restricted to these regions. The tapeworms are usually not to be detected in stool specimens of inhabitants of these regions, however the incidence of neuro cysticercosis (larval *Taenia solium* infection in CNS) would be a sign of the presence of tapeworm, and is a leading cause of epilepsy in the developing nations.

In the recent past few studies have been conducted on intestinal parasitic infections in various parts of Malakand region, Pakistan which indicates the presence of tapeworms

infection as Khan et al. (2011, 2012, 2015, 2017a, b, 2018a, b 2019, 2020) and Noor-un-Nisa et al. (2011). This study was planned to pinpoint the prevalence of tapeworm infection in school children of district Lower Dir, Khyber Pakhtunkhwa, Pakistan.

2. Materials and methods

2.1. Location and boundary

Dir is located in Khyber Pakhtunkhwa, province and lies in Hindu Kush range, covers 5,284 km² area. These days it forms two districts of Pakistan Upper Dir and Lower Dir (1,585 km). In the North side of lower Dir the rocky mountainous peaks rising from 1100 to 3119 meters. About all of it connects in the valley of the Panjkora which elevated in the Hindu Kush at Lat. 35.45 and joins the Swat River close to Chakdara, where the district is typically entered, at Lat. 34.40. Lower Dir district lies 124 km distance from Peshawar. This district starts from "Chakdara" just on the left side of the main road from Malakand Pass at 15 km distance (Figure 1).

2.2. Questionnaire survey

At the beginning of this research a meeting was arranged with head teachers and staff of the schools in the study area. The principals and staff were asked to give the permission. The questionnaire was organized about information on the demographic data (age and gender)

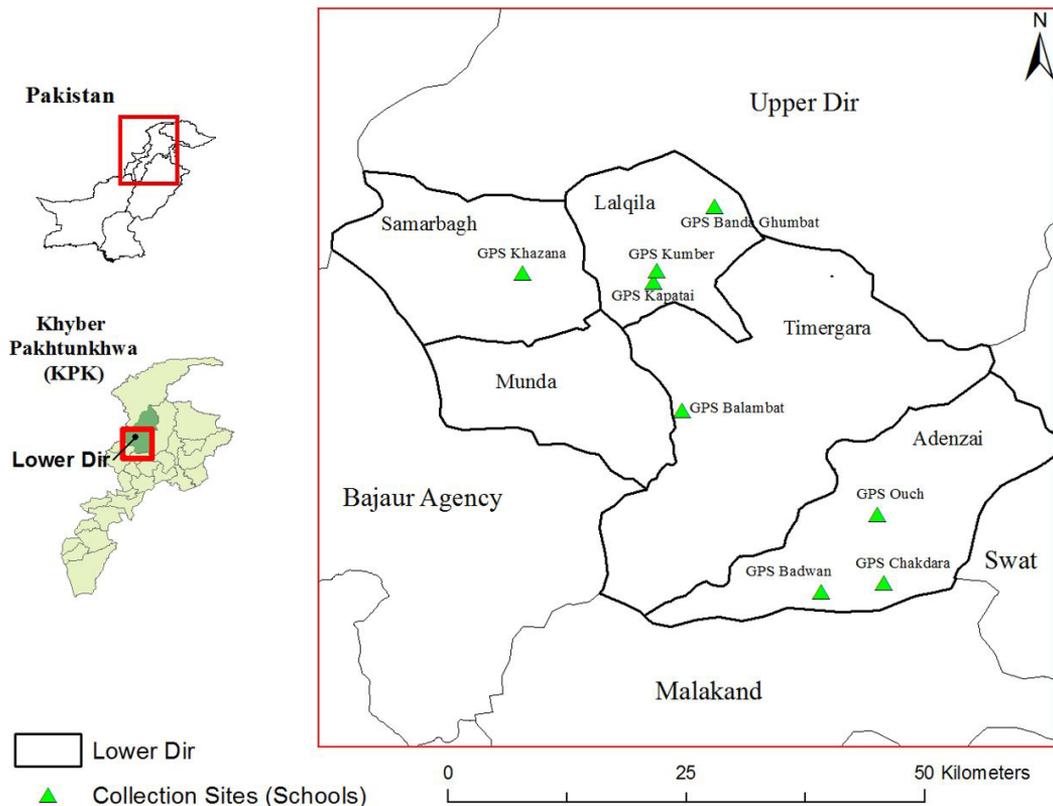


Figure 1. Study sites of the area in Lower Dir district (Khyber, Pakhtunkhwa, province, Pakistan).

as well as socioeconomic profile of the inhabitants (food source, water source, animal at home, toilet source, nail status, weight, height and location, clinical symptoms (abdominal pain, stomach pain), environmental hygiene and living condition characteristics (season, contact with domestic animals and soil). Faecal samples were collected from each of the student and preserved in 10% formalin, and then brought to, Laboratory of Parasitology, University of Malakand, where the samples were examined with the help of microscope by using direct smear technique (WHO, 1991). The students who were positive for parasites directed as to please make contact with their physician through their parents/guardian, brother or either otherwise warden.

2.3. Laboratory diagnosis

Each of the faecal specimen was observed first by naked eyes to find out of mature or some immature form of parasites. Then stool samples were faced to microscopic examination, with the help of wet-mount techniques. The formol-ether concentration was also be used for the verification of negative cases to be positive. About 3 g of faecal samples were diluted in 3 drops of salt solution or solution of Lugol's iodine (WHO, 1991). After formation of suspension a drop was taken through an wooden applicator and placed on the centre of the slide and after that a coverslip was sited. The slide with sample suspension was studied with the help of microscope. Solution of normal saline was used for the detection of trophozoite stages of intestinal protozoa and tapeworm eggs. At about one gram 125 of every stool specimen was emulsified in 10% formalin solution and formol-ether concentration technique (WHO, 1991).

2.4. Parasite identification

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

2.5. Statistical tests

The data was analyzed by using the software (Graph paid and Minitab) wherever applicable. P value when less than 0.05 was measured statistically.

3. Results

The overall prevalence was 71.7% (n=287/400). Single infection of cestode species was found in 69 individuals with 17.2% prevalence and multiple parasitic infections were identified in 19.7% (n=79/400) individuals. The multiple infections were comprised as 10% (n=40) double, 6.75% (n=27) triple and 3% (n=12) quadruple. Among the cestode infection *T.saginata* (22.64%), was the most common followed by *H. nana* (18.81%) while *H.diminuta* (1.39%) was reported in lowest rate of infection (Table 1, Figure 2).

Table 2 indicates a total of 9 species of helminths and one species of protozoan infection. Among the helminths *A.lumbricoides* was the most prevalent 33.1% (n=95), *T.saginata* 24.6% (n=65), hookworms 19.8% (n=57), *H.nana* 18.8% (n=54), *E.vermicularis* and *H.diminuta* 1.39% (n=4each), *T.trichura* 1.04% (n=3), *Toxocara* spp 0.69% (n=2) and *S.japonicum* 0.34% (n=1) were reported. One protozoan species was *Cryptosporidium* spp 0.69% (n=2) in current study.

In case of *A.lumbricoides*, hookworms, *E.vermicularis*, *T.trichura*, *T.saginata*, *H.nana* and *H.diminuta* the male children of below 8 years of age were highly infected. Other infections are reported in the same prevalence with slight difference if any (Table 3).

4. Discussion

Current study was pin point to understand the prevalence of tapeworm infection among school children of Lower Dir district, Pakistan. *Taenia saginata* (beef tapeworm) was the frequent intestinal cestode parasite reported in 22.6% (n=65) in this study. This study is comparable with 25% (Dar et al., 2013); 12.8% (Noor-un-Nisa et al., 2011), 9.98% (Khan et al., 2017a), 32.6% (Khan et al., 2018b), 16.7% and 12.8% (Khan et al., 2015). The transmission of these tapeworms occurs by ingestion of raw and semi cooked beef and accidental ingestion of the intermediate hosts and development of the larval stages.

The cestode parasite infection is high than other studies as 16.7%, 12.8% (Khan et al., 2015), 12.8% (Khan et al., 2012), 9.70% (Khan et al., 2019), 9.52% (Khan et al., 2018b), 8.98% (Khan et al., 2017a), 7.94% (Khan et al., 2019), 7.35% (Maqbool et al., 2007), 7% (Khan et al., 2012), 1.7%, 1.3%

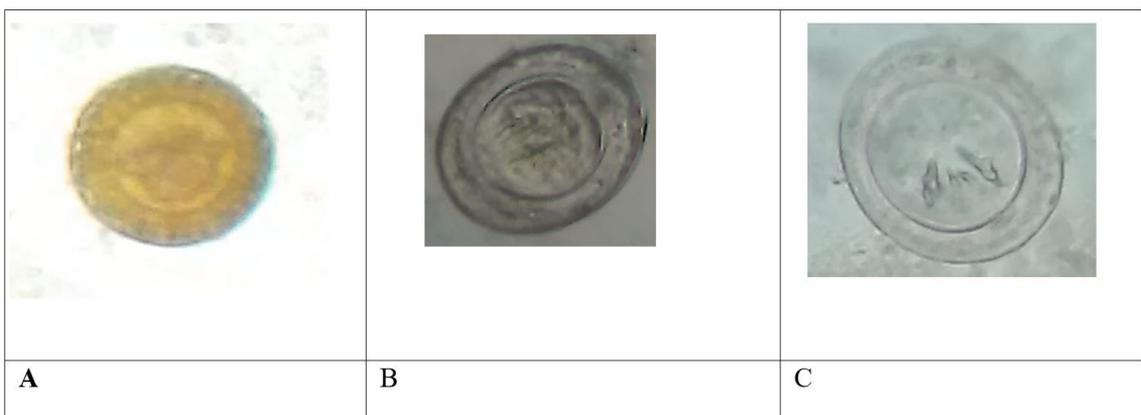


Figure 2. Tapeworm species eggs. (A) *Taenia saginata*; (B) *Hymenolepis nana*; (C) *Hymenolepis diminuta*.

Table 1. Pattern of mono-parasitism and poly parasitism among school children of Lower Dir, Pakistan.

Infection type	Species	Associated species	Number (%)
Total mono -parasitism	1 species (n=69)	<i>Taenia saginata</i>	34(8.5)
		<i>Hymenolepis nana</i>	31(7.75)
		<i>H.diminuta</i>	4(1)
	2 species (n=40)	<i>A. lumbricoides, H. nana</i>	10(2.5)
		<i>H. nana, T. saginata</i>	13(3.25)
		<i>T. saginata, hookworm ,</i>	12(3)
		<i>T. saginata, cryptosporidium</i>	2(0.5)
		<i>H. nana, T. tricura</i>	1(0.25)
		<i>H.nana, H.diminuta</i>	2(0.5)
		<i>T. saginata, A. Lumbricoides, hookworm</i>	40(10)
3 species (n=27)	<i>H. nana, E.vermicularis,T. saginata</i>	5(1.25)	
	<i>A.lumbricoides, H. Nana, E. vermicularis</i>	4(1)	
	<i>H. nana, T. saginata, hookworm</i>	2(0.5)	
	<i>A. lumbricoides, H.diminuta, hookworm</i>	5(1.25)	
	<i>H.nana, T.saginata, A.lumbricoides</i>	7(1.75)	
	<i>T. saginata, A. Lumbricoides, hookworm</i>	27(6.75)	
4 species (n=12)	<i>A.lumbricoides, hookworm, T.saginata, H. diminuta</i>	2(0.5)	
	<i>A.lumbricoides, E.vermicularis, H. nana, hookworm</i>	3(0.75)	
	<i>H.nana, T. Saginata, hookworm, E.vermicularis</i>	7(1.75)	
Total poly parasitism			12(3)
Total no. of infected individuals			79(19.75)
Total No. Examined			287(71.7)
			400

Table 2. Frequency and percentage of intestinal parasites among school children stools.

Group	Parasite species	Population infected	Prevalence (%)
Helminths	<i>Ascaris lumbricoides</i>	95	33.1
	<i>Taenia saginata</i>	65	22.6
	hook worms	57	19.86
	<i>Hymenolepis nana</i>	54	18.81
	<i>Enterobius vermicularis</i>	4	1.39
	<i>Hymenolepis diminuta</i>	4	1.39
	<i>Trichuris trichura</i>	3	1.04
	<i>Shistosoma japonicum spp</i>	1	0.34
	<i>Taxocara spp</i>	2	0.69
Total helminth infection		285	99.3
Protozoan	<i>Cryptosporidium spp</i>	2	0.69
Total protozoan infection		2	0.69
Total number of infection		287	71.75
Total number of individuals			400

Table 3. Prevalence of intestinal tapeworms, roundworms, flatworms and protozoan parasitic infections among school children in Lower Dir, Pakistan.

Parasites	Age		Sex		Over all	%
	<8	>8	Male	Female		
Nematodes						
<i>Ascaris lumbricoides</i>	57	38	77	18	95	33.1
<i>Ancylostoma duodenale</i>	30	27	41	16	57	19.8
<i>Enterobius vermicularis</i>	3	1	3	1	4	1.39
<i>Trichuris trichura</i>	3	-	3	-	3	1.04
<i>Taxocara spp</i>	1	1	1	1	2	0.69
Cestodes						
<i>Taenia saginata</i>	45	20	48	17	65	22.6
<i>Hymenolepis nana</i>	36	18	45	9	54	18.8
<i>Hymenolepis diminuta</i>	3	1	2	2	4	1.39
Trematodes						
<i>Schistosoma japonicum</i>	1	-	1	-	1	0.34
Protozoans						
<i>Cryptosporidium spp</i>	1	1	1	1	2	0.69
Total No. of infection					287	71.7
Total No. of samples						400

(Arshad et al., 2019), 1.2%, 1.0% (Chaudhry et al., 2004), 0.7% (Kosar et al., 2017), 0.4% (Arshad et al., 2019), and 0.3% (Haider et al., 2018). The infection rate is low than other studies, 33.79% Islamabad (Shakoor et al., 2018), 32.6% conducted in district Swat (Khan et al., 2018b) and 25% in Punjab ((Dar et al., 2013). Changeable prevalence of intestinal pathogenic tapeworm for different areas may due to the different ecological, personal habits, cultural and geographical restrictions. Diseases caused by tapeworms is a public health concern in low and middle-income nations including Pakistan (Khan et al., 2018b).

Hymenolepis nana (dwarf tapeworm) has wide distribution normally infects the people in Africa, Eastern, Southern Europe and Asia. It has estimated that *H. nana* infect 75 million people in the world. It complete its life cycle in one host can easily be transmitted from one individual to another (auto-infection) and easily renewed by new generation. *H. nana* was the most prevalent 18.81% (n=54) in urban locality of district Lower Dir, which is comparable with 10.7% in district Swat (Khan et al., 2018b). The current infection rate is higher than other studies 10.1% (Khan et al., 2012), 10.1% (Khan et al., 2015), 10% (Khan et al., 2012), 9.36% (Khan et al., 2017a), 8.7% (Arshad et al., 2019), 8.09% (Anwar et al., 2018), 6.78% (Khan et al., 2019), 6.3% (Haider et al., 2018), 6.2% (Ilyas et al., 2018), 5.9%, 4.82% (Shakoor et al., 2018), 4.6%, 3.26% (Maqbool et al., 2007), 3.24% (Khan et al., 2019), 2.77% (Khan et al., 2018b) 2.0% (Kosar et al., 2017) and 1.7% (Chaudhry et al., 2004). The infection rate is lower than other studies conducted in Lahore 27.8%.

Hymenolepis diminuta has a universal distribution whose definitive hosts are rodentia species. Infection of human is rare and occurs by accidental ingestion of infected arthropods (intermediate host) harbouring cysticercoids, infective larvae of the parasite (King, 1995; Schantz, 1996). In present research plan overall prevalence of the *H. diminuta* in school children the selected localities of Lower Dir is 1.39 (n=4). *H. diminuta* is the common parasite of rat and mice, but it is observed in school children this may be due to contaminated water and food, where children playing with mud which is transferable to human being through mouth, the infection resulting from accidental ingestion of fleas (insect host).

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