

Soil transmitted helminthiasis in different occupational groups in Swat, Khyber Pakhtunkhwa, Pakistan

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Abstract: We investigated the prevalence of geohelminth parasites in farmers, education concerned and shepherd of Swat, Khyber Pakhtunkhwa, Pakistan. A total of 1041 stool samples were examined from January 2006 to December 2008 using direct smear (Normal saline and Lugol's Iodine solution) the concentration methods and procedures. Seven hundred and sixty three (73.2%) individuals were found infected with one or more than one geohelminth parasites. Four hundred and eighteen (54.7%) were infected with single parasite and three hundred forty five (45.3%) with multiple infections. *Ascaris lumbricoides* 460 (53.0%), *Trichuris trichura* 228 (26.2%), *Enterobius vermicularis* 123 (14.1%) and *Ancylostoma duodenale* 56 (6.45%) were detected. The adults were found more parasitized than children and males were more infected than females. Shepherds were found more infected than farmers and education concerned. Although Swat is an area with poor hygiene located in temperate zone near the border of Afghanistan and China. The prevalence of reported geohelminth parasites here compared with the same studies is unexpectedly high. These type of studies should continue time to time to know the hazardous of such parasitic infections for the betterment of the human health.

Keywords: Geohelminth infections, Intestinal parasitic diseases, gastrointestinal diseases, Microscopy, Larval nematodes, Pakistan.

INTRODUCTION

Geohelminth parasites are still a major health issue in tropical, sub-tropical and temperate areas of the world and are characteristically found among people with low socioeconomic status and poor hygiene. The helminth frequently parasitizing man are roundworms (*Ascaris lumbricoides*), hookworms (*Ancylostoma duodenale* and *Necator americanus*) and whipworms (*Trichuris trichura*). These helminths are widely distributed; more than 3.5 billion people are infected with intestinal worms. Of them, 1.47 billion have roundworms; 1.3 billion are infected with hookworms and 1.05 billion with whipworms. It is estimated that about 400 million schoolage children are infected with these helminth parasites. Children between 5 and 15 in ages are frequently infected but the incidence of hookworm infection tends to grow with increasing age. Therefore, adolescent girls and women of childbearing age are generally infected with hookworms (Chan *et al.*, 1994; Luong 2002).

In Pakistan the intestinal parasitic infections are widely prevalent, with variable distribution in different parts of the country. Various surveys have been conducted in different parts of the country by different workers; Multan, Bahawalpur and Peshawar (Farooqi, 1964); Multan (Farooqi, 1965); Karachi (Haleem, 1965); Lahore

(Ansari and Naru, 1968); Islamabad (Pal and Malik, 1979); Peshawar (Siddiqi and Bano, 1979); Karachi (Bilquees *et al.*, 1982); Rawalpindi-Islamabad (Pal and Rana, 1983 a and b); Peshawar (Nawaz and Nawaz, 1983); Karachi (Baqai *et al.*, 1985); Hazara Division (Shah *et al.*, 1986); Karachi (Baqai and Zuberi, 1986); Dir district N.W.F.P (Pal and Subhani, 1989); Hyderabad and Latifabad (Khan, 1993); Quetta Baluchistan (Nawaz and Nawaz, 1993); Kurram Agency (Ali, 1993); Lahore (Akhtar, *et al.*, 1993); Islamabad (Qureshi, 1995); Islamabad (Jamil, 1999); Chitral (The Northern areas of Pakistan) (Stoddart, 1999); Larkana, Sindh (Shaikh *et al.*, 2000); Shikarpur, Sindh (Shaikh *et al.*, 2003); Muzaffarabad, Azad Kashmir (Chaudhy *et al.*, 2004); Karachi (Kamran *et al.*, 2005); Mirpure Mathelo, Sindh (Tasawar *et al.*, 2006); Lahore (Maqbool *et al.*, 2007); Quetta city (Sajjad *et al.*, 2009) and other parts of the country but these studies have mainly been restricted to particular areas and targeted population.

MATERIALS AND METHODS

Study area

The current study was conducted in district Swat, 5,337 km² area, reserved with approximately 1.2 million populations. It lies from 34°34' to 35° 55' North and 72° 08' to 72° 50' East. Its boundaries are linked with Chitral and Ghazir districts of Northern areas of Pakistan in North, Kohistan and Shangla district in the East, In the South Buner district and Malakand protected areas and in

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the West lower and upper Dir districts The temperature falls to -2° in the winter season and shoots to 33° in the summer. Agriculture is the main occupation followed by live-stock. The highest recorded rainfall of the district is 242mm during March.

Socioeconomic profile

The Swat houses are built of wood and mud in rural areas and with blocks and bricks in urban areas by the inhabitants. The government provides them with basic amenities, such as electricity and piped water supply. The people of Swat use surface or un-treated tap-water for drinking. Sanitation practices are also very low, people use open fields and cattle sheds for defecation which is later on used as manure forcrops. During cultivation and rainy seasons the surface runoff and waste water from the agricultural field's ingress in to channels, the major source of drinking water. The poor sanitation practices i.e. use of traditional latrine, habit of open defecation, lack of health and hygiene education and use of such contaminated water are the main sources of gastrointestinal parasitic infections in the people of Swat. The people have poor socio-economic conditions. i.e poor housing, poor domestic and personnel hygiene, unemployment and poverty.

Population surveyed

This study (January 2006 to December 2008) was conducted for the investigation of diversity of different intestinal parasitic fauna in human population of Swat, Pakistan. A total of 1041 stool samples were collected from different site and locations of the district as well as from B.H.U.s, Hospitals and some Schools of the region. The population surveyed comprised farmers 365, education concerned 420, Shepherds 256, children and adults of both the gender. The occupational groups were selected on the basis of their socio-economic profiles. The specimens were randomly selected. No gastro-intestinal complaint was recorded at the time of collection.

Data collection

Each of the participants was provided a wide- mouth plastic bottle, labeled with name, age, sex, locality, occupation and date of collection. The containers were given with 10% M.I.F (Merthiolate, Iodine, Formaldehyde) preservatives. The containers were provided with a wooden spatula, tied with a rubber band in a mini plastic bag. The participants were instructed to collect about 10grams of the personnel single stool specimens at morning. These specimens were later brought to Southern Agricultural Research Centre (SARC), Karachi, Pakistan Agricultural research Council (PARC), Vertebrate pest control institute (VPCI), Medical zoology laboratory for final examination.

Stool examination

The stool specimens were examined by naked eyes for detection of adult or any segmental stage of parasite. The

specimens were then submitted for microscopically examination, through wet mount techniques, in a fresh normal saline solution and Lugol's iodine solution. The concentration methods (Sedimentation, floatation and Centrifugation) were also used. The shape, size, color and marking on the surface of the egg-shell, the yolk granule, ovum, differentiated embryo, operculum and the three pairs of embryonic hook lets in case of cestode ova were carefully examined. Positive slides were compared morphologically with reference materials. The slides prepared were used for photo-micrographs.

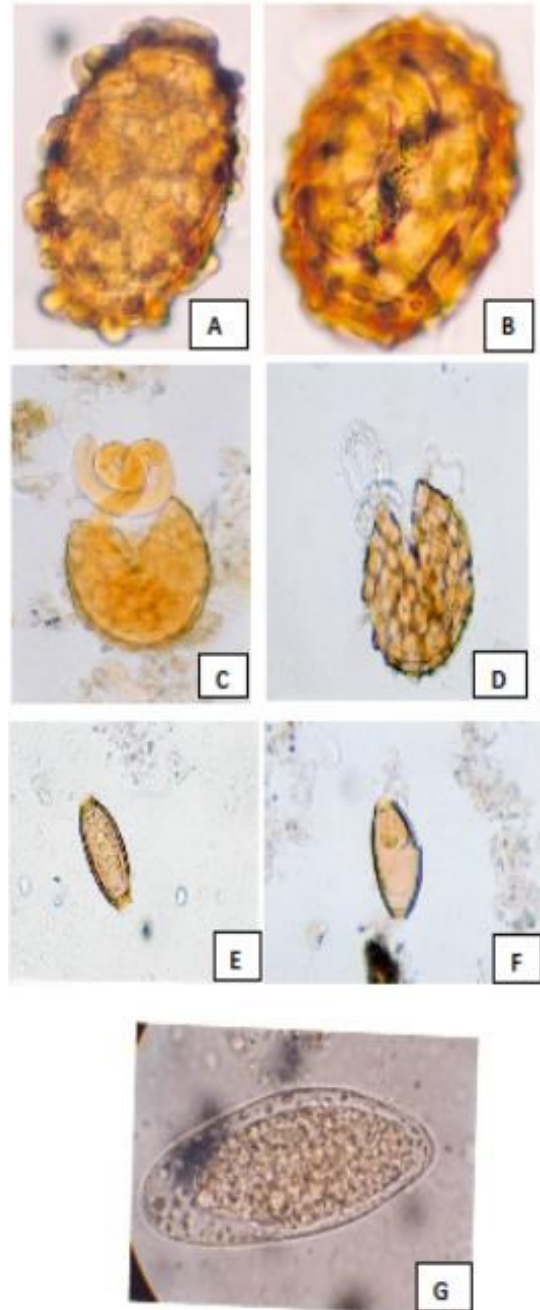


Fig. 1: Photographs of three helminth species recorded for the first time from Swat, Pakistan A) *Ascaris lumbricoides* (un-fertile egg) B) *Ascaris lumbricoides* (fertile egg) C)

and D) *Ascaris lumbricoides* eggs in hatching condition: E) *Trichuris trichura* egg: F) *Trichuris trichura* egg in hatching condition: G) *Enterobius vermicularis* egg

RESULTS

Although 1350 stool containers were distributed to respondents who agreed to participate, only 1041 (77.1%) individuals provided stool specimens. The analysis of the results was based on respondents who provided stool samples. The respondents were between 9 and 80 years old with a median of 11 years. 651 were males and 390 were females. Over all parasitic prevalence was 73.2% including 54.7% single and 45.2% multiple infections were recorded. The stool specimens were found to be positive for *Ascaris lumbricoides* (53.0%), *Trichuris trichura* (26.2%), *Enterobius vermicularis* (14.4%) and *Ancylostoma duodenale* (6.45%), cestodes and protozoans were not included in the analysis. Farmers were found more infected than education related individuals and shepherds. Males were found more infected than females as well as the respondents below 15 years in age in farmers and education concerned while above 15 years in shepherd were found more infected.

Table 1 Illustrates the distribution of nematode parasitic infections in 763 infected individuals. 867 total no. of infections were recorded including 349 (40.2%), 292 (33.6%) and 226 (26.0%) from farmers, education related individuals and shepherds respectively. Prevalence of *A.lumbricoides* was 53.0%, followed by *Trichuris trichura* 26.2%, *Enterobius vermicularis* 14.4% and *Ancylostoma duodenale* 6.45% was recorded.

Table 2 Shows the pattern of distribution of geohelminths in single as well as in associated form. 418 (54.7%) and 345 (45.3%) as single and multiple infections were recorded.

Table 3 shows that shepherds were found more infected than farmers and education concerned. Farmers and shepherd above 15 years and individuals related with education below 15 years of age were more infected. Male individuals were found more infected than females.

DISCUSSION

The present study provides information regarding geohelminth parasitic infections in farmers, education concerned and shepherds of Swat, Pakistan. This study was based on single stool examination. We are not aware of any other report that has characterized the present status of this population, studying the occupation based on geohelminth parasites. Majority of the males participated in the study as compared to females individuals due to cultural, religious and traditional. The prevalence of *Enterobius vermicularis* was 9.81% in the present study. In Islamabad the prevalence is reported

reasons. The occupations were chosen because they are an integral part of the economy of this region.

More than half of the studied samples were singly infected and the other half were with multiple infections. Current finding suggests that Geo-helminths (soiltransmitted parasites) were mostly co-related with each other. Present study is comparable with other studies conducted in other parts of the country.

The presence of multiple infections highlights the need for thorough investigation of local populations. There was an interesting relationship of the parasitic infections among the occupational groups, genders and ages. However, age above 15 years in shepherds and farmers while in education concerned below 15-years of age showed more prevalent rate. Similarly males were found to be more parasitized than females while occupation wise farmers showed high prevalence rate of infections.

Compared with the results of related studies conducted in other parts of the country, the present study showed prevalence of infection for *Ascaris lumbricoides* was 53.0%, this nematode infection was quite high (68.7%) reported in a survey conducted in the neighboring district Chitral, located in the Northern areas of Pakistan Stoddart (1999); 24.1% infection in hospital patients in Lahore Akhtar *et al* (1993); 31.0% in Kurram Agency Ali (1993). High prevalence of this nematode for particular areas might be the same ecological, cultural and geographical associations. Although this parasite has a wide prevalence on contrary to the distribution of other parasites in human populations of Pakistan. It is concluded that *Ascaris lumbricoides* infection is widely prevalent with wide geographical distribution.

The existence of a source of *Ascaris lumbricoides* is a significant factor leading to high incidence of infection in an area of endemicity. Poor personal hygiene, sanitation and the use of human excreta as fertilizer on farms and vegetable gardens may result in infection. Nevertheless, it is desirable to make a careful study of epidemiology of soil-transmitted helminths before undertaking large-scale control activities, especially with regard to periodic treatment schedules (Booth *et al.*, 1992).

The present study shows incidence of *Trichuris trichura* to be 18.1%. The study of Stoddart (1999) shows the prevalence of *T.trichura* to be 22.5% followed by Ali (1993) in Kurram Agency in which the prevalence is 7.8. This parasite is also present in other parts of the country but investigated in low quantity. It is therefore concluded that *Trichuris trichura* is also a global nematode parasite with a wide range of geographical distribution.

to be 9.1% in a survey of school children (Pal and Malik, 1979) while Jamil (1999) recorded this parasite with the

Table 1: Prevalence of geohelminth in farmers, education related individuals and Shepherds in Swat, Pakistan

Parasites	Occupations			Total	%
	Farmers	Education related individuals	Shepherds		
<i>Ascaris lumbricoides</i>	188	164	108	460	53.0
<i>Trichuris trichura</i>	92	79	57	228	26.2
<i>Enterobius vermicularis</i>	52	34	37	123	14.41
<i>Ancylostoma duodenale</i>	17	15	24	56	6.45
Total No. of infection	349 (40.2)	292 (33.6)	226 (26.0)	867	

Table 2: Pattern of Geohelminth parasites in farmers, education related and shepherds in Swat, Pakistan

Parasites	Occupational groups			Total	%
	Farmers	Education related individuals	Shepherd		
Pattern of parasites					
Single parasite	144	171	103	418	54.7
Helminths	129	159	89	377	49.4
Protozoans	15	12	14	41	5.37
Multiple parasite	139	106	100	345	45.2
Helminths	111	93	67	371	48.6
Protozoans	0	0	0	0	0
Total infected individuals	283	277	203	763	

Table 3: Distribution of Geohelminths parasites among 1041 individuals in Swat, Pakistan.

Parameters	Farmers			
	Ages, n (%)		Genders, n (%)	
	< 15 years	>15 years	Male	Female
Total examined	120	245	229	136
Total infected	101 (27.6%)	182 (49.8%)	175 (47.9%)	108 (29.5%)
	Education related individuals			
Total examined	238	182	263	157
Total infected	151 (35.9%)	126 (30%)	178 (42.3%)	99 (23.5%)
	Shepherds			
Total examined	108	148	159	97
Total infected	88 (34.3%)	115 (44.9%)	127 (49.6%)	76 (29.6%)

prevalence rate of 13.8% conducting a survey in urban and sub-urban population of Islamabad.

E.vermicularis is a cosmopolitan human parasite. Organic material containing eggs of this parasite may be of human origin. The adult live mostly in the ileocecal region. The eggs are passed by migrating adult females in the anus and peri-anal area. The eggs can directly infect other host, either by fecal-oral route as through airborne inhaled and swallowed eggs. Its life time is estimated to be up to 2 months (Roberts & Janovy 2000, Rey 2001). A hypothetical origin of this parasite in the Americas can be ruledout. *E. vermicularis* has a long history of coevolution with its human host. They have been coexisting together in Africa long time before human dispersion throughout the continents (Ferreira *et al.*, 1997; Hugot *et al.*, 1999).

Prevalence of *Ancylostoma duodenale* was 4.46% in the present study. This nematode infection was recorded 5.6 % in hospital patients of Peshawar (Farooqi, 1965); 6.1% in Dir district (Pal and Subhani, 1989); 4.23 and 4.27% prevalence was recorded in Larkana and Shikar pura (Shaikh *et al.*, 2000 and 2003). The infection rate was low in other studies investigated. Although the parasite has wide distribution but with considerable difference in prevalence.

Literature search shows that studies on the prevalence of human intestinal parasites have mainly been restricted to confined localities and targeted populations in Pakistan. Mostly the school children have been studied, It was desirable therefore to investigate which intestinal parasites the local population harbours and to obtain estimates of both the prevalence and intensities of such infections.

Table 4: Descriptive statistics of the data in table 1 and 2.

Table 1		Table 2	
Mean	56.5	Mean	89.66666667
Standard Error	18.45941494	Standard Error	26.45961283
Median	47	Median	120
Standard Deviation	36.91882988	Standard Deviation	64.81255022
Sample Variance	1363	Sample Variance	4200.666667
Kurtosis	1.382876988	Kurtosis	-1.76871783
Skewness	1.256588656	Skewness	-0.8662935
Range	84	Range	144
Minimum	24	Minimum	0
Maximum	108	Maximum	144
Sum	226	Sum	538
Count	4	Count	6
Confidence Level (95.0%)	58.74609688	Confidence Level (95.0%)	68.01660012

Comparatively low temperatures prevail in Swat district. Farming is the principal occupation and until recently most farmers used night soil as fertilizer because of its ready availability. Raw manure flowed into the rivers or is widely used in vegetable gardens. Such conditions provide an optimized environment for the development of helminth infections.

People in rural areas of Swat have difficulty in assessing good health care and basic health education; therefore diseases such as parasitic infections are still prevalent in urban areas also. The Ministry of public health should set a number of programs for awareness, education and control.

Un-hygenics and illiteracy are the conditions which continue to promote the transmission of geohelminth infections in past, present and in future because untreated or incompletely treated individuals can serve as wandering reservoirs of infection for long-lived parasites. To maintain a low prevalence of such infestations, the government should cover the cost of medical examination, laboratory test, treatment and medicines. These costs are high, bearing in mind that expenditure of international medical health care are increasing all over the world. It is recommended that health education should be increased to raise the awareness of the communities about such health problems.

CONCLUSIONS

Shepherds were found with low parasitic profile than education concerned and farmers. However the magnitude of *Ascaris lumbricoides* was high than other geohelminths. Males were more infected than females. Farmers and shepherds above 15 years while education concerned below 15 years were found more infected. A campaign should be launched on geohelminths infection,

their transmission and preventive measurements and control amongst farmers, schools and in public sectors.

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