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Soil transmitted helminth infections and their effect on nutritional status of children in Kashmir

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Abstract
The high prevalence of intestinal helminth infections among children living in developing countries impairs growth in these populations. Present study was aimed to compare the nutritional status of children infected by soil-transmitted helminths (STH) with uninfected children. Stool samples and Anthropometric measurements were taken from 382 children. Stool samples were processed by using both simple smear and zinc sulphate concentration methods. Nutritional status was assessed by Waterlows classification of the 382 children surveyed, 78.27% were infected by either *Ascaris lumbricoides* or *Trichuris trichiura* or both. Children infected by STH were found to be more malnourished than uninfected children. The present study concludes that Soil-transmitted helminths are abundant among school children of Kashmir valley which have a negative impact on their nutritional status.

Keywords: children, nutrition, helminth, nematode, Kashmir

1. Introduction
Soil-transmitted helminth infection is a major factor predisposing to poor nutritional status among children of low socioeconomic status in developing countries. However, studies on the impact of soil-transmitted helminth infection on nutritional status are limited [1]. Furthermore, most studies on the prevalence of helminth infections are limited to preschool children [2]. t is also important to determine the prevalence of helminth infections in older children and the effect of helminth infections on their nutritional status. This paper presents data comparing the prevalence of soil-transmitted helminth infections in children of Kashmir valley and the effect these infections on their nutritional status.

2. Material and Methods
Kashmir valley, situated at an altitude of 6000 feet, constitutes the major portion of Jammu and Kashmir State India, consisting of 10 districts, *viz*., Annantnag, Kulgam, Shopian, Baramulla, Ganderbal, Bandipora, Budgam, Kupwara, Pulwama, and Srinagar with about 46 Tehsils and about 50 towns. The study was carried out in all the 10 districts. This study was conducted between October 2016 to March 2017. Official meetings with the personnel from health services, city councils and schools, as well as parents and school children from the study sites, were carried out in order to explain the protocol of the study. In total 382 children which include 219 male and 163 female between the ages of 5-15 yrs. (9.2±2.3) with no disabilities or those not receiving antiparasitic treatment were included in the study. Initially 480 children accepted to participate but 98 were rejected during the study because they had contaminated faecal samples. Written consents were required from both parents in order for the children to participate. Children requiring medical assistance were properly treated or referred for medical attention. The children's ages were obtained through school records.

Stool examination
Fresh morning stool samples were collected in nylon containers containing 10ml. of 10% formaldehyde. The containers were labeled, and immediately transported to the parasitology laboratory, Department of Zoology, S. P. College campus, Cluster University of Srinagar, for further processing. The stool specimens were processed using direct smear and zinc sulphate concentration techniques.

Assessment of nutritional status
To study whether, there is any relation between, the helminth infection and the malnutrition in the children, nutritional status of the infected and normal children was estimated by using Waterlow's classification [3].

Waterlow's Classification
When a child's age is known, measurement of weight enables almost instant monitoring of growth. Measurements of height assess the effect of nutritional status on long-term growth.
Waterlow's classification defines two groups for protein energy malnutrition.

1. Malnutrition with retarded growth, in which a drop in height/age ratio points to chronic condition – shortness or stunting.
2. Malnutrition with low weight for a normal height, in which the weight for height ratio is indicative of an acute condition of rapid weight loss or wasting.

This combination of indicators makes it possible to label and classify children with reference to two poles: children with

insufficient but well proportioned growth and those with a normal height but who are wasted.

Interpretation of indications

$$\text{Weight/Height} = \frac{\text{Weight of the child}}{\text{Weight of the normal child at same height}} \times 100$$

$$\text{Height/Age} = \frac{\text{Height of the child}}{\text{Height of the normal child at same age}} \times 100$$

Table 1

Nutritional status	Stunting (%age of height/Age)	Wasting (%age of weight/height)
Normal	> 95	>90
Mildly Impaired	87.5 – 95	80 – 90
Moderately impaired	80 – 87.5	70 – 80

Weight in children was measured in Kilograms to the nearest decimal point, using a spring balance. Height was measured in centimeters to the nearest decimal point, using a measuring tape fixed to a wall. A computer program (SPSS 10.05 for Widows, Spss Inc. Chicogo, Illinois, USA) was used for data analysis. Differences were considered significant when P value of less than 0.05 was obtained.

3. Results

Among 382 children subjected to stool examination, data revealed that 299 (78.27%) cases were infected with either *Ascaris lumbricoides* or *Trichuris trichiura* or both. Single and mixed type infection was observed almost in equal proportions. 149 (39.0%) children were infected by single type of helminth, in which *Ascaris lumbricoides* was found in 91 (23.82%) and *Trichuris trichiura* in 58 (15.18%) children. Mixed type infection by *Ascaris lumbricoides* and *Trichuris trichiura* was observed in 150 (39.26%) children.

In the present study, nutritional status of the infected and uninfected children was observed. It was found that infected children were more prone to malnutrition 158 (52.84%) than uninfected children 17 (20.48%) [P<0.05]. Children infected by multiple types of helminths were found to be more malnourished 92 than children infected by single type helminth 65. Results of the present study show that *Ascaris lumbricoides* is the main helminth responsible for causing malnutrition, when present as a single infecting parasite than *Trichuris trichiura.*

4. Discussion

Results of the present study indicate a prevalence of 78.27% for soil-transmitted helminth infections. These figures when compared with studies conducted in other parts of the world show that Kashmir valley is one of the most hyper-endemic regions for intestinal helminthiasis. For example studies conducted on the frequency distribution of gastrointestinal helminths by Bundy *et al*. (1988), showed a high overall prevalence of 62% among the urban slum children of Malaysia [4]. Rodriguez *et al*., (2000) reported a high prevalence of 72% among the school children studying in a public institution in Maracaibo, Venezuela [5].

The high prevalence of Soil-transmitted helminth infections is a consequence of a low standard of living, poor sanitation, lack of personal hygiene, traditional methods of agriculture, indiscriminate defecation, the use of night soil as fertilizers and other occupational work.

Malnutrition was found to be prevalent in the children of Kashmir valley, but it was found to be more prevalent in children infected by gastrointestinal helminths than in uninfected children. Further, it was also observed that mixed type infection was responsible for causing more malnutrition than those with single type infection. These figures when compared to other parts of India (Table 3) show that in Kashmir valley, malnutrition is highly prevalent [6] and needs early attention of medical practitioners, social scientists, economists, governmental and non-governmental organizations. The reasons behind malnutrition are many, but from present study, it was clear that helminthiasis was one important factor responsible for malnutrition in already nutritionally compromised children. Various studies across the world show that Ascariasis causes malabsorption of Vitamin A; abnormal fat and increase intestinal transit time, which ultimately leads to malnutrition [7, 8, 9].

Table 2: Nutritional Status of Infected and Uninfected Children

Particulars	Normal	Mild Malnutrition			Moderate Malnutrition			Severe Malnutrition			Total Malnutrition			
		S (%)	W (%)	T (%)	S (%)	W (%)	T (%)	S (%)	W (%)	T (%)	S (%)	W (%)	T (%)	*P* value
Not infected	66 (79.51)	2 (2.4)	13 (15.6)	15 (18.07)	*	2 (2.40)	2 (2.40)	*	*	*	2 (2.4)	15 (18.07)	17 (20.48)	0.001
Infected	141 (47.1)	19 (6.35)	67 (22.40)	86 (28.76)	15 (5.0)	41 (13.71)	56 (18.72)	1 (0.33)	15 (5.01)	16 (5.34)	35 (11.70)	123 (41.13)	158 (52.84)	
Single type infection	84 (56.37)	10 (6.71)	34 (22.81)	44 (29.53)	5 (3.3)	13 (8.72)	18 (12.08)	*	3 (2.01)	3 (2.01)	15 (10.06)	50 (33.55)	65 (43.62)	0.08
Mixed type infection	58 (38.66)	9 (6.0)	33 (22.0)	42 (28.0)	10 (6.6)	28 (18.66)	38 (25.33)	1 (0.66)	11 (7.33)	12 (8.0)	20 (13.33)	72 (48.0)	92 (61.33)	
Infection by *Ascaris*	46 (50.54)	9 (9.89)	23 (25.27)	32 (35.16)	3 (3.2)	8 (8.79)	11 (12.08)	*	2 (2.19)	2 (2.19)	12 (13.18)	33 (36.26)	45 (49.45)	0.2
Infection by *Trichuris*	38 (65.51)	3 (5.17)	9 (15.51)	12 (20.68)	2 (3.4)	5 (8.62)	7 (12.06)	*	1 (1.74)	1 (1.74)	5 (8.62)	15 (25.86)	20 (34.48)	

Table 3: Prevalence of malnutrition in different Indian Cities[6]

City (Year)	Number	Classification	Prevalence
Vadodra (2002)	3157	IAP	63% Grade I-41% Grade II-20% Grade III-2%
Delhi (2001)	150	IAP	26% Grade I-11% Grade II-9% Grade III-6%
Varanasi (2001)	70	WHO	Chronic Energy Deficiency 51% Stunting 10%
Chandigarh (2000)	1400	IAP	67%
Delhi (1997)	630	WHO	Under weight 58%, Stunted 53%, Wasted 23%
Luckhnow	1061	WHO	Under weight 68%, Stunted 63%, Wasted 26%
Srinagar (1997)	584	IAP	60% Grade I-33% Grade II-21% Grade III-6%
Calcutta (1994)	1280	IAP	51% Grade I-28% Grade II-17% Grade III-7%
Bhopal (1992)	1000	IAP	63% Grade I-41% Grade II-15% Grade III-2%
Calcutta (1989)	601	Gomez and WHO	92% Grade I-40% Grade II-44% Grade III-9% Stunt 81% Wasted 9%

Other studies have described how even mild and moderate chronic helminth infection and anaemia impair the physical and mental development in children [10, 11, 12].

From the above discussion it is clear that communities, where intestinal helminth infections are rampant, are at more risk of becoming malnourished than those, where prevalence of helminth infections is low.

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6. References

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