

Intestinal Parasitic Infection with Nutritional Status among Orphan Children in three cities of Nepal: Prevalence and Associated risk factors

Chaudhary RB^{1,2}, Bhattachan B^{1,3}, Thapa Magar D¹, Dharmi RS¹, Karki AB¹, Sherchand JB³

¹ Shi-Gan International College of Science and Technology, Kathmandu, Nepal

² National Institute of Tropical Medicine and Public Health Research, Kathmandu, Nepal

³ Department of Microbiology and Public Health Research Laboratory, Tribhuvan University of Teaching Hospital, Kathmandu, Nepal

Corresponding authors: Mr. Ram Bahadur Chaudhary and Mr. Balkrishna Bhattachan

E-mail: ramtharool@gmail.com/ balkrishna_bhattachan@hotmail.com_

Abstract

Introduction: Intestinal parasitosis and malnutrition are common health problems among children in developing countries like Nepal. The aim is to determine the prevalence of intestinal parasites along with nutritional status in orphan children and find out its risk factors.

Methods: National Institute of Tropical Medicine and Public Health Research Laboratory, Kathmandu, Nepal had approved this research. Cross sectional study was conducted from January to June, 2014. Stool samples were collected in clean wide mouthed plastic container from ≤ 15 year's children of different orphanages in Chitwan, Kaski and Kathmandu Valley of Nepal. Socio-demographic information was collected using a structured questionnaire. Formalin-ether-sedimentation technique was done for detection of cyst and eggs of parasites. For nutritional status, anthropometric measurements were taken at the time of interview.

Results: In total of 309 orphan children (male: 167, female: 142), 20.3% (63/309) had some kinds of cysts or eggs of parasites. Altogether six different parasites were detected; in which infection rate of *Entamoeba coli* was highest 5.2% (16/309), followed by *Giardia lamblia* 3.6% (11/309), *Entamoeba histolytica* 3.6% (11/309), *Trichuris trichiura* 2.9% (9/309), *Hymenolepis nana* 2.3% (7/309) and *Ascaris lumbricoides* 1.2% (4/309). 1.6% had multiparasites. The prevalence of malnutrition was found to be 16.1% (50/309). Among those malnourished children, infection rate of parasites in obesity and thinness children were found 31.3% (5/16), and 25.8% (8/31) respectively.

Conclusion: Intestinal parasites and malnutrition are associated each other in orphan children with its risk factor like age, sex and other behavioral activities. Prevalence of protozoa was found higher than helminthes. Obesity was predominance in malnutrition children.

Keywords: Intestinal parasites, Nutritional status, Orphan-children, Kathmandu, Kaski, Chitwan, Nepal

Introduction

Intestinal parasitosis (IP) is a major public health problem, particularly in the developing countries. According to WHO, billions of people are affected by IP globally and millions are made ill, the majority being children.¹ Among the intestinal protozoan

parasites, *Entamoeba histolytica* causes death more than 100,000 annually.² Similarly, *Giardia lamblia* affects approximately 200 million people worldwide.³ However, intestinal helminthes, *Ascaris lumbricoides*, hookworm and *Trichuris trichiura* infect 1.4 billion, 1.3 billion and 1.0 billion people worldwide, respectively.⁴ IP, a major public health problem in south Asian countries

is aggravated by hot and humid climate, poverty, malnutrition, high population density, and poor health.⁵ Multiple socio-economic, cultural, physiological and behavioral parameters along with illiteracy and poor sanitation influence intestinal parasitic infection.^{6,7}

Malnutrition might be risk factor for parasites especially, Soil Transmitted Helminthes infection (STH), because of the high prevalence of malnutrition in Nepal.⁸ Of the indicators of nutritional status evaluated in previous studies, low body mass (BMI, 18.5) was significantly associated with STH infection among Pacific school children⁹ and hookworms infection among adults and the elderly in a rural area of Brazil.¹⁰ A higher incidence of whipworm infection among underweight preschool-age children in Peru¹¹ and school-age children in southwest China.¹²

In Nepal, the prevalence of intestinal parasitosis is reported considerably low to nearly cent percent,^{13,14} attributed to lower socioeconomic status and poor hygienic conditions.¹⁵ Nepal is a country landlocked between China and India. Geographically, it is divided into three regions: Himalayan, Mountain, and Terai region. The total population is nearly 30 million.¹⁶ This study was conducted in orphanages of Kathmandu, Chitwan and Kaski districts of Nepal. Kathmandu and Kaski districts are located in Mountain region whereas Chitwan district lies in Terai region of Nepal. The aim of this study is to determine the prevalence of intestinal parasitosis along with nutritional status in orphan children and find out its risk factors.

Methods

Study design and sites

A cross-sectional study was conducted from January to June 2014 from three well-facilitated districts. Study site was undertaken in Kathmandu, Kaski and Chitwan districts of Nepal. In Nepal, Kathmandu (capital city) is situated at an average elevation of 1,400 meters (4,600 ft) above the sea level and has an approximate population density of 4,416 per square km within a total area of 50.67 square kilometers (19.56 sq. m).¹⁷ Chitwan district is located southern part from capital city. It occupies 2,218 sq.km area which is 1.5% of

total area of Nepal. Moreover, Kaski district is located western part from Kathmandu. It covers an area of 2,017 square km and had a population of 492,098.

Sample collection

Prior sample collection, each child was informed its purpose and instructed the procedure how to collect the stool sample. Altogether 309 stool samples (about 20 gm fresh stools) were collected in a clean dry wide mouthed and screw capped plastic container. Study was designed on three cities of districts, Chitwan, Kaski and Kathmandu. The data were collected from trained volunteer. A short questionnaire was filled which included

- a. Demographic data: Age, Sex
- b. Behavioral data: Soil contact by bare foot, Nail biting habit

Children were interviewed in their mother tongue (Nepali). Design questionnaire were checked for accuracy. Written informed consents were taken from all participating children and their chief persons. Collected stool samples were fixed with 10% formal in and were transported to National Institute of Tropical Medicine and Public Health Research laboratory for further processing and these were processed by Formal–ether sedimentation technique.

Anthropometric survey

Trained field staff collected anthropometric measurements from the children, using a height measuring board and a digital scale (Seca 877; Seca, Germany) with a precision of 0.1cm and 0.1kg, respectively and adhering to standard procedures.¹⁸ Anthropometric indices were calculated in accordance with the WHO reference, using AnthroPlus (WHO; Geneva, Switzerland).¹⁹ Body Mass Index (BMI), defined as the weight in kilogram of the individual divided by the square of the height in meter, was used to determine the nutritional status of the orphan children into severe malnutrition (BMI < 15.9 kg/m²), moderate malnutrition (BMI = 16–16.9 kg/m²), mild malnutrition (BMI = 17–18.4 kg/m²) and normal (BMI = 18.5–25 kg/m²) as recommended by WHO.²⁰

Microscopic examination

Formal-ether sedimentation technique

About 3-4 ml of formalin fixed stool samples were kept in test-tube and shaken well for 2-3 minutes, then filtered using by cotton gauge. 3-4 ml of ether was added and shaken vigorously. Liquid suspension stool samples were centrifuged. Then four layers were appeared, sediment portion was tested by wet preparation with iodine solution. Cyst, Eggs or trophozoite of parasites were detected microscopically under 10X followed by 40X objectives.

Data analysis

Pearson's chi-square test of p values was calculated to determine the significance of result using SPSS version 16 for window program. The p-value < 0.05 was considered as statistically significant. The nutritional status was assessed by tallying the calculated BMI with the BMI chart of WHO.

Results

A total of 309 stool sample of children, ratio between male (167) and female (142) were 1.2 : 1, was studied, categorizing in to three age groups i.e. ≤ 5 , 6-10, 11-15 year. Out of 309 samples, 63(20.3%) samples had one or more intestinal parasites. The highest parasitic infection was detected among the children with Obesity 31.3% (5/16) followed by Thinness 25.8% (8/31), Normal 19.3 % (50/259) and severe thinness (0.0%).



Figure1. In orphan children, prevalence of intestinal parasitic infections in Kathmandu area was highest 21.5% followed by Kaski 20.8% and Chitwan districts 18.9%, were shown in fig1

Note: There are 14 zones in Nepal where n indicates the total number of orphan children of districts

Table 1. Socio-demographic and behavioral study of intestinal parasitic infection of Kathmandu, Kaski and Chitwan districts were shown in table 1.

Characteristics		Total (n=309)	Positive parasites (n=63)	P- value	Kathmandu n= 23	Kaski n= 20	Chitwan n= 20
			No. %		No. %	No %	No. %
Age (year)	≤5	41	6 (14.6)	>0.05	2 (4.9)	4 (9.8)	0 (0.0)
	6-10	99	27 (27.2)		10 (10.1)	8 (8.1)	9 (9.1)
	11-15	169	30 (17.7)		11 (6.5)	8 (4.7)	11 (6.5)
Sex	Male	167	32 (19.1)	>0.05	10 (5.9)	11 (6.5)	11 (6.5)
	Female	142	31 (21.8)		13 (9.2)	9 (6.3)	9 (6.3)
Soil contact by bare foot	Yes	90	30 (33.3)	<0.05	10 (11.1)	11 (12.2)	9 (10.0)
	No	219	33 (15.0)		13 (5.9)	9 (4.1)	11 (5.0)
Nail biting habit	Yes	69	24 (34.8)	<0.05	11 (15.9)	7 (10.1)	7 (10.1)
	No	240	39 (16.3)		12 (5.0)	13 (5.4)	13 (5.4)

Children with age group 6-10 years had the highest (27.2%) total parasitic infection (TPI) rate. TPI rate in female (21.8%) was higher than male (19.1%). Children with soil contact through bare foot had higher (33.3%) infection than those with no soil contact (15.0%). Those children having habit of nail biting had higher TPI rate (34.8%) than children without nail biting habit (16.3%). Detail description of parasitic infection rate in Kathmandu, Kaski and Chitwan district respectively were shown in table 1.

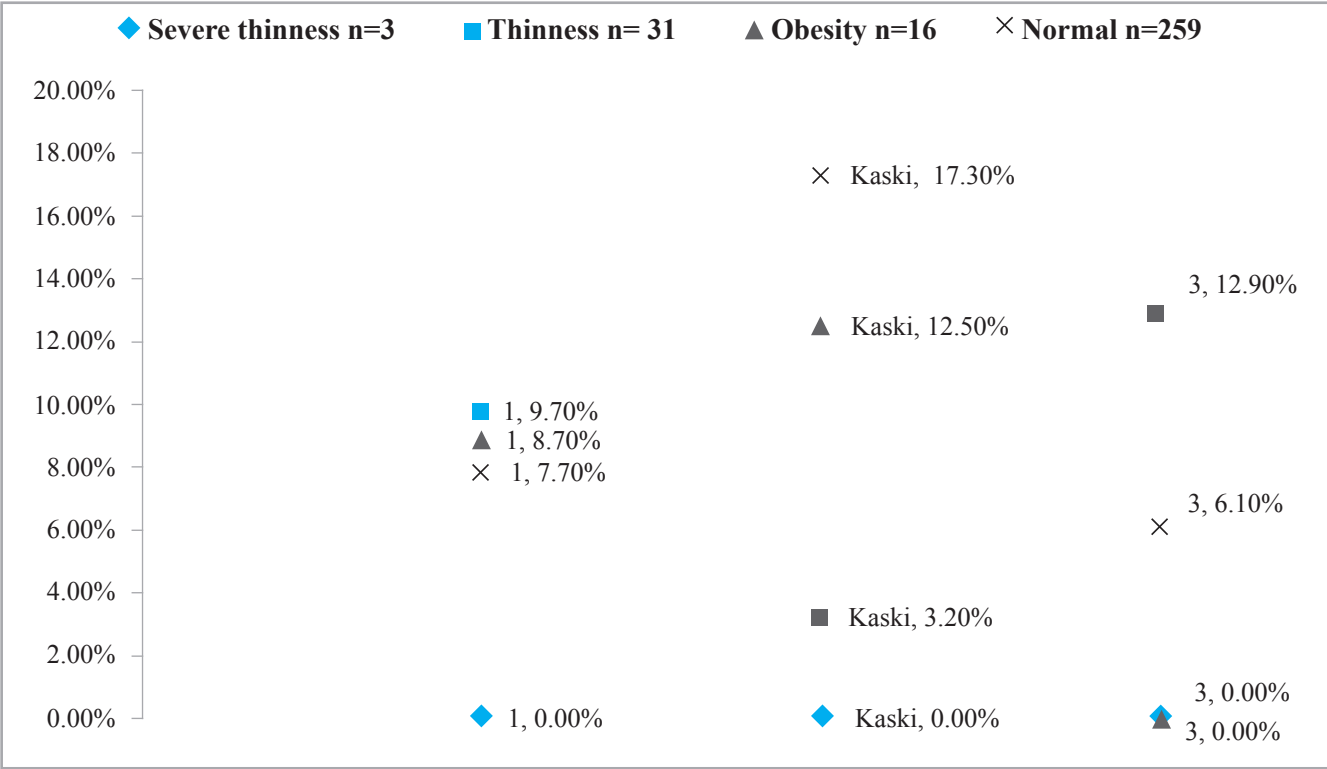


Fig 2. Nutritional status association with parasitic infection rate among orphan children in Kathmandu, Kaski and Chitwan respectively were shown in fig 2.

The parasitic infection, among children having thinness was highest (12.9%) in Chitwan followed by Kathmandu (9.7%) and Kaski (3.2%). Similarly, in obesity, parasitic infection was highest (12.5%) in Kaski followed by Kathmandu (8.7%) and Chitwan (0.0%). Detail description of Normal and severe thinness of children in Kathmandu, Kaski and Chitwan districts were shown in fig 2.

Table 2. Prevalence of intestinal parasites of orphan children in Kathmandu, Kaski, and Chitwan were shown in table 2.

Intestinal parasites	Kathmandu n= 23	Kaski n= 20	Chitwan n= 20	Total n=63	Prevalence (%) 20.3
Single parasites	No.	No.	No.		
Protozoa	14	12	12	38	12.3
<i>Giardia lamblia</i>	4	3	4	11	3.6
<i>Entameoba histolytica</i>	5	5	1	11	3.6
<i>Entameoba coli</i>	5	4	7	16	5.2
Helminthes	7	7	6	20	6.4
<i>Trichuris trichuria</i>	5	3	1	9	2.9
<i>Ascaris lumbricoides</i>	1	2	1	4	1.2
<i>Hymenolepsis nana</i>	1	2	4	7	2.3
Multi parasites	2	1	2	5	1.6
Protozoa	1	1	1	3	0.9
Helminthes	0	1	0	1	0.3
Protozoan+Helminthes	1	0	0	1	0.3

Infection rate of protozoa in children was higher (12.3%) than helminthes (6.4%). 1.6% had multiparasities. Infection rate of *Entamoeba coli* was highest 5.2% (16/309), followed by *Giardia lamblia* 3.6% (11/309), *Entamoeba histolytica* 3.6% (11/309), *Trichuris trichiura* 2.9% (9/309), *Hymenolepis nana* 2.3% (7/309) and *Ascaris lumbricoides* 1.2% (4/309). Detail description of intestinal parasites in Kathmandu, Kaski and Chitwan district at orphanages were depicted in Table 2.

Discussion

The study was carried out among orphan children of age ≤15 years from 11 different orphanages of Chitwan (2 orphanages), Kaski (4 orphanages) and Kathmandu Valley (5 orphanages), Nepal. Around 25 children were sheltered in one orphanage. Those orphanages were well facilitated and were conducted by Non-Governmental Organizations. Malnutrition and intestinal parasitic infections are common among orphan’s children in rural community of Nepal.²¹ Orphans children are the group of underprivileged children in society in the developing countries, where children are at high risk of intestinal parasitic infection due lack of medical facilities when

they are abandoned in young.²² In our study, intestinal parasitic infection was 20.3% in orphan-children of three-study site of districts in Nepal. Among them, infection rate of parasitosis in Kathmandu was most followed by Kaski and Chitwan districts.

Protozoan infection rate in orphan children was higher than Helminthes. In addition, highest infection rate in *E. coli* was detected (5.2%) whereas *A. lumbricoides* (1.2%) was lowest. In the previous study, highest infection rate of *Taenia* spp. was detected (21.0%) in school children in Chitwan, Nepal, (Bhattachan et al 2015),²³ and the highest prevalence rate was found in *G. lamblia* (7.4%) in Lalitpur, Nepal, (Tandukar et al 2013).²⁴ Moreover, of them *G. lamblia* was most common in Kathmandu, Nepal (Thapa et al 2011).²⁵ It might be due to some of the protozoan cyst are resistant to chlorinated drinking water. It may be due to the difference in the life cycle of the two types of parasites. Protozoan parasites are found in the stool immediately after the infection while considerably long time takes to appear the eggs of helminthes parasites in feces after de-worming .²³

In age group, the highest infection rate of parasites (27.3%) was detected in between 6-10 years of children. In previous study, infection rate of intestinal parasites detected (25.2%) in 6-12 year children in Chitwan, Nepal (Bhattachan et al 2015).²³ In contrast, infection rate of parasites was (19.2%) in 6-10 years school children in Lalitpur, Nepal (Tandukar et al 2013).²⁴ Children in this age move around over a wider territory, increasing the possibility of acquiring infection from contaminated environment. They need more healthcare and sanitation practice. This could be due to proper care given to children of less than 5 years and children of age group 6 to 10 years were likely to play outside with bare feet.

In our study, in malnutrition (16.1%), parasitic infection rate in thinness and obesity were 25.8%, and 31.3% respectively. In previous study, the overall prevalence of malnutrition was 21.2% and the most frequent type of malnutrition among parasitic infection was stunting (12.6%) (Reji et al 2011).²⁶ This could be due to the lack of balance diet and irregular health checkup of children and illiteracy of both children and caretaker.

In soil contact by bare foot, parasitic infection rate of children playing in muddy place (33.3%) was higher than those used shoes (15.0%) with significance ($P < 0.05$). In parallel study, in Ethiopia, parasitic rate of infection with no shoes wearing habit (9.5%) is higher than shoes wearing habit (4.2%) (Abate et al 2013).²⁷ Especially, the helminthes are refractory to host immunity. Eggs as well as larvae can reside on soil up to 3 weeks and can actively penetrate the skin (Bethony et al 2006).²⁸ This could be another reason for the higher prevalence of parasitosis among children playing bare foot.

In limitation of this study, we cannot show the detail measurement of Nutritional statistical data due to our research based on only association between malnutrition and parasitic infection of children. Moreover, researcher could not examine test of stool sample of all children due to informed consent and privacy of organization.

Conclusion

Our finding depicts that the parasitic infection and malnutrition is still high in orphan children though they are cared. The relation between intestinal parasites and nutritional status of orphan children was associated each other with its allied risk factors like age, sex, soil contact, nail biting habit, which helped to find out its prevalence and correlation. this finding suggest that

both the children and caregiver should be aware of proper sanitation and diet. Moreover, regular BMI assessment of children should be conducted. The government body and policy maker should play role for monitoring the orphanages regarding on the health of the children.

Conflict of interest: None declared.

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