GENDER VARIATIONS IN THE PREVALENCE OF PARASITIC INFECTIONS AND THE LEVEL OF AWARENESS IN ADOLESCENTS IN RURAL NEPAL

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Abstract. The study was conducted in rural school adolescent children to investigate the awareness and its association in parasitic infections in boys and girls. Of the 182 children examined 119 (65.3%) were male and 63 (34.6%) were female, age ranged 12-20 years with median age 15 years. Out of 182 stool samples examined 73 (40%) were found to be positive for parasites in which two or more parasites were found in 10 stool samples. *Giardia lamblia* 33 (18.1%) was the predominant parasite followed by hook worm 27 (14.8%) *Entamoeba histolytica* 13 (7.1%), *Ascaris lumbricoides* 05 (2.7%), *Hyminolepis nana* 02 (2.2%) and *Trichuris trichiuria* 01 (0.5%). Thirty-one (49.2%) in 63 females and 40 (33.6%) of the 119 males were positive for parasitic infections. The prevalence of worm infection was significantly higher in female children than male ($p \leq 0.05$). In contrast to the high parasitic prevalence rate in females they possessed significantly higher levels of awareness about parasitic infections. Out of 119 males 99 (83.2%) and 61 (96.8%) of the 63 females ($p \leq 0.05$) knew that worms suck food from host body. Similarly, 62.2% of males and 96.85 of females ($p \leq 0.05$) knew that parasites suck blood from human body. More study should be carried out to find out the gender difference in parasitic infection and level of exposure to risk factors.

INTRODUCTION

Nepal is a land-locked country, almost rectangle in shape situated on the southern slope of the Himalayas. The country is divided into Himalayas (snow land), mountain and tarai (flat land) regions which lie in between 70-8,848 meter altitude, southern part of the country. Nepal is a least developed country among the developing countries of the world. The country has approximately 23 millions population and about 92% people live in rural area. The per capita income is approximately US$ 200 and literacy rate is only 40%. The current study area is located in the central tarai region. Most of the population is agricultural based and rural in nature (Fig 1).

Parasitic diseases contribute significantly to the total morbidity in communities, particularly in the developing countries. Helminthic infection is a major public health problem in Nepal and the incidence varies in different ethnic groups which may be due to differences in environmental, behavioral and genetic factors (Williams-Blangero *et al*, 1993). Analysis of the Tribhuvan University Teaching Hospital (TUTH) record from 1985-1992 revealed that the positive rates of the intestinal parasites were 29.1 to 43% and higher prevalence was found in children (Rai *et al*, 1993). Some of the study also revealed that the prevalence of parasitic infection is more common in girls in comparison to boys (Sherchand *et al*, 1997). Recent study showed that the level of awareness of intestinal parasites was also very low and revealed that more than 90% of the studied population in one study did not have any awareness other than round worm (Rai *et al*, 1998). About 10% of the untreated cases are heavily infected and they tend to cluster in children (Warren, 1991). This study presents the prevalence of parasitic infection, awareness of the adolescents towards parasitic diseases and its gender difference.

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MATERIALS AND METHODS

Study area and population

The study was carried out in a rural high school located about 125 km from the capital Kathmandu. The school is located in the center of 10 villages having approximately 10,000 population. The population is rural in nature and nearly 99% of the people in this area are depending on agriculture. Most of the adult population were illiterate. The housing pattern was native and made of local materials and most of the houses did not have latrine. Soil contamination from feces was rampant. Treatment facilities were only available in the local market, which is about 4 km from the study area. The district hospital is located in 25 km distance. Most of the people get water from shallow tube well. The high school where the study was performed is the only one in 10,000 population, however there are many primary schools located in this region. The map of the survey area is shown in Fig 1.

One hundred and eighty-two adolescent children (12-20 years old) who registered voluntarily for physical examination and submitted their stools for examination were included in this study.

Specimen collection and examination

Fecal samples were collected in clean and dry plastic containers. Examination of the feces was done in duplicate by making saline and iodine smears on the same day by medical laboratory technologists in the field. Those students who were positive with helminthic parasites were treated with mebendazole and those positive for protozoal parasites were prescribed metronidazole and diloxanide furate according to their body weight. In addition, health education program was also arranged by using different posters and flip chart. Furthermore, an interaction session was also arranged in the evening during which time parents were free from their agricultural and household duties and discussed the results of the stool test and other health issues.

Awareness of the students on parasitic diseases

The study also measured the knowledge, attitude and practice (KAP) to assess the level of the awareness of the students on parasitic diseases. Simple structured questionnaire survey was used to assess the KAP, which was done inside the class room in the presence of investigator and a class teacher.

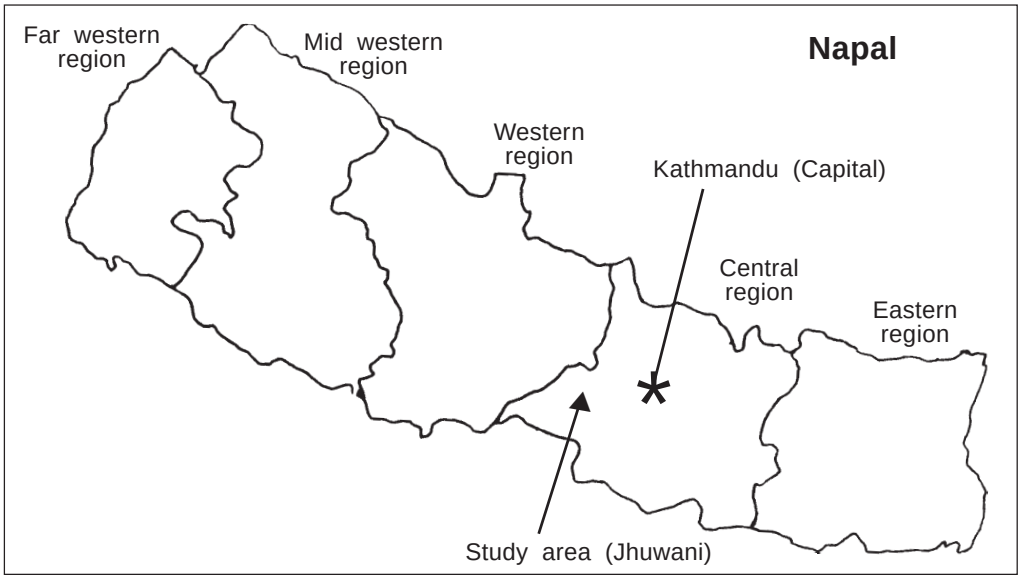

Fig 1–The map of the study area.

Data analysis

Data were analyzed by using EPI info version 6 statistical program using appropriate statistical packages.

RESULTS

Characteristics of the study population

Of the 182 school children examined, 179 children were 12-18years age group and only 3 children were above 18 years of age. In Nepal, the enrolment of girls in school is still low, therefore of the total 182 stools examined only 63 (34.6%) were from females and 119 (65.3%) were from males. It was found that most girls get married while they are around 16 years old. Because of that, proportionally less and less number of girl population were seen in higher age groups.

Characteristics of the population

Mean age (year):	15.07 years
Median	15 years
Range	12-20 years
Male	119 (65.3)
Female	63 (34.6)
25 percentile	14 years
75% percentile	16 years

Distribution of the parasitic infection

Of the 182 stool samples tested, 73 (40.0%) were positive for parasitic infection. The highest rate of infection was *Giardia lamblia* (18.1%). Of the 73 positive samples, 10 samples were mixed parasitic infection. The predominant parasites were protozoal group of parasites followed by nematodes. The highest rate of positivity in males was *Giardia lamblia* whereas hook worm was most prevalent (Table 2) in female cases.

Comparison on the level of KAP

Even though most of the families in the study area consume vegetable grown in their own farm, 84.1% of male and 93.7% of females children did not know that consumption of green vegetables without proper washing and cooking can transmit worm infection. Similarly, 70.6% of males and 71.5% of females did not know that consumption of meat without

Table 1
Age and sex distribution of children in the study sample.

Age (years)	Male	Female	Total	%
12	02	01	03	1.6
13	18	13	31	17.0
14	23	15	38	20.9
15	20	16	36	19.8
16	31	10	41	22.5
17	16	05	21	11.5
18	06	03	09	4.9
19	02	0	02	1.1
20	01	0	01	0.5
Total	119	63	182	100
Percent	65.3	34.6	99.9	

Table 2
Distribution of worm infection according to gender.

Type of parasite	Male	Female	Total	Prevalence (%)	p-value
Hook worm	12	15	27	14.8	
Ascaris lumbricoides	04	01	05	2.74	
T. trichiura	01	0	01	0.5	
H. nana	02	0	02	2.2	
Gardia lamblia	21	12	33	18.1	
E. histolytica	06	07	13	7.1	
Total positive cases	42	31	73	40.0	
Total no tested	119	63	182		
Prevalence rate (%)	33.6	49.3			<0.05

Table 3
Comparison of level of KAP in male and female children.

KAP (Level of awareness)	Gender and response				p-value
	Male		Female		
	Yes	No	Yes	No	
Consumption of green vegetable without proper washing and cooking leads to parasitic infection	19	100	04	59	>0.05
Percentage	15.9	84.1	6.3	93.7	
Consumption of meat without adequate cooking causes parasitic infection	35	84	18	45	>0.05
Percentage	29.4	70.6	28.6	71.4	
Naked feet walking can lead to parasitic infection	89	30	51	12	>0.05
Percentage	74.8	25.2	81.0	19.0	
Defecation on courtyard causes parasitic infection	105	14	59	14	>0.05
Percentage	88.3	11.7	93.6	6.4	
Defecate in latrine always	90	29	60	03	<0.05
Percentage	75.6	24.4	95.2	4.8	
Parasites suck food from the body	99	20	61	02	<0.05
Percentage	83.2	16.8	96.8	3.2	
Parasites suck blood from the body	74	45	61	02	<0.05
Percentage	62.2	37.8	96.8	3.2	

proper cooking could cause some types of parasitic infections. In contrast, 74.8% of males and 81% of females believed that walking with naked feet could lead to worm infestation. In addition 88.3% of males, 77.8% of females believed that defecation on courtyard might cause worm infection.

Significantly high percentage (Table 3), 95.7% females used to defecate in latrine in comparison to 75.7% male children ($p \leq 0.05$). Also, significantly high percentage of girls had knowledge that parasites can consume food and blood from the host body ($p \leq 0.05$).

DISCUSSIONS

The study was aimed to find out the prevalence of parasitic infections in adolescent children in a rural, agricultural based area and to find out their KAP to parasitic diseases.

Of the 182 stool samples examined, 73 (40.0%) samples were positive for parasites. Out of 182 samples tested, 42 males (33.6%) were positive and of the 63 samples tested from females 31 (49.3%) were positive. Significantly high level ($p \leq 0.05$) of parasites were found in females. Among the helminthic and protozoal parasites, *Giardia lamblia* was the predominant parasite followed by hookworm. *Giardia lamblia* was the most commonly prevalent parasite in males and hookworm in females.

The outcomes of present study differed from most of previous studies which revealed that round worm was the most prevalent parasites (Rai *et al,* 1993; 1998; Sherchand *et al,* 1998; Williams-Balangero *et al*, 1993) whereas *Giardia lamblia* was the most commonly found parasite in the present study. However, hook worm infection was found in higher rate in our study and it concedes with previous studies (Rai *et al,* 1993; Sherchand *et al,* 1998). Hook worm infection was most prevalent in pregnant

women (Vaidya and Acahrya, 1998) and rural children (Sherchand *et al,* 1998). But most of the previous studies did not compare the prevalent of parasitic infection in males and females (Table 4) even though gender difference is very important.

Intestinal parasitic infections persist and flourish wherever poverty, inadequate sanitation, insufficient health care and overcrowding are entrenched. Ascariasis is a mirror of socioeconomic status, a reflection of environmental sanitary practices and an indicator of a presence or lack of health awareness and health education whereas *Necator americanus* is common species of hook worm in rural communities where the environmental condition favor the developmental stages (Crompton and Savioli, 1993). Although most of previous studies revealed highest prevalence rate of round worm infection this study revealed the prevalence of study only 2.7% of the population. This could be related to high level of health awareness of the children, which is shown in Table 3. The high prevalence of hookworm infection can also be interpreted with rural nature of the population and also to the exposure to paddy field without wearing shoes especially during the cultivation. This study concedes with another study done in Indonesia which showed significantly lower prevalence of *Ascaris* and *Trichuris* infections in those who graduated from senior high school or university. The factors influencing soil transmitted helminth infection includes natural factors such as temperature and humidity and socioecological factors, structure of dwelling, life style, and habits of food consumption. However, the construction of latrine and improvement of education might contribute to the decrease of infection rate of soil transmitted helminth (Toma *et al,* 1999).

When male and female children were born in a family, the family gives completely difference preference for their development. The majority of Nepalese society is patrimonial and girl leaves their parents after marriage. Traditionally, the parents believe that only male child will take care and look after them when they become old, almost all the opportunity is therefore preferentially given to the male children. Even now in many rural areas, girls are not enrolled in school and their job at home is to look after their younger sibling, help cooking and to look and support her mother in household work. In addition, they are also

Table 4
Summary of other studies in Nepal.

Author and year	Population characteristics and major findings
Rai *et al,* 1993	Approx 30,000 population during 1985-1990 in central region, Teaching Hospital. Total prevalent rate was 29-43%. Hook worm was the most prevalen parasite followed by round worm.
Rai *et al,* 1998	Studied in 261 school children in central and 242 eastern region. Prevalent rate was 57.5 and 55.4 and round worm was most common.
Sherchand *et al,* 1997	604 children, 0-9 years old, southeastern, rural village. Prevalent rate was 60%, hook worm 11.6% followed by round worm.
Sherchand *et al,* 1998	Chisapani VDC, eastern region, in a primary school in Nepal, 135 male and 84 female children were studied. Prevalent rate 87.7 and round worm 14.6% and hook worm 11.5%.
Vaidya and Achrya, 1998	3,732 pregnant women in Maternity Hospital, Kathmandu, 34% were positive, 15.7% for hook worm and 8.6% for whip worm.
Williams-Balangero *et al* (1983)	450 people 0-45 years old +age group in Giri village central region. Round worm, whip worm and hook worm were in decreasing order and more common in Girel ethnic group.

suppose to raise cattle and collect firewood from the jungle and bring water from a water source. Only female members and especially daughters-in-law do the cooking and cleaning the house. The discrimination of female which shows the level of gender bias in Nepal, which is one of the countries where women still die younger than men. Literacy rate of women is only 25% compared with 54.5% of men. Even infant mortality rates favor boys over girls (Butcher *et al*, 1997).

Although many studies revealed the prevalence of different parasites but those studies did not determine gender differences and other responsible factors. This study showed that 84% of the 119 males and 93.7% of 63 females did not know that consumption of green vegetables without proper washing and cooking can transmit parasitic infections. In addition, 20-25% of boys and girls do not know that that bare-foot walking can cause worm infection which could be the cause for high prevalence (14.8%) of hook worm infection in that particular population. In the present study significant difference was found in male and female adolescent in defecating behaviors such as 75.5% of the males and 96.8% of females ($p \leq 0.05$) used latrine all the time. Similarly, 83.2% of males and 96.8% of the females ($p \leq 0.05$) believed that parasites can suck food from the body. And 62.5% of males and 96.8 females believed that parasites suck blood from the body. Significantly higher percentage of girls had knowledge than males that parasites suck food materials and blood in human (Table 3).

The present study revealed that even though female students had high level of awareness, they were found having significantly high level of parasitic infection. Hence, future studies should not concentrated only on the prevalence of the parasitic infection but should also give an attention to the socio-ecological and exposure to risk factors with emphasis on gender differences. Furthermore, more studies should be done in rural and difficult parts of the country since most of previous studies were done in central and eastern semi-urban and urban areas.

ACKNOWLEDGEMENTS

We are most grateful to Dr YP Singh for his advice and comments. We are also grateful to school headmasters Mr Kaladhar Aryal, Mr Gopal Prasad Rijal, Mr Tunga Prasad Adhikari, Mr Janak Adhikari and Mr Basu Dev Dhungana who provided us every help. We are also thankful to all school teachers and students of Jhuwani High School and all the community members who rendered heart felt cooperation. We also thank JOCV for partial support.

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