

Prevalence of Intestinal Parasites and Associated Risk Factors in Chepang Community of Saktikhor Area, Chitwan, Nepal

Srijana Adhikari, Janak Raj Subedi*, Shanti Chaudhary

Central Department of Zoology, Tribhuvan University, Kathmandu, Nepal.

Abstract: Objective: Pathogenic species of protozoa and helminth cause intestinal parasitosis, which continues to be a significant community well-being issue in many regions of the world, especially in pastoral regions of developing countries like Nepal. The study focused on determining the prevalence of intestinal parasitic infections and the associated risk factors among the people of the Chepang community of the Saktikhor area in the Chitwan district.

Materials and Methods: A transversal study was conducted between May 2017 and October 2017, with a total of 125 participants. The fecal samples were examined using a wet media (saline media, iodine preparation), concentration and sucrose flotation method. The association between risk factors and parasitic prevalence was evaluated using the Pearson's chi-square test.

Results: The general prevalence of intestinal parasite infection was 52%. Infections with soil-borne helminth were more common than those with cestodes and protozoa. Common intestinal parasites included *Ascaris lumbricoides* (69.23%), *Trichuris trichiura* (9.23%), Hookworm (7.69%), *Strongyloides stercoralis* (4.62%), *Hymenolepis nana* (6.15%), *Taenia* sp. (6.15%), and *Entamoeba coli* (9.23%). High prevalence of infection was observed among male (53.96%) participants and those aged over 20 years (69.44%). Pearson's chi-square test revealed a substantial relationship between prevalence of parasite and age group ($P=0.0452$), hand washing material ($P<0.001$) and preference for defecation site ($P<0.001$).

Conclusion: Hence, a heavy occurrence of intestinal parasites within the Chepang community is particularly evident. There is a need for increased emphasis on intrusion, which can be achieved by improving personal hygiene and sanitation of participants and constructing proper sanitary toilets to prevent the spread of parasitic infections.

Keywords: IPIs, Helminth, Cestode, Protozoan, HMP, NTDs, Community, Prevalence.

INTRODUCTION

Pathogenic helminth and protozoan species are responsible for intestinal parasitic infections (IPIs) [1]. They belong to neglected tropical diseases (NTDs) [2-5] and are globally endemic [6]. Over 24% of people worldwide are infected with IPIs, the bulk of who live in underdeveloped nations [7]. These infections are among the widespread disease globally, with sub-Saharan Africa, Southeast Asia, China, South India and South America being the most endemic areas [8, 9]. Indeed, a highlight of the human microbiome project was the assessment of intestinal parasites (IPs) [10]. However, given that the project focused predominantly on western populations, the present comprehension of IP distribution unavoidably concentrated on European and American enterotypes [11]. There is less knowledge about the formulation of the IPs in Asian people, notably, in evolving or underdeveloped countries [12]. The IPIs have also affected Nepal, a little, underdeveloped nation in South Asia [13]. Abdominal infection still has an elevated prevalence of 48.9% [14] and 54.0% [15] as shown by studies in several regions of Nepal. In Nepal, the most common parasites recorded are *Ascaris lumbricoides*, Hookworm, *Hymenolepis nana*, *Trichuris trichiura*,

Giardia lamblia, *Entamoeba histolytica* [16]. The parasites play substantial purpose in nutrient biotransformation and inherent immunological reactions [17-19]. The unevenness of the make-up of the parasite has been displayed to be related with the establishment of diseases such as inflammatory intestinal tract infection, corpulence, diarrhea, weakness, and even carcinoma sometimes [20-22].

There are various risk factors associated with the transmission of intestinal parasites. People still have cultural values in rural areas regarding their food and have poor personal hygiene and sanitation [23]. In rural communities, parasites passed down via ingestion are commonly found. In people who regularly eat fresh vegetables and raw meat infected with food borne pests, infection may occur [24, 25]. In people who walk shoeless on contaminated soil or eat soil-polluted food, soil transmissible parasites (nematodes) may occur [26, 27]. Other elements linked with intestinal parasitosis are the deficiency of drinkable water and warm and moist tropical environment [28, 29]. One of the Sustainable Development Goals of the United Nations is to end NTDs epidemics by regulating the transmission of IPIs and mitigating potential risk factors (2030 Agenda; Goal 3.3).

Several infectious diseases, like intestinal parasitosis, are

*Address correspondence to this author at the Central Department of Zoology, Tribhuvan University, Kathmandu, Nepal.
Email: janzoology@gmail.com

commonly found in deprived and vulnerable populations like Chepang because of their poor hygiene management, deficiency of clean drinking water, lack of healthcare facility, lack of education, and other basic needs [15, 30, 31]. In addition, they have poor quality of life [32]. A recently conducted experiment on the Chepang community of Makwanpur district revealed an overall prevalence of 39.8%, and the most prevalent helminth and protozoan were *A. lumbricoides* (15.6%) and *E. histolytica* (5.4%) respectively [33]. No other works are recorded in the gut microflora of this community. Understanding how the parasites' alter through communities provides a representative to assess the susceptibility of infection of various communities and to promote the establishment of community-targeted drugs. The objective of this study is to find out the prevalence of intestinal parasites in the Chepang community and to identify the risk factors associated with the prevalence of parasites.

MATERIALS AND METHODS

Study Design and Area

A transversal study was conducted between May 2017 to October 2017 and incorporated the Chepang community residing in Saktikhor area of Chitwan district, Nepal (Fig. 1). The Saktikhor area is situated approximately 160 km west of the Kathmandu valley. For this study, people were randomly selected using voluntary sampling technique. A total of 125 individuals were enlisted. The information on socio-demographic specifics and risk factors were collected using pre-tested question sets. The question sets included the parameters like Gender (Male/Female), Age groups (2-10 years/11-20 years/20 years above), Education (Literate/Illiterate), Occupation (Agriculture/Other), Number of family members ($<5/\geq 5$), Feeding habit (Vegetarian/Non-vegetarian), Eating undercooked food (yes/No), Drinking water treatment (Yes/No), Use of handwashing material (Water only/Soap), Defecation site preference (Open field/Toilet) and Barefoot walking habit (Yes/No).

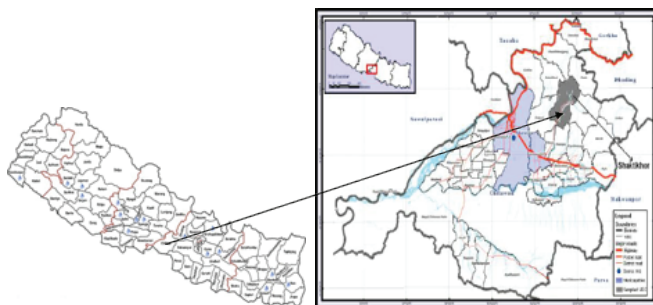


Fig. (1). Map of Nepal Showing Saktikhor Area, Chitwan.

Study Population

Chepang community is one of the highly marginalized ethnic communities of Nepal, residing on the mountains and sharpest slopes of Chitwan, Dhading, Gorkha, Makawanpur, Lamjung, and Tanahu districts [34]. They have a population of 68,399, accounting for 0.26% of Nepal's total population [35]. The Chepang people's basic way of living involves hunting, fishing, searching for wild tubers, and conventional method of cultivation in proximity of forests [36].

Sample Collection, Preservation and Examination

Neat plastic vessels were provided to the participants with thorough guidance about fecal sample collection. The fecal samples were collected in the morning time and preserved in 2.5% $K_2Cr_2O_7$ solution before transportation to the laboratory of Central Department of Zoology, Tribhuvan University, Kathmandu. Each sample was examined carefully for the detection of intestinal parasites by Wet mount (saline mounts and iodine preparation), concentration and sucrose floatation method.

Data Analysis

The data collected from laboratory reports and field surveys were filed as numbers and percent. The R-studio software windows version 1.1.463 was used to analyze the data. Pearson's chi-square test was performed to evaluate the association between potential risk factors and prevalence of intestinal parasite. A p-value of <0.05 is considered to be statistically significant.

RESULTS

Prevalence by Socio-Demographic Characteristics (Age, Sex)

A total of 125 participants, 63 (50.4%) male individuals and 62 (49.6%) females, were included in this study. The overall prevalence of intestinal parasitic infection was 52% (65/125). The prevalence rate was 53.96% (34/63) in males and 50% (31/62) in females. There was no significant difference in the prevalence of parasites between the two sexes ($p=0.791$). The participants of the age group 20 above had a higher prevalence rate of 69.44% (25/36) when compared to other age groups [2-10 years 42.85% (6/14), 11-20 years 45.85% (34/75)]. Significant difference was seen in the prevalence of parasites among different age groups ($p=0.045$).

Distribution of Parasites

All together seven species of intestinal parasites were recorded from the fecal sample of the study populations of the Chepang community. Six species were helminths and one was protozoan. The prevalence of intestinal helminths and protozoans was 90.77% (59/65) and 9.23% (6/65), respectively. The most common intestinal parasites were soil-transmitted

helminths which included *Ascaris lumbricoides* 69.23% (45/65), *Trichuris trichiura* 9.23% (6/65), Hookworm 7.69% (5/65), and *Strongyloides stercoralis* 4.62% (3/65). Two cestodes and one non-pathogenic protozoan identified were *Hymenolepis nana* 6.15% (4/65), *Taenia* sp. 6.15% (4/65), and *Entamoeba coli* 9.23% (6/65) respectively.

Intensity of Single, Double and Triple Infection of Parasites

Regarding the intensity of infection, single infection (84.61%, 55/65) was more common compared to double (13.85%, 9/65) and triple infections (1.54%, 1/65) as shown in Table 1, 2 and 3 respectively. In single infection, the highest intensity was of *Ascaris lumbricoides*. Similarly, in double infection, the combination of *Ascaris lumbricoides* and *E. coli* had highest

intensity. The combination of *Ascaris lumbricoides*, *Strongyloides stercoralis* and *Trichuris trichiura* showed triple infection in a participant.

Risk Factors Associated with Intestinal Parasitic Infections

For the analysis of association of risk factors with prevalence of parasite, Pearson's chi-square test was conducted. There was no significant association between intestinal parasitic infection and gender ($p=0.79$), education ($p=0.96$), occupation ($p=0.27$), number of a family members ($p=0.27$), feeding habit ($p=0.15$), eating undercooked food ($p=0.50$), drinking water treatment ($P=0.05$), and barefoot walking habit ($p=0.91$). However, three risk factors were identified that were associated with parasitic infection. Those were age

Table 1. Intensity of Single Infection of Parasite.

S.No.	Parasites	Total Infected	No. of Infected Male	Percentage of Infected Male (T=65)	No. of Infected Female	Percentage of Infected Female (T=65)
1.	<i>Ascaris lumbricoides</i>	39	25	38.46%	14	21.54%
2.	<i>Taenia</i> sp.	4	3	4.62%	1	1.52%
3.	Hookworm	3	1	1.52%	2	3.08%
4.	<i>Entamoeba coli</i>	3	1	1.52%	2	3.08%
5.	<i>Hymenolepis nana</i>	3	2	3.08%	1	1.52%
6.	<i>Trichuris trichiura</i>	3	1	1.52%	2	3.08%
	Total	55	33	50.77%	22	33.84%

Table 2. Intensity of Double Infection of Parasites.

S.No.	Parasites	No.	No. of Infected Male	Percentage of Infected Male (T=65)	No. of Infected Female	Percentage of Infected Female
1.	<i>A. lumbricoides</i> + <i>T. trichiura</i>	1	-	-	1	1.52%
2.	<i>A. lumbricoides</i> + <i>H. nana</i>	1	-	-	1	1.52%
3.	Hookworm+ <i>E. coli</i>	1	-	-	1	1.52%
4.	<i>E. coli</i> + <i>A. lumbricoides</i>	3	1	1.52%	2	3.08%
5.	<i>T. trichuris</i> + <i>S. stercoralis</i>	1	-	-	1	1.52%
6.	Hookworm + <i>E. coli</i>	1	-	-	1	1.52%
7.	<i>S. stercoralis</i> + <i>E. coli</i>	1	-	-	1	1.52%
	Total	9	1	1.52%	8	12.31%

Table 3. Intensity of Triple Infection of Parasites.

S.No.	Parasites	No	No. of Infected Male	Percentage of Infected Male (T=65)	No. of Infected Female	Percentage of Infected Female
1.	<i>T. trichiura</i> + <i>S. stercoralis</i> + <i>A. lumbricoides</i>	1	-	-	1	1.52%
	Total	1	-	-	1	1.52%

groups ($p=0.045$), hand washing material ($p<0.001$) and defecation site preference ($p<0.001$).

DISCUSSION

The general prevalence of intestinal parasite in Chepang community living in the Saktikhor area of Chitwan district was 52%. A recent study of the same ethnic community of Makwanpur district [33] and studies on other indigenous communities of Nepal [12, 37] showed lower prevalence rates than the present study. Moreover, the prevalence rate was also lower in both national and international scenarios too done with school age children of different parts of the world [38-43]. The outcome of this study documented the high prevalence of soil-transmitted helminth compared to cestode and protozoan parasite. The result is similar to the researches done in intestinal parasite of the children, which also showed a high prevalence of helminth parasites in those children [44-46]. However, the study contradicted the findings of some previous studies which discovered a low prevalence of helminth parasites [1, 47]. The finding of this study is similar to some other works as they also reported a low prevalence of protozoan parasite [23, 48]. The variation of intestinal parasites in these communities may be due to variation in territory, age groups, education, environmental sanitation, and cleanliness behavior of the members.

Gender-wise, the prevalence rate was slightly higher in males compared to females. This result is in accordance with a retrospective study in a tertiary care hospital of Nepal [49] and in studies of parasites in children of Nepal [50-53] and other countries [54, 55]. Additionally, the age-wise prevalence was higher in the age group of above 20 years which is slightly similar to the study in human intestinal parasite of Shiagu of Abia state [56]. The high prevalence of parasites in males and in the age group above 20 years might be because they are the bread earners of the family and mostly work outside of the house in fields without using any safety measures to prevent parasite infection.

Ascaris lumbricoides was the most prevalent helminth recorded with a prevalence rate of 69.23%. The result is similar to the findings of various studies [56-59] which also recorded a high prevalence of *A. lumbricoides*. The other recorded helminths in this study were *T. trichiura*, Hookworm, and *Strongyloides stercoralis*. This high prevalence of helminths, particularly, *A. lumbricoides* in the study population might be due to poor hygiene conditions, lack of awareness, open place defecation, and contamination of food and water. *A. lumbricoides* eggs can survive a long time in the environment compared to other helminth eggs [37]. This might be the reason that its prevalence rate is higher than other helminths. The occurrence of cestodes like *Taenia* sp. and *Hymenolepis nana* in the study population may be due to consumption of uncooked or inadequately cooked meat. The only protozoan parasite recorded in this study is *Entamoeba coli* which

contributes 9.23% of total infection. The finding of this research is in agreement with the study in school children of Kathmandu [60] and South Chennai, India [61] which also recorded the prevalence of *E. coli* as protozoan parasite in their study. *Entamoeba coli* are generally non-pathogenic. However, it sometimes causes diarrhea and its occurrence may be because of fecal contamination of water source. Various studies on the intensity of parasitic infections showed a high prevalence of single parasitic infection than that of double and multiple infections [39, 62, 63]. These studies resemble our finding, which also showed the high intensity of a single infection, and the least was a triple infection. This study also assessed the relationship between prevalence of parasite and potential risk factors among the participants.

The prevalence of parasite was irrelevant with gender, education, occupation, number of family members, feeding habit, eating undercooked food, drinking water treatment, and barefoot walking habit of the participants. The finding of our study was consistent with earlier studies conducted in different parts of Thailand [47, 64-66]. Pearson's chi-square test revealed a notable relationship amid the prevalence of intestinal parasite and age groups. The participants of the age group above 20 years had a significantly larger infection rate compared to other age groups. Also, the rate of infection was remarkably linked with handwashing material and defecation site preference. People who used to wash their hands only with water and those who defecate in open places were mostly infected. The results are similar to the findings obtained in other previous works too [67-69]. As a whole, a remarkable relationship was seen between the prevalence of parasites and age group, use of handwashing material, and defecation site preference of the participants of that specific examined region.

CONCLUSION

Hence, this study shows a significant occurrence of intestinal parasites among the Chepang people of the Saktikhor area of Chitwan district. These infections result mainly from poor hygiene and sanitation condition of the people of that area and lack of proper sanitary toilets. Consequently, the concentration on intrusion should be given to curtail infection rate in that particular area which can be done by improving personal hygiene and sanitation of the participants and by constructing proper sanitary toilets. This, in turn, will help to prevent contamination of soil, food, and water.

AUTHORS' CONTRIBUTION

Srijana Adhikari : Data curation, formal analysis, investigation and writing-original draft.

Janak Raj Subedi : Conceptualization, data curation, investigation, methodology, supervision, writing-review & editing.

Shanti Chaudhary : Conceptualization, methodology, writing-review & editing.

CONFLICT OF INTEREST

Declared none.

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