Original Article

Prevalence of intestinal parasites in humans and domestic animals in Jirel community, Dolakha, Nepal

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Abstract

Introduction: Gastrointestinal (GI) parasites are major health concerns in both humans and domestic animals. Livestock farming is one of the common livelihood practices in rural Nepal. The proximity at human and domestic animal interface increases the chances of dissemination of enteric parasites, especially those of zoonotic importance. This study was aimed at finding the parasite prevalence and risk factors in both humans and their domestic animals in Jirel community. **Materials and Methods:** A field survey was conducted on the Jirel ethnic people and their domestic animals in Dolakha district, where a total of 152 fresh fecal samples from humans and domestic animals (cow, pigs, goats, chickens, ducks, and pigeons) were collected. The feces were examined by wet mounts and concentration techniques. A structured questionnaire survey was carried out among the local people and owners of the domestic animals to gather sociodemographic information, awareness, and hygienic practices in relation to parasite transmission. **Results:** The enteric parasite prevalence was found to be highest in goats (80.0%;12/15), followed by pigs (55.55%;5/9), cows (45.45%;6/11), chickens (11.7%;4/34), and humans (1.41%;1/71), while the fecal samples of ducks and pigeons did not contain any parasites. The only parasite identified in humans was *Ascaris lumbricoides.* Similarly, three genera of GI parasites (*Eimeria* sp., *Strongyloides* sp, and *Trichuris* sp.) from goats, two genera each from cow (*Eimeria* sp. and *Strongyloides* sp.), pigs (*Entamoeba* sp. and *A. suum*), and chickens (*Eimeria* sp. and *Ascaridia galli*), were detected. **Conclusions:** Based on the direct field observation, questionnaire survey and laboratory analysis, it is concluded that the Jirel community people are aware of health and hygiene; however, intervention measures are necessary to prevent parasitic infection in their domestic animals.

Keywords: Domestic animals, intestinal parasites, Jirel, Nepal, prevalence

Introduction

Intestinal parasites cause significant morbidity and mortality, especially in humans and animals in endemic countries.[1] Globally, gastrointestinal (GI) infections are common, particularly in communities with low socioeconomic status, illiteracy, ignorance, poor housing conditions, and unhygienic lifestyles. The food- and water-borne parasitic infections affect deprived and poor people

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of low- and middle-income countries mostly in tropical and subtropical areas.[2] It has been linked to serious public health issues in rural areas of several developing nations, including Nepal.[3] In Nepal, intestinal parasite infections are widespread, and it has been considered to be a serious public health concern.[4] Lack of awareness, inadequate hand washing after defecation, not taking antiparasitic medication, and contaminated drinking water are some of the predisposing factors. Similarly, in domestic animals, certain factors like season, agro-climatic regions, and management practices have a notable influence on GI parasitism.[5]

Most common human pathogenic protozoan parasites are *Giardia lamblia*, *Entameoba histolytica*, *Cryptosporidium*, and *Cyclospora cayetanensis*.[6] The most common intestinal worms, also called geo-helminths and soil-transmitted helminthes, globally reported are *Ascaris lumbricoides*, *Trichuris trichiura*, and hookworm (*Ancylostoma duodenale* and *Necator americanus*).[7] Therefore, amoebiasis, ascariasis, hookworm infection, and trichuriasis are among the ten most common intestinal parasitic infections in the world.[8]

Commonly occurring enteric parasites in small ruminants like goats and sheep are *Eimeria*, *Haemonchus*, *Ostertagia*, *Strongyloides*, *Oesophagostomum*, *Bunostomum*, and *Trichostrongylus*, while in domestic pigs are *Cryptosporidium*, *Balantidium coli*, *Ascaris suum*, *Oesophagostomum*, *Strongyloides ransomi*, *Taenia solium, Trichostrongylus axei*, and *Trichuris suis*.[5,9] GI parasites especially helminthes are prevalent globally in chicken afflicting production efficacy.[10] The susceptibility of the definitive host, availability of the intermediate hosts, agro-ecological characteristics of different regions, climatic factors,[11] temperature, and humidity[12] have been incriminated as the determinant factors in relation to the occurrence and intensity of helminth parasites.

One of the common livelihood practices in rural parts of Nepal, including the Jiri village of Dolakha district, is livestock farming. The domestic animals are either kept in captive or semicaptive or mixed farming system. The fecal matter of these animals is used as farm manure. As intestinal parasites of zoonotic importance are ubiquitous, they pose public health threats to both humans and animals because of their proximity coupled with sanitation and hygienic measures.[13] Jiri is well known as one of Nepal's best trekking routes and tourist hot spot as it is the main gateway to the Mount Everest region. Primary care physicians (PCPs) are among the health professionals who come in the first contact with the individuals having any kind of ailments or infections. The role of PCPs is crucial in minimizing and/or preventing the spread of communicable parasitic infections through awareness. In the Jiri community, there is no comprehensive study regarding the GI parasite infection prevalence in humans and domestic animals after the introduction of a nationwide deworming program for children under 5 years since 2003, which provided deworming tablets biannually. Therefore, a field visit was conducted in this ethnic community to collect fecal samples of humans and domestic animals and gather sociodemographic information with an emphasis on determining the prevalence of GI parasites and associated risk factors.

Materials and Methods

Study area

Jiri Municipality is located in Dolakha district (27°33'48″ to 27°46'26″ N and 86°11'19″ to 86°25'50″ E) in Bagmati Province, Central Nepal [Figure 1]. It is the land of ethnic people called the Jirels and they love themselves being called Jiriba. Characterized by the humid, subtropical, and dry winter climate with the maximum temperature around 30°C, Jiri is the major entrance to the Everest region, which is located approximately 190 km east of the Kathmandu valley. Jiri is well known for tourism as it is naturally endowed with lush foliage, lovely waterfalls, and rural landscapes.

Ethical clearance

The field visit and sampling were carried out with prior oral consent from the people participating in the study at the witness of the local community leader. None of the recruited humans and animals in the study were harmed during sampling.

Field visit, questionnaire survey, and sample collection

Field visit and sampling was conducted in April 2022. On the first day of the field visit, the participants were gathered in different groups; the objective and benefit of participating in the study was discussed among them; they were provided with sterilized wooden spatula, sample collection vials, and zipper plastic bags. Thirty-three households were randomly selected for collection of fecal samples and personal interview. All the participants were informed that they had the right to withdraw consent at any time. Only the participants who had not taken anthelmintic drugs in last six months were informed to collect fresh feces in the morning and transfer it into the already provided sterile vial and then into the zipper plastic bags. They were also instructed not to contaminate the feces with urine or soil. A sufficient number of samples from pigs were not possible as only three households

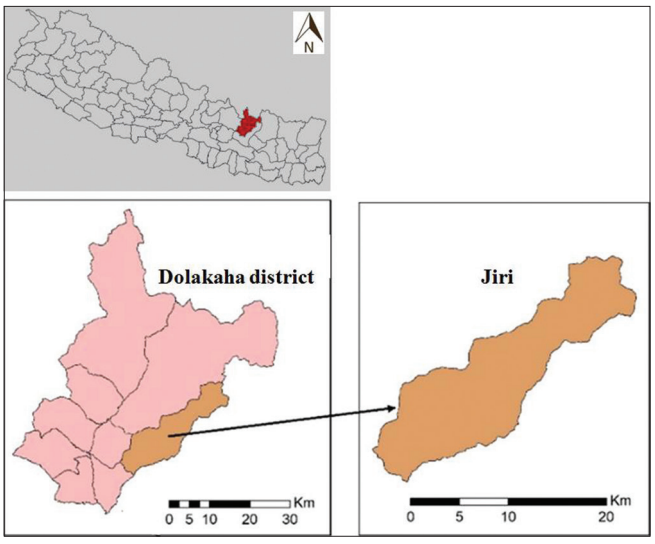

Figure 1: Location map of the Jirel community, Jiri, Dolakha district, Nepal

had reared pigs. Fecal samples of poultry were obtained from their respective pens. A total of 152 fecal samples (humans, $n = 71$; goats, $n = 15$; cows, $n = 11$; pigs, $n = 9$; chicken, $n = 34$; ducks, $n = 7$; pigeons, $n = 5$) were collected. All the collected fecal samples were visualized for their consistency, color, and presence of blood, mucous and adult helminth parasites or segments, and labeled properly. The samples were received in the morning of the following day and preserved in 2.5% potassium dichromate solution and transported to lab. A questionnaire survey, group discussion, and personal interview were carried out with the participants to gather socio-demographic information.

Microscopic examination and identification

All the fecal samples were processed through wet mounts (physiological saline and 1% Lugol's solution), floatation (saturated sodium chloride solution; specific gravity 1.2), formal-ether sedimentation, and modified Ziehl-Neelsen stain method as described earlier.[14-17] The wet mounts of the fecal specimens were examined under high power (×400), and stained smear under oil immersion objective (×100). The parasites were identified on the basis of morphological characters.[14,15,18]

Results

Demographic information of the human participants under study was recorded during field visits [Table 1]. Most participants (≈89%) responded that they wash their hands with soap before eating and after using the toilet. The majority of the respondents also mentioned that they had good hygiene practices like regular trimming fingernails and wearing boots or shoes while walking outside. About 76% of the participants responded that they had taken anthelmintic medication in the previous six months.

None of the human fecal samples had neither mucous nor blood, and adults or segments of helminths. The majority of the samples were brown color with solid consistency. Out of 71 total samples examined, only one (26 years male) was found shedding the eggs of *Ascaris lumbricoides*. Among the examined fecal samples of pigs, 55.55% (5/9) were positive for at least one GI parasite, and two genera of GI parasites namely *Entamoeba* sp. (11.11%;1/9) and *Ascaris suum* (44.44%;4/9) were recorded. Based on the questionnaire survey, none of the family members associated with pig rearing was diagnosed to have any GI parasites. Likewise, 55% (6/11) feces from cows were diagnosed with the infection of *Eimeria* sp. (36.3%;4/11) and *Strongyloides* sp. (18.1%;2/11). The analysis of fecal samples of goats revealed that 80% (12/15) were positive for Strongyle-type eggs (53.33%;8/15), *Strongyloides* sp. (40%;6/15), *Trichuris* sp. (5.8%;2/15), and *Eimeria* sp. (5.8%;2/15). However, none of the trematode and cestode parasites were recorded. Very few of the fecal samples of chicken (11.7%;4/34) were found positive for GI parasites, two each for oocysts of *Eimeria* sp. and eggs of *Ascaridia galli*; however, none of the samples of duck and pigeon were positive for any GI parasites [Table 2 and Figure 2].

Table 1: Socio-demographic characteristics of the human participants

Demographic variables	Characteristics	Frequency	Percentage
Gender	Female	43	60.56
	Male	28	39.44
Age (years)	≤15	18	25.35
	16–30	13	18.31
	31–45	9	12.68
	≥46	31	43.66
Drinking water	Tap water	46	64.79
	Boiled water	25	35.21
Hand wash before meal and after defecation	With soap and water	63	88.73
	With water only	8	11.27
Self-rated health	1	2	2.82
	2	10	14.08
	3	23	29.58
	4	27	38.03
	5	9	12.68
Nail trimming habits	Yes	41	57.75
	No	10	14.08
	Sometimes	20	28.17
Wearing shoes outdoor	Yes	44	61.97
	No	11	15.49
	Sometimes not	16	22.53
Noticed worms in the stool	Yes	5	7.04
	No	66	92.96
Raw meat consumption	Yes	0	0.00
	No	71	100
Use of anthelmintic drugs (in the last 6 months)	Yes	54	76.06
	No	17	23.94
Presence of free-ranging poultry	Yes	43	60.56
	No	28	39.44
Covering prepared food	Yes	67	94.36
	No	4	5.63
Diarrhea/abdominal discomfort	Yes	4	5.63
	No	58	81.69
	Sometimes	9	12.68
Personal hygiene	Yes	29	40.84
	Sometimes	39	54.93
	No	3	4.22

The characteristics of the rearing system of poultry by the local farmers were assessed during a questionnaire survey [Table 3]. Forty-one individuals involved in poultry keeping were requested for key information about poultry keeping practices. Most of the farmers (90.24%; 37/41) responded that they keep their poultry in captive, and only four farmers responded that they keep them in the free-range system. None of the farmers used antiparasitic drugs on their poultry.

Discussion

Infection with intestinal parasites in humans is widespread throughout the world; however, it is preventable through awareness and hygienic practices which can be effectively implemented by the direct involvement of medical professionals like PCPs. Contrarily our study reported only 1.41% prevalence of the intestinal parasite (only *A. lumbricoides*) in humans, while

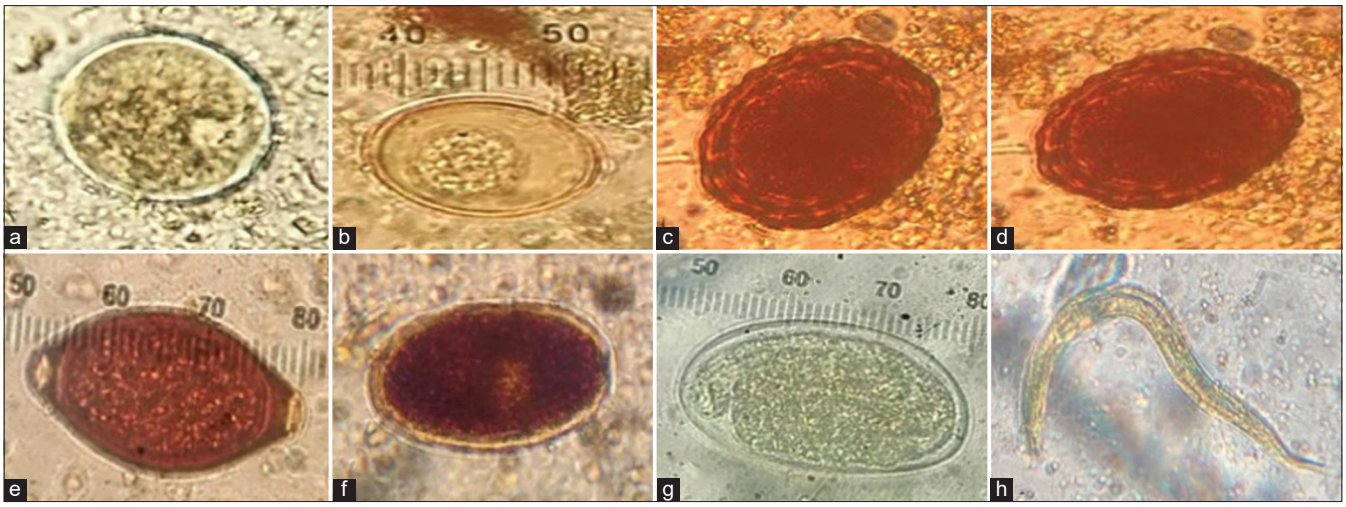

Figure 2: Intestinal parasites identified in humans, cows, pigs, goats, and chickens in the Jiri community, Dolakha. a: Cyst of *Entamoeba* sp.; b: Oocyst of *Eimeria* sp.; c: Egg of *Ascaris suum*; d: Egg of *Ascaris lumbricoides*; e: Egg of *Trichuris* sp.; f: Egg of *Ascaridia galli*; g: Embryonated nematode egg; h: Larva of *Strongyloides* sp

Table 2: Host-wise prevalence of GI parasites

Hosts	Sample number	Total prevalence (%)	Parasite wise prevalence (%)	
Humans	71	1.4% (1/71)	*Ascaris lumbricoides*	(1.4% (1/71)
Pigs	9	55.55% (5/9)	*Entamoeba* sp.	(11.11%; 1/9)
			Ascaris suum	(55.55%; 4/9)
Cow	11	54.54% (6/11)	*Eimeria* sp.	(36.3%; 4/11)
			Strongyloides sp.	(18.1%; 2/11)
Goat	15	80.0% (12/15)	*Eimeria* sp.	(5.8%; 2/15)
			Strongyle-type eggs	(53.33%; 8/15)
			Strongyloides sp.	(40%; 6/15)
			Trichuris sp.	(5.8%; 2/15)
Chicken	34	11.7% (4/34)	*Eimeria* sp.	(5.8%; 2/34)
			Ascaridia galli	(5.8%; 2/34)
Duck	7	No parasite detected		
Pigeon	5	No parasite detected		
Total	152	18.4% (28/152)		

Table 3: Characteristics of poultry rearing practice in the Jirel community

Questionnaire	Response	Frequency	Percentage
Rearing system	In captivity	37	90.24
	Free range	4	9.75
Coop cleaning	Everyday	4	9.75
	Every week	30	73.17
	Once a month	6	14.63
	Occasionally	1	2.43
Training for rearing	Yes	-	-
	No	41	100
Eating well	Less	-	-
	No change	41	100
Chicken health	Sick	1	2.43
	Healthy	40	97.56
Treatment	Frequently	2	4.87
	When sick	39	95.12
	Never	-	-

5.63% of respondents reported that they had experienced diarrhea or abdominal discomfort which could be associated with other enteric parasites that were not detected in this study or may be due to some other reasons beyond the scope of this study. This very low prevalence could be due to the positive impact of periodic deworming practice, improved socioeconomic status and public awareness, good hygiene, and health measures among the people as witnessed during the field visit. A lower frequency was found in many earlier studies conducted in rural areas. According to some surveys, the overall parasite infection rate in humans was found to be 11% (11/163) in Bharatpokhari, Kaski,[19] 11.3% (4/70) in Nawalpur district,[20] and 8% (8/100) in immunocompromised cancer patients in hospital-based study.[21] Similarly, in Sarki ethnic community, 31.32% (156/498) were positive for GI parasites;[22] however, as high as 97% (97/100) were found in the indigenous Chepang people in central Nepal.[3] Some other earlier studies[23,24] have reported that the prevalence of GI parasite infection in humans was recorded as much lower

in those who used soap and water after defecating than in people who only used water, and the prevalence rate was higher among kids who had the habits of biting their nails. Since about 89% of the participants in this study responded that they wash their hands with soap before eating and after defecation, and 86% trim their fingernails, this study is congruent with the previous findings of a very low prevalence of intestinal parasites.

Food handlers or those involved in the preparation and serving of food and who have poor personal hygiene may pose a risk of spreading intestinal parasites to the general public in a community.[25] The frequency of intestinal parasites, particularly pathogenic protozoa, was found to be associated with unhygienic food handling practices.[26] Since 94.36% of participants in our study responded that they had the regular practice of covering their prepared food. Therefore, in this study, the absence of protozoan parasites in human fecal samples is reasonable. A previous study conducted among the Jirel population of eastern Nepal showed that they were dissatisfied with biomedical approaches, and they were frequently unable to confirm the efficacy of drug therapy as they continuously observed adult worms in their stools.[27] However, our study reported that 76.06% of the participants had used anthelmintic drugs in the last six months. This reflects their positive attitude towards the available biomedical measures and facilities at the local level. Moreover, 80.29% of respondents rated themselves as having good health conditions. Other demographic characteristics such as wearing shoes in outdoor work, avoiding consumption of raw meat and good hygienic behaviors justify the very low prevalence of intestinal parasite in humans as reported in this study.

Majority of the small-holder pig farms in rural villages of Nepal are operated as a free-range system, where *Ascaris suum*, *Strongyloides* sp., *Trichuris suis*, several strongyle nematodes, and protozoan parasites have been reported.[3,28] In similar types of studies conducted in India[29] and Korea,[30] 28.4% (238/839) and 46.7% (170/364) pigs were reported to have infections of various types of GI parasites, respectively. Despite a very small sample size in our study (as more numbers of pigs were not available in the study area), we have reported *Entamoeba* sp. and *A. suum*. It indicates that the prevalence of GI parasites in pigs could be higher with a diversity of parasites in other nearby areas where an extensive survey is worthwhile considering this study as a pilot survey. The total prevalence of helminths was higher than that of protozoan parasites in this survey. As observed in the field visit, the pig rearing practice apparently looked satisfactory in terms of cleaning measures. However, keeping pigs in groups in single pigsty and lack of training to the farmers could be attributed to the present prevalence of GI parasites in them.

On the other hand, the overall prevalence of GI parasite in cattle (54.54%) is in agreement with the higher prevalence reported in stray cattle in the Kathmandu valley (72%;72/100),[31] Thailand (96.09%;320/333),[32] India (43.03%;256/595),[29] and Colombia (50.5%;101/200).[33] In our study, about 67% of the parasite-positive cows were found shedding oocyst of *Eimeria* sp. Bovine coccidiosis has a common prevalence in almost all cattle-raising areas.[34] *Eimeria* is capable of adapting to diverse climatic conditions and has a long life span as it is protected within the oocyst. The higher prevalence of *Eimeria* sp. in this study may be associated with contaminated pastures used for cattle grazing.[12]

The higher prevalence of GI parasites in goats in this study (80.0%;12/15) is worth comparing with that reported in Malaysia (79.4%;251/316)[35] and South Africa (37.1%; 107/288).[36] It might be because most of the goats were released outside to graze, and possibly they had infections from the contaminated environment and food. Likewise, 100% of the goats under study were found positive for GI parasite in Rwanda[37] and Thailand.[38] Ruminants including goats are significantly affected by strongyle nematodes.[39]

GI parasite infection prevalence in chickens varies in different countries, such as 40% (50/125) in Nepal,[40] 92.2% (224/243) in the Philippines,[41] and 65.5% (131/200) in Ghana.[42] In a global and regional review, it was found that the chicken raised in the free-range system had a significantly higher pooled prevalence (84.8%) than in the backyard system (82.6%).[10] Since very few chickens in this study (9.75%) were free range, opportunities for parasitic transmission could, therefore, be low. During field observation, chickens and ducks were found in separate sheds with proper sanitation, proper food, and hygienic environmental conditions. In this study, the absence of parasites in ducks and pigeons might be attributed to the smaller sample size and we did not notice any opportunity to encounter with intermediate host of cestodes and trematodes in the study area. However, this study was circumscribed by some limitations like a short time of only two days visit and inadequate response by some of the participants. Nevertheless, based on the results obtained in this study, it is worthwhile to recommend that intervention measures are crucial at the local level in order to minimize the infection prevalence in domestic animals and humans through primary preventive measures.

Conclusions

The extremely low prevalence of intestinal parasites among humans in the Jirel community could be attributed to periodic deworming practice, hygiene, and health awareness. The moderate to high prevalence in domestic animals might be associated with environmental and food contamination. The improved health facilities and positive perception of the community people can help reduce the burden of enteric parasite infection. Yet, periodic monitoring of domestic animals to identify the sources of infection and possible preventive measures is necessary.

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Conflicts of interest

There are no conflicts of interest.

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