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Seasonal prevalence of gastrointestinal parasites of goats in North -East Himalayan region of Sikkim, India

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ABSTRACT

The present study was conducted to determine the reasonality of gastro intestinal parasitism in goats in a selected area in Sikkim. Of the total 1,921 faecal samples examined 1,258 (65.49%) were positive for different gastrointestinal parasitic infections with eggs per gram of faeces (EPG) in the range of 100–4,800. The most prevalent gastrointestinal helminth parasite eggs detected were strongyles (63.51%), *Eimeria* (54.51%), *Strongyloides* (34.25%), *Moniezia* (32.12%), *Nematodirus* (22.33%), *Trichuris* (11.71%), *Dicrocoelium* spp. (10.20%) and amphistome (8.95%) in decreasing order. The prevalence of gastrointestinal parasitic infection was high in August (82.22%) and low in January (44.08%). The seasonal distribution of gastrointestinal parasitism indicated higher percentage of infection during summer (75.29%) followed by autumn (74.54%) and spring (64.23%). The infection rate was significantly lower in winter (51.33%).

Key words: Gastrointestinal parasites, Goat, Seasonality, Sikkim

The gastrointestinal parasitic infections of goats and sheep have been investigated in different climatic environments of India (Tariq *et al*. 2010, Sharma *et al*. 2013, Bhat *et al*. 2014) and of the world (Ratanapob *et al*. 2012, Gizachew *et al*. 2014). However, the seasonal prevalence of gastrointestinal helminths parasitizing these animals in sub-tropical and humid climatic environment similar to the North-East Himalayan region of Sikkim, India, has not been investigated previously. The prevalence of gastrointestinal nematode infection is very high in Sikkim (Rahman *et al*. 2012, Pal *et al*. 2014, Pal *et al*. 2015). The aim of this investigation was to determine the seasonality of gastrointestinal parasitism in goats as monitored by faecal egg counts during 12–month period in the goats of a selected region in Sikkim.

MATERIALS AND METHODS

Faecal samples of 1,921 goats (youngs and adults) of both sexes and different ages were collected from 13 different places situated at the elevations of 600 to 1,600 m amsl of Sikkim between February 2013 and January 2014 and subjected to qualitative and quantitative examination of gastrointestinal parasites (Soulsby 1982) and the parasites were identified by examining the eggs (Soulsby 1982).

The meteorological data (total rainfall, mean maximum and minimum monthly temperature and average relative humidity) for the study area are shown in Fig. 1.

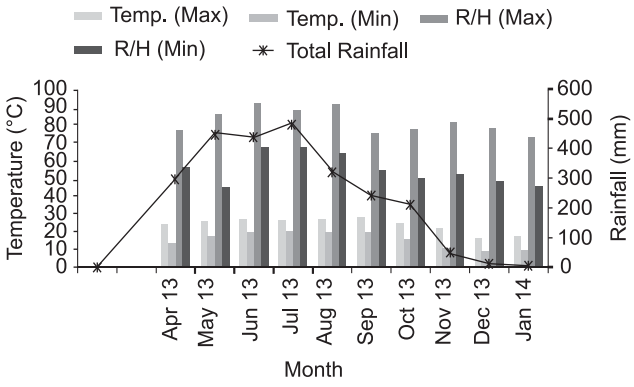

Fig. 1. Average relative humidity, mean monthly maximum and minimum temperature 0, and total rainfall at Tadong, Gangtok during the study period.

RESULTS AND DISCUSSIONS

Of the 1,921 domestic goats examined, 1,258 (65.49%) were found to be infected with one or more parasite species (Table 1). The seasonal prevalence of gastrointestinal parasitic infections was monitored by recording the numbers of animals infected with one or more helminth species by quarter during one calendar year (Tables 1, 2). The highest prevalence of gastrointestinal (GI) parasitism was found in August (82.22%) and the lowest rate was observed in

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Table 1. Seasonal distribution of gastrointestinal parasite abundance, epg range and mean epg counts using coprological examination of examined goats and degree of EPG

Season	Number of goats examined	Percentage of egg positive goats	EPG range	Mean epg count	EPG Category (%)		
					Low	Moderate	Severe
Spring (March-May)	534	343(64.23)	200-1600	817.00	65(12.17)	207(38.76)	71(11.42)
Summer/Rainy (June-August)	425	320(75.29)	600-4800	2100.34	43(10.12)	112(26.35)	165(38.82)
Autumn/post-rainy (September-November)	436	325(74.54)	1200-4400	2000.33	54(12.39)	123(28.21)	148(33.95)
Winter (December-February)	526	270 (51.33)	100-1200	667.01	111(21.11)	122(23.19)	07(1.33)
Total	1921	1258(65.49)	100-4800	1396.17	323(16.81)	564(29.36)	391(20.35)

Table 2. Parasite-wise seasonal prevalence in goats of Sikkim using coprological examination

Parasites	Spring (March-May)		Summer (June-Aug)		Autumn (Sep-Nov)		Winter (Dec-Feb)		Total	
	No. of animals infected (n=534)	Percentage (%)	No. of animals infected (n=425)	Percentage (%)	No. of animals infected (n=436)	Percentage (%)	No. of animals infected (n=526)	Percentage (%)	No. of animals infected (n=1921)	Percentage (%)
Strongyles	332	62.17	319	75.06	321	73.62	248	47.15	1220	63.51
*Strongyloides*spp.	105	19.66	193	45.41	247	56.65	113	21.48	658	34.25
*Trichuris*ovis	39	7.30	66	15.53	83	19.04	37	7.03	225	11.71
*Nematodirus*spp.	156	29.31	117	27.52	102	23.39	54	10.27	429	22.33
Amphistome spp.	39	7.31	51	12.01	54	12.38	28	5.32	172	8.95
Dicrocoelium spp.	45	8.43	57	13.41	51	11.67	43	8.17	196	10.20
Eimeria spp.	288	53.93	273	64.23	274	62.84	212	40.31	1047	54.51
Monieziaexpansa	193	36.14	185	43.53	128	29.36	135	25.67	617	32.12
Total	343*	64.23	320	75.29	325	74.54	270	51.33	1258	65.49

*Total no. of animals affected is less than the summation of individual infection because same animal was infected with more than one type of gastro-intestinal parasite: n, total number of samples collected.

January (44.08%) (Fig. 2). During December, January and February the recorded mean egg counts were above 400 eggs per gram of faeces (epg). The highest prevalence rate was observed during the rainy season (75.29%) and the lowest during the winter (51.33%; Table 1). Upon grading the level of prevalence, all the seasons had high prevalence. The seasonal pattern observed was that more eggs were found from June (end of pre-monsoon) to July/August. In the summer (rainy) and autumn (post-rainy) seasons, higher mean egg counts and animals found positive were recorded as compared to any other season with the highest epg counts of 2100.34 and 2000.33, respectively (Table 2). With the beginning of the winter from December onwards, the mean total egg count reduced to low level, steadily decreasing to a minimum of 450.50 epg in January; it then rose sharply with the increase in rainfall. The greater proportions of study animals (29.36%) were with moderate EPG while fewer (16.81%) showed low to severe infection rates (Table 1). The distribution of eggs was significantly different ($P<0.001$) among seasons. The rainy and post-rainy season had higher egg counts compared with both the winter and spring season. The prevalence rates in the summer (75.29%) and autumn (74.54%) seasons were significantly higher than the spring (64.23%) or winter (51.33%) season (Table 2). During these periods, two peaks were identified in March/April and August/September. However, gastrointestinal parasitic infections was determined to occur throughout the year, agreeing with Rahman *et al*. (2012) in Sikkim, Kapoor (2013) in Kullu valley and Bhat *et al*. (2014) in Kashmir valley in India.

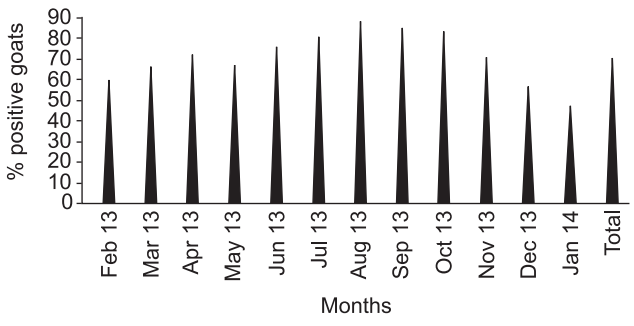

Fig. 2. Monthly prevalence of gastrointestinal parasitism in examined goats using coprological examination in 2013/2014.

Table 3. Number of goats examined and the seasonal pattern of gastrointestinal parasitic infection according to sex of the examined goats using coprological examination

Season	Male		Female	
	n	Number (%) of positive goat	n	Number (%) of positive goat
Spring (March-May)	219	136 (62.10)	315	207 (65.71)
Summer (June-Aug)	227	165 (72.69)	198	155 (78.28)
Autumn (Sep-Nov)	205	146 (71.22)	231	179 (77.49)
Winter (Dec-Feb)	260	127 (48.85)	266	143 (53.75)
Total	911	574 (63.01)	1010	684 (67.72)

Table 4. Number of goats examined and the seasonal pattern of gastrointestinal parasitic infection according to age of the examined goats using coprological examination

Season	1-2 years (young)		>2 years (adult)	
	n	Number (%) of positive goat	n	Number (%) of positive goat
Spring (March-May)	193	118 (61.14)	341	225 (65.98)
Summer (June-Aug)	206	145 (70.39)	219	175 (79.91)
Autumn (Sep-Nov)	195	142 (72.82)	241	183 (75.93)
Winter (Dec-Feb)	179	85 (47.48)	347	185 (53.31)

The high prevalence during the rainy and post-rainy seasons may be due to favourable conditions for the development of larvae in the host and environment and also the availability of intermediate host (Lone *et al*. 2012). High rainfall in spring also helps in providing suitable molarity of salt present in soil, which is an important factor for ecdysis (Soulsby 1982). Moreover, high humidity and moderate temperature during the monsoon also favoured bacterial multiplication, which was used as nutrition by free living larvae for their survivability (Katoch *et al*. 1998). Thus, the presence of sufficient feed during rainy season could in turn increase the nutritional status, and these well-fed animals developed good immunity that suppressed the fecundity of the parasites. Relatively low infections recorded during winter could be associated with the absence of or harbouring of immature larvae and/or low level of infection.

The low mean epg value observed January to May might be associated with self-cure phenomenon (Soulsby 1982). The result was in accordance with earlier workers (Lone *et al*. 2012, Singh *et al*. 2013, Bhat *et al*. 2014). Sanyal and Singh (1995) reported increased parasite burden both inside the host as well as on the pasture during rainy season in seven different agroclimatic zones of India. The present observation also indicated similar trend with minor modification owing to various agroclimatic conditions and timing of onset of monsoon in the study area.

The result in this study could be because most of the goats were from lower altitude, low ridge areas, which are thought to be suitable for the survival of larval stage of the parasites. More importantly, the condition could be due to less or slow development of immunity in goats to gastrointestinal parasites compared with the situation in sheep and cattle (Regassa *et al*. 2006).

Further analysis of data revealed that the highest prevalence was of strongyle (63.51%) followed by *Eimeria* (54.51%), *Strongyloides* (34.25%), *Moniezia expansa* (32.12%), *Nematodirus* (22.33%), *Trichuris ovis* (11.71%), *Dicrocoelium* (10.20%) and amphistome (8.95%). Seasonal prevalence of different genera and species of parasites are depicted in Table 3. The various species of endoparasites recovered during present investigation have been reported by various researchers in different parts of the world (Nwosu *et al*. 2007, Gizachew *et al*. 2014). A variety of factors like grazing habits, level of education and economic capacity of the farmers, standard of management and anthelmintic used can influence the prevalence of helminthes (Bhat *et al*. 2014).

Female goats had higher prevalence rates in all the seasons than male goats (Table 4). In the rainy and post-rainy seasons highest prevalence rates were recorded in both sexes. Male animal had the lowest prevalence in the winter season as compared to the female goats. However, most of the researchers have observed higher rate of haemonchosis in female hosts compared to males (Gauly *et al*. 2006, Qamar *et al*. 2009). This indicates that male and female goats have equal chance of infection if they are exposed to the same contaminated communal grazing pasture (Mulatu *et al*. 2012). The higher percentage of infection in the females may be due to the alteration in the physiological condition of the animals during pregnancy and lactation (production activity).

Animals above two years of age were more susceptible with gastrointestinal parasitic infections (66.89%) than 1–2 years young goats (63.39%). Adult goats had higher prevalences in all seasons than the young goats but the differences were not statistically significant (Table 4). Lowest prevalence was noted in the winter for above 2 years of age (53.31%) and young (47.48%) goats. The cause of variation on the basis of age is difficult to explain but it might be due to exhausted immune system, difference in grazing area and management variation of animals (Biswas *et al*. 2014).

The present observations indicated the importance of gastrointestinal helminth parasites in goats in all seasons, age groups and both sexes and poly-parasitic nature of the disease. The high prevalence of gastrointestinal parasites of goats recorded is indicative of the abundance and importance of the disease in the study area and its potential

contribution to limiting the productivity of goats. Keeping in view the above results, some control measure for gastrointestinal parasites can be undertaken to reduce the intensity of the parasitic infection. As a sequel to the present study, the ecology of the nematode larval infestations of pastures in the region merits investigation.

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