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Research Article

Prevalence of gastrointestinal helminth infections in goats at Goat Research Station, Byrnihat.

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Abstract

The survey was conducted on the prevalence of gastrointestinal helminthic infections in goats raised at Goat Research Station Byrnihat during the period of June 2013 to May 2014. A total of 167 numbers of goats were surveyed for presence of helminthic infections in three batches as per season. In the first batch (during the rainy season), a total of 63 goats, in the second batch (during winter season), a total of 48 goats and in the third batch *(*during summer season), a total of 56 goats of different age groups, of either sex were examined for detection of mixed helminthic infections. The objectives of this study were (i) to determine the prevalence rate of gastrointestinal helminthic infections in goats raised in Goat Research Station, Byrnihat, Assam Agricultural University, throughout the year as per season; (ii) to determine the various types of gastrointestinal parasites (nematode, trematode and cestode) infecting the goats. The higher prevalence rate was observed in rainy season (92.06%) followed by winter (75.00%) and summer season (32.14%). Also higher feacal egg count was observed in rainy season (3525±170.40) followed by winter (1575±62.92) and summer season (1225±85.39). No significance difference was observed in FEC values ($P<0.05$) between different age groups of either sex.

Keywords: Faecal egg count, gastrointestinal helminthes, goats, seasonal prevalence.

Introduction

Small ruminants play a critical role in agriculture in India and makes important contribution towards growth and development of agricultural sector. Goats are among the main meat-producing animals in India; their meat (chevon) is one of the choicest meats and has huge domestic demand. Besides meat, goats provide other products like milk, skin, fibre and manure. Goats are important part of rural economy, particularly in the arid, semi-arid and mountainous regions of the country. Due to various factors like management, housing facilities and diseases caused by bacteria, virus and most importantly parasites. Goats are known as poor man's cow (or mini-cow) because of its immense contribution to the poor man's

economy. Gastrointestinal nematodes such as *Haemonchus contortus*, trematodes like paramphistomum, and cestodes like *Moniezia expansa* infections were widely prevalent in goats of north eastern region due to hot and humid climate. Reduced body weight, delay in puberty, rough body coat, anemia and death are common in infected animals if there is mixed infection. The prevalence of gastrointestinal helminthic parasites load and pathogenesis in small ruminants depend on various factors, such as climate, sex and age, physiological status of the animal and managemental practices (Barger, 1989; Thamsborg *et al*., 1996; Vlassoff *et al*., 2001). Goat Research Station, Byrnihat, is located in Meghalaya and is a low-lying area where animals were reared under semi-intensive system. As a result, parasitic infections are very common in the farm in spite of periodic deworming with broad-spectrum anthelmintics. Resistance due to frequent use of synthetic drugs poses a problem and challenge to the farm. Hence, despite the best effort to minimize parasite load, anthelminthic resistance is thought to be one of the causes for recurrent infection in the kids and adult goats accompanied by anemia. Hence, the present study was carried out to determine the prevalence of various gastrointestinal helminthes in goats as per age, sex and season with suitable strategy and effective control measures.

Materials and Methods

Geographical location

The study was conducted on goats raised at Goat Research Station, Byrnihat, Meghalaya during the period of June 2013 to May 2014. Byrnihat is located between the latitude 20.1^0 to 26.5^01 N and longitude 85.49^0 to 92.52^0 E and total area is 259 Acres. The maximum and minimum mean monthly temperature vary from 23.15^0 C and 9.5^0 C in winter to 29.68^0 C and 31.25^0 C in summer, respectively. The average annual rainfall is 138.02 mm and relative humidity is 66.65 %. Meteorological data (monthly relative humidity, rainfall and temperature) were obtained from Automatic Weather Station Byrnihat located at Goat Research Station, Byrnihat-793101.

Population Study and Management

One hundred sixty-seven numbers of goat were surveyed in three different batches during various seasons of the year. The animals were apparently healthy and were reared outdoor in sheltered pens with proper ventilation. The goats were fed with concentrate feeds along with pasture grazing. There is a provision of drinking water all the time. The animals had acquired a natural parasitic burden through pasture grazing. The faecal samples were collected at weekly intervals for a period of forty-two days for three occasion *viz.* during summer, rainy and winter season from each of the animals.

Information on rearing conditions and managemental procedures of goats regarding feeding and control of parasites were collected from the farm manager. Apart from the seasonal prevalence of gastrointestinal helminthes parasites, other factors such as sex and species of animal, information regarding anthelminthic medication were preferred as elements influencing the parasitic load.

Collection and Examination of Faecal sample

The faecal samples of about 20-30 grams were collected in sterile polythene bags with proper labeling for identification and transported it in a cool box to the laboratory where they are stored at 4^0C for not more than 2-3 days prior to examination of the samples. Both the qualitative and quantitative assay of faecal samples was carried out using Direct, floatation and sedimentation; and Stoll's technique (Soulsby 1982).

Statistical analysis

All the data were analyzed statistically using SPSS program (version 19) and prevalence rate and FEC data were analyzed by one-way ANOVA and ($P<0.05$) was considered statistically significance.

Results and Discussion

The examination of 167 (63+48+56) faecal samples collected from goats showed positive result for helminthic infection except 5 during rainy, 12 during winter and 18 during summer season. The species wise analyses of faecal samples are shown in Table 1 and Figure 1.

The highest prevalence rate of helminth parasites was found during rainy season (92.06%) followed by winter (75.00%) and summer (32.14%), which may be due to the favorable environmental factors for the

Table 1 Species wise prevalence of gastrointestinal parasites of goats in Goat Research Station Byrnihat:

Species	No. of samples examined	Mixed infection	Season			Age			Sex	
			Rainy	Winter	Summer	Adult	Young	Kid	Male	Female
Haemonchus contortus	167	80 (47.90)	48 (76.19_{A}^{a})	20 ($41.\mathbf{67}_{AB}^{\mathbf{a}}$)	12 (21.43_{B}^{a})	12 (26.08_{A}^{a})	48 (60.75_{B}^{a})	20 (47.62_{AB}^{a})	21 (36.21_{A})	59 (54.13_{A})
Strongyloides sp.	167	17 (10.17)	10 (15.87_{A})	3 (6.25_{AB})	1 (1.79_{B})	6 (13.04_{A})	10 (12.65_{AB})	1 (2.38_{AB})	5 (8.62_{A})	12 (11.01_{A})
Trichostrongyloides sp.	167	16 (9.58)	11 (17.46_{A})	6 (12.25_{AB})	2 (3.57_{B})	10 (21.74_{A})	6 (7.59_{AB})	0 (0.00)	7 (12.07A)	9 (5.39A)
Gongylonema sp.	167	17 (10.17)	17 (26.98A)	0 (0.00)	0 (0.00)	9 (21.42_{A})	8 (10.13_{AB})	0 (0.00)	9 (15.52_{A})	8 (7.34_{A})
Oesophagotomum sp.	167	12 (7.19)	12 (19.04_{A})	0 (0.00)	0 (0.00)	7 (15.22_{A})	5 (6.33_{AB})	0 (0.00)	4 (6.90_{A})	8 (7.34_{A})
Paramphistome sp.	167	47 (28.14)	26 (41.26_{A}^{a})	12 (25.00_{AB}^{a})	9 (16.07_{AB}^{a})	9 (19.56_{A})	30 (37.97_{AB})	8 (19.05)	21 (36.21_{A})	26 (23.85_{A})
Moniezia expansa	167	25 (14.97)	14 (22.22Aa)	6 (12.50_{AB}^{a})	5 (8.93_{AB}^{a})	9 (19.56_{A})	15 (18.98_{AB})	1 (2.38)	11 (18.97_{A})	14 (12.84_{A})
Moniezia benedini	167	16 (9.58)	7 (11.11_{A})	4 (8.33_{AB})	5 (8.93_{AB})	4 (8.70_{A})	12 (15.19_{AB})	0 (0.00)	7 (12.07_{A})	9 (8.26_{A})

Figure within parenthesis indicate percentage

Values bearing same superscript in a row do not differ significantly in groups and values bearing same subscript in a column do not differ significantly between seasons ($P > 0.05$)

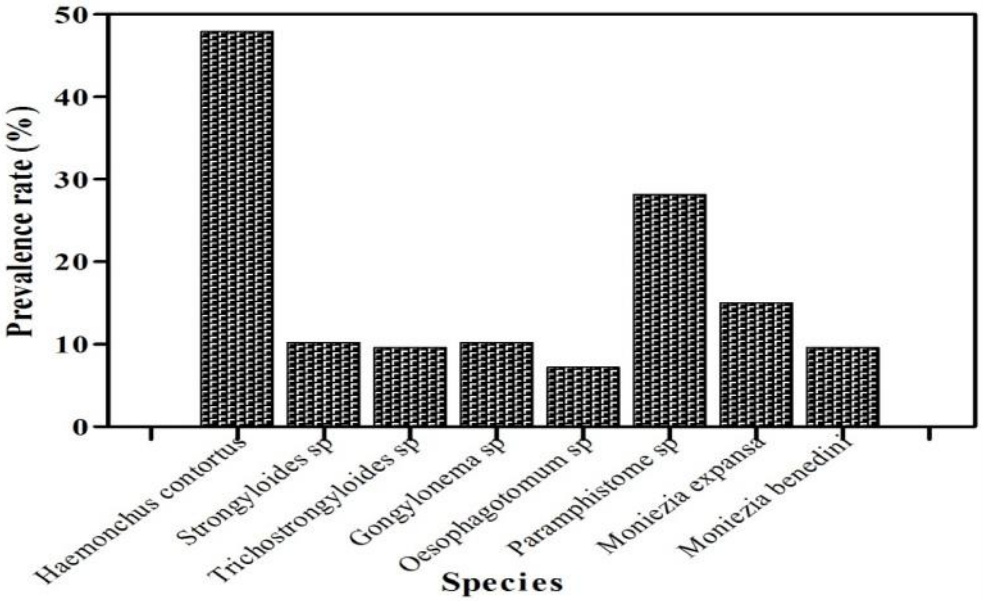


Figure 1 Species wise prevalence rate of gastrointestinal helminthic parasites in goats of various age group of either sex during the year 2013-2014.

development and growth of most helminthes species (Andrews 1999, Lima *et al*., 1998 and Dagnachew, *et al*., 2011) (Table 2 and Figure 2). The prevalence of nematodes was found to be the highest (79.36 %, 41.67 % and 21.43 %) followed by trematode (41.26 %, 25.00% and 16.07 %) and cestode (31.75 %, 20.83 % and 8.93 %) during rainy, winter and summer, respectively. (Table 2 and Figure 2). The highest prevalence rate of nematodes observed during the rainy season are in good agreement with other studies which shows that rainfall and temperature were the dynamic predisposing factors influencing the prevalence of nematodes (Singh *et al.,* 1997; Ninny *et al*., 2001; Vlassoff *et al*., 2001; Keyyu *et al*., 2005., Kapoor, 2013). The faecal copro-cultures examination revealed various species of nematodes, of which, *Haemonchus contortus* was found to be the most predominant parasite affecting the goats. The observed results are in agreement with the findings of other author from other part of world (Dagnachew, *et al*., 2011). And amongst the cestodes, infection rate of *Moniezia expansa* is higher than that of *Moniezia benedini* and among the trematodes, only occurance of *Paramphistomes* was recorded with different infection rates during various seasons of the year (Table 1and Figure 1).

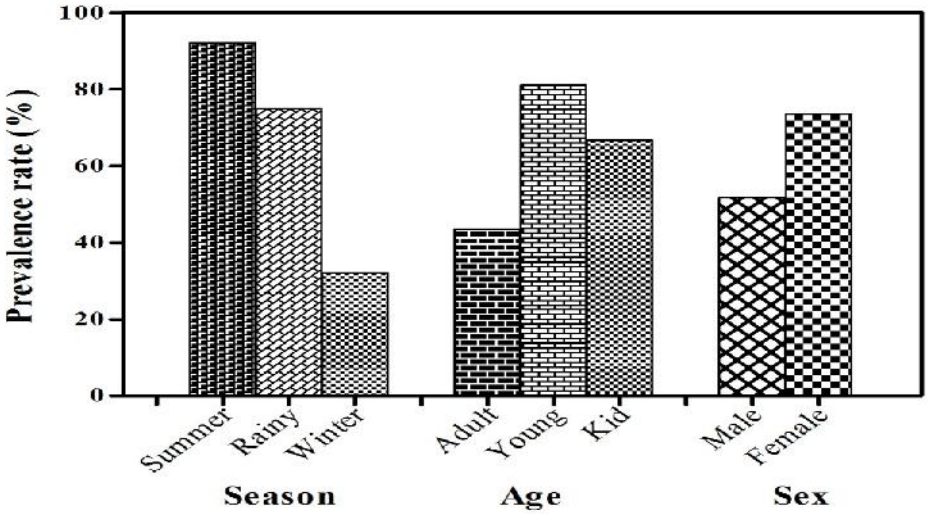
Table 2 Season wise prevalence of gastrointestinal helminthic parasites in goats

Season	No. of samples examined	Mixed infection	Nematode	Trematode	Cestode
Rainy (July-Oct)	63	58 (92.06_A^a)	50 (79.36_A^a)	26 (41.26_A^a)	20 (31.75_A^a)
Winter (Nov-Sept)	48	36 (75.00_{AB}^a)	20 (41.67_{AB}^a)	12 (25.00_{AB}^a)	10 (20.83_{AB}^a)
Summer (March-June)	56	18 (32.14^a)	12 (21.43_B^a)	9 (16.07_B^a)	5 (8.93_B^a)

Figure within parenthesis indicate percentage

Values bearing same superscript in a row do not differ significantly in groups and values bearing same subscript in a column do not differ significantly between seasons ($P > 0.05$)

Figure 2 Prevalence rate of gastrointestinal helminthic parasites in goats of various age group of either sex during the year 2013-2014.



During summer, most of the helminth species are susceptible to desiccation in dry climatic conditions that results from the high temperature at which even eggs fail to develop into L_3 stage (Banks *et al*., 1990; Tembely, 1998; Waruiru *et al*., 1998 and Dagnachew, *et al*., 2011). This may be the reason for lower prevalence rate of helminthic infections during summer that are in favour with the findings of Fikru Regassa *et al*., (2006) and Dagnachew, *et al*., (2011) showing positive association of climatic factors with prevalence of gastrointestinal helminths of various host species.

The highest prevalence rate of mixed infection was found amongst the kids and youngs followed by adults with 76.19 %; 75.95% and 43.48%, respectively and no significance difference (P>0.05), was observed between the groups (Table 3 and Figure 2). The prevalence rate of nematode, trematode and cestodes are found to be highest in youngs *viz*. 63.29%, 37.97% and 31.65%; 47.62%, 19.05% and 2.38 % in kids and 26.08%, 19.56% and 19.56% in adults respectively. However, the highest parasitic load was found in young ones with mean FEC±SEM of 2400.00±182.60 followed by kids with mean FEC±SEM of 2075±149.60 and the lowest mean FEC±SEM of 1850±150 was recorded in the adults (Table 5 and Figure 3). Younger animals were more prone to infection compared to adult goats (Urquhart *et al*., 1996) and (Vlassoff *et al*., 2001), which may be due to host resistance in old aged animals. The findings of the present study disagree with the finding of some earlier workers (Pomroy *et al*., 1986, Jallow *et al*., 1994), who had reported higher level of parasitic infections in adult goats. Similarly, few authors have demonstrated an increased prevalence rate in young group (Gupta *et al*., 1976; Raza *et al*., 2007). The lower prevalence in adults may be due to their inherent immunity. The hypothesis that older animals can acquire immunity against gastrointestinal parasites has been supported experimentally by different studies (Gamble and Zajac, 1992; Knox, 2000).

Table 3 Age wise prevalence of gastrointestinal helminthic parasites in goats

Age	No. of samples examined	Mixed infection	Nematode	Trematode	Cestode
Adult	46	$20(43.48_A{}^a)$	$12(26.08_A{}^a)$	$9(19.56_A)$	$9(19.56_A{}^a)$
Young	79	$60(75.95_{AB}{}^a)$	$50(63.29_{AB}{}^a)$	$30(37.97_{AB})$	$25(31.65_{AB}{}^a)$
Kid	42	$32(76.19_{AB})$	$20(47.62_{AB}{}^a)$	$819.05_{AB})$	$1(2.38^a)$

Figure within parenthesis indicate percentage

Values bearing same superscript in a row do not differ significantly in groups and values bearing same subscript in a column do not differ significantly between age group (P > 0.05)

Females are found to be more susceptible to helminthiasis as compared to males despite similar husbandry practices with infection rate of 73.39% and 51.72% respectively, but no significant difference (P>0.05) was detected between male and female (Table 4) in our study. The prevalence rate of nematode, trematode and cestodes were found to be 55.14%, 23.85% and 22.02% in females and 39.65%, 36.21% and 18.97% in males, respectively. It is supposed that sex is a determinant element influencing prevalence of parasitism (Maqsood *et al*., 1996; Valcárcel and García, 1999) ; females are more prone to parasitism during pregnancy and peri-parturient period due to stress and decreased immune status (Urquhart *et al*., 1996).

Table 4 Sex wise prevalence of gastrointestinal helminthic parasites in goats

Sex	No. of samples examined	Mixed infection	Nematode	Trematode	Cestode
Male	58	$30(51.72_A{}^a)$	$23(39.65_A{}^a)$	$21(36.21_A)$	$11(18.97_A)$
Female	109	$80(73.39_A{}^a)$	$59(55.14_A)$	$26(23.85_A)$	$24(22.02_A)$

Figure within parenthesis indicate percentage

Values bearing same superscript in a row do not differ significantly in groups and values bearing same subscript in a column do not differ significantly between male and female (P > 0.05)

The faecal egg counts (FECs) were highly variable during various seasons of the year and their faecal egg count ranges from 0 to 6000. Rainy season (July-October) has the highest faecal egg count with geometric FEC±SEM of 3525±170.40 followed by winter (November–February) with mean FEC±SEM of 1575±62.92. During the rainy season, the average relative humidity was 69.46 % and total rainfall recorded was 309.75 mm. The lowest FEC±SEM of 1225±85.39 was recorded during summer season (March-June) (Table 5 and Figure 3). During winter season (December, January and February), the relative humidity, rainfall and maximum & minimum temperatures were found to be 85.25%, 47.6 mm, 23.15^0C & 9.50^0C, respectively. The relatively high FEC during this period when compared with summer season may be due to high humidity (and rainfall). This is in good agreement with the findings of (Rahman *et al* 1996); and (Moinuddin *et al* 2011) who reported ≥ 80% - 90% of relative humidity as a favorable condition for hatching of parasitic eggs. The faecal egg counts (FECs) observed during the rainy season differs significantly (P<0.05) from winter and summer seasons. However, no significant difference (P>0.05) was recorded between winter and summer.

The lowered level of FEC observed during the summer months (March, April and May) despite high temperature may be due to deworming of the herd in the month of February. Deworming of the animals was done routinely thrice a year in the month of February, May and October in the GRS, Byrnihat.

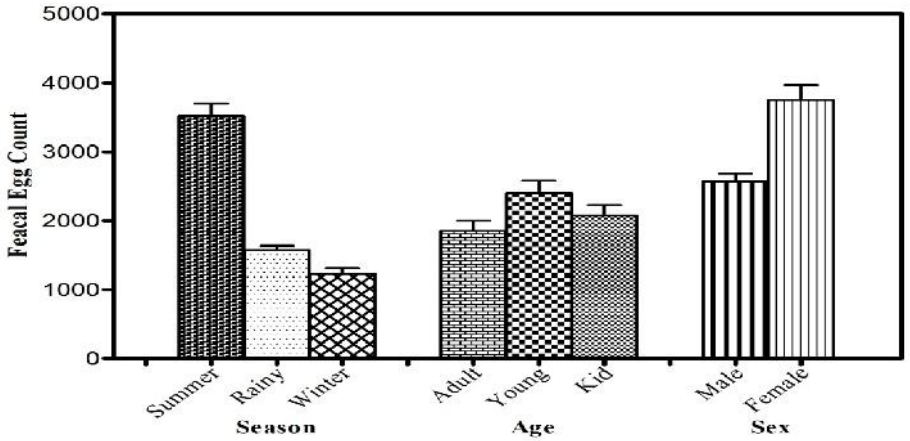
The ability of eggs and larvae of gastrointestinal parasites to survive in different environmental conditions depends on the species and developmental stage of the parasite during adverse conditions. In this study, the highest pasture larval counts were recorded in September, whereas the lowest was in March. The optimal temperature for development of the maximum number of larvae in the shortest feasible time is generally in the range of 18- 26ºC (Urquhart *et al*., 1996). At higher temperature, the larvae are hyperactive and development is faster, thus depleting their lipid reserves. The mortality rate then rises, so that a few will survive to L_3 stage. At lower temperature, developmental process slows down and below 10^0C, the development from egg to L_3 stage usually cannot take place. The present study showed, in general, that the animals allowed for pasture grazing harbored a variety of worms, but the worm burden reached a threshold pathogenic level during the monsoon season. The FEC reached peak in September, declined gradually, and thereafter minimum level during the month of March. These results are in agreement with those of (Tembely *et al*., 1997; Jithendran, 2000 and Chaudary *et al*., 2007). The number of infective larvae ingested by animals each day is considered as epidemiological variable of the highest influence on the parasitic rates of the animals under grazing condition (Barger, 1999). The higher FEC of gastrointestinal nematodes in September may be due to the soaring number of infective larvae

Table 5 Mean faecal egg counts (FEC) of goats in Goat Research Station, Byrnihat due to mixed helminthic infections of various age group of either sex during the year 2013-2014.

Parameters		No. of animal examined	No. of animal infected	Mean FEC±SEM			
				Mixed infection	Nematode	Trematode	Cestode
Season	Rainy	63	58	$3525\pm170.40_{A}^{a}$	$1525\pm47.27_{B}^{a}$	$525\pm47.87_{C}^{a}$	$1575\pm25.00_{B}^{a}$
	Winter	48	36	$1575\pm62.92_{A}^{b}$	$1075\pm47.87_{B}^{b}$	$200\pm40.82_{C}^{b}$	$300\pm57.74_{BC}^{b}$
	Summer	56	18	$1225\pm85.39_{A}^{bc}$	$987.50\pm71.81_{B}^{bc}$	$125\pm47.87_{C}^{bc}$	$112.5\pm12.5_{BC}^{ab}$
Age	Adult	46	20	$1850\pm150_{A}^{bcd}$	$950\pm155.50_{B}^{abcd}$	$250\pm64.55_{C}^{abcd}$	$650\pm50.00_{BC}^{d}$
	Young	79	60	$2400\pm182.60_{A}^{de}$	$1250\pm210.20_{B}^{abcde}$	$400\pm108.00_{C}^{abcde}$	$750\pm64.55_{BC}^{de}$
	Kid	42	32	$2075\pm149.60_{A}^{bdef}$	$1388\pm31.46_{B}^{abcdef}$	$275\pm75_{C}^{abcdef}$	$412.5\pm71.81_{C}^{bdf}$
Sex	Male	58	30	$2575\pm103.10_{A}^{efg}$	$997.5\pm38.81_{B}^{abcdefg}$	$300\pm57.74_{BC}^{abcdefg}$	$1278\pm73.07_{BC}^{g}$
	Female	109	80	$3757\pm221.70_{A}^{a}$	$1395\pm45.00_{B}^{abcdefg}$	$530\pm43.59_{C}^{adefg}$	$1825\pm85.39_{B}^{a}$

Means bearing same superscript in a column do not differ significantly within various parameters and means bearing same subscript in a row do not differ significantly between different parasites ($P > 0.05$)

Figure 3 Mean faecal egg counts (FEC) of goats naturally infected with mixed helminthic infections, of various age group of either sex during the year 2013-2014



ingested by goat and/or the arrested larvae resumed their development to adult stages. The low FEC in February could be attributed to low number of infective larvae pickup by goat from pasture during this period and deworming in January.

The higher prevalence of helminthiasis in goats maintained on semi-intensive grazing in our study was however different from other reports (Nganga *et al*., 2004; Taylor, 1985), who had observed reduced rate of infection in goats kept on semi-intensive grazing system and preferred to browse shrubs (Taylor, 1985). The findings of present study is in agreement to different researchers (Fikru Regassa *et al*., 2006; Keyyu *et al*., 2006; Raza *et al*., 2007), who have found a direct influence of grazing characteristics on the prevalence rate of most of the gastrointestinal helminths.

Conclusion

Small ruminant helminthiasis is found to be an important problem in the study area. It was observed that above and beyond the seasonal effects, age, sex, de-worming; some other factors like system of rearing, housing system, feeds provided including both concentrate and roughage (green & dry), grazing behavior etc., play an important role in prevalence of parasitic infections in goats. Hence, knowledge about these factors is important in controlling and preventing the incidence of gastrointestinal parasite infections in goats.

Prevalence of helminthic infections in goats raised in Goat Research Station, Byrnihat may be due to development of anthelminthic resistance. Therefore, combination of selective use of anthelmintics with traditional/veterinary medicine particularly targeted at young age along with good managemental practices could improve the control of gastrointestinal helminthic infections in goats both under semi-intensive system of housing and under field conditions of rearing by small landholder farmers. Further studies on the economic importance of helminthiasis and drug resistance patterns of anthelmintics will be conducted for the holistic implementation of helminthiasis control.

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