J Parasit Dis (July-Sept 2017) 41(3):843–849
DOI 10.1007/s12639-017-0900-z

ORIGINAL ARTICLE

Prevalence of caprine GI helminths in temperate areas of Jammu & Kashmir

S. J. Bihaqi[1] · I. M. Allaie[1] · M. A. A. Banday[1] · Z. A. Wani[1] · R. A. Shahardar[1]

Received: 1 March 2015 / Accepted: 23 February 2017 / Published online: 17 March 2017

Abstract Prevalence study on GastroIntestinal (GI) helminths of goats was carried out at Govt. Farms of twin districts of Bandipora and Ganderbal and locally reared goats of district Baramulla of the Kashmir Valley over a period of one year from December 2011 to November 2012. A total of 1016 faecal samples were examined which revealed overall prevalence of GI helminths to be 74.70%, with platyhelminths and nemathelminths in 14.76 and 70.07% animals, respectively. The helminths recorded in the present study were *Fasciola* spp. (2.75%), *Dicrocoelium* spp. (3.44%), paramphistomes (3.05%), *Moniezia* spp. (9.44%), strongyle worms including *Nematodirus* spp. (68.30%), *Strongyloides* spp. (5.90%) and *Trichuris* spp. (4.29%). On coprocultural examination *Haemonchus* spp. (71.05%) was found to be the most predominant strongyle worm followed by *Trichostrongylus* spp. (12.86%), *Chabertia* spp. (8.47%) and *Ostertagia* spp. (7.62%). Seasonal prevalence of GI helminths was observed highest in summer (78.03%) followed by spring (75.39%), winter (74.90%) and autumn (70.47%), the difference being statistically non-significant ($P > 0.05$). The prevalence of platyhelminths was found to be non-significantly higher in winter (20.00%) followed by spring (15.07%), summer (12.54%) and autumn (11.41%). Nemathelminths were recorded highest in summer (75.68%) followed by spring (71.82%), autumn (68.50%) and winter (64.31%). EPG ranged from 0 to 1500 and an average EPG count was found to be 312.7 ± 17.76. EPG was found to be highest in summer (453.80 ± 45.25) followed by spring (313.2 ± 28.76), autumn (256.1 ± 17.48) and winter (190.2 ± 32.0).Overall prevalence of GI helminths was found more in adult goats (77.85%) compared to young ones (67.42%), the difference being statistically significant ($P < 0.05$). Similarly, it was found to be higher in females (75.89%) as compared to males (66.12%) and the variation being statistically non-significant ($P > 0.05$).

Keywords Goats · GI helminths · Kashmir · Prevalence · Temperate

Introduction

Goats are one of the earliest domesticated ruminants which have served mankind longer than cattle and sheep. It is reared for the production of milk, meat and hair, particularly in arid, semi-tropical or mountainous areas. In temperate, tropical and sub-tropical zones, goats are kept often as supplementary animals by small farmers. Helminthiosis, especially parasitic gastro-enteritis, constitutes to pose a serious health threat and a limitation to the productivity of small ruminants due to the associated morbidity, mortality, cost of treatment and control measures (Nwosu et al. 2007). The climate in a certain locality is one of the factors that determine the type and severity of parasitic infections in goats. In Jammu and Kashmir State, the incidence of parasitic infection in goats from Jammu region has been reported by Khajuria and Kapoor (2003) and by Yadav et al. (2006) and from Kashmir Valley, a single study done so far is on record by Tariq et al. (2010). Therefore, there is a need to carry out further studies on regional basis to determine GastroIntestinal (GI) helminths burden so as to

✉ I. M. Allaie
idreesmeharaj@skuastkashmir.ac.in

[1] Division of Veterinary Parasitology, Faculty of Veterinary Sciences and Animal Husbandry, Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Shuhama Campus (Alusteng), Srinagar 190006, India

evolve the package of practices for control of these parasites in order to prevent economic losses. So, the present study was undertaken to work out the prevalence of GI helminths of goats of Kashmir Valley.

Materials and methods

Study area: The study was restricted to Govt. Farms of twin districts of Bandipora and Ganderbal and locally reared goats of district Baramulla of the Valley over a period of one year from December 2011 to November 2012. The Farms included Mountain Research Centre for Sheep and Goat, Shuhama, Ganderbal and Govt. Sheep Breeding Farm, Hardshua, Bandipora. Ganderbal is located in north east of Kashmir, lying between latitude 34.7°–34.22°N and longitude 74.4°–74.56°E, at an average altitude of 5100 ft. above sea level. Climatically winters are extremely cold with heavy snowfall while as summers are pleasant. The mean temperature, rainfall and relative humidity ranged from 1 to 30 °C, 39 to 81 mm and 51 to 90%, respectively. Bandipora comprises of three tehsils and is situated at 34.25°N and 74.38°E with an average altitude of 5541 ft above sea level. The climate is of temperate type with cold snowy winters and pleasant weather in summer. Baramulla covers an area of 3353 sq. km and is situated at an average height of 5226 ft. above sea level and at 74.3°E longitude and 34.2°N latitude. Average minimum and maximum temperature varied from −2.08 to 16 °C. The average annual rainfall was 100.89 mm.

Parasitological examination: A total of 1016 samples were collected during all the four seasons of the Valley viz; Winter (December–February), Spring (March–May), Summer (June–August), and Autumn (September–November). The samples were collected directly from rectum and brought to the laboratory in mini polythene bags for examination. The samples were collected from either sex and included both the age groups viz; adult goats (age $>$ 1 year) and young goats (age $<$ 1 year). Samples were first examined grossly for colour, consistency, presence of blood, mucous and dead worms. Then these were examined by standard sedimentation and floatation techniques (Soulsby 1982). Randomly selected positive faecal samples in each season were then examined by quantitative technique (Stoll's dilution method) to determine the parasitic load i.e. eggs per gram of faeces. Faecal samples positive for strongyle eggs were also subjected to coproculture randomly using jar and petridish methods in each season and the third stage larvae were harvested to find out prevalence of different genera of strongyle worms.

Stastical analysis: The results were subjected to standard statistical analysis as per Snedecor and Cochran (1994). The data on the prevalence between different seasons and groups, which included males and females, adult and young goats was analyzed using 'Z' test. Mean EPG between different groups on different dates was compared using ANOVA and LSD.

Results and discussion

The prevalence of GI helminths was studied taking into consideration the overall prevalence, seasonal prevalence, age wise prevalence and sex wise prevalence in goats of Kashmir Valley.

Overall Prevalence: The overall prevalence of GI Helminths was found to be 74.70%. This is in accordance with Khajuria and Kapoor (2003) who recorded the overall prevalence of 78.82% for various parasites found in goats of Kathua region of J&K. Sutar et al. (2010) and Hassan et al. (2011) reported prevalence of 62.75 and 63.00% in the goats of Maharashtra and Chittagong respectively. Pathak and Pal (2008) reported prevalence of 85.22% in goats of Durg district of Chhattisgarh. The variation in the present study might be attributed due to the differences among the geographical locations and climatic conditions of the study areas, method of study, sample size, breed of the animals and managemental practices involved. Prevalence of platyhelminths was found to be 14.76% with trematodes in 8.07% animals. Among trematodes, prevalence of *Dicrocoelium* spp. (3.44%) was highest followed by paramphistomes (3.05%) and *Fasciola* spp. (2.75%). Among cestodes the only genus reported was *Moniezia* spp. with a prevalence rate of 9.44%. Sharma et al. (1989) reported 14.8% prevalence of *Fasciola* spp. infection in goats of Kashmir Valley while as Khajuria and Kapoor (2003) had recorded the incidence of 5.83% of *Fasciola* spp. in goats in Kathua region of Jammu. Jithendran (1996) found 4.1% of goats from Kangra valley of Himachal Pradesh positive for Dicrocoeliosis, whereas Khajuria and Kapoor (2003) reported prevalence of *Dicrocoelium* spp. in goats of Kathua region of Jammu as 2.55%. Khajuria et al. (2013) recorded a prevalence of 5.4% of Paramphistomes in stationary goat flocks of the middle agro-climatic zone of Jammu province. Khajuria and Kapoor (2003) reported *Moniezia* spp. infections in goats of Kathua district of Jammu. Pathak and Pal (2008) and Nath et al. (2011) reported prevalence of *Moniezia* spp. to be 17.04 and 11.33% in goats of Durg district of Chattisgarh and in Black Bengal goats in Chittagong, Bangladesh respectively. The reason for low prevalence of platyhelminth infection can be due to the fact that the animals are mostly stall fed. These animals are not allowed to graze in the open, thus exposure of animals to the snails is avoided, and hence low infection was reported in the present study. Nemathelminths were found in 70.07% samples with

strongyle worms including *Nematodirus* spp. (68.30%) being highest followed by *Strongyloides* spp. (5.90%) and *Trichuris* spp. (4.29%) (Table 1). Tariq et al. (2010) reported prevalence of gastrointestinal nematodes to be 54.3% while examining goats from Kashmir valley respectively. Prevalence of 77.31% was reported by Pal papri and Bandyopadhyay (2004) and Jithendran (1998) during a study on GI Nematodosis in goats in Sikkim. Predominance of strongyle infection to the tune of 67.46 and 44.62% was reported by Khajuria and Kapoor (2003) and Yadav et al. (2006) respectively in the Jammu region of J&K. Khajuria and Kapoor (2003) recorded the prevalence of *Trichuris* spp. to be 8.11% in goats of Kathua region of Jammu. Prevalence of 6.45, 3.5 and 3.08% for *Trichuris* spp. has been reported by Palampalle et al. (2002), Hassan et al. (2011) and Yadav et al. (2006) respectively. The higher prevalence of nemathelminth parasites in the present study can be due to the fact that these animals are kept in close confinement, stall fed, which increases the temperature and moisture of the shed. This makes the conditions favourable for the hatching of the nematode eggs and completions of life cycle in a short period of time. This close confinement also increases the chances of transmission of infection from an infected animal to other healthy animals.

Seasonal Prevalence: Highest prevalence of GI helminths was observed in summer (78.03%) followed by spring, winter and autumn (75.39, 74.90 and 70.47% respectively), the difference being non-significant ($P > 0.05$). This is in accordance with the findings recorded by Makhdoomi et al. (1995) in sheep in Kashmir valley and Khajuria and Kapoor (2003) in goats in Kathua region of J&K. Sutar et al. (2010) reported higher prevalence in monsoon season (77.33%) followed by winter (60.83%) and summer (51.53%) in goats of Ahmednagar district of Maharashtra. Climatic factors influence the rate of larval movement. Hawkins (1945) suggested that heavy rainfall lower the resistance of animals and this is taken as advantage by the infective larvae in establishment of heavy infection. Platyhelminth infection (20.00%) was observed highest in winter followed by 15.07, 12.54 and 11.41% in spring, summer and autumn respectively, the variation being statistically non-significant ($P > 0.05$). Owing to the prolonged-staged life cycle of the platyhelminths, the animals are exposed to infection during the vulnerable months of summer and autumn and while completing the stages of life cycle, the parasite reaches its sexual maturity during winter months and as harsh conditions of winter lowers the immune resistance of the animal, the platyhelminth infection increases. Trematodes showed non-significantly ($P > 0.05$) highest prevalence in winter (10.19%) followed by summer, autumn and spring with prevalence rate of 7.84, 7.48 and 6.74% respectively.

Table 1 Overall prevalence of GI helminths of goats in Kashmir Valley

Host	No. of samples examined	Mixed infection	Trematodes			Cestodes			Total platyhelminths	Nematodes			Total nemathelminths	Total GI helminths
			F	D	P	Total	M	Total		S	St	T		
Adult goat	709	163 (22.99^{a})	24 (3.38^{a})	30 (4.23^{a})	25 (3.52^{a})	68 (9.59^{a})	56 (7.89^{a})	56 (7.89^{a})	110 (15.51^{a})	503 (70.94^{a})	45 (6.34^{a})	35 (4.93^{a})	515 (72.63^{a})	552 (77.85^{a})
Young goat	307	60 (19.54^{a})	4 (1.30^{b})	5 (1.62^{b})	6 (1.95^{b})	14 (4.56^{b})	40 (13.02^{b})	40 (13.02^{b})	40 (13.02^{a})	191 (62.21^{b})	15 (4.88^{a})	10 (3.25^{a})	197 (64.19^{b})	207 (67.42^{b})
Total	1016	223 (21.94)	28 (2.75)	35 (3.44)	31 (3.05)	82 (8.07)	96 (9.44)	96 (9.44)	150 (14.76)	694 (68.30)	60 (5.90)	45 (4.29)	712 (70.07)	759 (74.70)

Figures within parenthesis indicate percentage

Values with same superscript in a column under a subgroup do not vary significantly ($P > 0.05$)

F = *Fasciola* spp., D = *Dicrocoelium* spp., P = Paramphistomes, M = *Moniezia* spp., S = strongyle worms, St = *Strongyloides* spp., T = *Trichuris* spp.

Among trematodes, *Dicrocoelium* spp. and *Fasciola* spp. showed highest prevalence in winter followed by spring, autumn and summer. *Dicrocoelium* spp. infection being highest in winter is in correspondence with the study of Jithendran (1996) and Godara et al. (2014) who recorded prevalence of *Dicrocoelium* spp. in goats of Kangra valley of Himachal Pradesh (4.1%) and Jammu (28.9%) respectively. The seasonal trend shown by *Fasciola* spp. in the present study is in accordance with Khallaayoune and Hari (1991) and Kumar et al. (2007) in goats of Haouz area of Morocco (23.8%) and of Uttaranchal (2.62%). Paramphistomes showed a different seasonal pattern with highest prevalence in summer followed by autumn, spring and winter. Goats being browsers exhibit lesser infection of paramphistomes than other ruminants. Khajuria and Kapoor (2003) could not detect any ova of paramphistomes in goats of Kathua region of Jammu. Summers being the drier months of the year, lead to concentration of snails in an around the areas of natural waters. This coincides with the grazing area of the animal and hence increased influx of infection to the animals. The prevalence of trematodes with respect to their seasons differed non-significantly ($P > 0.05$). *Moniezia* spp. showed highest prevalence rate in winter (12.54%) and lowest in autumn (5.90%). 11.11 and 8.23% was its prevalence in spring and summer seasons respectively, the variation being non-significant ($P > 0.05$). The prevalence of Nemathelminth parasites was recorded highest in summer (75.68%) followed by spring (71.82%), autumn (68.50%) and winter (64.31%), however the variation was non-significant ($P > 0.05$). The same trend was observed for strongyle worms. The prevalence of *Strongyloides* spp. and *Trichuris* spp. was highest in summer followed by autumn, spring and winter. The prevalence of these nematodes differed non-significantly ($P > 0.05$) with respect to their seasons (Table 2). After a winter period, spring rise is evident which reaches to maximum in summer and again drops to low levels in autumn. The rainy season starting in spring and continuing to early summer makes environmental conditions more favourable for the development and survival of pre-parasitic stages of nematodes and led to an increased availability of infective larvae in the rainy and post rainy seasons. This seasonal variation and trend is in line with the results of Tariq et al. (2010) and Khajuria and Kapoor (2003).

Agewise Prevalence: Overall prevalence was found more in adults (77.85%) compared to young ones (67.42%). The study revealed significant statistical difference between the two age groups ($P < 0.05$). Hassan et al. (2011) reported the similar findings while determining prevalence of GI helminths in Black Bengal goats of Chittagong, Bangladesh. Shahnawaz et al. (2011) and Wani et al. (2011) also reported the high prevalence of GI

Table 2 Seasonal prevalence of GI helminths of goats in Kashmir Valley

Season	Host	No. of samples examined	Mixed infection	Trematodes				Cestodes		Total platyhelminths	Nematodes			Total nemathelminths	Total GI helminths
				F	D	P	Total	M	Total		S	St	T		
Winter	Adult Goat	189	35	9	13	4	22	20	20	39	121	8	7	126	148
	Young Goat	66	10	2	2	0	4	12	12	12	37	2	1	38	43
	Total	255	45 (17.64^a)	11 (4.31^a)	15 (5.88^a)	4 (1.56^a)	26 (10.19^a)	32 (12.54^a)	32 (12.54^a)	51 (20.00^a)	158 (61.90^a)	10 (3.92^a)	8 (3.13^a)	164 (64.31^a)	191 (74.90^a)
Spring	Adult Goat	172	42	6	7	4	14	15	15	27	126	9	9	127	133
	Young Goat	80	17	1	2	1	3	13	13	11	49	4	2	54	57
	Total	252	59 (23.41^a)	7 (2.77^a)	9 (3.57^a)	5 (1.98^a)	17 (6.74^a)	28 (11.11^a)	28 (11.11^a)	38 (15.07^a)	175 (69.44^a)	13 (5.15^a)	11 (4.36^a)	181 (71.82^a)	190 (75.39^a)
Summer	Adult Goat	167	46	4	4	10	17	12	12	23	129	14	10	132	136
	Young Goat	88	21	0	0	3	3	9	9	9	61	5	4	61	63
	Total	255	67 (26.27^a)	4 (1.56^a)	4 (1.56^a)	13 (5.09^a)	20 (7.84^a)	21 (8.23^a)	21 (8.23^a)	32 (12.54^a)	190 (74.50^a)	19 (7.45^a)	14 (5.49^a)	193 (75.68^a)	199 (78.03^a)
Autumn	Adult Goat	181	40	5	6	7	15	9	9	21	127	14	9	130	135
	Young Goat	73	12	1	1	2	4	6	6	8	44	4	3	44	44
	Total	254	52 (20.47^a)	6 (2.36^a)	7 (2.75^a)	9 (3.54^a)	19 (7.48^a)	15 (5.90^a)	15 (5.90^a)	29 (11.41^a)	171 (67.32^a)	18 (7.08^a)	12 (4.72^a)	174 (68.50^a)	179 (70.47^a)

Figures within parenthesis indicate percentage

Values with same superscript in a column under a subgroup do not vary significantly ($P > 0.05$)

F = *Fasciola* spp., D = *Dicrocoelium* spp., P = Paramphistomes, M = *Moniezia* spp., S = strongyle worms, St = *Strongyloides* spp., T = *Trichuris* spp.

platyhelminths and nemathelminths, respectively in adult sheep than in young in Kashmir valley. The prevalence of platyhelminths was found non-significantly ($P > 0.05$) higher in adults (15.51%) compared to the young (13.02%). Higher trematode infection was found in adults (9.59%) as compared to young (4.56%), the difference being significant ($P < 0.05$). *Dicrocoelium* spp., *Fasciola* spp. and paramphistomes were also found higher in adults compared to young, the variation being statistically significant ($P < 0.05$). The higher infection in adults may be attributed to the cause that adults graze in the low land area where by increasing the possibility of incurring more infection. *Moniezia* spp. showed different trend with higher prevalence in young goats (13.02%) compared to adults (7.89%), the variation being statistically significant ($P < 0.05$). Previous infection and age of the host afford some protection against reinfection and hence disease is usually seen in young animals (Soulsby 1982). Nemathelminths were found higher in adults (72.63%) than young (64.19%), the variation being significant ($P < 0.05$). Among nemathelminth parasites, strongyle worms were also found significantly higher ($P < 0.05$) in adults than young goats. *Strongyloides* and *Trichuris* spp. also followed the same trend with higher prevalence rate in adults compared to young, the variation being non-significant ($P > 0.05$) (Table 1). Decreased young one infection may also be associated with the intake of immunoglobin rich colostrum which increases the immunity of the young animals.

Sexwise Prevalence: 66.12 and 75.89% males and females were found positive for GI helminths respectively, the variation being non-significant ($P > 0.05$). The prevalence of platyhelminths was found non-significantly ($P > 0.05$) higher in females (15.24%) compared to males (11.29%). Trematodes were found higher in females (8.29%) as compared to males (6.45%), the variation being non-significant ($P > 0.05$). *Dicrocoelium* spp., paramphistomes and *Fasciola* spp. were found higher in females than males, the variation being non-significant ($P > 0.05$). *Moniezia* spp. followed similar trend with higher prevalence in females (9.97%) than males (5.64%), the variation being non-significant ($P > 0.05$). Nemathelminths were found non-significantly ($P > 0.05$) higher in females (70.85%) compared to males (64.51%). Strongyle worms followed a similar pattern with non-significantly ($P > 0.05$) higher prevalence in females compared to males. However, *Strongyloides* and *Trichuris* spp. followed a different trend with higher prevalence rate in males than females, the variation being non-significant ($P > 0.05$) (Table 3). Patel et al. (2001) and Shahiduzzaman et al. (2003) observed the similar trend of higher infection in female goats than males. However Gorsky et al. (2004) reported that males were more infected with

Table 3 Sex-wise prevalence of GI helminths of goats in Kashmir Valley

Sex (host)	No. of samples examined	Mixed infection	Trematodes			Cestodes			Total platyhelminths	Nematodes			Total nemathelminths	Total GI helminths
			F	D	P	Total	M	Total		S	St	T		
Male	124	26 (20.96[a])	3 (2.41[a])	3 (2.41[a])	3 (2.41[a])	8 (6.45[a])	7 (5.64[a])	7 (5.64[a])	14 (11.29[a])	79 (63.70[a])	9 (7.25[a])	6 (4.83[a])	80 (64.51[a])	82 (66.12[a])
Female	892	197 (22.08[a])	25 (2.80[a])	32 (3.58[a])	28 (3.13[b])	74 (8.29[a])	89 (9.97[a])	89 (9.97[a])	136 (15.24[a])	615 (68.94[a])	51 (5.71[a])	39 (4.37[a])	632 (70.85[a])	677 (75.89[a])
Total	1016	223 (21.94)	28 (2.75)	35 (3.44)	31 (3.05)	82 (8.07)	96 (9.44)	96 (9.44)	150 (14.76)	694 (68.30)	60 (5.90)	45 (4.29)	712 (70.07)	759 (74.70)

Figures within parenthesis indicate percentage

Values with same superscript in a column under a subgroup do not vary significantly ($P > 0.05$)

F = *Fasciola* spp., D = *Dicrocoelium* spp., P = Paramphistomes, M = *Moniezia* spp., S = strongyle worms, St = *Strongyloides* spp., T = *Trichuris* spp.

Table 4 Overall parasitic load of GI helminths of goats in Kashmir Valley

Age (host)	No. of samples screened	EPG range	Mean EPG
Adult goat	113	0–1500	$332.7^{a} \pm 21.0$
Young goat	59	0–1500	$274.57^{a} \pm 32.0$
Total	172	0–1500	312.7 ± 17.76

Values with same superscript in a column do not vary significantly ($P > 0.05$)

nematode species than females. Moreover Tariq et al. (2010) did not find any difference in the susceptibility to the nematode infection between sexes in Valley. The reason for higher EPG in females is because females experience periparturient rise in faecal egg counts due to pregnancy and lactation stress. In lactating animals there is also marked increase in susceptibility to newly acquired infection in the periparturient period (Shubber et al. 1981).

Intensity of Infection: EPG ranged from 0 to 1500 with an average EPG count of 312.7 ± 17.76 (Table 4). EPG was found highest in summer followed by spring, autumn and winter. The study revealed a statistical difference of summer with all the other seasons ($P < 0.05$). Spring season was found to have a statistical difference with summer and winter ($P < 0.05$). Autumn season was found to show statistical difference with summer ($P < 0.05$). The winter season was found to show statistical difference with summer and spring seasons ($P < 0.05$) (Table 5). The similar seasonal trend of mean EPG was observed by Tariq et al. (2010) with the mean EPG of 2552.3 ± 85.7 in summer and 134.1 ± 9.1 in winter. Palpari and Bandyopadhyay (2004) however reported higher mean EPG of 3500 in autumn and least mean EPG of 150 in winter. The findings of high EPG in summer correlates with the agroclimatic conditions of the Valley. The Valley being temperate in climate with a marked difference in the four seasons influence the occurrence of infection in the goats. Valley observes maximum rainfall in late spring which increases the chances of hatching and dissemination of larvae. Similarly in winters the inhibitory signals in the form of high precipitation and hypobiosis leads to decreased availability of the infective larvae and eggs to the animals. Moreover less contact of animals with grassland during autumn and winter reduces the chance of infection. EPG ranged from 0 to 1500 in both the age groups but the average EPG was 274.57 ± 32.0 and 332.7 ± 21.0 in young and adult goats, respectively. The figures indicate higher average EPG in adult goats than young ones, the variation being statistically non-significant ($P > 0.05$) (Table 4). In females and males EPG ranged from 0 to 1500 and 0 to 1400, respectively with an average of 316.8 ± 21.4 and 302.1 ± 39.7, respectively. Average

Table 5 Seasonal comparison of parasitic load of GI helminths of goats in Kashmir Valley

Season	Host	No. of samples screened	EPG range	Mean EPG
Summer	Adult goat	34	0–1500	485.3 ± 49.6
	Young goat	18	0–1700	394.4 ± 91.6
	Total	52	0–1700	$453.8^{a} \pm 45.25$
Spring	Adult goat	23	0–900	330.4 ± 43.8
	Young goat	15	0–500	286.7 ± 29.1
	Total	38	0–900	$313.2^{b} \pm 28.76$
Autumn	Adult goat	30	0–400	273.3 ± 17.2
	Young goat	11	0–500	209.1 ± 43.6
	Total	41	0–500	$256.1^{bc} \pm 17.48$
Winter	Adult goat	26	0–300	203.8 ± 16.2
	Young goat	15	0–300	166.7 ± 27.0
	Total	41	0–300	$190.2^{c} \pm 32.0$

Values with same superscript in a column do not vary significantly ($P > 0.05$)

Table 6 Sex-wise parasitic load of GI helminths of goats in Kashmir Valley

Sex (host)	No. of samples screened	EPG range	Mean EPG
Male	47	0–1400	$302.1^{a} \pm 39.7$
Female	125	0–1500	$316.8^{a} \pm 21.4$
Total	172	0–1500	312.7 ± 17.76

Values with same superscript in a column do not vary significantly ($P > 0.05$)

EPG was found higher in females than males, but the variation was non-significant ($P > 0.05$) (Table 6).

Coproculture Examination: On coprocultural examination, *Haemonchus* spp. (71.05%) was found to be the predominant strongyle worm followed by *Trichostrongylus* spp. (12.86%), *Chabertia* spp. (8.47%) and *Ostertagia* spp. (7.62%). This predominance of *Haemonchus* spp. over the other strongyle worms has also been reported by Tariq et al. (2010) and Wani et al. (2011) in goats and sheep of Kashmir valley respectively. This is because of the fact that the females of *Haemonchus* spp. are prolific egg layers (Urquhart et al. 1996) and infective stages of *Haemonchus* spp. survive for prolonged periods on pastures (Soulsby 1982). However, Saiful-Islam and Taimur (2008) has reported predominance of *Trichostrongylus* spp. over other strongyle worms in goats in Bangladesh.

Acknowlegement The authors are highly thankful to the In charges of twin Farms of Bandipora and Ganderbal for allowing the sample collection. The authors are also highly thankful to Prof. T.A.S. Ganai

for doing stastical analysis of the data. The help rendered by the divisional staff especially by Mr. Mohammad Ramzan Parray is highly acknowledged.

References

Godara R, Katoch R, Yadav A, Borah MK (2014) Dicrocoeliosis in goats in Jammu, India. J Parasit Dis 38:201–204

Gorsky P, Niznikowski R, Strzelec E, Popielarczyk D, Gajewska A, Wedrychowicz H (2004) Prevalence of protozoan and helminth internal parasite infections in goat and sheep flocks in Poland. Arc Tieraucht Dummerstorf 47:43–49

Hassan MM, Hoque MA, Islam SKMA, Khan SA, Roy K, Banu Q (2011) A prevalence of parasites in black Bengal goats in Chittagong, Bangladesh. Int J Livest Prod 2:40–44

Hawkins PA (1945) Studies of sheep parasites. Observations on weather in relation to untreated nematode infections. J Parasitol 31:17

Jithendran JP (1996) Occurance of hydatidosis and various liver fluke infections in sheep and goats in Kangra valley: an abattoir study. J Vet Parasitol 10:63–67

Jithendran KP (1998) Epidemiology of gastro-intestinal nematodes in migratory sheep and goats in North–Western humid Himalayan region. Ind J Anim Sci 68:894–896

Khajuria JK, Kapoor PR (2003) Prevalence of parasites in sheep and goats at Kathua Jammu. Ind Vet J 17:121–126

Khajuria JK, Katoch R, Yadav A, Godara R, Gupta SK, Singh A (2013) Seasonal prevalence of gastrointestinal helminths in sheep and goats of middle-agro climatic zone of Jammu province. J Parasit Dis 37:21–25

Khallaayoune K, Hari M (1991) Seasonal variations of *Fasciola hepatica* infection in goats in the area of Haouz, Morocco. Annals Vet Res 22:219–226

Kumar RR, Garg R, Yadav CL, Banerjee PS, Godara R, Kumar S (2007) Prevalence of fasciolosis in sheep and goats in Uttranchal. J Vet Parasitol 21:15–16

Makhdoomi DM, Shugufta N, Banday SD, Moulvi B (1995) Incidence of different ovine gastrointestinal parasites in Kashmir. Ind Vet J 72:898–900

Nath B, Roy K, Shaikat A, Shill S (2011) A study on prevalence and pathological effects of intestinal helminths in black Bengal goats in Chittagong. Yuzuncu Yil Univ Vet Fak Derg 22:139–142

Nwosu CO, Madu PP, Richards WS (2007) Prevalence and seasonal changes in the population of gastrointestinal nematodes of small ruminants in the semi-arid zone of North–Eastern Nigeria. Vet Parasitol 144:118–124

Palampalle HY, Deshpande PD, Narladkar BW (2002) Gastro-intestinal nematodiasis in bovines of Marathwada region. J Vet Parasitol 16:71–72

Pal P, Bandyopadhyay S (2004) Prevalence of gastro-intestinal nematodiasis in goats in Sikkim. J Vet Parasitol 18:127–130

Patel MD, Nauriyal DS, Hasnani JJ, Gupta RS (2001) Prevalence of gastrointestinal parasitism in goats maintained under semi-intensive and field management systems. Ind J Vet Med 21:99–101

Pathak AK, Pal S (2008) Seasonal prevalence of gastrointestinal parasites in goats from drug district of Chhattisgarh. Vet World 5:36–137

Saiful-Islam KBM, Taimur MJFA (2008) Helminthic and Protozoan internal parasitic infections in free ranging small ruminants of Bangladesh. Slo Vet Res 45:65–72

Shahiduzzaman M, Alim MA, Rahman M, Mondal MMH (2003) Seasonal influence on the occurrence of *Haemonchus contortus* in slaughtered black Bengal goats in Bangladesh. Bang J Vet Med 1:45–48

Shahnawaz M, Shahardar RA, Wani ZA, Shah SA (2011) Prevalence of ovine platyhelminth parasite infection in Ganderbal area of Kashmir valley. Ind J Anim Sci 81:40–43

Sharma RL, Dhar DN, Raina OK (1989) Studies on the prevalence and laboratory transmission of fascioliasis in animals in the Kashmir Valley. Brit Vet J 145:57–61

Shubber AH, Lloyd S, Soulsby EJL (1981) Infection with gastrointestinal helminths: efffect of lactation and maternal transfer of immunity. Z Parasit 65:181–189

Snedecor GW, Cochran WG (1994) Statistical methods, 8th edn. Iowa state University Press, IOWA

Soulsby EJL (1982) Helminths, arthopods and protozoa of domesticated animals, 7th edn. Bailliere, Tindall

Sutar AU, Kengar SB, Patil SS, Khan MR (2010) Prevalence of gastrointestinal parasites in goats of Ahmednagar district of Maharashtra. Vet World 3:456–457

Tariq KA, Chishti MZ, Ahmad F (2010) Gastro-intestinal nematode infection of goats relative to season, host sex and age from the Kashmir valley, India. J Helminth 84:93–97

Urquhart GM, Armour J, Duncan JL, Dunn AM, Jenings FW (1996) Veterinary parasitology, 2nd edn. Blackwell Science, London

Wani ZA, Shahardar RA, Shahnawaz M (2011) Prevalence of nemathelminth parasites in sheep of Ganderbal district of Kashmir valley. J Vet Parasitol 25:26–29

Yadav A, Khajuria JK, Raina AK (2006) Seasonal prevalence of gastrointestinal parasites in sheep and goats of Jammu. Ind Vet J 20:65–68