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ORIGINAL ARTICLE

Gastrointestinal helminthosis: prevalence and associated determinants in goats of Jabalpur, India

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Abstract A total of 632 faecal samples of goats of Jabalpur district of Madhya Pradesh state were examined during three years of the study period (November 2012–October 2015), out of which 82.75 % samples were positive for helminthic infections. Among various helminths, maximum prevalence was of strongyles (32.59 %) followed by amphistomes (14.40 %), *Moniezia* spp. (12.50 %), *Strongyloides* spp. (0.79 %), *Trichuris* spp. (0.47 %) and *Fasciola gigantica* (0.32 %). Year wise prevalence revealed a highly significant ($p < 0.01$) decrease in prevalence of helminths. Except *Trichuris* and *Moniezia* spp., the effect of year was significant for prevalence of all other gastro-intestinal helminths observed during the study. Significantly higher ($p < 0.05$) helminth infections were observed in monsoon (87.97 %) as compared to that of winter (81.48 %) or summer (79.03 %) season. The seasonal difference in prevalence was found significant for strongyles, *Strongyloides* spp., amphistomes and *Moniezia* spp. There was no significant variation in *Trichuris* spp. and *Fasciola gigantica* infections in relation to season. Age wise prevalence of helminths was non-significantly higher in kids (83.13 %) than in adults (82.62 %). Except *Moniezia* spp., age wise observations did not reveal any significant difference ($p > 0.05$) in prevalence of other gastrointestinal helminths.

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Introduction

Gastrointestinal helminths are an obstacle to goat industry causing growth retardation, weight loss, decreased feed conversion ratio, milk production, low fertility, and in cases of massive infections, high mortality rates (Torres-Acosta et al. 2012). Epidemiological pattern of the helminthic diseases will provide a basis for evolving strategic and tactical control of these helminths. However, parasitic control strategies may differ for different agroclimatic zones due to difference in ecological factors and managemental practices. Jabalpur is located in Agro-climatic Zone III (i.e. Kymore Plateau and Satpura Hills) of the state of Madhya Pradesh. Few studies on the prevalence of gastrointestinal helminths of small ruminants in Jabalpur (Chedge et al. 2013; Gupta et al. 2013) have been carried out where statistical analysis of data was not applied. Thus, studies on the prevalence and risk factors associated to gastrointestinal helminthosis in goats in Jabalpur are still incipient.

Materials and methods

During 3 years of study period (November 2012–October 2015), a total of 632 faecal samples of goats from four selected villages (Ghana, Panagar, Ramnagra and Temarbhita) located distantly apart in the study area were collected and examined by floatation and sedimentation methods (Zajac and Conboy 2012). Each year was divided into three seasons viz. winter (Nov–Feb), summer (March–

June) and monsoon (July–October). Meteorological information was collected from the Agro-meteorology, Department of Physics, College of Agricultural Engineering, JNKVV, Jabalpur. The maximum temperature varied from 21.2 to 42.7 °C and minimum 6.6 to 26.8 °C. The maximum relative humidity varied from 35 to 95 % and minimum 12–82 % with an average annual rainfall of 1619.54 mm. Goats were divided into two groups according to their age as kids (6 months–1 year) and adults (>1 year). Chi square test was used for analyzing the data. A p value of less than 0.05 was considered significant and less than 0.01 highly significant (Snedecor and Cochran 1994).

Results and discussion

Out of the total 632 goats examined, 523 (82.75 %) were positive for gastrointestinal parasites. Among various infections, maximum prevalence was of strongyles (32.59 %) followed by amphistomes (14.40 %), *Moniezia* spp. (12.50 %), *Strongyloides* spp. (0.79 %), *Trichuris* spp. (0.47 %) and *Fasciola gigantica* (0.32 %). Year wise prevalence revealed a decreasing trend in overall prevalence of helminths. The effect of year was found highly significant ($p < 0.01$) for prevalence of gastrointestinal helminths. The overall prevalence of helminths (predominated by strongyles) was highest in monsoon season and average maximum temperature during monsoon showed an increasing trend year wise while average minimum relative humidity showed a decreasing trend. This may be the reason for a decreasing trend in overall prevalence of gastrointestinal helminths. According to Soulsby (1982) the primary factors affecting the development of the eggs and larvae of trichostrongylid nematodes are temperature and moisture. The prevalence of strongyles increased slightly in the second year as compared to first year and then decreased significantly in the third year. *Strongyloides* spp. was found only in first year of study while it was absent in second and third year. Similar trend was observed in the prevalence of *F. gigantica*. *Trichuris* was prevalent only in the third year of the study. Prevalence of amphistome was almost constant in first and second year but decreased significantly ($p < 0.05$) in third year of study. Except *Trichuris* and *Moniezia* spp., there was significant difference in the year wise prevalence of other gastrointestinal helminths (Table 1).

Higher helminth infections were observed in monsoon (87.97 %) followed by winter (81.48 %) and summer (79.03 %) season (Table 2). The difference in prevalence rate in different season was significant ($p < 0.05$). In line with seasonal trend observed in the present investigation,

Table 1 Year wise prevalence of gastrointestinal helminths in Jabalpur, India

Year	No of samples	Infected (%)	Prevalence (%) of gastro-intestinal helminths					
			Strongyle	*Strongyloides*	*Trichuris*	*Fasciola*	Amphistome	*Moniezia*
I	112	103 (91.96)	51 (45.54)	5 (4.46)	0	2 (1.79)	23 (20.54)	13 (11.61)
II	65	56 (86.15)	31 (47.69)	0	0	0	13 (20)	7 (10.77)
III	455	364 (80)	124 (27.25)	0	3 (0.66)	0	55 (12.09)	59 (12.97)
X^2 value	$df = 2$	9.60**	21.19**	21.62**	4.18	8.78*	7.05*	0.35

Figures in parentheses indicate percentage

** The χ^2 values were considered highly significant at $p < 0.01$ level. * The χ^2 values were considered significant at $p < 0.05$ level

Table 2 Seasonal dynamics of gastrointestinal helminths in Jabalpur, India

Season	No of samples	Infected (%)	Prevalence (%) of gastro-intestinal helminths					
			Strongyle	*Strongyloides*	*Trichuris*	*Fasciola*	Amphistome	*Moniezia*
Winter	81	66 (81.48)	40 (49.38)	0	0	1 (1.23)	2 (2.47)	6 (7.41)
Summer	310	245 (79.03)	62 (20.00)	0	2 (0.65)	0	66 (21.29)	49 (15.81)
Monsoon	241	212 (87.97)	104 (43.15)	5 (2.07)	1 (0.41)	1 (0.41)	23 (9.54)	24 (9.96)
X^2 value	$df = 2$	7.69*	45.00**	9.18*	2.40	2.58	25.91**	6.44*

Figures in parentheses indicate percentage

** The χ^2 values were considered highly significant at $p < 0.01$ level. * The χ^2 values were considered significant at $p < 0.05$ level

Table 3 Age wise prevalence of gastrointestinal helminths in Jabalpur, India

Age	No of samples	Infected (%)	Prevalence (%) of gastro-intestinal helminths					
			Strongyle	*Strongyloides*	*Trichuris*	*Fasciola*	Amphistome	*Moniezia*
Kid	166	138 (83.13)	52 (31.33)	0	1 (0.60)	0	21 (12.65)	29 (17.47)
Adult	466	385 (82.62)	154 (33.05)	5 (1.07)	2 (0.43)	2 (0.43)	70 (15.02)	50 (10.73)
X^2 value	$df = 1$	0.02	0.17	2.69	0.34	2.00	0.56	5.08*

Figures in parentheses indicate percentage

* The χ^2 values were considered significant at $p < 0.05$ level

previous workers have also reported similar trend (Khajuria et al. 2013; Singh et al. 2015). The microclimate under dung pat is favourable for better survival of parasitic stages as it saves them from harsh climatic conditions and further leads to more contamination of pasture during monsoon. Strongyle infections were maximum in winter (49.38 %) followed by monsoon (43.15 %) and summer (20 %). The seasonal difference in prevalence was also significant ($p < 0.01$). *Strongyloides* infections were present in monsoon (2.07 %) while they were absent in summer and winter. The seasonal difference in prevalence was significant ($p < 0.05$). Amphistomes were significantly higher ($p < 0.01$) in summer (21.29 %) season as compared to that of monsoon (9.54 %) or winter (2.47 %). High prevalence of amphistomes in summer might be due to ingestion of metacercariae as a result of local overcrowding around water points. Bansal et al. (2015) also found higher prevalence of amphistomes in summer. Similarly *Moniezia* spp. was significantly higher ($p < 0.05$) in summer (15.81 %) as compared to that of monsoon (9.96 %) or winter (7.41 %). This finding is consistent with that described by Khajuria et al. (2013) where infection rates of *Moniezia* spp. were higher in summer and post monsoon season. There was no significant difference in prevalence of *Trichuris* spp. and *Fasciola gigantica* in relation to season (Table 2).

Age wise prevalence revealed that the overall gastrointestinal helminth infection was slightly higher in kids (83.13 %) than in adults (82.62 %) but the difference was not significant. Significantly higher ($p < 0.05$) *Moniezia* infection was observed in kids (17.47 %) as compared to adults (10.73 %). The age wise observations did not reveal any significant difference in prevalence of other gastrointestinal helminths (Table 3). Apparently higher prevalence of helminth infection in kids corroborates to the findings of Talukdar (1996) and Pundlikrao (2009) in Assam and Nagpur, respectively. Young animals were more susceptible for parasitic infections due to their low immunity. As these animals were probably not been exposed to infections and their dams also serve as an additional source of infection.

Parasitic prevalence studies are important to know risk factors associated with the disease in the area to formulate control strategies for the disease. This study revealed that the year and season have significant effect on prevalence of gastrointestinal helminths. The study will contribute to provide baseline data regarding parasitic prevalence in the area.

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