Gastrointestinal parasitic infection in diverse species of domestic ruminants inhabiting tribal rural areas of southern Rajasthan, India

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Abstract A total of 415 adult domesticated ruminants, 130 cattle (*Bos taurus*), 108 buffaloes (*Bubalus bubalis*), 94 goats (*Capra hircus*) and 83 sheep (*Ovis aries*) inhabiting tribal rural areas of southern Rajasthan, India were investigated for evidence of gastrointestinal protozoan and helminthic infections. In southern Rajasthan humid ecosystem is predominant and has number of perennial freshwater bodies. Fresh faecal samples of these animals were examined microscopically by direct wet smear with saline and 1 % Lugol's iodine and formalin ether concentration. Of these 296 (71.32 %) were found to be infected with different species of gastrointestinal parasites. The highest (93.84 %) prevalence of these parasitic infections was found in cattle followed by goats (82.97 %), sheep (55.42 %) and buffaloes (46.29 %). Except cattle no other ruminants revealed protozoan infection. A total 8 species of gastrointestinal parasites were encountered. Among these parasites *Fasciola hepatica* was the commonest (15.18 %) followed by *Haemonchus contortus* (11.32 %), *Ancylostoma duodenale* (10.36 %), *Trichuris trichiura* (9.15 %), *Amphistome* species (7.95 %), *Moniezia expansa* (6.98 %), *Strongyloides stercoralis* (4.57 %) and *Balantidium coli* (3.37 %). The prevalence rate of these parasitic infections also varied seasonally. The highest prevalence rate was found in rainy season (84.21 %) followed by winter (73.9 %) and summer (52.8 %). The possible causes for variation in prevalence of parasitic infections are also discussed.

Keywords Domestic ruminants · Gastrointestinal parasites · Helminths · Infection · Protozoan · Southern Rajasthan · India

Introduction

Domestic ruminants viz., cattles (*Bos taurus*), buffaloes (*Bubalus bubalis*), goats (*Capra hircus*) and sheep (*Ovis aries*) have significant contributory role in national economy and social economic condition all over the world. In India, especially in rural areas farmers and agriculturists are still dependent economically on these animals. Besides mortality and morbidity in ruminants, gastrointestinal parasites also cause considerable economic loss in terms of productivity, growth and increased susceptibility of animals to other parasitic infections. Gastrointestinal parasitism directly or indirectly affects the economic losses in number of ways such as lowered fertility, reduced work capacity, reduction in food intake, lower weight gain and milk production, treatment cost and mortality in heavily parasitized animals. Therefore, several workers conducted epidemiological studies on gastrointestinal parasitic infections in different species of domestic animals inhabiting different ecological conditions and geographical provinces. Seasonal occurrence and variable prevalence rate (39.34–92.4 %) of these parasitic infections have been reported from different states of India as Andhra Pradesh (Sreedhar et al. 2009), Chhattisgarh (Pathak and Pal 2008), Haryana (Gupta et al. 1987), Jammu and Kashmir (Mir et al. 2008; Tariq et al. 2010; Khajuria et al. 2012; Lone et al. 2012), Karnataka (Murleedharan 2005), Maharashtra (Maske et al. 1990; Chavhan et al. 2008; Sutar et al. 2010; Padwal et al. 2011), Meghalaya (Bandyopadhyay et al. 2010a, b), Punjab (Singh et al. 2012), Sikkim (Rahman et al. 2012) and Uttar Pradesh (Bano and Sultana 2003, 2009). From the state of Rajasthan such studies or reports are too scanty especially in tribal region of southern Rajasthan. However, few reports are available from arid region of western Rajasthan (Godara and Sharma 2010;

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Wadhwa et al. 2011). Therefore, the present pilot study was undertaken to find out various species of gastrointestinal parasites and their prevalence rate of infection in diverse species of ruminants inhabiting rural tribal areas of southern Rajasthan where humid ecosystem or environment is persisting. Simultaneously seasonal occurrence of protozoan and helminthic infections has also been observed.

Materials and methods

A cross-sectional coprological survey (October 2010 to September 2011) was carried out in tribal rural areas/villages of Dungarpur and Udaipur districts of southern Rajasthan, India for the evidence and prevalence of gastrointestinal protozoan and helminthic infections in local breeds of domestic ruminants. In southern Rajasthan humid environment is predominant and number of perennial rivers and reservoirs also exist.

Faecal samples of 415 domesticated ruminants, 130 cattle (*B. indicus*), 108 buffaloes (*B. bubalis*), 94 goats (*C. hircus*) and 83 sheep (*O. aries*) were collected in dry, clean, leak proof small glass bottles labeled with name of owner, animal species and identification number. These samples were processed for wet film preparation using 1 % Lugol's iodine and formalin ether concentration technique (Paniker 2002) for the evidence of protozoan and helminthic infection (Choubisa et al. 2012). Identification of ova, cysts, trophozoites and larvae of these parasites was made on the basis of morphological features (Soulsby 1982).

Results and discussion

Out of 415 faecal samples collected from different species of domesticated ruminants, cattles, buffaloes, sheep and goats 296 (71.32 %) were found to be positive for gastrointestinal parasitic infections (Table 1). Of these 10 (9.25 %) samples

Figs. 1–7 Ova and holotype of diverse species of intestinal parasites of domestic animals ($\times 400$). 1 *Balantidium coli*, 2 *Fasciola hepatica*, 3 *Moniezia expansa*, 4 *Haemonchus contortus*, 5 *Trichuris trichiura*, 6 *Strongyloides stercoralis*, 7 *Ancylostoma duodenale*

Table 1 Gastrointestinal protozoan and helminthic infection in domestic ruminants inhabiting tribal rural areas of southern Rajasthan, India

Ruminants (species)	Faecal samples examined	Samples positive for			Total
		Protozoan	Helminths	Mixed	
Cattle (<i>Bos taurus</i>)	130	14 (10.76)	108 (83.07)	–	122 (93.84)
Buffalo (<i>Bubalus bubalis</i>)	108	–	40 (37.03)	10 (9.25)	50 (46.29)
Goat (<i>Capra hircus</i>)	94	–	78 (82.97)	–	78 (82.97)
Sheep (<i>Ovis aries</i>)	83	–	46 (55.42)	–	46 (55.42)
Total	415	14 (3.37)	272 (65.54)	10 (2.40)	296 (71.32)

Figures in parentheses indicate percentage

On ANOVA score variation between the protozoan, helminths and mixed infection was found significant; p value 0.001; but between the ruminant animals though variation seem to be significant the p value is 0.5 (non-significant)

Table 2 Distribution of gastrointestinal parasites in diverse species of domestic ruminants

Parasites	Domestic ruminants				Total
	Cattle	Buffalo	Goat	Sheep	
(A) Protozoan					
<i>B. coli</i>	14 (10.76)	–	–	–	14 (3.37)
(B) Helminths					
(i) Trematodes					
<i>F. hepatica</i> (Liver fluke)	24 (18.46)	02 (1.85)	19 (20.21)	18 (21.68)	63 (15.18)
<i>Amphistome</i> spp.	10 (7.69)	10 (9.25)	08 (8.51)	05 (6.02)	33 (7.95)
(ii) Cestodes					
<i>M. expansa</i>	12 (9.23)	–	12 (12.76)	05 (6.02)	29 (6.98)
(iii) Nematodes					
<i>A. duodenale</i> (Hook worm)	20 (15.38)	10 (9.25)	08 (8.51)	05 (6.02)	43 (10.36)
<i>H. contortus</i>	32 (24.61)	–	12 (12.76)	03 (3.61)	47 (11.32)
<i>S. stercoralis</i> (Thread worm)	06 (4.61)	–	08 (8.51)	05 (6.02)	19 (4.57)
<i>T. trichiura</i> (Whip worm)	04 (3.07)	18 (16.66)	11 (11.70)	05 (6.02)	38 (9.15)
(C) Mixed infection	–	10 (9.25)	–	–	10 (2.40)
Total	122 (93.84)	50 (46.29)	78 (82.97)	46 (55.42)	296 (71.32)

Figures in parentheses indicate percentage

On ANOVA score variations were found to be non-significant both among the various species of protozoan, helminths and the mixed infection (p value 0.11); and between the ruminant animals (p value 0.2)

revealed evidence of mixed infection (protozoan + helminth) and these were observed only in buffaloes. In the present pilot study eight species of gastrointestinal parasites were detected and identified (Figs. 1–7). Of these parasites, one was protozoan and remaining were helminth parasites, digenetic trematodes, cestodes and nematodes (Table 2).

The highest (93.84 %) prevalence of parasitic infection was observed in cattle followed by goats (82.97 %), sheep (55.42 %) and buffaloes (46.29 %). Among the bovines and flocks, buffaloes and sheep revealed minimum prevalence of parasitic infection (Table 1). Among the various species of gastrointestinal parasites, digenetic trematode parasite *Fasciola hepatica* (Liver-fluke) was more prevalent and showed maximum (15.18 %) prevalence of infection followed by *Haemonchus contortus* (11.32 %), *Ancylostoma duodenale* (10.36 %), *Trichuris trichiura* (9.15 %), *Amphistome* species (7.95 %), *Moniezia expansa* (6.98 %), *Strongyloides stercoralis* (4.57 %) and *Balantidium coli* (3.37 %). The highest prevalence of these parasitic infections was observed in rainy season (84.21 %) followed by winter (73.91 %) and summer (52.8 %). Data pertaining to prevalence of parasitic infection in different species of ruminants were found to be significant statistically.

In the present coprological investigation 71.32 % prevalence of gastrointestinal parasitic infection was observed in diverse species of domestic ruminants, which is relatively higher than (39.34–67.24 %) reported from Andhra Pradesh (Sreedhar et al. 2009), Jammu and Kashmir (Tariq et al. 2010; Khajuria et al. 2012) and Maharashtra (Chavhan et al. 2008) states. Relatively a high prevalence rate (72.99–92.4 %) has also been reported from other geographical provinces (Maske et al. 1990; Bandyopadhyay

et al. 2010a) of India. These findings clearly revealed that prevalence rate of gastrointestinal parasitic infection greatly vary from one geographical region to another and also vary from species to species in domestic animals. This variation may be due to variation in local ecosystem as well as agro climatic condition. In desert or arid ecosystem of western Rajasthan 12–43.95 % prevalence rate of parasitic infection has been observed and reported in local breed of domestic animals (Godara and Sharma 2010; Wadhwa et al. 2011), which is lower than prevalence (71.32 %) observed in the present studied areas where humid ecosystem predominantly exists. Animal parasites also prefer such type of humid environment for their survival and multiplication (Williamson and Payne 1978; Yadav and Tandon 1989). A high incidence of *Fasciola* (15.18 %) and *Amphistome* (7.95 %) digenetic trematode parasites in the present study is due to presence of a large number of their intermediate snail host species in various perennial freshwater bodies (Choubisa and Sharma 1986; Choubisa 1991, 2008, 2010). Rainy season provides a most favourable environment for accomplishment of life cycle of these digenetic trematode parasites (Choubisa 2002). Therefore, a high incidence of *Fasciola* and *Amphistome* parasites in monsoon is possible. In rainy season drinking water and food/fodder of animals gets contaminated. Therefore, in rainy season a high prevalence of protozoan and helminthic infection is possible. Several workers (Muraleedharan 2005; Chavhan et al. 2008; Pathak and Pal 2008; Sreedhar et al. 2009; Sutar et al. 2010; Tambe et al. 2011; Khajuria et al. 2012) have also observed and reported comparatively high prevalence of gastrointestinal parasitic infections in monsoon period. On the contrary few workers have also observed and reported a high incidence of these

parasitic infections in summer (Mir et al. 2008) and winter (Padwal et al. 2011) season, but the reason is not clear yet.

Among bovines and flocks, cattle and goats revealed maximum prevalence rate of parasitic infection. Infact cattle and goats are relatively more active as compared to their counterparts. Therefore, active movement may increase the frequency of exposure to contaminated drinking water and food. Although sheep also more active but revealed low prevalence rate of parasitic infection. Indeed sheep develop immunity against parasitic infection and reinfection during their earlier life span (Vlasoff et al. 2001; Macaldowie et al. 2003). Therefore, a low prevalence is possible in sheep.

To conclude, gastrointestinal parasitic infections in domesticated ruminants of tribal rural areas of southern Rajasthan are relatively more prevalent and hyper endemic. To check economic losses and improvement of socio-economic condition of farmers 'deworming programme' and preservation of animal health is highly suggestive in the present studied tribal areas of Rajasthan. Although present study is at pilot level, nevertheless, the findings reported here in shall not only significantly add to existing knowledge of gastrointestinal parasitoses but also help in planning pasture and grazing management and other prophylactic strategies.

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