Incidence of gastrointestinal nematodes in goats in and around Mhow, Madhya Pradesh

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Abstract Gastrointestinal (GI) parasitism in animals is considered as one of the major problems in India causing recurring economic losses to livestock production system owing to morbidity and mortality. But data pertaining to epidemiology of GI nematodes in goats is meager from Malwa region of Madhya Pradesh. Therefore, the present investigation was carried out to study the incidence of GI nematodes in goats in and around Mhow and accordingly a total of 900 faecal samples of goats were collected from Mhow and its adjoining areas and faecal sample examination revealed the incidence of strongyle, *Strongyloides papillosus*, *Trichuris* spp. and mixed infection from the study area. Significantly higher infection of GI nematodes was evidenced in the monsoon season (50.67%) when compared with summer (41.33%) and winter (38.33%) seasons. Significantly higher infection rate was documented in >1 year-old-goats (50.43%) than <1 year-old-goats (19.31%). Non-significantly higher infection was noted in females (46.04%) than their male counterparts (39.50%).

Keywords Gastrointestinal nematodes · Goats · Incidence · Madhya Pradesh · Mhow

Introduction

Economic impact of gastrointestinal (GI) parasites in livestock industry encompasses mortality and morbidity losses, enhanced susceptibility to diseases and losses resulting from condemnation of carcasses and viscera as well as cost of drugs and veterinary aids (Rajakaruna and Warnakulasooriya 2011). As per the estimates of de Haan and Bekure (1991) in Sub-Saharan Africa, endoparasites caused annual mortality and production losses to the tune of US\$ 2 billion. As per the estimates of Das et al. (2013), the GI parasitism in goats caused a monetary loss of Rs. 372.35/goat/year from rural area of Jabalpur. Therefore, the gastrointestinal parasitism is considered as one of the major constraints for profitable livestock industry in tropical and subtropical countries including India. While GI nematodes are regarded as one of the most important groups causing recurring economic losses to livestock production systems throughout the world due to morbidity and mortality. Further, it causes emaciation, anaemia, hypoproteinaemia, oedema, weakness, diarrhoea and death. Sanyal et al. (1996) reported that, the parasitic gastritis dominated by haemonchosis, was a major constraint to the profitable sheep and goat production in India as the climate is favourable for the development and survival of free living stages of these parasites throughout the year. But the data pertaining to epidemiology of GI nematodes in goats is meagre from Malwa region of Madhya Pradesh (MP) and hence it becomes mandatory to develop data on epidemiology of gastrointestinal nematodes in goats for the implementation of future control measures against GI nematodes in the region. Therefore, the present investigation was carried out to study the incidence of GI nematodes in goats in and around Mhow (MP).

This study is a part of M.V.Sc. thesis of first author.

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Materials and methods

The incidence study was conducted by collecting faecal samples from Mhow and its adjoining areas, viz. Mhow, Borkhedi, Keoti, Bajrangpur, Santer, Nawada, Panda, Harsola, Jamli and Harnyakhedi. The study area i.e. Mhow is located in Indore district of Madhya Pradesh and its geographical coordinates are 22°33'0" North and 75°46'0" East. The Indore district is located in Western region of MP, on the Southern edge of the Malwa plateau. Every month faecal samples of goats were collected during all the three seasons of the year. A questionnaire was prepared to record the details of animals like age, sex, name and address of the owner and samples were collected from <1 year-old and >1 year-old goats of both the sexes. Every month rectal faecal samples of goats were collected in an individually labeled polythene bags and each bag was numbered as per the serial no. of the questionnaire. For collection of rectal faecal samples, clearance certificate was obtained from Institutional Animal Ethical Committee of the college. A total of 900 samples were collected from the study area and were transported to the laboratory for further examination. The faecal samples were processed by employing faecal floatation and sedimentation techniques (Soulsby 1982). The association of incidence of different GI nematodes with season, age and sex was analysed by employing Chi square test (Snedecor and Cochran 1994).

Results

The faecal sample examination of 900 goats from Mhow and its adjoining areas revealed strongyle worms, *Strongyloides papillosus*, *Trichuris* spp. and mixed infection. The data pertaining to season, age and sex-wise incidence of GI nematodes in goats is depicted in Table 1. The highest rate of incidence was documented during monsoon (50.67%) followed by summer (41.33%) and winter (38.33%) with significant difference ($p < 0.01$) in season-wise incidence as during monsoon season, 50.67% goats were found to be infected with highest incidence of *Trichuris* spp. (20.00%) when compared with strongyle worms (13.00%), mixed infection (12.33%) and *S. papillosus* (5.33%). In winter season, 38.33% goats were positive for GI nematodes with highest incidence of *Trichuris* spp. (24.33%) followed by strongyle worms (14.00%) while none of the animal was found infected with *S. papillosus* and mixed infection during the winter season. During summer season, the incidence rate of GI nematodes was documented as 41.33%, where the strongyle worms showed the highest incidence of 28.33% than *Trichuris* spp. (8.00%), *S. papillosus* (4.00%) and mixed infection (1.00%). The significant difference ($p < 0.01$) was noticed in age-wise incidence with an overall incidence of 19.31% in case of goats <1 year of age with highest incidence of *Trichuris* spp. (9.41%) followed by strongyle worms (5.45%), mixed infection (2.97%) and *S. papillosus* (1.49%) while the goats >1 year of age showed 50.43%

Table 1 Season, age and sex-wise incidence of GI nematodes of goats in and around Mhow

Parameters	Examined	Positive	Strongyle	<i>S. papillosus</i>	<i>Trichuris</i> spp.	Mixed infection
Season						
Monsoon	300	152 (50.67)	39 (13.00)	16 (5.33)	60 (20.00)	37 (12.33)
Winter	300	115 (38.33)	42 (14.00)	00	73 (24.33)	00
Summer	300	124 (41.33)	85 (28.33)	12 (4.00)	24 (8.00)	03 (1.00)
Chi square value	–	10.10**	29.36**	15.33**	29.83**	66.31**
Age						
<1 year	202	39 (19.31)	11 (5.45)	03 (1.49)	19 (9.41)	06 (2.97)
>1 year	698	352 (50.43)	155 (22.21)	25 (3.58)	138 (19.77)	34 (4.87)
Chi square value	–	61.76**	29.27**	2.28 (NS)	11.69**	1.34 (NS)
Sex						
Male	357	141 (39.50)	31 (8.68)	06 (1.68)	83 (23.25)	21 (5.88)
Female	543	250 (46.04)	135 (24.86)	22 (4.05)	74 (13.63)	19 (3.50)
Chi square value	–	3.75 (NS)	38.27**	4.48*	13.80**	2.88 (NS)
Total	900	391 (43.44)	166 (18.44)	28 (3.11)	157 (17.44)	40 (4.44)

Figures in parentheses are percentage of positive animals

NS non significant

** $p < 0.01$, * $p < 0.05$

incidence of GI nematodes with highest incidence of strongyle worms (22.21%) followed by *Trichuris* spp. (19.77%), mixed infection (4.87%) and *S. papillosus* (3.58%). Non-significantly higher infection was recorded in case of females (46.04%) with a incidence of strongyle worms (24.86%), *Trichuris* spp. (13.63%), *S. papillosus* (4.05%) and mixed infection (3.50%) than that of males (39.50%) with a incidence of *Trichuris* spp. (23.25%) strongyle worms (8.68%), mixed infection (5.88%) and *S. papillosus* (1.68%).

Discussion

The topography of the grazing area, nature of its soil and vegetation, availability and type of water sources, climatic parameters like temperature, relative humidity and the rainfall play an important role on the epidemiology of GI nematodes. Accordingly, the Mhow and its adjoining area was selected to analyse the pattern of incidence of GI nematodes of goats from the study area. The GI nematodes in goats in and around Mhow were identified as strongyles, *S. papillosus* and *Trichuris* spp. The surveyed animals were harbouring the mixed infection as well. Similar type of infection in goats of Madhya Pradesh was also reported by Dubey and Chaudhry (1998), Singh et al. (1999), Das et al. (2011), Bansal (2012), Chedge et al. (2013), Dongre et al. (2015), Singh et al. (2015) and Gaherwal et al. (2016). Similar type of infection in domestic animals of Madhya Pradesh was also recorded by Dixit et al. (2011), Gupta et al. (2011, 2012) and Jamra (2013). Findings of the present survey are also in accordance with the findings of Sreekrishnan et al. (1998), Chavan et al. (2008), Kripali et al. (2009), Sharma et al. (2009), Arunachalam et al. (2011), and Barua et al. (2015) in goats from different parts of India. The present survey encountered highest incidence of strongyle worms followed by *Trichuris* spp., mixed infection and *S. papillosus*.

The current study witnessed the significantly higher incidence of GI nematodes during the monsoon season than that of summer and winter (Table 1), which is in accordance with Deshpande et al. (2001), Chavan et al. (2008), Sharma et al. (2009), Barua et al. (2015), Singh et al. (2015) and Thakuria et al. (2015) in case of goats from different parts of India. The highest incidence of GI nematodes in monsoon may be due to the presence of adequate moisture and temperature in the environment which might have resulted in increased frequency of transmission of the infective larvae to the final host. The development, survival and transmission of eggs and infective larvae of gastrointestinal nematodes is influenced by climatic and environmental factors like temperature, humidity and precipitation. As the moderate climatic

temperature, high relative humidity and rainfall prevailing in the monsoon season used to favour the hatching of eggs and development of infective larvae, which might be the reason for highest incidence of GI nematodes witnessed during monsoon season. According to Hawkins (1945), hot and humid weather of the monsoon season produces stress on the animal resulting in decreased immune status and ultimately which makes the animal more prone to the heavy infection. Additionally, the embryonated eggs of *Stroglyoides* spp. require the moist environment to develop the infective stages (Croll 1975). These might be the factors responsible for higher incidence recorded during monsoon season. Suitable molarity of salt present in the soil during monsoon which is an important factor for ecdysis might be responsible for higher rate of infection during monsoon season (Soulsby 1982). The higher rate of incidence during monsoon is also attributed to the direct relationship between the incidence and with that of rainfall, humidity and temperature. As the sufficient rainfall and moisture during the monsoon season favour the survival of infective larvae in the pasture and increases the probability of uptake of infective larvae resulting in higher rate of incidence. Followed by monsoon, the summer season experienced 41.33% incidence of GI nematodes and ranked second as far as season-wise incidence is concerned. Whereas lowest incidence was evidenced during winter season, which is in accordance with the findings of Sharma et al. (2009) who recorded similar pattern of infection in goats from semi-arid region of India and Thakuria et al. (2015) also evidenced same pattern in goats of Assam.

The present survey experienced significantly ($p < 0.01$) higher infection of GI nematodes in >1 year than <1 year-old goats. Additionally, significantly ($p < 0.01$) higher infection of strongyle and *Trichuris* spp. was in evidence in >1 year-old than <1 year-old animals. While non-significant difference was recorded in case of *S. papillosus* and mixed infection (Table 1). The results obtained in the current study are in accordance with Sharma et al. (2009), Bansal (2012), Chedge et al. (2013) and Jamra (2013) in case of goats, cattle and buffaloes from India including most of the surveys from MP. Additionally, Almalaik et al. (2008) recorded similar findings in case of goats while in case of sheep, Jegede et al. (2015) and Tramboos et al. (2015) experienced similar pattern of infection as far as age groups of animals are concerned. The results of the present investigation, showing higher infection in adults than that of young ones might be due to the fact that, young suckling kids are being kept at home and they are not allowed to graze on the pasture land and most of the times the pasture happens to be infected with infective larvae, as infected adult animals continually shed the eggs of GI nematodes and this cycle continues owing to which, the present investigation might have experienced higher incidence in

case of adults which are grazing on pasture than that of young ones which are generally kept at home.

The results depicted in Table 1 are indicative of non-significantly higher incidence of GI nematodes in female goats when compared with their male counterparts. Similar findings were also reported by Bansal (2012) in case of goats from MP, Kuchai et al. (2011) in case of sheep from Ladakh, Mir et al. (2013) in case of sheep from Jammu, Sajid et al. (1999) in case of sheep from Pakistan, Jegede et al. (2015) in case of goats from Nigeria, Raza et al. (2014) in case of goats from Pakistan and Tramboos et al. (2015) in case of sheep from Kashmir valley. As far as sex-wise incidence of GI nematodes is concerned, the present survey witnessed difference (although non-significant) in rate of incidence which could be due to influence of sex on the susceptibility of animals to infections which might be due to genetic predisposition and differential susceptibility owing to hormonal differences. The present research study experienced the susceptibility of female goats to gastrointestinal nematodes when compared with that of males which is based on non-significantly higher rate of infection in case of females than that of males which is not only attributable to hormonal differences but also to the pregnancy and lactational stress.

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Compliance with ethical standards

Conflict of interest Authors would hereby like to declare that there is no conflict of interests that could possibly arise.

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