Original Research

Prevalence of Gastrointestinal Helminths and Assessment of Associated Risk Factors in Dairy Cows from Punjab Districts, India

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Abstract

A total of 1133 faecal samples were collected from dairy cows of various districts representing different agro-climatic zones of Punjab and examined for gastrointestinal helminths. Coprological examination revealed an overall prevalence of 41.22% with mean egg per gram of faeces ranging from 160.47 ± 12.94 to 202.33 ± 11.93. The parasites reported with their respective prevalences (%) were strongyles (31.60%), amphistomes (13.42%), Moniezia spp. (4.41%), Fasciola spp. (3.80%), Trichuris spp. (1.85%), Strongyloides spp. (1.59%) and Capillaria spp. (0.44%). Results of multivariate analysis showed prevalence of gastrointestinal helminths to be significantly associated with risk factors as districts, agro-climatic zones and seasons. Maximum prevalence was recorded in monsoon (43.75%) and lowest in winters (39.56%). The highest infection rate was reported from sub-mountain zone (47.82%) and Ludhiana district (52.68%). Coproculture analysis revealed the presence of larvae of Oesophagostomum, Haemonchus, Trichostrongylus, Cooperia, Chabertia, Bunostomum, Strongyloides and Nematodirus in decreasing order.

Key words: Coproculture, Dairy Cows, Gastrointestinal Parasites, Prevalence, Punjab, Risk Factors

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Introduction

Gastrointestinal (GI) helminth infections have been recognized as a global problem in the livestock sector and associated with huge economic losses to the dairy farmers. The losses are manifested in terms of morbidity/mortality in acute cases and reduced weight gain, feed conversion, milk production, and poor reproductive performance, particularly in chronic infections (Edosomwan and Shoyemi, 2012). Diverse agro-climatic conditions, animal husbandry practices and pasture management have been shown to influence the incidence and severity of various parasitic diseases in a particular region. Therefore, comprehensive knowledge of the epizootiology of GI parasitism is a crucial requirement for the sustainable

control of helminths, as it interacts with the host under specific climatic, management and production conditions (Jittapalapong *et al*., 2011).

Prevalence studies on GI parasitism in cattle have been reported worldwide (Jittapalapong *et al*., 2011; Asif Raza *et al*., 2013; Yahaya and Tyav, 2014) including India (Gupta *et al*., 2012; Laha *et al*., 2013). Studies from Punjab state (Haque *et al*., 2011; Jyoti *et al*., 2011; Singh *et al*., 2012) reported only coproscopic prevalence data and information regarding intensity of infection and identification of strongyle parasites is lacking. Hence, the present study was planned to determine the prevalence and associated risk factors of various GI parasites in dairy cows and to identify the genera of various strongyle parasites from Punjab state.

Material and Methods

Collection of Samples

A total of 1133 faecal samples were collected from apparently healthy adult dairy cows randomly selected from all types of farm practices in 21 districts of different agro-climatic zones of Punjab *viz*. sub-mountain undulating zone with average annual rainfall of >900 mm (Gurdaspur, Hoshiarpur), undulating plain zone: 800-900 mm (Ajitgarh, Rupnagar and Nawanshahr), central plain zone: 500-800 mm (Amritsar, Fatehgarh Sahib, Jalandhar, Kapurthala, Ludhiana, Patiala and Tarn Taran), western plain zone: 400-500 mm (Fazilka, Faridkot and Firozpur) and western zone: <400 mm (Barnala, Bathinda, Mansa, Moga, Muktsar and Sangrur). The samples were placed in sterile polythene bags, labeled, kept in cool transport box and brought to the laboratory for further examination.

Coproscopic Examination

The faecal samples were subjected to standard qualitative examination using direct smear method and concentration techniques (floatation and sedimentation) for detection of the helminthic eggs. The eggs were identified on the basis of typical morphological features (Soulsby, 1982). Samples positive for helminthic eggs were subjected to quantitative faecal sample examination employing standard McMaster's and Stoll's dilution technique for nematode and trematode eggs, respectively to calculate the eggs per gram (EPG) of faeces in order to assess the severity of infection (Soulsby, 1982). A representative number of faecal samples positive for strongyle eggs were pooled in equal quantities and used in coproculture at 27ºC as per standard protocol. The hatched out larvae were harvested and used for identification (Van wyk and Mayhew, 2013).

Statistical Analysis

All data analyses were performed by SPSS software version 19.0. Association between prevalence of GI helminth infections and various risk factors was carried out by chi-square test. Variables with significant

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association at P<0.05 (two-sided) were subjected to the multivariate logistic regression model. The results were each expressed as P value and odds ratio (OR) with a 95% confidence interval (CI 95%).

Results and Discussion

Coproscopic Examination

Of the 1133 samples examined, 467 samples were found positive for GI helminths with an overall prevalence of 41.22% (details in Table 1).

Table 1: Season and zone wise prevalence of GI helminths in cattle of Punjab

Risk Factors		Number of Samples (% Prevalence)									
		Examined	**Positive**	**Mixed**	**Strongyle**	***Strongyloides***	***Trichuris***	***Moniezia***	***Capillaria***	**Amphi-stome**	***Fasciola***
Season	Summer	342	140 (40.93)	54 (15.79)	108 (31.58)	4 (1.17)	6 (1.17)	19 (5.56)	1 (0.29)	54 (15.79)	19 (5.56)
	Rainy	336	147 (43.75)	62 (18.45)	113 (33.63)	3 (0.89)	5 (1.49)	17 (5.06)	2 (0.6)	48 (14.29)	11 (3.27)
	Winter	455	180 (39.56)	52 (11.43)	137 (30.11)	11 (2.42)	10 (2.2)	14 (3.08)	2 (0.44)	50 (10.99)	13 (2.86)
	χ^2 value		1.416	7.909*	1.109	3.424	0.562	3.317	0.354	4.185	4.249
Agro-climatic Zones	Sub-Mountain	184	88 (47.82)	32 (17.39)	68 (36.95)	6 (3.26)	3 (1.63)	8 (4.35)	3 (1.63)	34 (18.48)	5 (2.72)
	Undulating Plain	141	62 (43.97)	27 (19.15)	41 (29.08)	2 (1.42)	2 (1.42)	5 (3.55)	2 (1.42)	13 (9.22)	3 (2.13)
	Central Plain	483	206 (42.65)	75 (15.53)	153 (31.68)	4 (0.83)	11 (2.28)	22 (4.55)	0 (0)	75 (15.53)	30 (6.21)
	Western Plain	127	47 (37.01)	15 (11.81)	42 (33.07)	3 (2.36)	3 (2.36)	6 (4.72)	0 (0)	11 (8.66)	2 (1.57)
	Western	198	64 (32.32)	19 (9.6)	54 (27.27)	3 (1.51)	2 (1.01)	9 (4.54)	0 (0)	19 (9.6)	3 (1.51)
	Total	**1133**	**467 (41.22)**	**168 (14.83)**	**358 (31.6)**	**18 (1.59)**	**21 (1.85)**	**50 (4.41)**	**5 (0.44)**	**152 (13.42)**	**43 (3.8)**
	χ^2 value		11.561*	8.436	4.701	5.597	1.629	0.314	12.568*	13.010*	13.915**

** P < 0.05; ** P < 0.01*

Along with mixed infections (14.83 %), various GI helminths in decreasing order of prevalence were strongyles (31.60%), amphistomes (13.42%), *Moniezia* spp. (4.41%), *Fasciola* spp. (3.80%), *Trichuris* spp. (1.85%), *Strongyloides* spp. (1.59%) and *Capillaria* spp. (0.44%). Quantitative examination of faecal samples revealed mean EPG of 178.85±10.99, 202.33±11.93 and 160.47±12.94 for strongyles, amphistomes and *Fasciola* spp., respectively. A wide range of variation in prevalence rates of GI helminths (18.22% to 88.5%) has been reported by various workers (Edosomwan and Shoyemi, 2012; Asif Raza *et al*., 2013; Pfukenyi *et al*., 2007; Rahman and Samad, 2010) including India (Hafiz *et al*., 2011; Gupta *et al*., 2012). Previous reports from the same region, reported 37.97% (Haque *et al*., 2011) and 45.52% (Jyoti *et al*., 2013) prevalence rate of GI helminths which are in close agreement to findings of present study.

Furthermore, Hafiz *et al*. (2011) reported 42.67% positivity for GI helminths in cattle from Kashmir which is similar to our findings. The results are also congruent with those reported from Zimbabwe (Pfukenyi *et al*., 2007), Thailand (Jittapalapong *et al*., 2011) and Nigeria (Edosomwan and Shoyemi, 2012). However, several workers have reported higher prevalence rates of GI helminths in cattle (Samanta and Santra, 2009; Rahman and Samad, 2010; Gupta *et al*., 2012; Asif Raza *et al*., 2013). The lower prevalence in present study may be possibly due to different geographical area, sample size as well as adoption of improved animal husbandry practices, animal welfare and rational use of anthelmintics in this part of the country (Singh *et al*., 2012).

Strongyle infection was reported to be the most predominant infection in cattle which is similar to the previous reports from the region (Haque *et al*., 2011; Jyoti *et al*., 2013), India (Pandit *et al*., 2004; Samanta and Santra, 2009; Gupta *et al*., 2012) as well as abroad (Waruiru *et al*., 2000; Squire *et al*., 2013). The higher prevalence rate of strongyles may be due to presence of suitable environmental conditions (hot and humid climate), essential for development of pre-parasitic stages of strongyles (Singh *et al*., 2012). Furthermore, amphistome prevalence was reported to be higher than *Fasciola* spp. which may be due to the lack of an effective treatment up to now against cattle paramphistomosis (Mage *et al*., 2002).

Regarding severity of GI helminthic parasitism, strongyle worm burden was low when compared to other parts of India (Wadhwa *et al*., 2011; Laha *et al* 2013) as well as abroad (Pfukenyi *et al*., 2007; Rahman and Samad, 2010; Hailu *et al*., 2011) which may be attributed to the better managemental and husbandry practices prevalent (Singh *et al*., 2012). The EPG of amphistomes was higher to the EPG of *Fasciola* which may be attributed to the fact that proportion of animals shedding amphistome egg remains higher than those shedding *Fasciola* eggs in all zones, management systems, farms as well as age groups (Keyyu *et al*., 2005). Coprolculture analysis revealed the presence of nematodes of genera *Oesophagostomum* (28%), *Haemonchus* (22%), *Trichostrongylus* (17%), *Cooperia* (12%), *Chabertia* (9%), *Bunostomum* (6%), *Strongyloides* (4%) and *Nematodirus* (2%) in decreasing order of the prevalence. Various workers have encountered these nematodes from different parts of India (Murleedharan, 2005) and abroad (Waruiru *et al*., 2000; Hailu *et al*., 2011 Asif Raza *et al*., 2013).

Seasonal Dynamics of GI Helminths

Season was found to play an important role in the prevalence as significant association was observed between the prevalence and season (P = 0.001; OR: 1.059; CI 95%: 0.796-1.409). The highest infection rate was recorded in monsoon (43.75%), followed by summer (40.93%) and least in winter (39.56%) (details in Table 1). The most prevalent parasites were strongyles (31.60%) with maximum prevalence in rainy season followed by amphistomes (13.42%) in summer season. Severity of the strongyle infection based on the EPG count was found to be highest in rainy season (227.27±24.74) and may be associated

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with humid climatic conditions. Sanyal and Singh (1995) have indicated an increased parasite burden in the host as well as on pasture during the rainy season based on nationwide survey which is in congruent to our findings. The counts for amphistomes (206.67±22.95) and *Fasciola* spp. (160.00±19.74) were highest in summer and may be due to long pre-patent periods of these infections.

Prevalence of GI Helminths in Different Agro-Climatic Zones

Agro-climatic zones were found to be significantly associated with the prevalence of GI helminthic infection ($P < 0.013$; OR: 1.919; CI 95%: 1.267-2.907) with western regions revealing lower prevalence than sub-mountain zone. Strongyles were found to be most predominant from all the zones (details in Table 1) and among trematodes, amphistomes were most prevalent (13.42%). Simultaneously, western plain zone (4.72%) and central plain zone (4.55%) reported comparatively higher prevalence of *Moniezia* spp. infection. The EPG counts of strongyle (215.00±32.68) and amphistome (250.00±34.56) infection were found to be highest in western plain zone whereas, for *Fasciola* spp. highest count (275.00±62.62) was reported from the undulating plain zone. High prevalence of helminths particularly strongyles, amphistomes and *Fasciola* were recorded from the zones receiving high annual rainfall as compared to the drier zones. These findings may be attributed to the fact that zones receiving high annual rainfall provide optimum conditions of humidity and temperature required for development of infective stages. Similarly, highest EPG of strongyle, amphistome and *Fasciola* infection was recorded in sub-mountain zone with higher rainfall and relative humidity thus providing favourable environment required for development and dissemination of exogenous stage of worms along with suitable molarity of salt in soil, which is also an important factor for ecdysis (Hafiz *et al*., 2011).

Prevalence of GI Helminths in Districts of Punjab

A highly significant ($P = 0.000$; OR: 1.352; CI 95%: 0.636-2.874) association of the districts and prevalence of GI helminths was recorded in the present investigation with district Ludhiana revealing the highest infection rate (52.7%) and district Bathinda the minimum (10.7%) (details in Fig. 1). The maximum prevalence of strongyles, amphistomes, *Fasciola* spp. and *Moniezia* spp. was recorded from district Ludhiana (41.69%), Hoshiarpur (19.87%), Patiala (8.86%) and Muktsar (12.5%), respectively.

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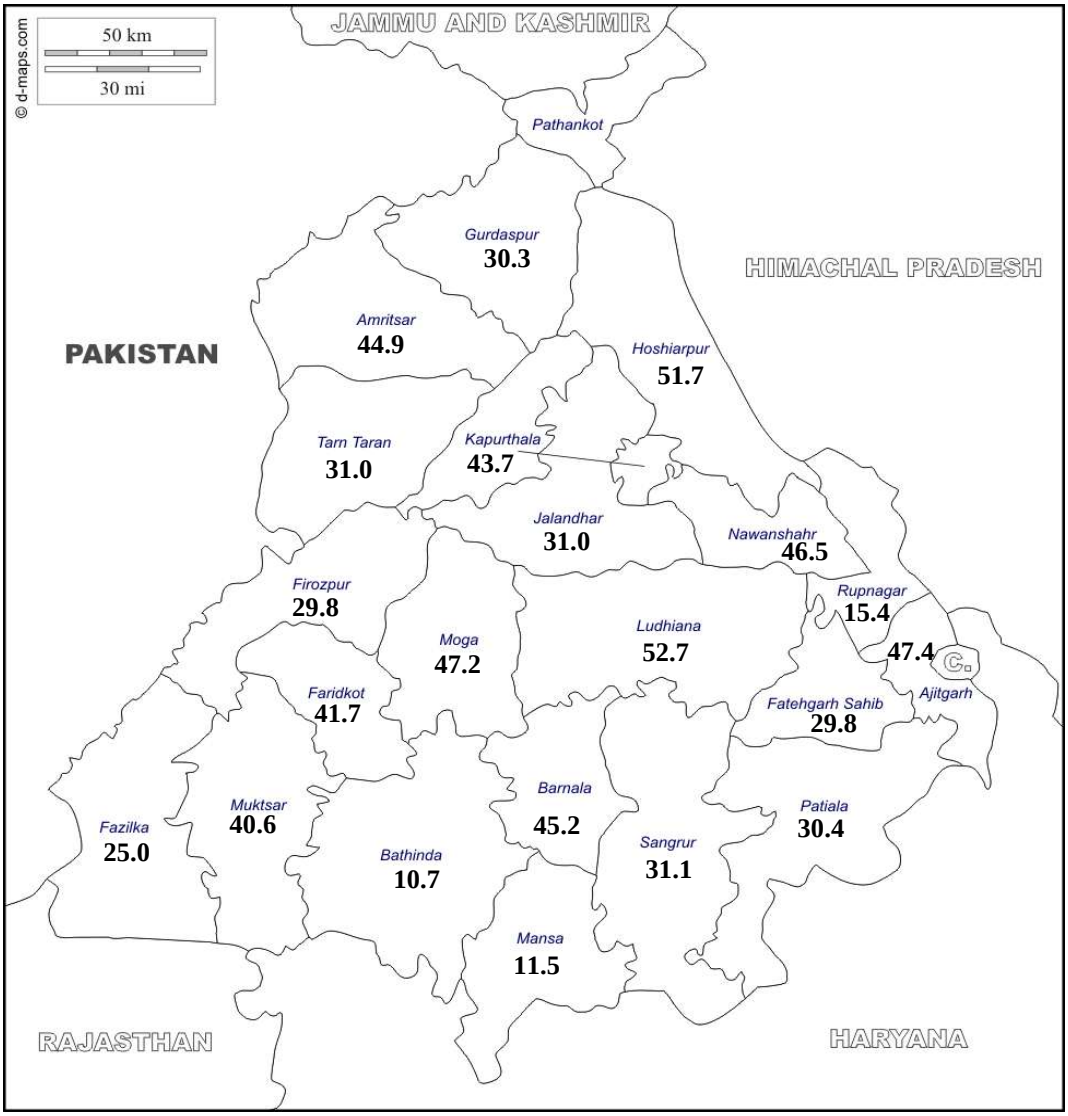

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Fig. 1: Percent prevalence of GI helminths in dairy cows from Punjab districts

Conclusion

Results of the current study reveal strongyles followed by amphistomes are the predominant GI helminths infecting dairy cows of the Punjab state and are significantly associated with geographical location and seasons. Maximum prevalence was recorded in sub-mountain zone and monsoon season.Therefore data generated in the present study could be of immense help in formulation of effective strategies for GI parasite control in different agro-climatic zones of Punjab.

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