Prevalence and risk assessment of gastrointestinal helminthoses in dairy animals of Bikaner, Rajasthan

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Abstract A total of 715 faecal samples were collected from dairy animals of eight tehsils of Bikaner district, Rajasthan during March 2015 to January 2016. An overall prevalence rate of 54.12 % was recorded for gastrointestinal helminthoses with highly statistical difference among dairy animals ($p < 0.01$). Quantitative analysis revealed mild to high severity of strongyle and *Strongyloides* sp. infections in cattle population, respectively whereas, mild severities of same infections were reported from the buffalo population of the region. Seasonal analysis revealed a non-significant difference with highest prevalence in rainy season (59.18 %). The tehsil wise analysis revealed a significant difference ($p < 0.05$) among tehsils with highest prevalence in Chhatargarh (69.70 %). Multivariate binary regression model revealed rainy season as the most favorable season and Chhatargarh as the tehsil with maximum risk for GI helminth infections. On coproculture of positive samples, the nematode infections in decreasing order of prevalence were *Haemonchus* sp. (36.33 %); *Oesophagostomum* sp. (26.33 %); *Strongyloides* sp. (13.67 %); *Trichostrongylus* sp. (11.67 %); *Bunostomum* sp. (7.33 %) and *Cooperia* sp. (4.67 %). The baseline data on the prevalence of various GI Helminths of dairy animals generated in the current study would be of immense help in formulating control strategies against infections in Bikaner district.

Keywords Bikaner · Dairy animals · Gastrointestinal helminthoses · Prevalence · Rajasthan · Risk factors

Introduction

Gastrointestinal (GI) helminthoses constitute a major impediment to livestock production throughout the world as animals of all ages are affected by a diversity of helminth parasites present in gastrointestinal tract (Hoste et al. 2006). In Rajasthan, the economy of rural people largely depends on cattle wealth (Swarnakar et al. 2015) and dairy farming is an important source of income for farmers in various tehsils of Bikaner which comes under hyper arid partially irrigated zone. Helminthic infections though cause nearly one-third of total losses due to all animal diseases (Anon 1990) are commonly overlooked as majority of the infected animals show little obvious clinical signs and the effects are gradual and chronic (Jithendran and Bhat 1999; Raza et al. 2010). The economic losses include reduced work capacity, lower fertility, reduction in food intake, lower weight gains and milk production, treatment costs, involuntary culling, higher susceptibility of animals to other infections and mortality in heavily parasitized animals (Yadav et al. 2004; Regassa et al. 2006; Rinaldi et al. 2011; Wadhwa et al. 2011). To combat these infections there is a need for strategic and well planned surveys of GI parasitic infection of the region but information regarding prevalence of these infections in dairy animals of the region seems to be sporadic (Godara and Sharma 2010; Wadhwa et al. 2011; Choubisa and Jaroli 2013). Therefore, present investigation was undertaken with the objective of assessing the occurrence of GI helminthoses in dairy animals of Bikaner district, Rajasthan with the ultimate aim to assist

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the veterinarians in forecasting and conscious the farmers to adopt appropriate control measures against gastrointestinal helminthoses.

Materials and methods

Study area

Coprological examination of dairy animals from eight tehsils of Bikaner district viz. Bikaner, Chhatargarh, Khajuwala, Kolayat, Lunkaransar, Nokha, Pugal and Shridungargarh was conducted. The district is located at 27° 11" to 29° 03" North latitude, 71° 54" to 74° 12" East longitude, 238 meters above sea level in North western region of Rajasthan, India. The ambient mean temperature (32.6–17.64 °C) and an annual mean rainfall (53.96 mm) of the Bikaner district were recorded from Agriculture Research Station, Bikaner during the study year from March 2015 to January 2016.

Collection of samples

A total of 715 faecal samples of dairy animals comprising of 500 cattle (290 native and 210 crossbred cows) and 215 buffaloes were collected randomly from eight tehsils of Bikaner district during summer, rainy and winter season along with other related information regarding species, age, sex, deworming history, milk yield and location. Faecal samples were qualitatively examined by faecal floatation and sedimentation techniques (Soulsby 1986) for helminth eggs and quantitatively by modified McMaster egg counting technique (Coles et al. 1992). Coproculture study was also performed to harvest and identify infective strongyle larvae (Soulsby 1986).

Statistical analysis

Statistical analysis was performed by using SPSS 20.0 software by applying Chi Square (χ^2) test and subjected to

the multivariate binary logistic regression model with significant association at $p \leq 0.05$ (two-sided).

Results

The overall prevalence of GI helminthoses in dairy animals was 54.12 % with maximum infection in native cattle (64.48 %) followed by crossbred (53.81 %) and buffaloes (40.46 %) at highly significant difference ($p < 0.01$) (Table 1). Furthermore, quantitative analysis of the positive faecal samples revealed eggs per gram (EPG) of faeces for strongyle ranging between 500 and 4900 with an average of 1680 ± 219.20 for crossbred cattle, $200\text{--}2000$ (772.22 ± 108.10) for native cattle and $100\text{--}1200$ (448.21 ± 76.95) for buffalo population whereas, for *Strongyloides* sp. EPG ranging between 300 and 2500 (946.67 ± 150.83) for crossbred cattle, $100\text{--}1100$ (469.23 ± 81.17) for native cattle and $100\text{--}700$ (410 ± 58.60) for buffalo population, indicating mild to high severity of strongyle and *Strongyloides* sp. infections, respectively in cattle population whereas, mild severities for the same in buffalo population—(Table 2).

Prevalence of GI helminthes in different tehsils of Bikaner

A significant variation ($p < 0.05$) in the prevalence of GI helminths in dairy animals from eight tehsils of Bikaner was recorded with highest prevalence in Chhatargarh tehsil (69.70 %) and least in Lunkaransar (46.07 %) (details in Table 1). Strongyle infection (33.43 %) was reported to be most prevalent and *Moniezia* sp. (3.03 %) was reported with least prevalence (Table 1). *Trichuris* sp. infection varied significantly ($p < 0.05$) among the various helminths reported from different tehsils however infection was not reported in Chhatargarh and Khajuwala whereas, *Moniezia* sp. infection was recorded in Lunkaransar, Pugal and Chhatargarh tehsils only. Multivariate binary regression model revealed Chatargarh tehsil at statistically

Table 1 Overall prevalence of gastrointestinal helminthoses of dairy animals in Bikaner

	Examined	Infected	Mixed	Strongyle	<i>Strongyloides</i>	<i>Trichuris</i>	<i>Moniezia</i>
Cattle							
Native	290	187 (64.48)	63 (21.72)	143 (49.31)	109 (37.59)	27 (9.31)	16 (5.51)
Crossbred	210	113 (53.81)	37 (17.62)	67 (31.90)	39 (18.57)	0 (0.00)	0 (0.00)
Buffaloes	215	87 (40.46)	23 (10.70)	29 (13.49)	16 (7.44)	15 (6.98)	0 (0.00)
	—	26.696**	7.626*	37.30**	42.138**	18.084**	—
Total	715	387 (54.12)	123 (17.20)	239 (33.43)	164 (22.94)	42 (5.87)	16 (2.24)

Figures in parentheses indicate percentage, * significant, ** highly significant

Table 2 Season and Tehsil wise prevalence of gastrointestinal helminthoses of dairy animals in Bikaner

	Examined	Infected	Mixed	Strongyle	<i>Strongyloides</i>	<i>Trichuris</i>	<i>Moniezia</i>
Season							
Summer	255	125 (49.02)	37 (14.50)	75 (29.41)	51 (20.00)	18 (7.06)	0 (0.00)
Rainy	245	145 (59.18)	54 (22.04)	95 (38.77)	68 (27.75)	15 (6.12)	16 (6.53)
Winter	215	117 (54.42)	32 (14.88)	69 (32.09)	45 (20.93)	9 (4.19)	0 (0.00)
χ^2	–	5.209	4.25	2.54	3.0521	1.594	–
Tehsil							
Bikaner	113	61 (53.98)	23 (20.35)	34 (30.09)	25 (22.12)	5 (4.42)	0 (0.00)
Nokha	98	59 (60.20)	17 (17.35)	26 (26.53)	21 (21.43)	2 (2.04)	0 (0.00)
Sridungargarh	104	49 (47.11)	19 (18.27)	43 (41.35)	25 (24.04)	13 (12.50)	0 (0.00)
Kolayat	109	59 (54.13)	13 (11.93)	37 (33.94)	28 (25.69)	11 (10.09)	0 (0.00)
Lunkaransar	89	41 (46.07)	24 (26.97)	45 (50.56)	27 (30.34)	7 (7.86)	10 (11.23)
Pugal	72	42 (58.33)	11 (15.28)	21 (29.17)	12 (16.67)	4 (5.56)	4 (5.56)
Chhatargarh	66	46 (69.70)	9 (13.64)	15 (22.73)	11 (16.67)	0 (0.00)	2 (3.03)
Khajuwala	64	30 (46.87)	7 (10.94)	18 (28.12)	15 (23.44)	0 (0.00)	0 (0.00)
χ^2	–	14.59*	8.162	10.88	4.34	10.21*	–
Total	715	387 (54.12)	123 (17.20)	239 (33.43)	164 (22.94)	42 (5.87)	16 (2.24)

Figures in parentheses indicate percentage, * significant, ** highly significant

highest risk for GI helminthoses in dairy animals of Bikaner, whereas, Lunkaransar was found at statistically lowest risk (Table 3).

Seasonal dynamics of GI heminthes of dairy animals of Bikaner

Season wise analysis revealed a non-significant difference with maximum prevalence of GI helminth infections during rainy season (59.18 %) followed by winter (54.42 %) and summer (49.02 %)(details in Table 1). Among the various helminth infections, strongyle and *Strongyloides* sp. infections showed highest prevalence during rainy season, followed by winter and summer. The present study revealed the presence of *Moniezia* sp. infection in rainy season only whereas, *Trichuris* sp. infection was recorded highest in summer season followed by rainy and winter. Multivariate binary regression model revealed rainy season as the most favorable season for the GI helminth infections whereas summer season was expressed as the season with minimum risk.

Coproculture studies

In coproculture, 300 infective strongyle nematode larvae (100 larvae in each season for eight tehsils) were examined. The coproculture study revealed *Haemonchus* sp. as the major contributor to nematode population (36.33 %), followed by *Oesophagostomum* sp. (26.33 %), *Strongyloides* sp. (13.67 %), *Trichostrongylus* sp. (11.67 %),

Bunostomum sp. (7.33 %) and *Cooperia* sp. (4.67 %) in the decreasing order of prevalence. The larvae of *Haemonchus* sp. and *Oesophagostomum* sp. were observed throughout the - study period while those of rest of the species were encountered occasionally. Variation in the seasonal pattern of different strongyles was reported with *Haemonchus* sp. reported to be predominant in rainy season whereas, *Oesophagostomum* sp. was found dominant in summer season.

Discussion

In the present study, strongyles were found to be the most prevalent GI helminths (33.43 %). In similar studies from various districts of Rajasthan, higher incidence of strongyles has been reported viz from Jaipur (Godara and Sharma 2010), Bikaner (Wadhwa et al. 2011) and Udaipur (Swarnakar et al. 2015) as well as from other states of India like Tamil Nadu (Saravanan et al. 2009), Jammu and Kashmir (Singh et al. 2009), Punjab (Haque et al. 2011), Sikkim (Rahman et al. 2012), Meghalaya (Laha et al. 2013) and Karnataka (Krishna Murthy and Placid D'Souza 2014). As far as the zonal distribution is concerned, the strongyle infection was found to be comparatively more prevalent in this drier zone which is concordant with the findings of other workers (Reinecke 1960; Durie 1962; Lima 1998).

The higher prevalence of helminths infections in case of cattle is also in agreement with findings of various workers reported from different parts of India (Singh et al. 2008; Yadav et al. 2008; Saravanan et al. 2009; Choubisa and

Table 3 Multivariate binary logistic regression for gastrointestinal helminthoses of dairy animals in Bikaner

Parameter	Logistic regression coefficient (B)	S.E.	Wald test	p value	Odd ratio
Season					
Summer	−0.224	0.191	1.372	0.241	0.799
Rainy	0.212	0.195	1.185	0.276	1.236
Winter	–	–	5.495	0.064	–
Tehsil					
Bikaner	0.289	0.279	1.072	0.300	1.335
Chatargarh	0.757	0.341	4.920	0.027	2.132
Khajuwala	−0.228	0.329	0.483	0.487	0.796
Kolayat	0.288	0.282	1.039	0.308	1.333
Lunkaransar	−0.054	0.297	0.033	0.856	0.947
Nokha	0.498	0.292	2.908	0.088	1.646
Poogal	0.213	0.320	0.442	0.506	1.237
Sridungargarh	–	–	11.715	0.110	–
Breed					
Buffalo	−0.980	0.193	25.672	0.000	0.375
Crossbred cattle	−0.436	0.188	5.398	0.020	0.646
Native cattle	–	–	25.713	0.000	–
Constant	0.385	0.254	2.287	0.130	1.469

Jaroli 2013; Chaudhri et al. 2014). Higher prevalence of GI helminthoses in native cattle may be attributed to the fact that the native animals spend longer period of time on extensive grazing as compared to crossbred cattle and buffaloes which are grazed proportionally less and kept stall fed mainly with comparatively improved animal husbandry practices (Mir et al. 2013; Akanda et al. 2014). Statistical analysis revealed the odd ratio for breed indicating a negative association in buffaloes and crossbred as compared to native cattle (Table 3).

Seasonal dynamics of GI helminth infections showed highest prevalence in rainy season which is in agreement with the reports of various workers from different parts of India (Singh et al. 2008; Sreedhar et al. 2009; Swarnakar et al. 2014; Maharana et al. 2015). This may be due to adequate moisture and optimum temperature in rainy season which favours the growth and survival of infective stages in the pasture (Akanda et al. 2014). The *Moniezia* sp. infection was recorded only in rainy season which may be due to opportunity of exposure to the intermediate hosts, i.e. free-living soil mites which are available adequately on pasture during rainy season (Cox and Todd 1962). Furthermore the infection was very low as compared to other GI helminths; which is similar to the findings of Keyyu et al. (2006) from Tanzania and Raza et al. (2014) from Pakistan. The difference in the tehsil-wise prevalence of Bikaner district may be due to variation in animal husbandry practices, pasture management of dairy animals and difference in the deworming programmes.

The coproculture study revealed *Haemonchus* sp. as major contributor to the nematode population. The development and survival of pre-parasitic stages of *Haemonchus* sp. require total monthly rainfall more than 50 mm and mean monthly maximum temperature more than 18.3 °C (Gordon 1953) which was close to the meteorological conditions of the present study area. Furthermore, similar findings regarding the predominance of *Haemonchus* sp. have been reported by many workers from different parts of India (Chavhan et al. 2008; Saravanan et al. 2009; Bushra et al. 2013; Jamra et al. 2014). The baseline data of prevalence of various GI helminths of dairy animals generated in the current study would be of immense help in formulating control strategies against infections in Bikaner district.

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Compliance with ethical standards

Conflict of interest We declare that we have no conflict of interest.

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