

Research Article

EPIZOOTIOLOGICAL STUDIES ON GASTROINTESTINAL HELMINTHS AND ASSOCIATED RISK FACTORS IN THE DAIRY ANIMALS OF INTERNAL DRAINAGE DRY ZONE OF RAJASTHAN, INDIA

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ABSTRACT: The aim of this study was to determine the prevalence and risk factors of gastrointestinal helminthic infections in dairy animals of internal drainage dry zone of Rajasthan, India. A total of 609 fecal samples were examined from September 2016 to August 2017. Out of them, 295 (Buffalo: 111, Cattle:184) were found positive with an overall prevalence of 48.44% for different gastrointestinal helminthic infections. The study revealed strongyles as the most dominant infection (44.99%) followed by *Strongyloides sp.* (6.90%). Seasonal dynamics revealed a highly significant statistical seasonal variation ($p < 0.05$) with maximum infection in rainy season (60.10%) whereas, a non-significant statistical difference in district wise prevalence was reported with the highest prevalence rate in Nagaur district (54.97%). Multivariate binary logistic regression model revealed positive association of summer ($B=0.83$) and rainy seasons ($B=1.39$) when compared to winter season whereas, association was reported positive in Nagaur ($B=0.27$) and negative in Jhunjhunu ($B= - 1.42$) and Churu ($B= - 0.15$) districts when compared to Sikar district. Similarly, a negative association in crossbred ($B= - 0.75$) and buffaloes ($B= - 0.53$) as compared to native animals was reported in the study. Quantitative analysis presented a mild to moderate gastrointestinal parasitic infection in terms of EPG (eggs per gram of feces) ranged from 100 - 400 (228.57 ± 42.06) and 100 - 300 (166.67 ± 33.33) for strongyles and *Strongyloides sp.* respectively. No fluke infection was reported in the dairy animals of the study area during the study period. Coproculture examination exhibited *Haemonchus* as the most predominant nematode genus, followed by *Oesophagostomum sp.*, *Strongyloides sp.*, *Trichostrongylus sp.* and *Cooperia sp.* in the decreasing order of prevalence. The current investigation may be used to formulate effective control strategies against gastrointestinal helminthic infections in the dairy animals of the region.

Key words: Dairy animals, Epizootiology, Gastrointestinal helminthic infections, Internal drainage dry zone, Rajasthan.

INTRODUCTION

India is an agriculturally and agro-climatically diversified country. Livestock play a significant role in the national economy of India and impart a crucial role in Indian agriculture. Parasitic infections are one of the major issues for livestock productivity (Wadhwa *et al.* 2011). However, the problem is neglected due to its chronic and insidious nature (Sanyal 1998). A comprehensive epizootiology and associated risk factor analysis with prevalence of gastrointestinal parasites in dairy animals is required to frame their sustainable control strategies according to different agro-climatic zones.

Although, such studies have been started in different parts of country *viz.* in Punjab (Haque *et al.* 2011); Andhra

Pradesh (Sreedevi and Hafeez 2014) but there is dearth of such studies in Rajasthan with a few sporadic studies from different patches of the state. Recently, area specific zone wise studies have also been conducted in different agro-climatic zones of Rajasthan *viz.* Monika *et al.* 2017, Renwal *et al.* 2017 and in continuation to the pattern, the present study has been conducted to assess the gastrointestinal helminth infections and associated risk factors in the Internal drainage dry zone of Rajasthan. Data generated from such epizootiological studies may empower us to frame zone wise, area specific effective control strategies to minimize the loss to livestock owners in terms of reduced milking and low weight gain.

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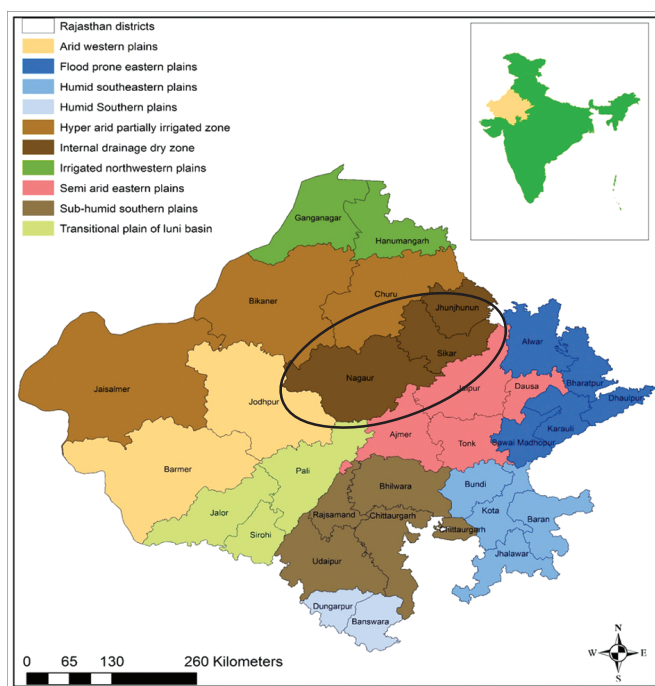


Fig. 1. Different agroclimatic zones of Rajasthan indicating study area.

MATERIALS AND METHODS

The present cross sectional study was conducted for a period of one year from September 2016 to August 2017 including all three seasons (winter, summer and rainy) to determine the prevalence of gastrointestinal tract helminthes in the dairy animals under field conditions at district Jhunjhunu, Sikar, Churu and Nagaur of Rajasthan state.

Study area

The Rajasthan state has been divided in 10 major agro-climatic zones. Present work has been carried out in

Internal Drainage Dry Zone out of the 10 agro-climatic zones. This zone comprises Jhunjhunu, Sikar, Nagaur and a part of Churu district (Fig. 1). The average Rainfall 300-500 mm and temperature ranging between 5.3°C to 39.7°C (D.O.A., Govt. of Rajasthan, 2016-17). The regions are enclosed with sand-dunes and sandy plains.

Collection of samples

A total of 609 fecal samples of dairy animals (268 buffaloes and 341 cattle) were collected directly from rectum or immediately dropped after defecation, randomly from the villages of four districts of internal drainage dry zone of Rajasthan. Collection of samples was repeated seasonally, with the aim to demonstrate the variation in seasonal prevalence and severity of infection. The samples were placed in sterile polythene bags, properly labeled the information regarding species, age, sex, deworming history and location kept in a cool transport box and brought to the laboratory for further examination.

Coprological examination

The fecal samples were first subjected to standard qualitative fecal sample examination by using floatation and sedimentation techniques (Sloss *et al.* 1994) for detection of helminthes 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 1982, Van Wyk and Mayhew 2013).

Statistical analysis

Statistical analysis was performed by using IBM-SPSS statistics 20.0 software by applying Chi Square (χ^2) test

Table 1. Overall Prevalance of GIT helminths in Dairy animals of Internal Drainage Dry Zone of Rajasthan.

			Examined (%)	Infected (%)	Mixed (%)	Strongyle (%)	Strongyloids (%)	Trichuris (%)
Animal type	Cattle	Native	112	61 (54.46)	7 (6.25)	53 (47.32)	15 (13.39)	1 (0.89)
		Crossbred	229	123 (53.71)	11 (4.80)	123 (53.71)	11 (4.80)	
	Buffaloes		268	111 (41.42)	3 (1.12)	98 (36.57)	16 (5.97)	
χ^2 value			-	9.467**	8.270	12.348**	9.282*	-
Total			609	295 (48.44)	21 (3.45)	274 (44.99)	42 (6.90)	1

Figures in parentheses show percentage, * = significant, ** = highly significant at (p<0.05) and (p<0.01) respective levels.

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

RESULTS AND DISCUSSION

Out of 609 fecal samples, 295 were found positive with an overall prevalence of 48.44% for different gastrointestinal helminth infections with 54.46% in native, 53.71% in crossbred and 41.42% in buffaloes and a mixed infection of 3.45% (Table 1). Among various infections, strongyle infection was the most predominant 274 (44.99%), followed by *Strongyloides sp.* 42(6.90%) (Table 1) which is in agreement to the similar studies from various districts of Rajasthan viz Swarnakar *et al.* 2015, Monika *et al.* 2017, Renwal *et al.* 2017 as well as from other states of India like U.P. (Singh *et al.* 2008), Tamil Nadu (Saravanan *et al.* 2009), Punjab (Haque *et al.* 2011, Singh *et al.* 2012), Sikkim (Rahman *et al.* 2012), Meghalaya (Laha *et al.* 2013) and Karnataka (Krishna Murthy and D'Souza 2016). In animal wise analysis, maximum infection was reported in native cattle (54.46%) followed by crossbred and buffaloes which is congruent to the findings of Monika *et al.* (2017) and Renwal *et al.* (2017). Higher prevalence 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 raised mainly on stall feeding with

comparatively improved animal husbandry practices (Monika *et al.* 2017, Renwal *et al.* 2017). Interestingly, a statistically significant ($p < 0.05$) higher prevalence of *Strongyloides* in native cattle as compared to crossbred and buffaloes may be due to the naturally free living occurrence of the parasite with comparatively higher free range grazing by native animal as compared to crossbred leading to the increase in the chance of exposure.

Seasonal dynamics

Seasonal dynamics revealed a highly-significant difference ($p < 0.01$) with maximum prevalence of GI nematode infections in rainy (60.10%) season followed by summer (45.05%) and winter (40.69%), which is in agreement with the reports of various workers from different parts of India (Sreedhar *et al.* 2009, Swarnakar *et al.* 2015, Maharana *et al.* 2015). Multivariate binary logistic regression model revealed increase in gastrointestinal helminth infections with the increase in ambient temperature and presented rainy season as the most favorable season ($B=1.391$, $OR=4.020$) for the gastrointestinal helminthic infections when compared with summer and rainy seasons (Table 3). The highest prevalence in rainy season might be due to adequate moisture and optimum temperature in rainy season which favors the growth and survival of infective stages in the pasture (Akanda *et al.* 2014).

Table 2. Season and district wise prevalence of GIT helminths in Dairy animals of Internal Drainage Dry Zone of Rajasthan.

		Examined (%)	Infected (%)	Mixed (%)	Strongyle (%)	<i>Strongyloides</i> (%)	<i>Trichuris</i> (%)
Season	Winter	204	82 (40.19)	1 (0.49)	77 (37.75)	6 (2.94)	1 (0.49)
	Summer	202	91 (45.05)	6 (2.97)	84 (41.58)	13 (6.44)	
	Rainy	203	122 (60.10)	14 (6.90)	113 (55.67)	23 (11.33)	
χ^2 value		-	17.528**	12.75**	14.620**	11.252**	-
District	Jhunjhunu	152	66 (43.42)	2 (1.32)	65 (42.76)	3 (1.97)	-
	Sikar	152	78 (51.32)	6 (3.95)	72 (47.37)	12 (7.90)	-
	Churu	154	68 (44.16)	6 (3.90)	64 (41.56)	10 (6.49)	-
	Nagaur	151	83 (54.97)	7 (4.64)	73 (48.34)	17 (11.26)	1 (0.66)
χ^2 value		-	5.419	6.698	2.726	10.486**	-

Figures in parentheses show percentage, *= significant, **= highly significant at ($p < 0.05$) and ($p < 0.01$) respective levels.

Table 3. Multivariate Binary logistic regression for Helminthoses in dairy animals of Internal Drainage Dry Zone of Rajasthan.

	Parameter	Logistic regression coefficient (B)	S.E	Wald test	P value	Odd ratio
Season	Winter					
	Summer	.829	.512	2.626	.105	2.292
	Rainy	1.391	.476	8.536	.003	4.020
District	Sikar					
	Jhunjhunu	-1.416	.660	4.594	.032	.243
	Churu	-.148	.454	.106	.744	.862
	Nagaur	.270	.416	.422	.516	1.310
Animal type	Cattle					
	Native					
	Crossbred	-.751	.438	2.935	.087	.472
	Buffaloes	-.531	.411	1.672	.196	.588
Constant		-2.849	.574	24.623	.000	.058

Table 4. Mean measurements (μm) of 3rd stage strongyle larvae in dairy animals of Internal Drainage Dry Zone of Rajasthan (Mean \pm S.E.).

Nematodes	Total length (Range)	Extension of tail sheath beyond tail (Range)	Intestinal cell no. and shape	Salient features
<i>Haemonchus</i> sp.	826.7 \pm 12.18 (783.04-883.56)	62.6 \pm 2.10 (55.22-73.58)	16 Triangular	Narrow bullet shaped head, the pointed tail of larva and tail sheath is usually 'kinked'.
<i>Oesophagostomum</i> sp.	828.77 \pm 16.48 (763.0-883.4)	142.27 \pm 5.60 (123.42-164.48)	18-22 Triangular	Long tail ending in a long fine filament.
<i>Cooperia</i> sp.	793.0 \pm 8.25 (755.67-813.33)	60.0 \pm 3.64 (51.42-73.58)	16 Triangular	Two conspicuous oval bodies at the anterior end of the oesophagus with tail ending bluntly.
<i>Trichostrongylus</i> sp.	691.79 \pm 10.84 (653.0-726.72)	24.37 \pm 1.44 (21.21-31.0)	16 Triangular	The tail sheath is conical and blunt at the tip.
<i>Strongyloides</i> sp.	614.32 \pm 10.68 (574.0-721.0)			No sheath and slender body with long oesophagus 1/3 to 1/2 of the total length of larvae.

District wise analysis

With only few studies in hand, there is a dearth of studies in this regard in the state. District wise prevalence of gastrointestinal helminthoses in the study area was recorded with highest prevalence in Nagaur district (54.97%) followed by Sikar (51.32%), Churu (44.81%) and Jhunjhunu (43.42%) district, respectively. This difference among the districts of internal drainage dry zone of Rajasthan may be due to variation in animal

husbandry practices, pasture management of dairy animals and difference in the deworming program management (Monika *et al.* 2017, Renwal *et al.* 2017). Multivariate binary logistic regression model revealed Nagaur district at statistically at highest risk (B=0.270, OR=1.310) for gastrointestinal helminthoses in dairy animals, whereas, Churu district was found at statistically lowest risk (Table 3).

Coproculture studies

The strongyle positive samples were subjected to coproculture and L₃ stage were recovered from fecal cultures in the present investigation, were identified on the basis of measurements of their total length, extension of tail sheath beyond the tip of the larvae (μm), intestinal cell number and shape and some morphological characters. The larvae were identified on the basis of key provided by Soulsby 1982, Taylor *et al.* 2007, Van Wyk and Mayhew 2013, and were identified as *Haemonchus sp.* as major contributor to the nematode population followed by *Trichostrongylus sp.*, *Oesophagostomum sp.* and *Cooperia sp.* in the decreasing order of prevalence. Various researchers in their respective studies on cattle population have encountered these nematodes from Rajasthan (Monika *et al.* 2017, Renwal *et al.* 2017), different parts of India (Jithendran and Bhat 1999, Murleedharan 2005) as well as abroad (Borgsteede *et al.* 2000, Hailu *et al.* 2011, Asif Raza *et al.* 2013). The larvae of *Haemonchus sp.*, *Cooperia sp.*, and *Trichostrongylus sp.* were observed throughout the study period while *Oesophagostomum sp.* was found dominant in summer season.

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