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Studies on Gastrointestinal Nematodosis and Associated Risk Factors in Dairy Animals of Arid Western Plains of Rajasthan

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Abstract

A total of 617 faecal samples (including 235, 188 and 194 samples from native cows, crossbred cows and buffaloes, respectively) were examined from January 2017 to December 2017, with an overall prevalence rate of 56.73% (native: 60.85%, crossbred: 57.45% and buffaloes: 51.03%) for gastrointestinal nematode infections and mixed infection in 11.35% with no statistical difference (p>0.05). Throughout the whole study period strongyles were found to be the most dominant (47.49%) followed by *Strongyloides* sp. (16.86%). A highly significant statistical variation (p<0.05) were reported in season wise as well as district wise analysis with maximum infection in rainy season (64.90%) and in Jodhpur district (62.54%), respectively. Quantitative analysis revealed EPG (eggs per gram of faeces) for stongyles ranging from 100-2500 (1291±237.56) and *Strongyloides* sp. from 100-800 (416.67±75.71). Multivariate binary logistic regression model revealed positive association of rainy (B=0.407) and negative association of summer season (B=-.221) when compared to winter season whereas, association was reported negative in Barmer district (B=0.517) when compared to Jodhpur district. Similarly, comparing to native animals, a negative association in crossbred (B=-0.197) and buffaloes (B=-0.462)was also reported in the study period. Coproculture analysis revealed the presence of nematodes of genera *Haemonchus* sp. (40.58%), *Oesophagostomum* sp. (26.09%), *Strongyloides* sp. (18.84%), *Trichostrongylus* sp. (8.695%) and *Cooperia* sp. (5.797%) in decreasing order of prevalence. Considering the impact of the infections on animal production and public health, the current investigation may be used to design rational, economic, selectively effective strategic and locally sustainable control programs against gastrointestinal nematode infections in the dairy animals of arid western plains of Rajasthan.

Keywords: Dairy animal, arid western plain, gastrointestinal nematode

1. Introduction

Arid Western plains of Rajasthan is located in the north western part of the state covering Barmer and parts of Jodhpur, consisting of 12.27% (16.35 lac) and 4.49% (5.82 lac) of total cattle and buffalo population of Rajasthan comprising drier parts of the state faces frequent drought conditions, which results in crop failure hence livestock is considered as a prime mover for sustainable development and food security. As regards to Indian scenario, the annual growth rate of cattle population is only 0.5% as against the expected growth rate of 1.1% for total livestock in India (Wadhwa et al., 2011). Parasitism is one of the major problems of profitable livestock production in terms of sub clinical effects viz. milk production, weight gain (Faizal et al., 2002), altered carcass composition, conception rate and clinical effects viz. roughness of coat, anemia, edema, diarrhoea) are clinical effects (Gadberry et al., 2001) but neglected due to its chronic and insidious nature (Sanyal 1998; Farooq et al., 2012; Lamy et al., 2012). Since the morbidity and mortality due to major bacterial and viral diseases are on the decline, it is high time that more emphasis should be placed on a programme for epidemiological surveys with establishing the data-base of parasitic diseases, developing region specific bio-climatogram of GIH and region specific effective control strategies of parasitic diseases of livestock at National level (Vanisri et al., 2016). Forecasting and Information to farmers to adopt appropriate and effective control measures against gastrointestinal nematodes (GIN) may be developed, as these losses can be minimized by early detection and timely initiation of prophylactic measures (Regassa et al., 2006; Yadav et al., 2005) as, most dairy farmers are not being able to understand the natural occurrence of these parasites in dairy animals, host parasite and environment interaction and increasing anthelmintic resistance (Delannoy-Normand et al., 2010). So taking these facts into consideration, the present study has been planned with the main Objective to record the prevalence and intensity of gastrointestinal nematode

infections in dairy animals of arid western plains of Rajasthan.

2. Materials and Methods

The present survey study was carried out for a period of one year from January 2017 to December 2017 covering all three seasons viz. winter, summer and rainy to determine the spectrum of gastrointestinal nematode infections in the dairy animals of Arid Western Plains of Rajasthan.

2.1. Study area

Out of ten agro-climatic zones of Rajasthan, Arid western plain zone of Rajasthan covers Barmer and part of Jodhpur district, which includes some of the Thar Desert, also known as the Great Indian Desert. The regions are enclosed with desert soils and sand dunes, aeolian soil, coarse sand in texture some places calcareous having short monsoon period with late onset and early withdrawal, erratic and uncertain rainfall with average rainfall from 200 mm to 370 mm witnessing frequent droughts. Average temperature varies from a maximum of 40 °C to a minimum of 8 °C (D.O.A., Govt. of Rajasthan, 2016-17).

2.2. Collection of samples

A total of 617 faecal samples (including 235, 188 and 194 samples from native cows, crossbred cows and buffaloes, respectively) were collected per rectally or immediately after defecation, randomly from the villages of Barmer and part of Jodhpur district of Arid western plains of Rajasthan, during winter, summer and rainy season for a period of one year during January to December 2017. The samples were placed in sterile polythene bags, properly labeled the information regarding species, age, sex, deworming history and location. The samples were kept in a cool transport box and brought to the Post graduate laboratory of Department of Veterinary Parasitology, CVAS, Bikaner, for further examination.

2.3. Coprological examination

The faecal samples were first subjected to standard qualitative faecal sample examination by using floatation and sedimentation techniques (Sloss et al., 1994) for detection of helminth eggs and quantitatively examined by modified McMaster egg counting technique (Coles et al., 1992). Coproculture study was also performed to harvest and identify infective strongyle type larvae (Soulsby, 1986; Van Wyk and Mayhew, 2013).

2.4. 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).

3. Results and Discussion

Out of 617 faecal samples from dairy animals, 350 were found positive with an overall prevalence of 56.73% for different gastrointestinal nematode infections with 60.85% in native, 57.45% in crossbred and 51.03% in buffaloes and a mixed infections of 11.35% (Table 1). Among various infections reported in the study, strongyles was reported as the most

Table 1: Overall prevalence of GIT nematodes in dairy animals of arid western plains of Rajasthan

Animal type			Examined	Infected (%)	Mixed (%)	*Strongyle* (%)	*Strongyloides* (%)	*Trichuris* (%)	Amphis-tome (%)
	Cattle	Native	235	143 (60.85)	34 (14.46)	121 (51.48)	40 (17.02)	12 (5.10)	4 (1.70)
		Cross-bred	188	108 (57.45)	18 (9.57)	91 (48.40)	34 (18.09)	-	1 (0.53)
	Buffaloes		194	99 (51.03)	18 (9.28)	81 (41.75)	30 (15.46)	4 (2.06)	2 (1.03)
χ^2 value			-	4.232	3.689	4.131	.475	11.098**	1.302
Total			617	350 (56.73)	70 (11.35)	293 (47.49)	104 (16.86)	16 (2.59)	7 (1.13)

The figures in parentheses show percentage,*: significant, **: highly significant at (p<0.05) and (p<0.01) respective levels

dominant 293(47.49%) infection with the highest prevalence in native (51.48%) followed by crossbred (48.40%) and buffaloes (41.75%) with a non-significant difference. Several recent studies have revealed longer periods of communal grazing providing higher exposure with marginal husbandry care to the native animals (Renwal et al., 2017 and Monika et al., 2017) which may be the probable reason for the higher infection in native cattle. However, *Strongyloides* sp. 104(16.86%) were found predominant in crossbred as compared to native and buffalo with a non-significant difference. Similar findings of higher prevalence of helminth infections in native animals were previously also reported from different parts of Rajasthan viz. Choubisa and Jaroli, 2013; Monika et al., 2017 and Renwal et al., 2017 as well as from other states of India viz. Uttar Pradesh (Singh et al., 2008), Uttarakhand (Yadav et al., 2008), Tamil Nadu

(Saravanan et al., 2009), Haryana (Chaudhari et al., 2014), Assam (Das et al., 2015).

In the quantitative analysis, severity of infection was reported maximum for strongyle infection in terms of EPG ranging from 100-2500 with an average of 1291.667±237.56 which is in concordant to the findings of Monika et al., 2017; Renwal et al., 2017 and Jithendran and Bhat, 1999, which can be attributed to the fact that though this agro climatic zone is a comparatively drier zone, the micro environment of the animal sheds provided optimal conditions (viz. moisture and temperature) for the development of the pre-parasitic free living stages of strongyles due to presence of kuccha flooring and poor drainage facilities (Haque et al., 2011).

3.1. Seasonal dynamics

A marked variation in the environment has been observed in the study area (DOA, 2016-17) and the seasonal dynamics revealed a highly-significant difference (p<0.01) with maximum prevalence of GI nematode infections in rainy (64.90%) season followed by winter (55.39%) and summer (40.69%), which is in correlation with the previous findings from the state viz. Swarnakar et al., 2014; Monika et al., 2017 and Renwal et al., 2017 as well as workers from other states viz. Yadavet al., 2005; Chavhan et al., 2008; Shirale et al., 2008 and Singh et al., 2008. Multivariate binary logistic regression model revealed positive correlation (B=0.441) of rainy season with odds ratio (1.502) as the most favourable season for the GI nematodosis when compared with summer and rainy season (Table 2). The highest prevalence in rainy season might be due to adequate moisture and optimum temperature in rainy season which supports the growth and survival of infective stages in the pasture (Regassa et al., 2006 and Shirale et al., 2008).

Table 2: Season and district wise prevalence of GIT nematodes in dairy animals of arid western plains of Rajasthan

Season		Examined	Infected (%)	Mixed (%)	*Strongyle* (%)	*Strongyloides* (%)	*Trichuris* (%)	Amphistome (%)
	Rainy	208	135 (64.90)	37 (17.79)	113 (54.33)	46 (22.12)	8 (3.85)	5 (2.40)
	Winter	204	113 (55.39)	21 (10.29)	96 (47.06)	33 (16.18)	5 (2.45)	-
	Summer	205	102 (49.76)	12 (5.85)	84 (40.98)	25 (12.20)	3 (1.46)	2 (0.97)
χ^2 value total		-	9.872**	14.956**	7.403*	7.350*	2.345	5.375
District	Jodhpur	307	192 (62.54)	47 (15.31)	163 (53.09)	60 (19.54)	9 (2.93)	7 (2.28)
	Barmer	310	158 (50.97)	23 (7.42)	130 (41.94)	44 (14.19)	7 (2.26)	-
χ^2 value		-	8.416**	9.547**	7.702**	3.151	.277	7.150**

3.2. District wise analysis

Statistical analysis using multivariate binary logistic regression model revealed Jodhpur district at comparatively higher risk for GI nematodosis in dairy animals, when compared with Barmer district (Table 3). District wise analysis revealed higher prevalence of gastrointestinal nematodosis in Jodhpur district (62.54%) followed by Barmer (50.97%). This difference

Table 3: Multivariate Binary logistic regression for nematodosis in dairy animals of arid western plains of Rajasthan

Season	Parameter		Logistic regression coefficient (B)	S.E	Wald test	*p* value	Odd ratio
	Winter				9.681	0 .008	
	Rainy		0.407	0.205	3.946	0.047	1.502
	Summer		-0.221	0.201	1.210	0.271	0.802
District	Jodhpur						
	Barmer		-0.517	0.167	9.602	0.002	0.596
	Cattle	Native			5.313	.070	
Animal type		Crossbred	-0.197	0.203	0.940	0.332	0.821
	Buffaloes		-0.462	0.201	5.303	0.021	0.630
Constant			0.683	0.204	11.207	0.001	1.980

among the districts of Arid western plain zone of Rajasthan may be primarily due to variation in annual rainfall which is recorded higher in Jodhpur district (DOA, 2016-17) providing more conducive conditions for parasitic perpetuation and secondarily due to variation in management and husbandry practices (Monika et al., 2017; Renwal et al., 2017).

3.3. Coproculture studies

The strongyle positive samples were subjected to coproculture and L_3 stage recovered from faecal cultures of the strongyle positive samples, 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 identification revealed *Haemonchus* sp. as the major contributor to nematode population (40.58%), followed by *Oesophagostomum* sp. (26.9%), *Strongyloides* sp. (18.84%), *Trichostrongylus* sp. (6.70%) and *Cooperia* sp. (5.80%) in the decreasing order of prevalence. Highest prevalence of *Haemonchus* sp. larva among various larvae reported in coproculture has also been previously reported in the state (Monika et al., 2017 and Renwal et al., 2017) as well as in the other parts of the country (Jithendran and Bhat, 1999; Gupta et al., 2011; Haque et al., 2011; Gupta et al., 2012; Bushra et al., 2013; Jamra et al., 2014; Vanisri et al., 2016; Dogo et al., 2017 and Gupta et al., 2018) (Table 4).

Table 4: Mean measurements (µm) of 3rd stage strongyle larvae in dairy animals of arid western plains of Rajasthan (Mean±SE)

Nematodes	Total length (Range)	Extension of tail sheath beyond tail (Range)	Intestinal cell no. and shape	Salient features
Haemonchus sp.	817.78±6.23 (778.16-835.94)	99.45±2.98 (89.51-112.2)	16 Triangular	Narrow bullet shaped head, the pointed tail of larva and tail sheath is usually 'kinked'.
Oesophagostomum sp.	822.29±12.69 (740.8-859.96)	162.59±4.98 (140.96-179.28)	18-22 Triangular	Long tail ending in a long fine filament.
Cooperia sp.	850.73±9.36 (822.12-893.88)	94.27±3.20 (82.68-109.55)	16 Triangular	Two conspicuous oval bodies at the anterior end of the oesophagus with tail ending bluntly.
Trichostrongylus sp.	697.37±7.35 (648.4-712.85)	29.92±1.297 (26.34-35.7)	16 Triangular	The tail sheath is conical and blunt at the tip.
Strongyloides sp.	633.36±8.89 (583.59-655.25)	-	-	No sheath and slender body with long oesophagus 1/3 to ½ of the total length of larvae.

4. Conclusion

Among different types of animals screened during the study, native animals were reported to have maximum gastrointestinal helminth infection with *Haemonchus* sp. as the most dominant genus. Seasonally, rainy season has been reported as the most desirable season for the perpetuation of helminth infection in the region. In district wise analysis, Jodhpur was reported to be at higher risk for gastrointestinal helminth infection. Also, the study reported moderate severity of strongyle infection in the dairy animals of the region.

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