Haryana Vet. (Dec., 2019) **58(2),** 193-196

Research Article

PREVALENCE AND RISK ASSESSMENT OF COCCIDIOSIS IN DAIRY ANIMALS OF ARID WESTERN PLAINS OF RAJASTHAN

PRAVEEN PANWAR, ABHISHEK GUPTA* and POONAM CHOUDHARY
Department of Veterinary Parasitology, College of Veterinary and Animal Science, Bikaner,
Rajasthan University of Veterinary and Animal Sciences, Bikaner -334001, India

Received: 29.10.2018; Accepted: 21.08.2019

ABSTRACT

The present investigation was conducted to determine the prevalence and risk assessment of coccidial infections in dairy animals of Arid Western Plains of Rajasthan. A total of 617 fecal samples (including 235, 188 and 194 samples from native cows, crossbred cows and buffaloes, respectively) were examined for a period of one year and revealed an overall prevalence rate of 25.45% (157/617) for coccidiosis. Risk assessment analysis *viz.* animal type wise and district wise analysis presented native cattle (30.21%) as the most infected and Jodhpur district (30.29%) as comparatively more conducive, respectively with a highly significant difference ($p<0.01$). Seasonal dynamics revealed highest prevalence in winter (30.88%) season with a non-significant difference. Quantitative analysis based on the estimation of oocysts per gram (OPG) of faeces revealed mild to moderate severity of *Eimeria* sp. infection ranging from 400-8300 with an average of 2206.25±518.56. Microscopic examination of sporulated oocyst revealed presence of seven morphotypes of Eimeria *viz.*, *E. bovis* (35.52%), as the major contributor followed by *E. zuernii* (18.03%), *E. pellita* (15.30%), *E. auburnensis* (12.02%), *E. alabamensis* (8.20%) and *E. subshperica* (5.20%) in the decreasing order of prevalence.

Keywords: Arid western plains, Assessment, Coccidiosis, Control strategy, Morphotypes

Economically cattle industry is one of the most important units throughout the world. Gastrointestinal illnesses cause main hindrances to production, especially in relation to younger animals, their impact on production usually consists of the consequences of delayed growth and even mortality in some cases (Cruvinel *et al.*, 2018). Coccidiosis is a faeco-oral route transmitting intracellular protozoan disease caused by *Eimeria* spp. with some recent reports of *Isospora* spp. (Nalbantoglu *et al.*, 2008) demanding regular monitoring of coccidial infection. Clinical coccidiosis in cattle mainly depends on factors like species of Eimeria involved, age of infected animal, number of oocysts ingested, presence of concurrent infections and management practices of the farm. Most species are considered to have a low pathogenicity; whereas infection with *E. bovis* or *E. zuernii* may cause severe disease in calves (Daugschies and Najdrowski, 2005) while *E. alabamensis* has been reported to cause clinical disease in older animals. Animals develop age-related species-specific active humoral and cellular immunity rapidly after first antigen contact to the coccidian parasites. It plays a role in the protection of older cattle that often serve as a source of infection for juvenile animals, which are more susceptible to infection (Farkas *et al.*, 2007). In spite of these facts there is a paucity in the comprehensive data on coccidial infections of dairy animals. However, some regional and sporadic reports from different parts of the country have been published from time to time (Das *et al.*, 2015; Gupta *et al.*, 2016; Murthy and D'Souza *et al.*, 2016 and Nain *et al.*, 2017). In recent past, studies have been conducted to assess the coccidial infection in the dairy animals of different zones of Rajasthan (Monika *et al.*, 2017 and Choudhary *et al.*, 2018). In sequence to it, the present study was undertaken to determine the prevalence, species composition (morphotypes) of coccidian species affecting dairy animals of Arid western plains of Rajasthan along with the assessment of associated risk factors.

*Corresponding author: dr.abhishek936@gmail.com

MATERIALS AND METHODS

Study area: Present work was performed in Arid western plain zone of Rajasthan, covering Barmer and part of Jodhpur district which includes part of Thar Desert, also known as the Great Indian Desert. This zone has an average rainfall of 200-370 mm and temperature ranging from 8 ºC to 40 ºC (D.O.A., Govt. of Rajasthan, 2016-17). The regions are enclosed with desert soils, sand dunes, aeolian soil and coarse sand with an erratic and uncertain rainfall witnessing frequent droughts.

Collection of samples: A total of 617 faecal samples (including 235, 188 and 194 samples from native cows, crossbred cows and buffaloes, respectively) were randomly collected season-wise, per rectally or immediately after defecation from the villages of two districts of Arid western plains of Rajasthan, during winter, summer and rainy seasons for a period of one year during January 2017 to December 2017. The samples were placed in sterile polythene bags, properly labeled with 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 faecal samples were first subjected to standard qualitative faecal sample examination by using direct smear method and floatation

technique for detection of coccidian oocysts. The coccidian parasites were identified on basis of the morphological features of oocysts as described by Soulsby (1986). For quantitative faecal sample examination, standard McMaster's technique was used to calculate the oocysts per gram (OPG) in faeces (Soulsby, 1986).

Sporulation of oocysts: Faecal samples positive for coccidian oocysts were mixed with 2.5 % potassium dichromate in petri dishes and kept in an incubator at a temperature ranging between 25-27 ºC for sporulation. The dimensions of the oocysts were recorded by the micrometric analysis using micrometer (ERMA, Tokyo) and species were identified and classified according to their size and morphological peculiarities *viz*. shape of the oocysts; thickness of the oocyst wall; presence/absence of micropyle, cap according to Soulsby (1986) and Taylor *et al.* (2007). The measurements were expressed in microns (µm) and composition in percentage (%).

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 AND DISCUSSION

In the present study, out of the total 617 faecal samples examined, 157 were found positive for coccidian oocysts with a prevalence rate of 25.45%, which is in reconciliation to the previous findings of Monika *et al.* (2017) from the state; Gupta *et al.* (2016) and Murthy and D'Souza *et al.* (2016) from different parts of India as well as Waruiru *et al.* (2000) and Squire *et al.* (2013) around the world. The native animals are usually resistant to disease and asymptomatic; which is playing an important role in transmission of infection to other animals. Fact that the exposure of local animal to low numbers of oocysts resulting in self-immunity and endemic stability without clinical diseases cannot be excluded, as native cattle showed higher prevalence rate during the study period.

'Animal type' wise analysis revealed highest prevalence in native cattle (30.21%) followed by crossbred cattle (28.19%) and buffaloes (17.01%) in the decreasing order of prevalence with a highly significant ($p<0.01$) statistical difference (Table 1). Multivariate binary logistic regression for coccidiosis indicated a negative association of buffaloes and crossbred when compared to native cattle with odds ratios of 0.433 and 0.849, respectively (Table 2). Further, Quantitative analysis based on the estimation of oocysts per gram (OPG) of faeces revealed mild to moderate severity of *Eimeria* spp. infection ranging from 400-8300 with an average of 2206.25±518.56 in dairy animals of arid western plains of Rajasthan. The findings

Table 1
Overall prevalence of coccidiosis in dairy animals of arid western plains of Rajasthan

Animal type			No. Examined	*Eimeria* positive (%)
	Cattle	Native	235	71(30.21)
		Crossbred	188	53 (28.19)
	Buffaloes		194	33 (17.01)
χ^2 value			-	10.839**
Season	Rainy		208	51 (24.52)
	Winter		204	63 (30.88)
	Summer		205	43 (20.98)
χ^2 value			-	5.432
District	Jodhpur		307	93 (30.29)
	Barmer		310	64 (20.65)
χ^2 value			-	7.568**
Total			617	157 (25.45)

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

of the present study are in harmony with the findings of Gupta *et al.* (2016) from Punjab but unlike to the findings of Monika *et al.* (2017) from Rajasthan and Das *et al.* (2015) from Assam and Marskole *et al.* (2016) from Jabalpur. Factors influencing the susceptibility of animals to coccidiosis *viz*. age, genetic predisposition, innate or adaptive immunity, stress level, hygiene conditions, dampness and precipitation of faeces, management in farms, location of the parasite in the intestinal epithelium, number and location of endogenous stages, breeding of animals, study design and methods as well as on climates and different geographical regions (Yu *et al.*, 2011) may be the probable reason in the severity variation.

District wise analysis: A high-significant statistical difference ($p<0.01$) was reported between the two districts with comparatively higher prevalence in Jodhpur district (30.29%) followed by Barmer (20.65%) (Table 1). Multivariate binary logistic regression analysis for coccidiosis revealed a negative association in Barmer district as compared to Jodhpur district with an odd ratio of 0.563 (Table 2) revealing Jodhpur to be more conducive environment district for the growth of coccidia infection.

Seasonal dynamics: Season wise prevalence was recorded highest during the winter season (30.88%) followed by rainy (24.52%) and summer (20.98%) with a statistically non-significant difference ($p>0.05$), which are contrary to the findings of Monika *et al.* (2017) from Rajasthan and Das *et al.* (2015) and Gupta *et al.* (2016) from the country. Multivariate binary logistic regression analysis for coccidiosis indicated a negative association in rainy and summer season as compared to winter season with odd ratios of 0.714 and 0.593, respectively (Table 2).

Management practice of keeping the animals altogether in close proximity for longer durations in winter season might be the probable reason for the transmission of infection.

Identification of morphotypes: Faecal samples with high coccidia infection were subjected to sporulation and identification was done on the basis of micrometric analysis and other morphological characters *viz*. thickness of oocyst wall, presence/absence of micropyle, micropylar cap which revealed the presence of seven morphotypes of *Eimeria* sp. in the study area. *Eimeria bovis* and *E. zuernii* are known pathogens causing morbidity and mortality in cattle (Heidari and Gharekhani, 2014). The findings of the present study presented *E. bovis* (35.52%), *E. zuernii* (18.03%), *E. pellita* (15.30%), *E. auburnensis* (12.02%), *E. alabamensis* (8.20%), *E. cylindrical* (6.01%) and *E. subspherica* (4.92%) in the decreasing order of prevalence (Table 3). Among coccidia population, dominance of *E. bovis* is in harmony to the findings of Monika *et al.* (2017) and Renwal *et al.* (2017) from the state as well as different parts of India (Das *et al.*, 2015; Gupta *et al.*, 2016 and other countries around the world (Bahrami and Alborzi, 2013; Heidari and Gharekhani, 2014 and Cardim *et al.*, 2018).

The findings of the current study would provide a basis for evolving effective control strategy for the management of coccidiosis in dairy animals of the arid western plains of Rajasthan.

ACKNOWLEDGEMENT

The authors thankfully acknowledge the financial support and facilities provided by RAJUVAS, Bikaner to carry out the research work.

Table 2

Multivariate binary logistic regression for coccidiosis in dairy animals of arid western plains of Rajasthan

Season	Parameter		Logistic regression coefficient (B)	S.E.	Wald test	P value	Odds ratio
	Winter		-	-	05.319	.070	-
	Rainy		-.337	.225	02.235	.135	.714
	Summer		-.523	.233	05.038	.025	.593
District	Jodhpur		-	-	-	-	-
	Barmer		-.574	.191	08.987	.003	.563
Animal type	Cattle	Native	-	-	12.400	.002	-
		Crossbred	-.164	.219	00.559	.455	.849
	Buffaloes		-.838	.243	11.924	.001	.433
Constant			-.245	.216	01.289	.256	.783

Table 3

Mean measurements (µm) of sporulated coccidian oocysts in dairy animals of arid western plains of Rajasthan (Mean ± S.E.)

Coccidia	Length (range)	Width (range)	Shape	Salient features
Eimeria bovis	27.56±0.49 (25.80-30.40)	19.99±0.38 (17.75-21.15)	Ovoid to sub spherical	Smooth wall with inconspicuous micropyle
E. zuernii	17.92±0.58 (15.62-21.17)	16.37±0.35 (14.91-17.85)	Spherical, Sub-spherical to ellipsoidal	Colourless to pale yellow smooth wall with no visible micropyle or oocysts residuum
E. cylindrica	21.35±0.81 (16.25-24.10)	13.35±0.29 (12.35-14.60)	Elongated cylindrical	smooth wall without micropyle
E. pellita	38.85±0.41 (36.63-39.90)	28.21±0.38 (26.53-30.06)	Egg shaped	Relatively thick brown wall with a micropyle
E. alabamensis	17.42±0.21 (16.50-18.30)	12.55±0.22 (11.57-13.50)	Predominantly pear-shaped	Smooth wall without micropyle
E. auburnensis	35.61±0.58 (32.80-37.90)	23.50±0.44 (21.45-24.85)	Ovoid to ellipsoidal	Yellowish-brown coloured smooth wall with narrow micropyle appearing as a pale area at narrow end
E. subspherica	10.20±0.21 (9.20-10.90)	9.97±0.47 (8.15-12.10)	Sub-spherical	Smooth wall with no visible micropyle

REFERENCES

Bahrami, S. and Alborzi, A.R. (2013). Prevalence of subclinical coccidiosis in river buffalo calves of southwest of Iran. *Acta Parasitol.* **58(4)**: 527-530.

Cardim, S.T., Seixas, M., Tabacow, V.B.D., Taroda1, A., Carneiro, P.G., Martins, T.A., Barros, L.D.D., Minutti, A.F., Chryssafidis, A.L., Vidotto, O. and Garcia, J.L. (2018). Prevalence of *Eimeria* spp. in calves from dairy farms in northern Parana state, Brazil. *Braz. J. Vet. Parasitol.* **27(1)**:119-123.

Cruvinel, L.B., Nicaretta, J.E., Bastos, T.D.S.A., Couto, L.F.M., Santos, J.B.D., Zapa, D.M.B., Cavalcante, A.S.D.A., Cruz, B.C., Borges, D.G.L., Borges, F.D.A., Soares, V.E. and Lopes, W.D.Z. (2018). *Eimeria* species in dairy and beef cattle of different ages in Goias state, Brazil. *Braz. J. Vet. Parasitol.* **27(2)**: 169-176.

D.O.A., Govt. of Rajasthan (2016-17). www.agriculture.rajasthan.gov.in.

Das, M., Deka, D.K., Sarmah, P.C., Islam, S. and Sarma, S. (2015). Diversity of *Eimeria* spp. in dairy cattle of Guwahati, Assam, India. *Vet. World.* **8(8)**: 941-945.

Daugschies, A., and Najdrowski, M. (2005). Eimeriosis in cattle: current understanding. *J. Vet. Med.* **52(10)**: 417-427.

Farkas, R., Szeidemann, Z. and Majoros, G. (2007). Studies on coccidiosis of calves in Hungarian dairy farms. *Parasitol. Res.* **101**: S113-S120.

Gupta, A., Singh, N.K., Singh, H. and Rath, S.S. (2016). Assessment of risk factors associated with prevalence of coccidiosis in dairy animals of Punjab. *J. Parasit. Dis.* **40(4)**: 1359-1364.

Heidari, H. and Gharekhani, J. (2014). Detection of *Eimeria* species in Iranian native cattle. *Int. J. Adv. Res.* **2(7)**: 731-734.

Marskole, P., Verma, Y., Dixit, A.K., and Swamy, M. (2016). Prevalence and burden of gastrointestinal parasitesin cattle and buffaloes in Jabalpur, India. *Vet. World.* **9(11)**: 1214-1217.

Monika, Gupta, A., Pilania, P.K., Kumar, N., Parmar, K.P. and Manohar, G.S. (2017). Studies on prevalence of gastrointestinal helminth infections and their associated risk factors in dairy animals of semi-arid eastern plains of Rajasthan. *Rumin. Sci.* **6(1)**: 55-62.

Murthy, C.K. and D'Souza, P.E. (2016). Prevalence of gastrointestinal parasites in bovines in Bangalore district, Karnataka. *J. Parasit. Dis.* **40(3)**: 630-632.

Nain, N., Gupta, S.K., Sangwan, A.K. and Gupta, S. (2017). Prevalence of Eimeria species in buffalo calves of Haryana. *Haryana Vet.* **56(1)**: 5-8.

Nalbantoglu, S., Sari, B., Cicek, H. and Karaer, Z. (2008). Prevalence of coccidian species in the water buffalo (*Bubalus bubalis*) in the province of Afyon, Turkey. *Acta Veterinaria Brno.* **77**: 111-116.

Renwal, K.K., Gupta, A. and Kumar, N. (2017). Prevalence and risk assessment of gastrointestinal helminthoses in dairy animals of Bikaner, Rajasthan. *J. Parasit. Dis.* **41(2)**: 557-561.

Soulsby, E.J.L. (1986). Helminths, Arthropods and Protozoa of Domestic Animals, (7th Edn.), Bailliere, Tindall and Cassell, London.

Squire, S.A., Amafu-Dey, H. and Beyuo, J. (2013). Epidemiology of gastrointestinal parasites of cattle from selected locations in Southern Ghana. *Livest. Res. Rural Dev.* **25(7)**: 117.

Taylor, M.A., Coop, R.L. and Wall, R.L. (2007). Veterinary Parasitology, (3rd Edn.), Blackwell Publishing Ltd. 9600 Garsington Road, Oxford ox4 2DQ, UK. pp. 838-839.

Waruiru, R.M., Kyvsgaard, N.C., Thamsborg, S.M., Nansen, P., Bogh, H.O., Munyua, W.K. and Gathuma, J.M. (2000). The prevalence and intensity of helminth and coccidial infections in dairy cattle in central Kenya. *Vet. Res. Commun.* **24(1)**: 39-53.