

Original Research Article

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Eimeria sp. Infection in Black Bucks (*Antilope cervicapra*) of Tal Chhappar Sanctuary of Rajasthan

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ABSTRACT

Keywords

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A total of 632 faecal samples were collected from Tal-Chhappar Sanctuary of Rajasthan during summer, rainy and winter season from November 2018 to September 2019 and examined qualitatively by faecal floatation for *Eimeria* sp. oocysts and quantitatively by modified McMaster egg counting technique. Coprological analysis of samples revealed an overall prevalence of 22.78% for *Eimeria* sp. Quantitative analysis revealed oocyst per gram (OPG) of faeces ranging from 300-2300 with an average of 704.35 ± 107.72 . Seasonal study revealed highest infection in rainy season (34.98%) followed by winter (19.80%) and summer season (12.56%). Statistical analysis using multivariate binary logistic regression model revealed highly significant difference ($P < 0.01$) in the prevalence of *Eimeria* sp. infection among different seasons.

Introduction

The blackbuck (*Antilope cervicapra*) is the sole living member of the genus *Antilope* in Indian subcontinent and plays important ecological roles in grassland ecosystem. It has genetic, medicinal, scientific, aesthetic and recreational value (Kunwar, 2015) and also has cultural value in Hinduism and Buddhism (Khanal, 2006). The blackbuck has recently moved from the “Near threatened” to “Least

Concern” in Red Data Book of IUCN (IUCN, 2017) and categorized in Appendix III of CITES. Rajasthan state comprises highest blackbuck population among 13 states of India in which blackbucks are found (FSI, 2015). The blackbuck population is at significant threat due to poaching and destruction of habitats including health related issues (Meena and Saran, 2018). Wild animals suffer from a variety of infectious and non-infectious diseases, particularly that of

parasitic origin (Akhter and Arshad, 2006; Lama *et al.*, 2015). Blackbucks are susceptible to various kinds of parasitic infections like coccidiosis, paramphistomiasis, fascioliasis, schistosomiasis, taeniasis and nematodiasis (Thornton *et al.*, 1973). Wildlife parasitic diseases represent an important field of investigation as they may have a significant impact on wild animal health, and may also have public health concern (Liatis *et al.*, 2017).

Coccidiosis is an important stress induced enteric protozoan parasitic disease affecting several animal species including wild ruminants and caused by various species of microscopic apicomplex an organism *Eimeria*. A number of epidemiological factors like moisture, temperature, and oxygen tension influence the disease pattern and stress factors like weaning, change of diet, harsh environment, poor nutrition and overcrowding can increase level of infection and incidence of the disease due to stress-induced immunosuppression (Urquhart, 1996).

Adequate data on parasitic infections of wild animals are not available due to lack of systematic investigations (Varadharajan and Kandasamy, 2000). Only as few studies for coccidia prevalence in black bucks have been carried out in India by Pilia *et al.*, (2014) and Mir *et al.*, (2016) in Rajasthan and Punjab state, respectively. Information on coccidia infections of blackbucks is scanty in Rajasthan. No such study in Tal-Chhappar sanctuary has been reported so far.

Keeping in view the significance of the parasite as an important cause affecting wild ruminants health and paucity of information in the region, the present study has been designed to map the prevalence rate and severity of coccidia infections in black bucks of Tal-Chhappar sanctuary along with associated risk factors.

Materials and Methods

Study area

The study area comprises of Tal-Chhappar sanctuary, which is located in Churu district of north-western Rajasthan in India and is spread over 7.19 Sq. Km area. Tal-Chhappar sanctuary comes under principal arid zone of the country and is characterized by large variation in temperature which reaches up to 48°C in June and minimum temperature falls below 4° in December – January. The area is characterized by stormy southwest winds and frequent dust storms with an average rainfall of 300 mm (D.O.A., Govt. of Rajasthan, www.agriculture.rajasthan.gov.in).

Sampling method and sample size determination

Simple random sampling technique was conducted to collect the faecal samples from individual study animals for coprological examination. Season was considered as risk factors for the occurrence of coccidia infections in blackbuck population. Since there was no record of previous prevalence in the study area, the sample size was calculated according to Thrusfield (2005) formula by using 50% expected prevalence with 5% absolute precision at 95% confidence interval.

$$n = \frac{z^2 * P_{exp} (1 - P_{exp})}{d^2}$$

Where, n= The sample size

P_{exp}= Expected prevalence (0.5)

d=Desired absolute precision (usually 5%)

z= Required confidence level, (Z=1.96 for 95% confidence interval)

The status of prevalence rate of infection, the expected prevalence of 15% with confidence limits of 95% and a desired absolute precision of 5% was studied by collecting maximum number of representative samples (Thrusfield, 2005). The number of samples thus calculated

was adjusted for finite population.

Collection of samples

A total of 632 samples collected randomly from blackbuck population collected from Tal Chhappar Sanctuary of Rajasthan during summer, rainy and winter season from November 2018 to September 2019.

The samples were placed in sterile polythene bags and labelled carefully indicating the host's detail, location and month of collection, kept in a cool transport box and brought to the Laboratory for further examination.

Coprological examination

Faecal samples were examined by direct smear and standard faecal flotation techniques for detection of coccidian oocysts. The coccidian parasites were identified on basis of the morphological features of oocysts as described by Soulsby (1982). Quantitative faecal examination was done by standard McMaster's technique to calculate the oocysts per gram (OPG) of faeces (Coles *et al.*, 2006).

Statistical analysis

All data analyses were performed by using statistical software program (SPSS for Windows, Version 20.0, USA). Association between the prevalence of coccidian infection with various factors (season, district and animal type) was carried out by Chi square (χ^2) test. Variables with significant association at $P \leq 0.05$ (two-side) were subjected to the multivariate Binary logistic regression model (Table 2).

The results were each expressed as logistic regression coefficient (B), wald test, Standard error (S.E.), P value and odd ratio (OR) with a 95 % confidence interval (CI 95 %).

Results and Discussion

The overall prevalence of *Eimeria* sp. Infection in the Blackbucks was recorded 22.78% during current study. In contrast, higher prevalence have been reported in various wild and captive ruminants including Blackbucks from Punjab (Mir *et al.*, 2016) whereas, a lower prevalence was recorded by Singh *et al.*, (2009) from Bhopal, Madhya Pradesh and Pilania *et al.*, (2014) from Bikaner, Rajasthan. Higher prevalence by Debenham *et al.*, (2016), Chaudhary and Maharjan (2017) and Cao *et al.*, (2019) has been recorded from Tanzania, Nepal and China, respectively. However, the variations regarding prevalence in various studies can most likely be attributed to difference in number and distribution of animals and variation in topography and climatic factors (Das *et al.*, 2018).

Seasonal dynamics of *Eimeria* sp. infections revealed a highly significant difference ($p < 0.01$) among seasons with highest prevalence in rainy season (34.98%) followed by winter (19.80%) and summer season (12.56%). No season targeted study for coccidia infection in blackbucks has been reported so far.

Multivariate binary logistic regression analysis for coccidiosis indicated a negative association in summer season and positive association in rainy season as compared to winter season i.e. odd ratio of infection decreased by 0.582 in summer and increased by 2.179 in rainy season with complete details in table 2. The negative b values of summer (-0.542) as compared to winter indicated a decreased prevalence of coccidiosis with increase in ambient temperature (table 2).

Eimeria sp. oocysts with and without micropyle cap has been detected during present study which is consistent to the

findings of Chaudhary and Maharjan (2017). Due to coccidiosis, the infected hosts generally exhibit loss of appetite, weakness, diarrhoea, particularly in fawns than the

adults, resulting in the compromised immune system (Ghimire *et al.*, 2008) indicating its high impact on the survival of blackbucks.

Table.1 Overall and season wise prevalence of *Eimeria* sp. infection in black bucks of T al Chhappar Sanctuary, Rajasthan

		Examined	Infected
Season	Summer	207	26 (12.56%)
	Rainy	223	78 (34.98%)
	Winter	202	40 (19.80%)
Overall		632	144 (22.78%)
χ^2 value			32.165**

Note: Figures in parentheses indicate percentage, *= significant, **= highly significant

Table.2 Multivariate binary logistic regression for *Eimeria* sp. Infection in black bucks

Parameter		Logistic regression coefficient (B)	S.E.	Wald test	P value	Odd ratio
Season	Summer	-0.542	0.274	3.904	0.048	0.582
	Rainy	.779	0.226	11.915	0.001	2.179
	Winter	-	-	30.424	0.00	-
Constant		-1.399	.177	62.760	0.00	0.247

Note: S.E.= Standard Error

Figure.1 Photomicrographs of *Eimeria* sp. oocysts in blackbucks (a) Oocyst with micropyle (b) Oocyst without micropyle



Quantification of the infection by means of oocyst per gram revealed mild to severe infection of *Eimeria* sp. ranging from 300-2300 with an average of 704.35 ± 107.72 which is in close approximation with the findings of Singh *et al.*, (2006).

Contrast to present findings, a lower intensity has been recorded by Mir *et al.*, (2016). The variations may be due to the differences in climate-ecology, management, sample size and time of sampling of the respective study areas.

In conclusion, present study represents a comprehensive report on prevalence of *Eimeria* sp. infection in blackbucks of Tal Chhappar Sanctuary, Churu, Rajasthan and the data generated could be of immense help in formulation of effective strategies for prevention and control of coccidiosis in order to upgrade the health and conservation status of black buck population.

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Conflict of interest

We declare that we have no conflict of interest.

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