Original Research

Epidemiological Investigations on Haemoprotozoan Infections in Cattle in Marathwada Region of Maharashtra

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Abstract

A study was conducted to establish the epidemiology of haemoprotozoan infections in cattle from Marathwada region. The present study was carried out from January 2018 to June, 2019. On blood smear examination, an overall prevalence was 7.52% (138 out of 1835) for haemoprotozoan infections with maximum prevalence of Theileriosis (5.83%) followed by Babesiosis (0.38%) and Anaplasmosis (0.11%) with mixed infection prevalence of 0.60% each Theileriosis and Babesiosis as well as Theileriosis and Anaplasmosis. Crossbred cattle (10.19%) were found to be more susceptible to haemoprotozoan infections than indigenous cattle (5.92%). Age-wise high rate of infection was in 2-5-year age group (9.48%) followed by 7.47% in > 5-year age group, 6.48% in 6 month-2-year age group while 4.18% in calves < 6 months with higher prevalence in females (9.18%) as compared to males (5.79%). The prevalence was found to be higher in lactating (10.30%) cows than pregnant one (7.46%). Highest prevalence was recorded during winter season (9.96%) followed by post monsoon (9.38%), summer (8.03%) and monsoon (4.48%). High milk yield (36.96%), heavy workload (20.29%), change in geographical location (15.94%), transportation (13.77%) and hot climate (10.87%) were observed as major predisposing factors.

Key words: Cattle, Epidemiology, Haemoprotozoan Infections, Marathwada, Maharashtra

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Introduction

Haemoprotozoan diseases like theileriosis, babesiosis and anaplasmosis causes substantial economic losses to the livestock industry throughout the world (Narladkar, 2018; Ananda *et al.*, 2009) in form of mortality, decreased productivity, lowered working efficiency in draught animals and increased cost for control measures (Kachhawa *et al.*, 2016). Total losses and expenditure on control measures of babesiosis and

anaplasmosis in India costs 57.2 million US dollars annually while annual loss due to theileriosis is to the tune of US$ 800 million (Ananda *et al.*, 2009**)**. The projected annual losses due to tropical theileriosis and babesiosis in India are INR 8092 and 580.16 crore, respectively (Narladkar, 2018). Owing to huge impact of haemoprotozoan infections on morbidity and mortality in dairy and draught animals, a study was aimed to establish the epidemiological profile of haemoprotozoan infections in Marathwada region of Maharashtra state.

Materials and Methods

Geographical Area

The study was conducted in and around Latur district of Marathwada region of Maharashtra (India). The climate of study area is tropical with four distinct seasons viz., monsoon (June-September), post monsoon (October-November), winter (December-February) and summer (March-May). During study period, the temperature ranged from 26.8° C to 43.6°C in the summer months and from 18° C to 35.4° C in winter with total annual rainfall of 450 mm.

Study Period and Location

The study was conducted at Teaching Veterinary Clinical Complex, College of Veterinary and Animal Sciences, Udgir from January 2018 to June 2019.

Study Animals

A total of 1835 clinical cases of cattle suffering from varied diseases or syndromes were reported from Latur, Nanded, Parbhani and Osmanabad districts of Marathwada region and adjoining Bidar district of Karnataka during study period. Out of 1835 admitted clinical cases of cattle, 847 cases admitted with signs of weight loss, persistent fever, anorexia, respiratory distress, enlargement of lymph nodes, coffee colored urine, anaemia, icterus, and no response to treatment were screened for laboratory evidence of anaemia. A total of 308 cattle showing anemia on haematological examination were further investigated for haemoprotozoan infections by blood smear examination.

Blood Sample Collection and Processing

During study period, 847 blood samples were collected in vial containing EDTA from jugular vein of the cattle which were suspected for haemoprotozoan infection or not responding to usual treatment. These samples were processed for complete blood count analysis on haemoanalyzer. Thin blood smears prepared from fresh anti-coagulated blood obtained from jugular vein of anemic cattle were stained with Giemsa stain (1: 10 ratio) and examined for haemoparasites.

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Collection of Ticks and Preservation

Ticks collected from body of affected animals and shed were preserved in 70 per cent alcohol and identified as per Soulsby (1986).

Data Collection

Animal data pertaining to age, sex, breed, month, season, production status and predisposing factors, if any were collected in a specially designed proforma for computation of prevalence of haemoprotozoan infections in cattle.

Statistical Analysis

Data obtained were compiled and tabulated for frequency and finally converted into percentage to draw inferences. Chi-square (X^2) value was calculated to determine the significance of association between disease and hypothesized causal factor viz., age, sex, breed and season as per the method described by Snedecor and Cochran (2014).

Results and Discussion

Among 308 blood smears examined from suspected cases, 138 (7.52%) clinical cases of cattle were found positive for haemoprotozoan infection on blood smear examination. Earlier from different parts of country, the prevalence of haemoprotozoan infections in cattle ranging from 11.1 to 74.47% was reported (Kala and Deo, 2018; Maharana *et al.*, 2016; Velusamy *et al*., 2014; Ananda *et al*., 2009). Among different haemoprotozoan diseases, highest (5.83%) prevalence was of theileriosis (Table 1). Similarly, Al Mahmud *et al.* (2015) reported 5.82% prevalence of theileriosis in cattle from Bangladesh. Mahajan *et al.* (2013) found 4.86% prevalence of theileriosis in crossbred cattle in Punjab. On contrary, higher prevalence rates (7.08%-45.4%) of theileriosis were previously observed by some workers (Devadevi *et al.*, 2018; Maharana *et al*., 2016; Kohli *et al*., 2014). The prevalence of babesiosis was recorded as 0.38% (Table 1). Similar to present findings Nair *et al.* (2011) reported 0.6% prevalence of babesiosis in cattle from Kerala. Velusamy *et al.* (2014) as well as Kala and Deo (2018) observed 1% prevalence of babesiosis in cattle from Tamil Nadu and Bihar, respectively. However, other workers have recorded very high prevalence (10.41% - 22.83%) of babesiosis in cattle from Gujarat and Karnataka (Krishnamurthy *et al.*, 2016; Vahora *et al*., 2012). The prevalence of anaplasmosis was found to be 0.11% (Table 1). The present findings on prevalence of anaplasmosis are in agreement with Kumar and Sangwan (2010) who reported 0.11% prevalence of anaplasmosis from Haryana. In contrast to our findings several other workers have recorded higher prevalence of anaplasmosis (2.64-7.97%) in cattle (Kala and Deo 2018; Velusamy *et al*., 2014; Vahora *et al*., 2012)

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Table 1: Prevalence of haemoprotozoan infections in cattle during January-2018 to June- 2019 (n=138)

S. No.	Parameter	No. screened	No. affected	Percent positive	Percent prevalence	X^2
Haemoprotozoan Infection						
1	*Theileria spp.*	1835	107	77.54	5.83	**0.001****
2	*Babesia spp.*	1835	7	5.07	0.38	
3	*Anaplasma spp.*	1835	2	1.45	0.11	
4	*Babesia spp. and Theileria spp.*	1835	11	7.97	0.6	
5	*Theileria spp. and Anaplasma spp.*	1835	11	7.97	0.6	
Breed						
1	Indigenous	1148	68	49.27	5.92	**0.008****
2	Crossbred	687	70	50.73	10.19	
Age						
1	Up to 6 months	335	14	10.15	4.18	**0.044***
2	6 months- 2 yr.	263	18	13.04	6.84	
3	2-5 yr.	675	64	46.38	9.48	
4	Above 5 yr.	562	42	30.43	7.47	
Sex						
1	Male	898	52	37.68	5.79	**0.0137***
2	Female	937	86	62.32	9.18	
Physiological Status						
1	Lactating	553	57	79.17	10.3	**0.962^{NS}**
2	Pregnant	201	15	20.83	7.46	
Season						
1	Monsoon	603	27	19.57	4.48	**0.0088****
2	Post Monsoon	192	18	13.04	9.38	
3	Winter	492	49	35.5	9.96	
4	Summer	548	44	31.89	8.03	
	Percent Prevalence				**7.52**	

*NS-Non significant; *Significant (p<0.05); **Highly significant (p<0.01)*

Prevalence of mixed infections of *Babesia spp.* and *Theileria spp.*, *Theileria spp.* and *Anaplasma spp.* was 0.60% each (Table 1). Kala and Deo (2018) observed high prevalence of mixed haemoprotozoan infections in cattle (21.29%) in Bihar. Vahora *et al.* (2012) found 2.73% prevalence of mixed haemoprotozoan infections in crossbred from Haryana. The differences observed in the prevalence may be due to the different geographical locations of the study areas, time periods and various methods of sample analysis (Velusamy *et al.*, 2014), distribution and density of the vectors, geo-climatic conditions, season, breed, and age of the animals (Maharana *et al.,* 2016). Breed-wise prevalence of haemoprotozoan diseases was found to be significantly (P<0.01) higher in crossbred cattle (10.19 %) as compared to indigenous (5.92%) cattle (Table 1). Among purebred indigenous cattle the prevalence was found to be highest in Gir (12.5%) followed by Red Kandhari (5.46%) and Deoni (5.09%) cattle. Similarly, Kulshrestha *et al.* (1978) found

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high prevalence of haemoprotozoan infections in exotic cattle (10.7%) as compared to indigenous cattle (1.4%). Several other workers have also reported higher incidence of theileriosis in crossbred cattle as compared to indigenous breeds (Velusamy *et al*., 2014; Ananda *et al.*, 2009). The present findings on higher incidence in crossbred cows may be attributed to stress of high milk yield potential and poor management practices (Velusamy *et al.*, 2014).

Age-wise prevalence of haemoprotozoan diseases was found to be highest in 2-5-year age group (9.48 %) followed by >5 years (7.47 %), 6 months to 2 years (6.84 %) and up to 6 months (4.18%) (Table 1). The effect of age on prevalence of haemoprotozoan diseases in cattle was significant (P<0.05). Ananda *et al.* (2009) reported highest incidence of haemoprotozoan diseases in cattle aged between 4-6 years (63.15%), followed by 1-2 years (21.05%) and below 6 months of age (15.79%). Velusamy *et al.* (2014) found higher occurrence of haemoprotozoan diseases among the age groups of 2-7 years in cross-bred animals and below 2 years in indigenous animals. On the contrary, Maharana *et al.* (2016) observed higher prevalence of anaplasmosis and theileriosis in older (>5 years) cattle followed by adult (1 to 5 years) cattle. Higher prevalence of haemoprotozoan diseases in younger animals was attributed to stress of high milk yield, seasonal stress and genetic makeup (Velusamy *et al.*, 2014).

Sex - wise prevalence of haemoprotozoan diseases in cattle revealed significantly (P<0.05) higher prevalence in females (9.18%) as compared to males (5.79 %) (Table 1). Further detail analysis revealed higher prevalence of haemoprotozoan diseases in indigenous male cattle and crossbred female cattle. Higher prevalence in female crossbred cattle was attributed to hormonal disturbances, parturition stress and lactation (Maharana *et al.*, 2016) and higher susceptibility of male indigenous cattle could be attributed to exposure to hot climate and stress of heavy work (Bhikane *et al.*, 2001). Prevalence of haemoprotozoan infection was found to be non-significantly higher in lactating (10.30 %) as compared to pregnant (7.46 %) cattle (Table 1). Radostitis *et al.* (2010) also reported occurrence of haemoprotozoan infections due to exposure to some stress factors such as parturition and lactation.

Lactation stage wise highest occurrence of haemoprotozoan diseases was observed in early lactation (96.49 %) followed by mid lactation (3.51 %) and no case reported during late lactation. Haemoprotozoan diseases cause significant morbidity and mortality in dairy animals, especially bovines, which are bearing production stress along with other diseases (McLeod and Kristjanson, 1999). The present finding might be attributed to suppressed immune defense during high milk yielding stage (Velusamy *et al*., 2014) and hormonal imbalance culminating in stress during early and mid-lactation. Highest occurrence of haemoprotozoan diseases was observed in early pregnancy (46.67 %) followed by mid pregnancy (33.33%) and late pregnancy (20.00 %). The present findings cannot be explained properly but it might be related to immune-suppression resulting from combined stress of pregnancy and lactation during early pregnancy. The haemoprotozoan diseases occurred throughout the year but highest occurrence was recorded during

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December (12.38 %) and February (11.33%), followed by March (9.74%), October (9.52%), November (9.19%), January (7.06%), April (7.95%), June (8.33 %), October, November, December and January (4.17 % each) (Table 1). The effect of month on prevalence of haemoprotozoan infection was found to be non-significant.

Season-wise highest prevalence was recorded during winter (9.96%) followed by post monsoon (9.38 %), summer (8.03%) and monsoon (4.48%) (Table 1). The effect of season with regard to prevalence of haemoprotozoan diseases was found to be highly significant ($P < 0.01$). In contrast to our present findings, most of the workers have reported highest incidence of haemoprotozoan diseases during either monsoon (Kala and Deo, 2018; Kohli *et al.*, 2014; Vahora *et al.*, 2012; Bhikane *et al.*, 2001) or summer (Velusamy *et al.*, 2014) and attributed it to higher tick activity during these seasons (Ananda *et al*., 2009). The highest prevalence of haemoprotozoan diseases recorded during winter season in present study might be due to stress of coinciding early lactation, poor plane of nutrition due to prevailing drought and change in environment due to change in location (including transportation).

On breed and season wise analysis it was noted that indigenous animals were found to be more affected during summer probably due to stress of hot climate and heavy work like ploughing and sowing whereas cross-bred cows were found to be more affected during winter owing to stress of early lactation and high milk yield.

Degree of Tick Infestation

Out of 138 clinical cases of cattle, tick infestation was observed in 131 animals. The occurrence of disease in 4.93 per cent animals without tick infestation may be attributed to breakdown of immunity in these carrier animals due to stress factors resulting in precipitation of the disease or flaring up of latent infection (Ananda *et al.*, 2009)**.**

Type of Tick Infestation

Maximum numbers of animals affected with haemoprotozoan infection were found to be infested with *Hyalomma anatolicum anatolicum* (50%) followed by *Riphicephalus (Boophilus) microplus* (26.19%) and mixed infestation of *Hyalomma anatolicum anatolicum* and *Riphicephalus (Boophilus) microplus* (16.67%). Many species of ticks have been incriminated as the natural vectors, but *Riphicephalus (Boophilus) microplus* and *Riphicephalus (Boophilus) annulatus* are reported to be major vectors of bovine babesiosis and *Hyalomma anatolicum anatolicum* for theileriosis (Radostits *et al.*, 2010)

Predisposing Factors for Haemoprotozoan Diseases

In maximum number of cases, the predisposing factor was found to be high milk yield (36.96%) followed by heavy workload (20.29%), change in geographical location (15.94 %), transportation (13.77%), hot

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climate (10.87%) and advanced pregnancy (2.17 %) (Table 1). Further breed wise analysis of data indicated heavy workload and hot climate were predominant predisposing factors for indigenous animals and high milk yield, change in geographical location and transportation were predisposing factors for crossbred cattle. Radostits *et al.* (2010) stated that several clinical cases occurring in cattle are usually caused by exposure to some stress such as parturition, lactation or starvation. Bhikane *et al.* (2001) reported that heavy workload and hot climate were predominant predisposing factors for babesiosis in indigenous cattle. Velusamy *et al.* (2014) mentioned that the weakening of immunity during high milk yielding stage in addition to genetic makeup and seasonal stress in summer months could be reason for high susceptibility to haemoprotozoan infections in cattle.

Conclusion

In conclusion, heavy tick infestation and rearing of high yielding crossbred cattle, which are more predisposed to stress of lactation has increased probability of haemoprotozoan infections in cattle in Marathwada region day by day. Therefore, it is essential to focus on preventive measures like tick control, management of stress, monitoring the prevalence and use of available vaccines against theileriosis to minimize the economic losses to dairy industry.

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