Acta Parasitologica Globalis 8 (2): 96-100, 2017
ISSN 2079-2018

DOI: 10.5829/idosi.apg.2017.96.100

Prevalence of Babesiosis in Cattle in and Around Jimma Town, OromiaRegion, South Western Ethiopia

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Abstract: Cross sectional study design was implemented from October 2013 to March 2014 with the aims of determining the prevalence of bovine babesiosis and its associated risk factors in and around Jimma town, southwestern Ethiopia. 390 cattle had conveniently been selected and blood collected from ear vein and jugular vein. Thin and thick smears as well as packed cell volume were measured for the detection of *Babesia* and anemia, respectively. Out of 390 blood samples of cattle 50 (12.8%) were infected with *Babesia*. Risk factors like age, sex, body condition score, breed and management system were not significantly associated with prevalence of bovine babesiosis (P>0.0) while risk factors like tick infestation, fever and packed cell volume were significantly associated with prevalence of bovine Babesiosis (P<0.05). It is concluded that the prevalence of bovine babesiosis is moderate in the area and tick vector should be controlled to control bovine babesiosis in the study area.

Key words: Bovine · Cross sectional study · Jimma · Prevalence · Risk factors · Tick

INTRODUCTION

Bovine babesiosis (cattle tick fever or red water fever) is economically the most important tick-borne disease of cattle caused by protozoan parasites of the genus *Babesia* [1] and characterized by fever, moderate to high morbidity and mortality [2].

More than 100 species of *Babesia* have been identified which are traditionally divided on the basis of their morphology into the small and large groups. The most prevalent species, *Babesia bovis* and *B. bigemina*, are found throughout most tropical and subtropical regions. To date, only ixodid ticks have been identified as vectors for *Babesia* spp. The specific tick vector must feed on a vertebrate reservoir that is competent in maintaining the *Babesia* organisms in an infectious state [3].

The most relevant pathogenicity aspect of these hemoparasites is the marked anemia that leads to high percentage of mortality in non-immune cattle herds [4]. Babesiosis is responsible for many economic impacts either, direct losses, such as mortality, reduction in meat and milk yield or indirect ones with the application of control measures.

In Ethiopia, no adequate emphasis has been given to livestock disease, particularly, to bovine babesiosis, despite of its devastating effect on cattle and other livestock [5]. Therefore, the aims of this research work were to know the prevalence of bovine babesiosis, the effects on Packed Cell Volume (PCV) and associated risk factors in and around Jimma town.

MATERIALS AND METHODS

Description of the Study Area: The study was conducted in Jimma town of Oromia Regional State, south-western Ethiopia. The study area, Jimma town is located at 355km south-western of Addis Ababa, lies between 360 10′ E longitudes and 70 40′ N latitude at an elevation ranging from 880 to 3360 meters above sea level [6]. Very currently Jimma Zone is divided in to 17 districts (hosting a total population of over 2.4 million, CSA (2008) an agro-ecological setting of highlands (15%), midlands (67%) and lowlands (18%) [7]. The area is characterized by a humid tropical climate of heavy annual rainfall that ranges from 1200-2000 mm per year. About 70% of the total annual rainfall is received during rainy season, which lasts from the end of

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May to early September. The mean annual maximum and minimum temperature ranges from 25°C-30°C and 7°C-12°C [8].

Study Animals: Cattle presented to Jimma university open air veterinary clinic were target animals. 390 cattle had been randomly selected in order to estimate the prevalence of bovine babesiosis.

Study Type and Sampling Procedure: A cross sectional study type was implemented to estimate the overall bovine babesiosis prevalence and their association with different risk factors. The sampling method used was simple random sampling to select the individual cattle in the villages (Kebeles). Sample size was determined using the formula for random sampling [9]. To determine the sample size an expected prevalence of 50% was taken in to consideration since there was no previous study conducted in the area. The desire sample size for the study was calculated using the formula given by Thrusfield [9] with 95% confidential interval and 5% absolute precision and it was 384 but 390 cattle were examined in this study for the sake of accuracy.

Study Methodology: Cattle presented to Jimma Universtity College of Agriculture and Veterinary Medicine open air clinic were target animals and blood sample was collected from ear and jugular veins. The sample site was shaved by using surgical blade, the area was disinfected by ethanol alcohol from the center to periphery. Blood was collected in heparin zed tubes from jugular vein and labeled. When blood collected from ear veins, first drop of blood was taken for smear preparation and capillary tubes were used to collect blood for PCV technique. Then, thin and thick smear as well as PCV technique was applied for the detection of *Babesia* and anemia, respectively. Thin blood films are air-dried, fixed in absolute methanol for 2-5 minutes and then stained with Giemsa for 30-40 minutes. It is preferable to stain blood films as soon as possible after preparation to ensure proper stain definition. Thick films were made by placing a small droplet of blood (approximately 50 ìl) on to a clean glass slide and spreading this over a small area using a circular motion with the corner of another slide. This droplet is not fixed in methanol, but simply air-dried and stained in Giemsa. This is a more sensitive technique for the detection of *Babesia* species, as RBCs are lysed and parasites concentrated, but species differentiation is more difficult. Unstained blood films should not be stored with formalin solutions as formalin fumes affect staining quality. Moisture also affects staining quality [10].

Data Analyzing: All raw data generated from this study were coded and entered in MS Excel database system. Using SPSS version 20.0 computer program, data were analysed. Chi-square (χ^2) test was used to determine the variation in infection, prevalence within a group of breeds, origin, ages, sex, body condition score, management system, production system (intensive or extensive), activities, fever and anemic animals in and around Jimma town. Statistical significance was set at $P < 0.05$ to determine whether there are significant differences between the parameters measured between the groups.

RESULTS

Over All Prevalence: Out of 390 blood samples of cattle examined, 50 samples were found infected with *Babesia* spp. The overall prevalence rate of babesiosis in and around Jimma town was 12.8%.

Prevalence Based on Risk Factors: Of the total 390 sample collected, 239 were females and 151 were males. Prevalence of 25 (10.5%) in female and 25 (16.6%) in male animals was observed and statistically with non-significant difference (P>0.05). Based on age, 226 were age of greater than five years (>5) with prevalence of 28 (12.4%), 134 were between age of 2-5 with prevalence of 19 (14.2%) and 30 were <2 years old with prevalence of 3 (10%) with statistically non-significant variation (P>0.05). Based on body condition scores of cattle, highest (15.9%) prevalence of babesiosis with poor body condition followed by moderate body condition animals (12.1%) and lowest (7.8%) prevalence of babesiosis with good body conditions was observed statistically with nonsignificant difference (P<0.05) (Table1).

Hematological Findings: The mean PCV of parasitized animals (25.32±3.119) was significantly lower (P<0.05) than those of non-parasitized animals (27.63±3.854) (Table 2).

Prevalence based on relation between babesiosis and febrile animals**,** 147 animals were found febrile and 243 were found non-febrile with prevalence of 10.0% (39) and 2.8%(11), respectively. Bovine babesiosis prevalence is highly related to fever occurrence and the association is statistically significant (P<0.05). Prevalence of bovine babesiosis based on tick infestation was 36 (9.2%) *Rhipicephalus decloratus* (*Boophilus decloratus*) and 14 (3.6%) for mixed tick infestations. In non-infected and infestation with other tick genera, the prevalence was nil. Prevalence of bovine babesiosis based on tick infestation is statistically significant (P<0.05). Based on breed, 371 were taken from local breed and 19 were taken from cross

Table 1: Prevalence of bovine babeiosis based on sex, age and body condition

Risk factors	Groups	Nº examined	Prevalence (%)	χ^2	P-value
Sex	Female	239	25 (10.5)	3.009	0.083
	Male	151	25 (16.6)		
Age	>5 year	226	28(12.4)	0.482	0.786
	2-5 year	134	19(14.2)		
	2-5 year	30	3(10%)		
Body condition	Good	77	6 (7.8)	3.165	0.205
	Moderate	149	18 (12.1)		
	Poor	164	26 (15.9)		

Table 2: PCV (mean± SD) of Infected and Non-Infected Animals

Condition	Nº examined	PCV (mean± SD)	T-test	P-value
Non-infected	340	27.63±3.854	5.247	≤ 0.001
Infected	50	25.32±3.119		
Total	390	27.09±3.818		

Table 3: Prevalence of bovine babesiosis based on fever, breed and tick infestation

Risk factors	Groups	Nº examined	Prevalence (%)	χ^2	P-value
Fever	Febrile	147	39 (26.5%)	41.97	≤ 0.001
	Non-febrile	243	11 (4.5%)		
TickInfestation	No tick	105	0%	13.05	0.005
	Rhipicephalus	*183*	36 (19.7%)		
	others	74	0%		
	Mixed	28	14 (50%)		
Breed	Local	371	12.0%(47)	0.158	0.699
	Cross	19	0.8%(3)		

Mixed=*Rhipicephalus*+ Others,
Others =*mbyloma* spp. and *Hyaloma spp.,*

Table 4: Prevalence of bovine babesiosis based on management system

Management system	Nº examined	Prevalence (%)	χ^2	P-value
Extensive	302	40 (13.2%)	0.913	0.634
Intensive	4	1 (25%)		
semi-intensive	84	9 (10.7%)		

breed. The prevalence estimated on each was12.0% and 0.8%, respectively and statistically nonsignificant (P>0.05) (Table3).

Prevalence of Bovine Babeiosis Based on Management System: Based on management system prevalence of bovine babeiosis was 40 (10.3%) in extensively managed, 9 (10.7%) under semi-extensive management system and 1(25%) in managed. Prevalence of bovine babesiosis based on management system has no statistically significant difference (P>0.05) (Table4).

The prevalence of the disease based on the presence of tick was statistically significant (P<0.05) those cattle having mixed tick species of *Rhipicephalus* other species has prevalence of 50% those infested only by tick species of *Rhipicephalus* has19.7%prevalence while those does not have tick with nil prevalence. This shows strong association between *Babesia* infection and tick species *Rhipicephalus*.

DISCUSSION

The present study revealed an overall prevalence of 12.8%. Our result is in proximate to the result of Hamsho *et al*. [11] and Fakhar *et al*. [12], who were reported the prevalence of 16.9% and 16.4 at Telteledistrict, Borena Zone, Ethiopiaand in Western Iran, respectively. Lower prevalence of 4.4% was recorded by Seid[13] in the study conducted on horse babesiosis in and around Jimma areas. This may be due to the reason, animals other than cattle have generally been considered of little epidemiological significance as reservoir hosts of *Babesia* [14]. The prevalence reported by Sitotaw *et al*. [15] at Debre- Zeit (0.9%) using giemsa stain technique was lower than the prevalence in the current study. This is attributed to they collected all the samples during dry season and samples of this study were collected in rainy season and early dry season. In general, prevalence intensity rate of tick borne hemoparasitic disease

infestation were generally low during dry season and higher in rainy season [16] and may be due to difference in husbandry and vector control manner.

Higher prevalence rate of bovine babesiosis was reported by Tembue*et al*. [17] (78.8%) by using Giemsa staining test as diagnostic tool. Similarly [18] on sero-prevalence of bovine babesiosis in Addis Ababa also reported a prevalence rate of 60% by using Giemsa staining test as diagnostic tool. This difference might be due to the matter of higher sensitivity of serological tests used, which was better than the technique that used in this study.

Prevalence of 10.5% in female and 16.6% in male animals was observed and statistically with non-significant difference (P>0.05). Our result is in agreement with the report of Fakhar *et al*. [12].

Based on age, 226 were age of greater than five years (>5) with prevalence of 28 (12.4%), 134 were between age of 2-5 with prevalence of 19 (14.2%) [19; 20] and 30 were <2 years old with prevalence of 3 (10%) with statistically non-significant variation (P>0.05). The age of animals and prevalence of bovine babesiosis are directly proportional, suggesting that infection and re-infection persisted even after the primary infection [17] or lower prevalence in young animals compared to adults can be attributed to restricted grazing of young animals which tends to reduced their chance of contact with the vectors of these diseases [15] and passive immunity gained from their mothers through colostrums. Our finding agrees with Fakhar *et al*. [12] and Tembue *et al*. [17] and contrary to Amorim *et al*. [19] that identified calves were more susceptible to *Babesia* species when compared to adult cows.

The prevalence based on body condition score was, 15.9% in poor body conditioned animals followed by moderate body conditioned (12.1%) and lowest prevalence of babesiosis with good body conditions (7.8%) statistically with nonsignificant difference (P>0.05). Our finding is in agreement with the report of Kamani *et al*. [20] but disagreed with the report of Sitotaw *et al.* [15]. Management system also assumed as risk factor for prevalence of babesiosis, but both were found statistically non-significant (P>0.05). In case of management system, the sample collected from each group was not proportional, which may affect the outcome. The result contradicts with the previous report of Salm *et al*. [21], who reported significant difference was observed in management system.

Comparison of the mean PCV between those infected with *Babesia* spp. and those not infected gave significant difference (P<0.05). This may explain the low PCV values recorded in infected with *Babesia* spp. of the animals as affirmed by Olayemi and Oyewale [22] whose study concurred that the presence of blood parasites renders the erythrocytes to be more susceptible to osmotic lysis resulting in lowered PCV values.

ACKNOWLEDGEMENT

The authors would like to acknowledge Jimma University School of veterinary medicine for providing essential materials.

CONCLUSION

It was found that moderate prevalenceof bovine babesiosis in the study area using of Giemsa stain. The prevalence of bovine babesiosis increases as age of animal increases. On the other hand, variables like body condition score, tick infestation, fever and PCV (Packed Cell Volume) are significantly associated with prevalence of bovine babesiosis. Therefore, it is concluded that attention should be given to control and prevent the disease.

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