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Prevalence of Bovine Babesiosis in Selected District of East Wollega Zone, Western Ethiopia

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Abstract

Bovine babesiosis is a heamoparasitic disease that affects cattle and results in severe morbidity and mortality in animals. To determine the frequency of bovine babesiosis and related risk factors, a cross-sectional study was carried out in two selected districts of East Wollega, Oromia regional state of Ethiopia. Blood sample was collected, thin and thick smears were made, and their ability to identify *Babesia* parasites was assessed. Anemia was evaluated using the packed cell volume. An overall prevalence of 5.2% was observed in 20 of the 384 (268 female and 116 male) animals that were purposefully chosen and analyzed to have *Babesia* parasites. *Babesia bovis* infection was found in 15 (3.91%) of the *Babesia*-infected animals, while *Bovis bigemina* infection was found in 5 (1.30%). The prevalence of bovine Babesiosis was substantially ($p<0.05$) correlated with risk variables, such as animal husbandry practices and previous treatment with anti-*Babesia* drugs. However, the prevalence of bovine babesiosis was not significantly correlated with the animals' age, sex, breed, or body condition score ($P > 0.05$). Bovine babesiosis was more common in male animals (6.0%) than in female animals (4.9%). The highest incidence (6.1%) was found in old (> 7 year-old) animals, followed by mature animals (4-6 years) (5.2%), while the lowest prevalence (4.2%) was seen in young (<3 year-old) animals. Similar to other animals, the incidence was higher in cattle with low body condition ratings (7.1%) than in those with medium and high ratings (5.0%) and 1.2%, respectively. Bovine babesiosis was discovered to be pervasive in the research area and to be a serious danger to the production of cattle in general. Appropriate methods must be created and implemented in order to lessen the effect of bovine babesiosis on cattle productivity and production.

Keywords: *Babesia*; *Bovine*; East *Wollega*; Prevalence; Ethiopia

Introduction

The largest population of livestock in Africa is reportedly found in Ethiopia. This country's economy has greatly benefited from the livestock industry, which continues to show the promise of supporting the nation's economic growth [1, 2]. About 54 million cattle, 25.5 million sheep, and 24.06 million goats reside in the nation [3]. The majority of cattle (98.95%) are of local varieties, with the remainder being hybrids and exotic species [4]. Although the country has the largest population of livestock in Africa, it still contributes the least to the economy, and disease might be seen as a major obstacle [5]. Animal disease is one of the main factors affecting output and productivity. Conditions brought on by hemoparasites are typically connected with the prevalence and spread of their vectors [6]. Bovine babesiosis is a tick-borne intra-erythrocytic protozoan parasites cause of disease in cattle brought on by the protozoan parasites *B. bovis, B. bigemina,* and *B. divergens*. The primary carriers of *B. bigemina* and *B. bovis, Rhipicephalus* (previously *Boophilus*) spp., are found across tropical and subtropical regions. *Ixodes ricinus* is the main carrier of the *B. divergens* [7, 8]. It is a protozoan parasite that is a member of the phylum *Apicomplexa*, order *Piroplasmida*, subclass *Piroplasmsia*, and genus *Babesia*. Piroplasmas are so named because their pear-shaped merozoites reside as tiny parasites inside mammals' red blood cells (RBC). Babesiosis is a hemolytic illness that can cause a rapid development of fever, anemia, icterus, hemoglobinuria, listlessness, anorexia, jaundice, and mortality. The significant anemia that causes a large proportion of deaths in non-immune cow herds is the most important element of hemoparasite pathogenicity. Most tropical and subtropical climates, including Ethiopia, are home to the two most common species, *B. bovis* and *B. bigemina*. *Babesia bovis* is a tiny parasite that often lives in the center of the erythrocyte. It is typically found in pairs that are at an oblique angle to one another and is around 1-1.5 m long and 0.5-1.0 m wide. The considerably longer parasite *Babesia bigemina* is frequently discovered in pairs that are acutely angled to one another. *Babesia bigemina* normally has a pearshape, however there are other unique variations. It is 3-3.5 mm length and 1-1.5 mm wide. In paired forms, each parasite frequently has two distinct red-staining spots. Sporozoites are introduced into the host during a tick bite and immediately infect red blood cells. *Babesia* sporozoites transform into piroplasms inside the infected erythrocyte in the host, producing two or, occasionally, four daughter cells that depart the host cell to infect more erythrocytes. It has a detrimental impact on the health of the cattle as well as on their productivity and output. It has significant economic significance, particularly for cattle, because it affects adults more severely than young animals, which results in direct losses through mortality and lower output of things like meat and milk [7]. Babesiosis may be actively prevented and controlled using vaccination, chemoprophylaxis, and vector control. Additionally, the prevalence of illness can be reduced by using genetically resistant cattle like *B. indicus* [8]. There is little data available in these study areas on the frequency of bovine babesiosis, despite several studies being carried out across Ethiopia to assess the status and economic significance of bovine babesiosis [1, 2]. Therefore, the objectives of this study were to investigate the prevalence of bovine babesiosis with its associative risk factors in the study area.

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Material and Methods

Description of study area

The study was carried out in Guto Gida and Diga district, which is located in East Wollega, Oromia regional state of Ethiopia. The districts 2,088 meters above sea level in latitude 90° 5'N and longitude 36°33' East. Nekemte is 331 kilometers west of Addis Ababa, the nation's capital. The lengthy summer rainy season (June to September), the short rainy season (March to April), and the dry winter seasons rotate in the climate (December to February). The ranges for daily temperatures and yearly rainfall are correspondingly 1450 to 2150mm and 15 to 27C. The region has a total land area of roughly 729,725 hectares, of which 3366,220 hectares are utilized for crop production, 184,412 hectares are used for animal grazing, 256,901 hectares are covered in forest, and 20,492 hectares are used for other purposes.

Study design

A cross-sectional study design was employed to determine the prevalence of bovine babesiosis and associative risk factors in selected district of East Wollega Zone of Oromia regional state, Ethiopia.

Sampling methods and sample size determination

Sample size determination

The total sample size was determined according to the formula given by Thrus field given below; using a five percent desired absolute precision, 95% confidence interval and 50% expected prevalence. Accordingly, the total sample size would be 384.

$$N = \frac{1.96^2 \text{ Pexp } (1\text{-Pexp})}{d^2}$$

Where N = required sample size, P exp= expected prevalence, d = desired absolute precision (0.05). Accordingly, 384 animals were included in this study.

Sampling method and source of study animal

Cattle presented to Nekemte veterinary clinic of Guto Gida district and Diga veterinary clinic of Diga district were included in the study. Nekemte and Diga veterinary clinics were selected based on purposive sampling because of the number of cattle presented to the clinics and their accessibility. Purposive sampling technique was utilized to obtain study animals from both Nekemte and Diga veterinary clinics. During sampling a clinical sign like change in urine colour, yellowish and paleness of visible mucous membrane and tick infestation was considered as criteria to purposively selected animals. Accordingly, 219 animals were selected from Nekemte veterinary clinic and 165 were selected from Diga veterinary clinic.

Sample collection, transportation, and laboratory investigation

The blood sample was collected either from the jugular vein or ear vein after proper restraining of the animal according to Urquhart. Before blood collection, the area of blood collection by puncture was cleaned; the hair was removed and disinfected with 70% alcohol. Blood sample was collected from the jugular vein by a heparinized vacutainer tube and by hematocrit capillary tube from ear vein and transported to Wollega University Veterinary Parasitology laboratory in ice box. Age, sex and body condition score of the studied animals were recorded during sampling. The ages of the animals was determined based on owners' information and as described by De-lahunta and Habel and also the body condition of the animals was determined according to Nicholson and Better worth.

Laboratory investigation procedures

Thin and thick blood smears on clean and dry glass slides were prepared from the blood samples. Thin blood smear films were air-dried and fixed in absolute methanol for 2-5 minutes and stained with Giemsa for 30 minutes, washed with tap water to remove an extra stain, and air-dried slides were examined under the oil immersion lens of a light microscope. Morphological characteristics of *Babesia* species were identified according to key Soulsby. Thick films were made by placing a small droplet of blood onto a clean glass slide and spreading this over a small area using in a circular motion on the corner of another slide, 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. PCV was measured to know the level of anemia for each individual animal. PCV was measured by filling blood into a hematocrit capillary tube up to ¾ its volume and sealing in soap and placing in a hematocrit centrifuge for 15000rp per 5 minutes. After centrifugation measured by PCV recorded.

Data management and analysis

Data collected were recorded properly and entered into a Microsoft Excel spreadsheet and analyzed using SPSS for Windows version 20 (SPSS Inc., Chicago, IL, USA) coded. Data were summarized using descriptive statistics. The associations between the prevalence of Bovine *Babesia* infection and the associated risk factors (age, sex and body condition score) were evaluated using logistic regression analysis. Student's t-test was applied to examine the differences in mean PCV values among *Babesia*s infection status. Analysis of variance (ANOVA) was applied to compare the mean PCV values of infected animals with different *Babesia* species. Differences were considered to be significant as $P < 0.05$ at 95% confidence interval.

Results

In this study, 384 cattle were examined to determine the prevalence of bovine babesiosis. The majority of the animals were local breeds (91.9%) and female (69.8%) animals. Most cattle had poor body conditions and the majority of them were (86.7%) reared under an extensive management system. Among the 384 cattle examined 20 (5.2%) were found to be infected with *Babesia*. The dominant *Babesia* species identified in the study area was *Babesia bovis* 15(3.91%) followed by *Babesia bigemina* 5(1.30%). A univariable logistic regression analysis was carried out to examine the associations of age, sex, breed, body condition score, and management system categories of the cattle with the prevalence of *Babesia* Table 1. The prevalence of babesiosis was higher in cross breed 19(5.4%) cattle than in local 1(3.2%) breed of cattle but, the prevalence was not significantly varied among breed of cattle ($P > 0.05$). A univariable logistic regression revealed that cattle of poor body condition score were more likely to be affected by *Babesia* than good-conditioned animals (OR = 6.25; 95% CI: 0.74%-53.1%). The odds of the infection of babesiosis in poor conditioned cattle were 6.25 times more likely than in cattle of good body condition score with 0.74%-53.1%. N, Number examined; BCS, Body condition score; †, Reference category; MLE, Maximum Likelihood Estimate; SE, Standard Error; OR, odds ratio; CI, confidence interval

PCV Results

In this study, the overall mean packed cell volume (PCV) value of the sampled animals was 24.6% ± 1.8. The mean PCV values among

Table 1: Results of logistic regression model analysis to evaluate the odds of cattle infected by *Babesia* based on the risk factors.

Risk factors		No. of animals		MLE			Odds	
		N	Positive (%)	Coef. (β)	SE	P	OR	95% CI
BCS	Good†	80	1(1.2)	-	-	-	1	-
	Medium	120	6(5)	1.46	1.14	0.20	4.29	0.46-40.3
	Poor	184	13(7.1)	1.83	1.09	0.09	6.25	0.74-53.1
Management	Intensive†	32	1(3.1)	-	-	-	1	-
	Semi intensive	19	4(21.1)	3.37	1.42	.02	29.0	1.81-46.4
Breed	Local†	31	1(3.2)	-	-	-	1	-
	Cross	353	19(5.4)	1.09	1.22	0.37	2.97	0.27-32.7
Age	Young†	96	4 (4.2)	-	-	-	1	-
	Adult	174	9 (5.2)	0.05	0.67	0.94	1.06	0.28-3.95
	Old	114	7(6.1)	0.51	0.71	0.47	1.66	0.42 -6.64
Sex	Female†	268	13 (4.9)	-	-	-	1	-
	Male	116	7 (6)	0.34	0.54	0.53	1.41	0.49 4.03
Constant				-3.29	0.41	0.00		

Table 2: The mean PCV value among the examined animals.

Infection status	No. examined	Mean PCV ± SD	t test	P value
Parasitemic	364	22.3 ± 1.3	6.2	0.00
Aparasitemic	20	24.7 ± 1.7		
Total	384	24.6 ± 1.8		

Babesia infected and uninfected cattle variables were compared using student's t test (Table 2). The mean PCV values of examined animals significantly ($P < 0.05$) varied with infection status. The mean PCV value of *Babesia* infected (22.3% ± 1.3) cattle was significantly ($P < 0.05$) lower than that of uninfected (24.7% ± 1.7) animals.

Discussion

The overall prevalence of Bovine babesiosis in the selected district of East Wollega was 5.2%, in which is markedly lower than the previous findings of 12.8% (50/390) reported from in and around Jimma Southwestern Ethiopia, 16.9% (65/384) reported from Teltele district, northwest Borana zone, southern Ethiopia. On the other hand, it is higher than the report of Wodajnew and Sitotaw who reported a prevalence of 1.5% (6/402) and 0.9% in and around Assosa Woreda Benishangul Gumuz regional state Western Ethiopia and at Bishoftu respectively. This variation in the prevalence of bovine *babesiosis* may be caused by various factors, including animal husbandry practices, anti-parasitic drug use for vector control, parasite variation in carriers of the disease over time, test sensitivity, distribution of infected vectors, and accessibility of animals to wildlife sanctuaries, parks, and forests where *Babesia* vectors are present. This study shows, the prevalence of *Babesia* infection is higher in animals with poor body condition score than in animals with medium body condition and good body condition score with no statically significance difference($P>0.05$%). This is in agreement with the previous study by Kamani. The present study revealed that the prevalence of *Babesia* infection was higher in males 6.0% (7/116) than in females 4.9% (13/268) cattle with stastically non-significant difference ($P>0.05$). This result which agrees with findings by Fakhar Choramo and Ibrahim, and Wodajnew who noted a higher prevalence in male cattle than female. Moreover, the higher prevalence of heamoparasitic disease in male animals might be due to the fact that male animals are subjected to stressful work that suppresses the immune system of the animals. Based on the age of the animal the present study revealed that the prevalence of bovine babesiosis is 6.1% (7/144) in old, 5.2% (9/174) in adults and 4.2% (4/96) in young respectively with statically non-significant variation ($P>0.05$). These results are in line with the findings of Ayaz from Pakistan who reported a high prevalence of Bovine babesiosis in old animals at 13.4% (61/452) followed by adult animals at 11.7% (48/409) while lowest was found in young animals. Furthermore, these current findings are in agreement with the findings of Choramo and Ibrahim who reported animals 28(12.4%) in old, 19 (14.2%) adults and 3(10%) in young in Jimma. But these findings are disagreeing with the report of Amorim who reported that calves were more susceptible to *Babesia* species compared to adult cattle. These variations can be because young animals have less rate of infestation with tick as compared to old animals. On the other hand, the lower prevalence in young animals is attributed to restrict grazing of young animals which tends to reduce their chance of contact with the vectors of these diseases. And passive immunity gained from their mothers through colostrums. In the current study PCV was measured for an individual animal to determine the level of anemia and to compare the mean PCV of parasiticmic (22.3 ± 1.3) and aparasitemic (24.7 ± 1.7) animals ($P<0.05$) this variation in PCV might be due to the parasite effect on blood by hemolysis of RBC.

Conclusion

The present study revealed that the overall prevalence of bovine babesiosis was 5.2% in the study area. Therefore, bovine babesiosis poses enormous economic loss through poor body weight gain, reduce productivity, treatment cost and death of affected animals. The prevalence of *B. bovis* and *B. bigemina* were 3.9% and 1.2% respectively. The prevalence of bovine babesiosis increases as the age of the animal increases and variables such as husbandry systems and ant-*Babesia* drug treatment history of the animal was significantly associated with the prevalence of bovine babesiosis. Therefore, Routine *Babesia* prevention measure should be under taken in study area and complete data set on epidemiology of babesiosis infections and their economic loss further detailed studies should be conducted in study area.

Abbreviations

OIE: Office of Internationa Epizootics

PCV: Pac Cell Volume

RBC: Red Blood Cell

SPSS: Statistical Package for Social Science

Data Availability

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Ethical Approval

The Haramaya University College of Veterinary Medicine approved this study. The official letter was written to the district veterinary clinics. The study purpose was explained, and the permission to get sample from animals was granted.

Conflict of Interest

The authors declare that they have no conflicts of interest.

Authors' contributions

E N and J G were involved in the design of the study; E N. collected data. A E and E N analyzed the data and drafted the manuscript. E N, J G, and A E revised the manuscript; all authors approved the final manuscript.

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References

1. Osayande UD, Bitto II, Okewale SA, Idahor KO (2017) Sperm storage capacity and total protein concentration in the testes of bucks in the native tropical environment. Journal of Veterinary Medicine and Animal Health 9:154-158.
2. Gatimel N, Moreau J, Parinaud J, Léandri R D (2017) Sperm morphology: assessment, pathophysiology, clinical relevance, and state of the art in 2017. Andrology 5:845-862.
3. Thomas J (2021) Determining reproductive fertility in herd bulls.
4. Amao OA, Showumi KA (2016) Reproductive characteristics of rabbit bucks fed diet containing raw or fermented cottonseed cake. British Biotechnology Journal 10:1-10
5. Babashani M, Lawa M, Njoku CO, Ate IU, Rekwot PI, et al. (2014) Effects of dietary gossypol on testicular histology and ultrasonograms of Yankasa rams. J Vet Adv 4:616-622.
6. Shandilya L, Clarkson TB, Adams MR, Lewis JC (1982). Effects of gossypol on reproductive and endocrine functions of male cynomolgus monkeys (Macaca fascicularis). Biol Reprod 27:241-252.
7. Hill D, Sugrue I, Arendt E, Hill C, Stanton C, et al. (2017) Recent advances in microbial fermentation for dairy and health. F1000Research 6:1-5
8. Soares Neto CB, Conceição AA, Gomes TG, de Aquino Ribeiro JA, Campanha RB, et al. (2021) A comparison of physical, chemical, biological and combined treatments for detoxification of free gossypol in crushed whole cottonseed. Waste and Biomass Valorization 12:3965-3975.