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Research Article

Bovine Anemia Associated With Trypanosomosis Infection in Local Breed Cattle's (Ethiopian Zebu Breeds)

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- Bovine anemia; Prevalence; Trypanosomosis; Associated risk factors; Zebu cattle

Abstract

In tropical Africa, protozoan parasites cause several diseases of social and economic importance. Among protozoan parasites, trypanosomosis is one of the most devastating diseases caused by infection with different species of trypanosomes, which are transmitted primarily by tsetse flies and other hematophagous flies to human, domestic animals and wildlife.

A cross-sectional study was conducted to estimate the prevalence and the analysis of major contributing risk factors of bovine anemia associated with trypanosomosis infection. From total examined cattle (n= 437) for anemia only 196 had anemia, with an overall prevalence rate of 44.85 per cent. Packed cell volume for all study animals were analyzed to compare the degree of anemia which resulted that, 73.58% (n=39) animals were anemic while 26.42% (n=14) non-anemic from total (n=53) trypanosome infected cattle and, 40.89% (n=157) were anemic from total of n=384 cattle without trypanosome infection. Hence, a significantly higher prevalence rate of anemia (73.58%) was observed in trypanosome infected cattle when compared to non-infected cattle (40.89%) χ^2= 20.13, p-value=0.00.

The overall resulted trypanosomosis prevalence was 12.13%; composed of n= 7.55 % (33), 3.66 % (16) and 0.92% (4) for *Trypanosoma congolense*, *Trypanosoma vivax* and mixed infection (both *Trypanosoma congolense* and *Trypanosoma vivax*), respectively.

The study concluded that trypanosomosis strongly cause anemia and recommended that controlling anemia was mandatory to maximize cattle production and reproduction, which could be achieved by controlling trypanosomosis and associated risk factors.

INTRODUCTION

The limitation on animal health, production and denied access of farmers to fertile arable land due to tsetse fly challenge and trypanosomosis exacerbated the severity of food insecurity in Africa in general and Ethiopia in particular. The overcrowding of cattle and people in tsetse and trypanosoma free areas remained a great challenge for both good land use practices and long term community development activities [1].

Trypanososmosis caused by different species of unicellular flagellated haemoprotozoan Trypanosoma is a widely prevalent economically important serious disease of domestic livestock and humans whose impact is poorly understood [2,3]. In tropical Africa, protozoan parasites cause several diseases of social and economic importance. Among protozoan parasites, trypanosomosis is one of the most devastating zoonotic diseases caused by infection with trypanosomes, which are transmitted primarily by tsetse flies and other hematophagous flies to human, domestic animals and wildlife. The disease constrains agricultural development in less than half of the African continent by causing livestock production losses due to poor weight gains, stunted growth, poor milk production, reproductive failure and finally death of animals [4]. Anemia is a major clinical sign following infection with pathogenic trypanosomes in cattle and other domestic animals [5,6], which could be measured by packed cell volume or blood plasma concentration. Usually PCV indicates anemia and status of trypanosoma infection in the animal which is indirectly correlated with animal production and reproduction performance [7]. Therefore, the study area lacks any scientifically investigated report regarding trypanosomosis and anemia. So, that objective of the study was to estimate the prevalence of anemia associated with trypanosomosis and analysis of major associated risk factors.

MATERIALS AND METHODS

Description of the study area and Study design

The present study was conducted in the Sokoru District of Jimma Zone in Oromia regional state Western Ethiopia. It is located at about 180 km west of the capital city Addis Ababa with the altitude ranging from 1160 to 2940 meters above sea level. A survey of the land in this District showed that 36.6% is arable or cultivable, 16.8% pasture, 17.2% forest, and the remaining 29.4% is built-up or degraded. Although coffee is another important cash

crop of this District, less than 20 square kilometers are planted with this crop at longitude 8.27 N and 36' 21 E and latitude 8.45 O N and 36.35O E respectively [8].

A cross-sectional study was conducted to estimate the prevalence of bovine anemia associated with trypanosomosis and analysis of major associated risk factors in four different peasant associations. A simple random sampling technique was followed and all selected cattle were local breeds. The sample size was determined by using Thrusfield formula (1995) [9] with an expected prevalence of 50%, a minimum sample size of 384 heads of cattle's, however; the study includes 437 heads of cattle's to increase study precision.

Study methodologies

Paired blood samples were collected from the auricular vein (marginal ear vein) of each animal using two hematocrit capillary tubes filled to ¾ of its height after the animal was properly restrained without pain and suffering and sealed with crystal sealant. The capillary tube was also used to measure the PCV for the determination of anemia and the comparison of infected animals with non-infected animals [10]. According to Van den Bossche et al., 2001[10], only cattle with packed cell volume (PCV)≤ 24 were considered as anemic. Then the capillary tube was cut 1mm below the buffy coat to include the top layer of red blood cells. The content of the capillary tube was expressed on to a clean microscopic slide, mixed and covered with a coverslip. Finally, prepared slides are examined for the presence of trypanosomes based on the type of movement in the microscopic field as confirmation of trypanosome species by morphological characteristics were done after staining with Giemsa and examination with oil immersion microscopy under×100 power of magnification [11]. During sample collection District, Peasant association, Age, Sex and Body Condition of each animal were recorded as body condition score were categorized based on [12].

Data analysis

Data collected from each study animal and laboratory analyses were coded into appropriate variables and entered in Microsoft excel, 2007 spreadsheet. All statistical analyses were performed using STATA software version 12 (Texas, USA). Categorical data were analyzed by using chi-square ($\chi 2$) test of independence whereas t-test was used to examine the difference in mean PCV between the study variables. In all cases, 95% confidence intervals were used (STATA- 12, 2012) [13].

RESULT

From total examined cattle for anemia n= 437; only n=196 of them had anemia, with an overall prevalence rate of 44.85%. Packed cell volume for all study animals were analyzed to compare the degree of anemia between trypanosoma infected and non-infected cattle's; which resulted in n=39, 73.58% anemic and n=14, 26.42% non-anemic from total of n=53 trypanosoma infected cattle's and n=157, 40.89% were anemic from total of n=384 cattle without trypanosoma infection. Therefore, significantly higher prevalence rate of anemia 73.58% was observed in trypanosoma infected cattle when compared with 40.89% prevalence rate without trypanosoma infection $\chi 2$= 20.13, p-value=0.00 (Table 1).

Mean packed cell volume (PCV) result in trypanosoma infected cattle was 20.68 ± 2.99, (CI=20.26, 21.09) and without infection 27.02 ± 1.93, (CI= 26.77, 27.26) with significant statistical difference Pr (T < t) = 0.00. The overall resulted Trypanosomosis prevalence was 12.13%; composed of n= 33(7.55%), 16(3.66%) and 4(0.92%) for *T. congolense*, *T. vivax* and mixed infection (both *T. congolense* and *T. vivax*) respectively. There was only a statistical significant difference in trypanosomosis prevalence between peasant associations and body condition score from considered contributing risk factors p=0.00 (Tables 2-4).

DISCUSSION

The result of the study was more in agreement with Tasew and Duguma R [14], who reported prevalence of anemia 39.1% with 8.57% prevalence of trypanosomosis in Western Oromia, however, resulted significant difference in prevalence of anemia was clearly due to increasing in prevalence rate of trypanosomosis 12.13% in current finding. Among considered associated risk factors peasant associations (localities), sex and body condition scores significantly affected the prevalence of anemia by far also in agreement with Steinet al, 2011 [15]. Furthermore, the study demonstrated severe anemia in T. congolense infected cattle than T. vivax with respective mean PCV of 18.55 and 24.13, Pr (T < t) = 0.00 could be due to the development process of T. congolense which is confined to intravascular blood and cause hemolysis of red blood cells [16,17].

Different range of mean PCV was recorded between 17.83 and 24.00 within respective localities of Doyokobota and Adama higher and lower, this significant difference in mean PCV could be directly related with a prevalence rate of Trypanosomosis and other contributing risk factors indirectly.

Finally, the study confirmed that identified trypanosoma parasites infection strongly cause anemia with an evidenced result of mean PCV in infected cattle's 17.72 and without infection 27.64, difference= -9.92, Pr (T < t) = 0.00. However, all caused anemia in the study is not necessarily due to Trypanosomosis maybe there are other causes other than study protozoa [18].

The study demonstrated a relatively higher prevalence of bovine trypanosomosis when compared with other study in the different areas [19]. Absence of *T. brucei*, in the study, may be due to the seasonal absence of the parasite in circulation as indicated by [20]. The predominance of *T. congolense* infection in cattle under a sufficient number of cyclical and mechanical vectors may be due to the development of a better immune response to other species of trypanosomes [21]. Among considered risk factors study location and body condition score had statistically significant effect on resulted prevalence rate of bovine trypanosomosis [22] (Figures 1 and 2).

CONCLUSION

The study concluded that trypanosomosis strongly cause anemia however, all recorded anemia in the study are not caused by study protozoa alone. Overall prevalence rate of anemia at study area were 44.85% with respective trypanosomosis prevalence rate of 12.13%. The study recommended that controlling trypanosomosis and associated risk factors was mandatory to maximize cattle production and reproduction, which could be achieved by controlling anemia.

Table 1: Prevalence of anemia with trypanosome infection and without infection.

Packed cell volume status	Observation	Prevalence (%)	Number of prevalence (%)		χ^2	p-value
			Infected	Non infected		
Anemic	196	44.85	39,(73.58)	157,(40.89)	20.13	0
Non anemic	241	55.15	14,(26.42)	227, (59.11)		
Total	437	100	53,(100)	384, (100)		

Table 2: Mean PCV of cattle's infected with different species of trypanosome.

Packed cell volume status	Mean PCV, SD	CI (confidence interval)	Mean PCV in *Trypanosoma* species				Pr (T < t)
			T.congo	*T. vivax*	Mixed infection	Total	
Anemic	20.68 ± 2.99	(20.26, 21.09)	17.34	19	18.33	17.72	0
Non anemic	27.02 ± 1.93	(26.77, 27.26)	27.25	28.11	25	27.64	
Average	24.17 ± 4.00	(23.79, 24.55)	18.55	24.13	20	20.34	

PCV= packed cell volume, SD= standard deviation, *T. congo= Trypanosoma congolense*, *T. vivax=Trypanosoma vivax*

Table 3: Status of anemia in different associated risk factors.

Associated risk factors		Mean PCV in trypanosome infections				Mean	P-value
		T. congolense	*T. vivax*	Mixed infection	Total		
Peasant association	Adama	24.69	-	-	24	24.68	0.00
	Doyokobota	23.99	24.10	-	17.83	23.72	
	Ghibe	24.92	26.50	23.40	20.92	24.25	
	MedaleGhibe	24.89	25.20	23.40	20.15	24.02	
Age group	Young	18.86	24.50	25.00	20.61	24.13	0.70
	Adult	18.24	23.90	18.33	20.13	24.20	
Sex	Male	18.86	24.50	25.00	19.72	24.19	0.00
	Female	18.24	23.90	18.33	21.08	24.16	
Body condition	Poor	17.21	18.35	17.71	17.89	22.78	0.00
	Medium	20.02	23.10	21.4	21.29	24.33	
	Good	18	28	26.44	22.86	26.37	
Overall		18.55	24.13	20.00	20.34	24.17	

Table 4: Trypanosomosis prevalence and major associated risk factors.

Associated risk factors		Prevalence of involved trypanosome species (%)				P- value	$\chi 2$
		T. congolense	*T. vivax*	Mixed infection	Total		
Peasant association	Adama	0.23	0.00	0.00	0.23	0.00	2.29
	Doyokobota	0.69	0.69	0.00	1.37		
	Ghibe	3.89	1.60	0.46	5.95		
	MedaleGhibe	2.75	1.37	0.46	4.58		
Age group	Young	3.66	1.37	0.23	5.26	0.57	1.13
	Adult	3.89	2.29	0.69	6.87		
Sex	Male	4.12	2.06	0.46	6.64	0.98	0.05
	Female	3.43	1.60	0.46	5.49		
Body condition	Poor	2.98	1.14	0	4.12	0.51	3.30
	Medium	3.89	1.83	0.69	6.40		
	Good	0.69	0.69	0.23	1.61		
Overall		7.55	3.66	0.92	12.13	-	-

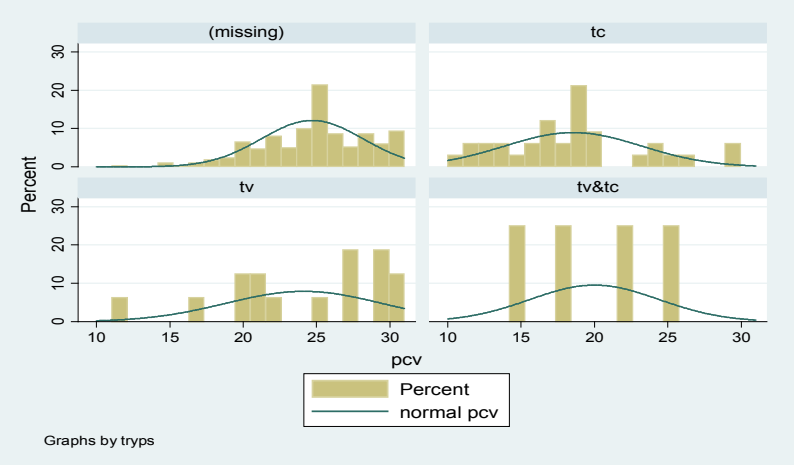

Figure 1 Infection patterns of trypanosome species between PCV results.
Pcv= packed cell volume, tc= T. congolense, tv= T. vivax, tv&tc= mixed infection

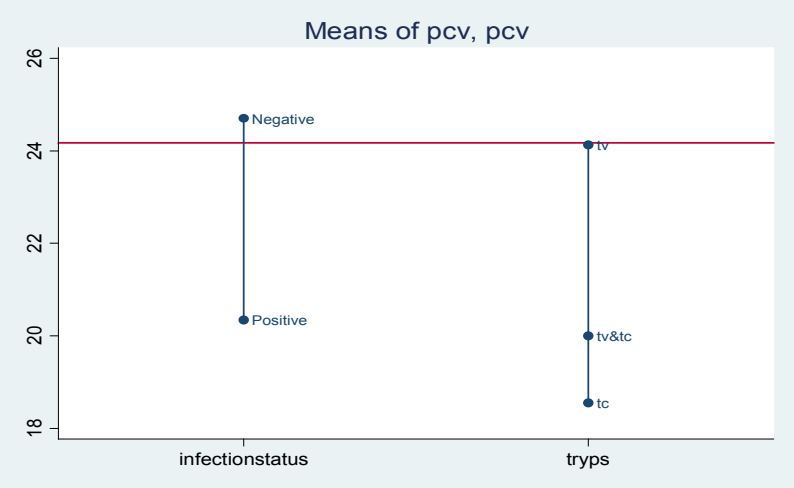

Figure 2 Comparative mean PCV in trypanosome infection and without infection.
Pcv= packed cell volume, tc= T. congolense, tv= T. vivax, tv&tc= mixed infection

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