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Occurrence and Associated Risk Factors of Trypanosomosis in Cattle of Bench-Sheko Zone, Southwest Ethiopia

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Abstract: Trypanosomosis is a serious parasitic disease in cattle that affected food production and economic growth in Ethiopia. A cross-sectional study design was carried out in the Bench-Sheko zone Southwestern Ethiopia with the aim of determine the occurrence and associated risk factors of trypanosomosis in cattle from November 2016 to November 2017. From a total of 450 randomly selected cattle the blood samples were collected and tested with parasitological methods. For this study, the collected blood samples were examined using buffy coat technique and wet blood smear. The packed cell volumes (PCV) of animal sampled on field animals were recorded using hematocrit reader. An overall of 12.9% (58/450) prevalence of trypanosomosis was recorded in the study areas. The highest infection was caused by *Trypanosome congolense* (55.2%) followed *Trypanosome vivax* (36.2%) and mixed species (5.2%) (*Trypanosome vivax* and *Trypanosome congolense*) with the *Trypanosome brucei* (3.4%) was the least in the areas. The origin, age and body condition were identified as risk factors ($p<0.05$) for cattle trypanosomosis in the zone, whereas no difference was observed between sex and skin color of cattle and the occurrence of trypanosomosis ($p>0.05$). A statistically significant variation was noted between aparasitaemic and parasitaemic cattle with the mean PCV ($p<0.05$). This study documents the occurrence of cattle trypanosomosis in Bench-Sheko zone. Therefore, it is important to conducted appropriate control techniques and create awareness on the effected of trypanosomosis on cattle production in study areas. Besides, further study should be carried out on both trypanosomosis and its vectors in the areas.

Key words: Prevalence · Risk Factors · Trypanosomosis · Cattle · Bench-Sheko Zone

INTRODUCTION

Ethiopia has a huge numbers of livestock with an estimated population of 59.5 million cattle [1]. However, parasitic disease are challenging to cattle production in the country. Bovine tyrpanosomosis are a part of the major herd health problem known to constraint the sectors [2, 3]. The disease is a serious problem to cattle rearing in country which affected food self-reliance efforts of the country [4]. The annual losses to the national economy are estimated to exceed US$200 million due to direct and indirect impact of trypanosomosis on the agricultural and livestock production in the country [5].

Trypanosomosis is the complex disease caused by several species of genus *Trypanosome* which affect livestock, wildlife and human [6, 7]. The disease is results in severe losses in cattle production and productivity in Ethiopia due to it covers ten million square kilometers of potential productive land [8]. *Trypanosome congolense*, *T. vivax* and *T. brucei* are *Trypanosome* species which cause cattle trypanosomosis in Ethiopia. The distribution of those species was limit to tsetse belt areas of the country however; *T. vivax* cause disease outside of belt areas due to it can be transmitted by mechanical vectors [9]. In Ethiopia, bovine trypanosomosis is well-known in the Western, South and Southwestern lowland and the associated river systems (Abay, Ghibe, Omo and Baro/Akobo). About 220, 000 square kilometers of the areas are infested with five species of tsetse flies namely *Glossina pallidipes*, *G. morsitans*, *G. fuscipes*, *G. tachinoides* and *G. longipennis* [10].

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Trypanosomosis is the serious parasitic disease of cattle in many parts of the world including Ethiopia [3]. About 35 million US$ was loss for curative and prophylactic treatment annually in Africa [11]. Mortality, morbidity, abortion, impaired fertility and cost of control were direct economic loss due to trypanosomosis in cattle [12, 13]. Indirect losses were due to the exclusion of cattle from tsetse-infected grazing lands and reduced crop production because of insufficient animal draught power [14]. The trypanosomosis which transmitted by tsetse was remain the major cause of cattle production losses in Ethiopia [15].

Trypanosomosis is widely spread parasitic disease in Bench-Sheko zone that compromise the cattle production and productivity in the zone. Therefore, knowing the current prevalence and associated risk factors of bovine trypanosomosis is essential for reduced economic losses and to implement effective control methods in the study areas. Hence, the study was conducted with the aim of determine the occurrence and associated risk factors of cattle trypanosomosis in the Bench-Sheko zone in the southwestern part of the Ethiopia.

MATERIALS AND METHODS

Study Areas: The study was conducted in Guraferda and Skeko districts of the Bench-Sheko zone. Guraferda district is located 625 km from Addis Ababa, the capital city of Ethiopia. The altitude of the district was 500-1900 meters above sea level. The agro-ecology of the district was characterized by mid-land (28%) and lowland (72%). The long rainy season of the district was started from June to September, short rainy season from March to May and dry season from June to February. The average rainfall and temperature were 1332mm and 27.5°C, respectively. The district has 22, 339 head of cattle, 2, 952 head of sheep and 3, 832 head of goats. Sheko district is 645 km far away from Addis Ababa. The district located between 6°50'N latitude and 35°00'E longitude. The altitude of the district was ranged from 950 to 1800 meters above sea level. The district was divided into main rainy season (June-October), dry season (November-February) and short rainy season (March-May). The mean temperature were 22.6°C and rainfall range from 1200 to 2200 mm. The agro-ecology of the district is divided into lowland (61.8%) and midland (48.2%). Local breed was dominated one with some crosses of Holstein-Friesian in both districts. The management systems of the districts were extensive (crop-livestock production) system and semi-extensive (urban production) system (Figure 1).

Study Population and Design: The zebu cattle in selected district of Bench-Sheko zone were the study population for this study. Those animals were used communal grazing land. Animals get water in the rainy season from seasonal rivers while in dry season from perennial rivers flowing long in their locality. The cross-sectional study design was carried out from November 2016 to November 2017 with aim of determine the occurrence and associated risk factors of trypanosomosis in cattle. The variable like sex, skin color, body condition and origin of cattle were recorded. The body condition of cattle was grouped as good, medium and poor. The age group was determined as young (>2 years), adult (2-5 years) and old (>5 years) according to Walkite, Zelka and Eticha [16].

Sampling Technique and Sample Size Determination: The Bench-Sheko zone was selected purposively based on the history of trypanosomosis reported, while district and kebeles were selected randomly. Two districts were selected randomly from this zone. Then eight kebeles were sampled from each district based on cattle population. The sample was calculated according to the formula of Thrusfield [17] using 95% confidence interval, 5% precision and 50% expected prevalence. Thus, the sample was 384 cattle, but a total of 450 cattle were used to increase the precision of the study.

Sample Collection and Parasitological Examination: A little sample of blood was collected from an ear vein using a heparinized microhematocrit capillary tube. One end of the hematocrit tube containing the whole blood sample was sealed with hematocrit clay. The hematocrit tube was centrifuge at 12000 rpm for 5 minutes. The capillary tube was cut using a diamond-tipped pen 1mm below the buffy coat to include the uppermost layer of the red blood cells and 3mm above to include the plasma. The content of the capillary tube was expressed on to a slide, homogenized on to clean slide and covered with a coverslip. The slide was examined under X40 objective and X10 eyepiece for the movement of the parasites.

A drop of blood was placed on a clean slide and spread by using another clean slide at an angle of 45° air-dried and fixed for 2 minutes in methyl alcohol. Then the slide was immersed in Giemsa stain for 50 minutes. The slide was drained and washed of excess stain using distilled water and allowed to dry by standing upright on the rank and was observed under a microscope with oil emersion objective lens. In this smear, trypanosome species were identified by their size, shape, position, location and size of the kinotoplast.

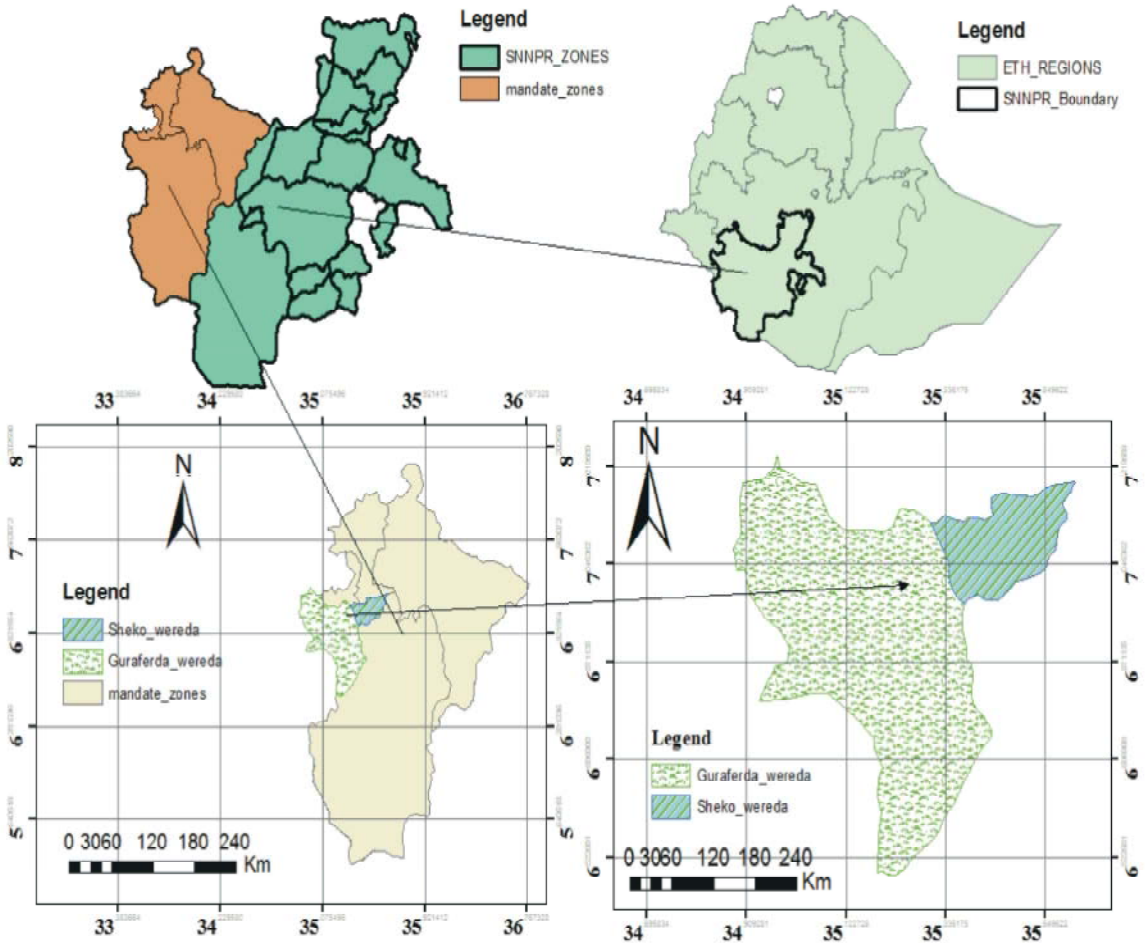

Fig. 1: Map of the study areas

The capillary tube with blood samples were placed in microhematocrit centrifuge with sealed end most. The samples were allowed to centrifuge at 12000 rpm for 5 minutes. Then, the tubes were placed in hematocrit and readings were stated as percentage of packed cell to the total volume of whole blood. Cattle with cell volume (PCV) <24% were known to be anemic.

Data Management and Analysis: Data recorded in this study was coded and stored in Microsoft® Excel for Windows 2010 and transferred to SPSS version 20.0. The prevalence of tyrypanosomosis was calculated by divining the number of positive sample to the total cattle sample. Association between trypanosomosis and associated risk factors were analyzed using logistic regression model. The t-test was used to test association the mean PCV of parasitaemic and aparasitaemic cattle. The variables with p-value less than or equal to 0.25 in univariable logistic regression, after checking for multicolinearity using collinear matrix index and interaction effect using cross-product terms were taken forward for multivariable modeling. The model fitness was observed using the Hosmer-Lemeshow test. For all statistical analysis, confidence intervals (CI) of 95% and p-value of 0.05 were used.

RESULTS

An overall of 12.9% prevalence of trypanosomosis was recorded in study areas. The prevalence of trypanosomosis in each district was determined to be 19.6% in Guraferda and 4.5% in Sheko districts of the Bench-Sheko zone. *Trypanosome congolence* was the dominant species with a proportion of 55.2%, followed by *T. vivax* (36.2%) and mixed infection (*T. vivax* and *T. congolense*) (5.2%) in Table 1.

The higher mean PCV value was observed in aparasitaemic cattle (27.5±3.09) than parasitemic cattle (20.8±2.08) (Mean±SD). The difference was statistically significant ($p<0.05$) (Table 2).

Table 1: Occurrence and distribution of *Trypanosome* species in Bench-Sheko zone

			Trypanosome species			
Districts	Number of examined	Prevalence (95% CI)	*T. congolence* (%)	*T.vivax* (%)	*T. brucei* (%)	Mixed (%)
Guraferda	250	19.6 (14.7-24.5)	27 (46.6)	19 (32.8)	2 (3.4)	1 (1.7)
Sheko	200	4.5 (1.6-7.4)	5 (8.6)	2 (3.4)	0 (0.0)	2 (3.4)
Overall	450	12.9 (9.8-16.0)	32 (55.2)	21 (36.2)	2 (3.4)	3 (5.2)

CI: Confidence Interval

Table 2: Mean PCV comparison parasitaemic and aparasitaemic cattle in Bench-Sheko zone

Condition	Numbers examined	Mean	SD	t-test	P-value
Parasitaemic	58	20.8	2.08	23.4	0.001
Aparasitaemic	392	27.5	3.09		

SD: Standard Deviation

Table 3: Univariable logistic regression analysis associated risk factors of cattle trypanosomosis in Bench-Sheko zone

Variables	Category	Total animal tested	Total animal positive (%)	OR (CL 95%)	P-value
Origin	Sheko (Ref)	200	9 (4.5)	-	-
	Guraferda	250	49 (19.6)	5.2 (2.4-10.8)	0.00
Sex	Male (Ref)	174	21 (20.1)	-	-
	Female	276	37 (13.4)	1.1 (0.6-2.0)	0.68
BCS	Good (Ref)	227	18 (7.9)	-	0.005
	Medium	82	12 (14.6)	2.0 (0.9-4.3)	0.080
	Poor	141	28 (19.9)	2.9 (1.5-5.4)	0.001
Age	Young (Ref)	59	5 (8.5)	-	0.002
	Adult	259	24 (9.3)	1.1 (0.4-3.0)	0.85
	Old	132	29 (22.0)	3.0 (1.1-8.3)	0.030
Skin color	White (Ref)	55	7 (12.7)	-	0.004
	Red	174	10 (5.7)	0.4 (0.2-1.2)	0.09
	Black	137	27 (19.7)	1.7 (0.7-4.1)	0.23
	Mixed	84	14 (16.7)	4.1 (0.5-3.7)	0.53

OR: Odds ratio; CI: Confidence interval

Table 4: Multivariable logistic regression model for associated risk factor of bovine trypanosomosis in Bench-Sheko zone

Factors	Total cattle examined	Total cattle positive (%)	AOR(95% CI)	P-value
Origin				
Sheko (Ref)	200	9 (4.5)	-	-
Guraferda	250	49 (19.10)	6.1 (2.9-13.2)	0.001
Age				0.006
Young (Ref)	59	5 (8.5)	-	-
Adult	259	24 (9.3)	0.6 (0.2-1.9)	0.400
Old	132	29 (22.0)	2.8 (1.6-5.4)	0.032
Body condition				0.030
Good (Ref)	227	18 (7.9)	-	-
Medium	82	12 (14.6)	2.5 (1.0-5.9)	0.044
Poor	141	28 (19.9)	3.5 (1.7-7.3)	0.001

AOR: adjusted odds ratio; CI: Confidence interval

The higher (19.6%) prevalence of trypanosomosis was observed in cattle originated from Guraferda than the Sheko district (4.5%). The difference was statistically significant ($p<0.05$) with cattle originated from Guraferda district was five times (OR=5.2) more probability to have trypanosome parasite than cattle originated from Sheko district. The highest (22%) prevalence of trypanosomosis was recorded in older age group. The difference was noted among them with older age group was three times (OR=3.0, $p<0.05$) more odds of trypanosomosis than younger age group. Higher trypanosomosis prevalence was recorded in male (20.1%) than female (13.4%) cattle, whereas no difference was observed between them. The highest trypanosomosis prevalence was recorded in poor body condition cattle (19.9%). The variation was statistically significant with poor body condition cattle

was 2.9 times more probability to have trypanosome parasite than good body condition cattle. Similarly, significant difference ($p<0.05$) was noted between skin color and prevalence of tyrpanosomosis. The highest (19.7%) prevalence of tyrpanosomosis was recorded in black skin color cattle (Table 3).

No significant interactions ($p>0.05$) between variables were detected. A Hosmer-Lemeshow goodness-of-fit value ($p=0.65$), indicated that the model was fit the data. The final multivariable logistic regression model showed that body condition, origin and age of cattle were independently associated ($p<0.05$) with bovine trypanosomosis in Bench-Sheko zone (Table 4).

DISCUSSION

Out of a total of 450 examined cattle, 58(12.9%) were positive for at least one of *trypanosome* species. Similar to this prevalence, Ataro, Berhanu and Andualem [18] and Alembo [19] were reported 14.2% and 11.2% prevalence of trypanosomosis in Humbo district and SNNPR, respectively. However, the present result was lower than the prevalence reported by Yalew and Fantahun [20] 21.5% in Bambasi woreda and Kassa and Megerssa [21] 26.3% in Nyangatom woreda in western Ethiopia. However, this result is higher than the prevalence reported by Dawit *et al.* [22] in Arbamich and 4.4% reported by Fayisa *et al*. [23] in Didesa district. The difference in prevalence of trypanosomosis was may be due to environmental factors, breed, prophylactic measure and management system difference in various areas.

In current study, *T. congolense* was the dominant specie (55.2%) followed by *T. vivax* (36.2%) that caused cattle trypanosomosis in study areas. This may be due to *Glossina* species (cyclical vectors) more effective to transmitter *T. congolense* than *T. vivax* and a higher number of serodems of *T. congolense* than *T. vivax* [24]. In addition, the problem of drug resistance is higher in *T. congolence* while *T. vivax* is more susceptible to treatment [25]. This result is in line with various studies conducted in Ethiopia [15, 26, 27, 28]. This finding is also in line with the report of Siyum *et al.* [14], who reported *T. congolense* (69.7%) was the predominant species followed by *T. vivax* (19.2%) caused cattle trypanosomosis in western Ethiopia.

The mean PCV of trypanosome positive cattle was lower (20.8±2.08) than the negative cattle (27.5±3.09) with the significant difference ($p<0.05$). The PCV higher than 24% may be considered as a recent infection of cattle [25]. However, lower PCV is may be not only due to trypanosomosis. Nevertheless, the difference in mean of PCV between the parasitemic and aparasitemic cattle showed that trypanosome infection involved in reducing the PCV in diseased cattle. This result in agreement with the previous study [29-32] who indicated that parasitaemic cattle had lower mean PCV than aparasitaemic cattle. Hence, the mean PCV was a good indicator of the health status of herd in an endemic area.

In the present study, significant difference ($p<0.05$) was observed between the prevalence of trypanosomosis and origin of cattle in study areas. The probability of trypanosome infection in cattle originated from Guraferda is six times (OR=6.1) more likely than cattle originated from the Sheko district. This may be due to the difference in ecosystems of the study areas that supported the proliferation of both the tsetse and biting flies and the regular application of prophylactic treatment between districts. This result is in line with that of Siyum *et al.* [14] and Mulatu, Lelisa and Damena [33] indicated that the occurrence of trypanosome parasite was associated with origins of cattle in Sayo and Dangur district in Ethiopia, respectively.

Statistical significant difference was observed in prevalence of trypanosomosis among age groups; older cattle (>5years) were almost three times (OR=2.8) more probability to affect by trypanosome parasite than their younger groups. This may be due to the older cattle travel long distances for grazing and draught as well as harvesting crop in tsetse challenging areas [34]. Moreover, young cattle are also naturally protected to some extent by maternal antibodies [35]. Likewise, tsetse fly is more attract to the odor of large cattle and cattle that showed less defensive behavior [36]. This result is in agreement with various studies in Ethiopia and elsewhere [34, 37, 38] reported age was associated with the occurrence of trypanosomosis in cattle.

The body condition of cattle was associated with occurrence of trypanosomosis with the poor body condition cattle were almost four times (OR= 3.5) more odds of trypanosomosis compared to good body condition one. This could be due to trypanosome parasite causes progressive loss of body condition in diseased cattle, but non-diseased cattle in good body condition have well developed immune system that could respond to foreign protein better than those of non-diseased with poor body condition cattle [39]. The association between prevalence of trypanosomosis and body condition in the current result was confirmed with the previous findings [20, 23, 29, 40, 41, 42]. Difference from the presence result,

Kitila *et al.* [15] and Dawit *et al.* [22] stated that body condition was not associated with the trypanosomosis occurrence in cattle. This difference may be due to variation in environmental factors, breed and management system in various areas.

In current study, no difference ($p>0.05$) was detected in the occurrence of trypanosomosis among the skin color of the cattle. The highest (6.0%) prevalence of trypanosomosis was recorded in cattle with black skin color. This may be due to tsetse flies are usual more attracting to cattle that have black skin color than other skin colors [40]. Similarly, no difference ($p>0.05$) was observed between the prevalence of trypanosomosis and the sex of cattle. This may be due to an equal chance of exposure of cattle to trypanosome parasite and even distribution of trypanosomosis in the districts. This is similar with the findings of Tulu *et al.* [3] and Biyazen, Duguma and Asaye [25] who reported sex was no associated with the occurrence of trypanosomosis in cattle.

In conclusion, in current study the higher prevalence of trypanosomosis was recorded in Bench-Sheko zone. *Trypanosome congolense*, *T. vivax* and *T. brucei* were responsible for cattle trypanosomosis in study areas. Body condition, age groups and origin of cattle were associated with the occurrence of trypanosomosis in present area. On the other hand, no difference was observed between trypanosomosis and sex and skin color of cattle. The lower mean of PCV was recorded in trypanosome positive cattle with significantly difference. Hence, it is important to conducted appropriate control techniques and creating awareness about the effect of tyrpanosomosis on cattle production. Moreover, further study should be carried out on both trypanosomosis and its vectors in study areas.

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