

## Research Article

# Bovine Trypanosomosis and Tsetse Fly Density in Seyo District, Kellelem Wollega Zone, Western Ethiopia

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Received: December 12, 2016; Accepted: December 28, 2016; Published: December 30, 2016

## Abstract

A cross-sectional study was conducted from May to June 2014 with the objectives of determining the prevalence of bovine trypanosomosis and the apparent density of tsetse flies in selected four villages of Seyo district, Western Ethiopia. For the prevalence and PCV determination, conventional parasitological and hematological techniques were employed, whereas for the entomological survey of vectors odor baited mono-pyramidal traps were deployed. The prevalence study revealed that, out of total of 312 cattle examined, 41 (13.14%) were found infected with trypanosomes. This result showed that infection rate among peasant associations, age, body condition and sex of the animals were not found significant to influence the prevalence of the disease ( $P > 0.05$ ). Two species of trypanosomes were isolated including *Trypanosoma congolense* and *T. vivax* and mixed of the two species. The mean PCV was significantly ( $P < 0.05$ ) lower (25.37%) in parasitaemic animals as compared to aparasitaemic animals (27.18%). During the entomological survey, three species of the tsetse flies (*Glossina pallidipes*, *G. morsitans submorsitans* and *G. tachnoides*) were identified. The overall apparent density of tsetse flies species caught was 4.27 Flies per Trap per Day (FTD). This particular study, taken as a whole, evidenced that tsetse fly and bovine trypanosomosis has continued to be a disease of major concern to cattle of the study area warranting an integrated intervention of the disease and its vectors to safeguard livestock production and productivity in the study area.

**Keywords:** Bovine trypanosomosis; Seyo; Tsetse fly; Western ethiopia

## Introduction

Ethiopia has an enormous and diverse livestock population that plays an important role in the economy and livelihoods of farmers and pastoralists with a total contribution of 15% of Gross Domestic Product and 33% of the agricultural output. Current estimates of livestock population show that there are 53.99 million heads of cattle, 25.5 million sheep, 24.06 million goats, 9.01 million equines, 0.92 million camels in Ethiopia [1]. Despite the large population of animals, productivity in Ethiopia is low due to poor nutrition, reproduction insufficiency, poor husbandry system and prevailing animal disease [2]. African Animal Trypanosomosis (AAT) was particularly detrimental even though other livestock disease has beleaguered farmers worldwide [3].

Trypanosomosis, a debilitating and fatal disease of various domestic animals, is caused the protozoan parasite of *Trypanosoma species* [4]. With exception of *T. equiperdum*, which is a venereal disease, all have arthropod vectors in which transmission is either cyclical or noncyclical. In cyclical transmission the tsetse fly is necessary an intermediate in which the trypanosomes multiply, undergoing a series of morphological transformations before it forms infective stage for next mammalian host are produced [5]. Tsetse-borne trypanosomosis occurs only in Africa south of the Sahara where there are tsetse flies. Animals become sick with trypanosomosis after they are bitten by infected tsetse flies [6]. Six species of trypanosomes are recorded in Ethiopia and most important

trypanosomes in terms of economic loss in domestic livestock, are the tsetse-transmitted species: *T. congolense*, *T. vivax* and *T. brucei* [7].

Tsetse fly can differ from other biting flies by their feathery arista of antenna that have further hairs branching off them and presence of the discal medial cell of the wing having a shape like a butcher's cleaver referred to as "hatchet cell" [8].

The tsetse fly is infected with the trypomastigote blood form, which loses its surface coat in the goiter of the fly and, while remaining there at least one hour, restructures its mitochondrion. The trypanosomes enter the mid gut where they transform through lengthwise division into the epimastigote form in the cardia. The trypanosomes penetrate the haemocoel and the mid gut epithelium and move from there to the salivary gland of the fly where they develop into the metacyclic infectious form; the trypanosomes are haploid. After the vertebrate host has been bitten by the tsetse fly, syngamy takes place; the trypanosomes become diploid and multiply [9].

Clear information is not yet available on the status of the disease and its vectors except complaints arising from farmers on the increased death rate of their livestock in Seyo district. A study on the status of the disease and investigating the vectors and their relative abundance is, thus, important for a successful control of trypanosomosis and its vectors in the areas. Hence, the present work aimed at determining the prevalence of bovine trypanosomosis and apparent density of tsetse flies in the study area.

**Table 1:** Prevalence of bovine trypanosomosis and associated risk factors in Seyo district.

Risk Factors	No. of examined	No. of positive	P-value	$\chi^2$
<b>Sex</b>				
Male	205(65.71%)	28(13.66%)	0.70	0.14
Female	107(34.29%)	13(12.15%)		
<b>Body Condition</b>				
Poor	40(12.82%)	6(15.00%)	0.93	0.14
Medium	156(50.00%)	20(12.82%)		
Good	156(37.18%)	15(12.93%)		
<b>Peasant Associations</b>				
Karo Baha	56 (17.95%)	6(10.71%)	0.19	9.95
Minko Lencha	78(25.00%)	3(3.84%)		
Ripha	96(30.77%)	18(18.75%)		
Walgayi Boboka	82(26.28%)	14(17.07%)		

## Materials and Methods

### Study area and period

The study was carried out from May to June 2014 in Seyo district located in Kellem Wollega zone of Oromia Regional State, Western Ethiopia. Dembi Dolo, which is a seat for both Seyo district and Kellem Wollega zone administrative, is situated at 653 Kilo meters due west of Addis Ababa. Seyo has an altitude ranging from 1100 to 2750m.a.s.l. The area has two distinct seasons: the dry season extending from December to May; and the wet season that extends from June to September. The mean annual rainfall ranges from 1500-1600mm, and the annual temperature ranges from 15-28°C. The peasant associations selected and included in the study were Ripha, Walgeyi Boboka, Karo Baha and Minko Lencha. The criteria for selection of the four peasant associations were nature of the habitat and farmers' complaints of the problem.

The cattle in the study areas are local breeds that are kept under traditional extensive husbandry systems with communal herding. The animal population of the Gambela district is estimated to be 1752 cattle, 325 sheep, 1194 goats, and 13 equines and Abobo has an estimated 4049 cattle, 44 sheep, 2141 goats, 116 equines population.

A cross-sectional study was conducted in four purposively selected villages of Seyo, western Ethiopia. Then simple random sampling technique was followed to select individual study animals. The number of animals required for the study was determined using the formula given by Thrusfield [10] for simple random sampling. The size of sample was determined using 95% level of confidence, 50% expected prevalence and 0.05-desired absolute precision. The sex, age, body condition and origin (villages) of cattle were explanatory variables used to associate with the prevalence. Body condition for each cattle was determined according to Nicholson and Butterworth [11]. The age of study animals was estimated based on dentition given by De Lahunte and Habel [12] for age determination and information from owners.

### Study Methodology

#### Prevalence and hematological study

Blood samples were collected in to heparinized microhaematocrit

**Table 2:** The mean catch of Glossina species and their relative abundance in Seyo district.

S.No.	Pas	G.p		G.m.m		G.tach		Total	FTD
		M	F	M	F	M	F		
1	Karo Baha	0	0	0	0	0	0	0	0
2	Minko Lencha	2	6	5	5	7	11	36	2.5
3	Ripha	21	44	31	64	44	85	189	9.63
4	Welgehi Boboka	4	11	4	12	15	30	76	2.38
Total		27	61	40	81	66	126	401	4.27

G.p: *Glossina Pallidipes*; G.m.m: *G. Morsitans Submorsitans*; G. tach: *G. Tachnoides*; FTD: *Fly/trap/day*; M: *Male*; F: *Female*; Pas: *Peasant Associations*.

tubes after piercing the ear. Then one end of the capillary tubes were sealed with sealant (Hawksley Ltd, Lancing, UK) and spun at 12,000 revolutions per minute (rpm) for five minutes to concentrate trypanosomes as buffy coat and to separate blood cells. Then packed cell volume (PCV) were read on haematocrit reader and recorded. The capillary tubes were then broken just below buffy coat and expressed on microscopic slide, mixed and covered with a 22x 22mm cover slip. Then it was examined under x40 objective of microscope using dark ground buffy coat technique to detect the presence of motile trypanosomes. For positive samples, Geimsa stain of thin blood smears were made, fixed with methanol for 5 minutes, and examined under oil immersion using x100 objective to identify the species of trypanosomes [13].

### Survey of tsetse fly

A total of 47 baited mono-pyramidal traps were deployed along suitable tsetse habitats such as bank of river and savannah lands to assess the apparent densities, distributions and species of tsetse flies involving in transmission of trypanosomes. All traps were baited with acetone, Octenol and cow urine and deployed at an interval of 200-250 meters. After 48 hours of trap deployment time the cages were collected and captured flies were identified according to morphological characteristics [14].

### Data management and analysis

Collected data were entered into a Microsoft Excel spreadsheet 2007. The prevalence was calculated as the number of infected individuals divided by the number of total examined and multiplied by 100. Statistical analyses were conducted using Statistical Package for Social Science (SPSS) version 20.0 software. Descriptive statistics were used to summarize data. The association between the prevalence of trypanosome infection and risk factors were assessed by logistic regression, whereas the student's t-test was used to assess the difference in mean PCV between trypanosome positive and negative animals. The test result was considered significant when the calculated p-value was less than 0.05. The density of fly population was calculated by dividing the number of flies caught by the number of traps deployed and the number of days of deployment and expressed as Fly /Trap/Day (FTD).

## Results

### Trypanosomes survey results

Out of the total 312 cattle examined, 41 (13.14%; 95% CI) were found infected with trypanosomes. The prevalence of trypanosomiasis was determined to be 18.75%, 17.07%, 10.71% and 3.84%, in

Ripha, Walgeyi Boboka, Karo Baha and Minko Lencha villages respectively. A higher prevalence (15.00%) was seen in animals with poor condition than that of those with medium (12.82%) and good (12.93%) body condition for the concerned blood parasite. But no significant difference was observed among the body conditions of cattle considered and infection with trypanosomes (Table 1).

Two species of trypanosome were detected: *T. congolense*, *T. vivax* and mixed of these two species. Out of 41 infected animals, 35 (85.36%) were found to be infected with *T. congolense*. Therefore, *T. congolense* is considered as the predominant trypanosome species responsible for infection of cattle residing in the all peasant associations of the district. The remaining three (7.32%) were *T. vivax*, and three (7.32%) were found to be harbor mixed infection of the two species.

Higher infection rate occurred in male than female animal. But no significance difference was observed in prevalence between sex groups ( $P>0.05$ ). The infection rate in male and female cattle was 13.66% and 12.15% respectively (Table 1). The highest prevalence was observed in middle age groups (19.05%) followed by old (12.02%) and young cattle (9.76%). However, statistically significant difference was not observed between the age groups ( $P>0.05$ ).

The overall mean PCV in the study area was  $26.94\pm 4.31$ SD ( $t=110.34$ ,  $DF=311$ ,  $p=0.00$ ,  $95\%CI= 26.46-27.42$ ). Animals without parasites were observed with a higher mean PCV value (27.18) as compared to parasitaemic animals (25.37%).

### Tsetse fly survey results

A total of 401 tsetse flies were trapped by deploying 47 traps mono-pyramidal traps. Tsetse flies caught during the study period were *Glossina pallidipes*, *G. m. submorsitans*, and *G. tachnoides* (Table 2). The overall apparent density of tsetse fly was 4.27 Flies/Trap/Day (FTD). Male accounts 66.83% of total captured tsetse fly. The male to female ratios of *Glossina* species were 1:2.26, 1:1.95 and 1:1.91 for *Glossina pallidipes*, *G. morsitans submorsitans* and *G. tachnoides* respectively.

## Discussion

The overall bovine trypanosomiasis prevalence in this study was 13.14%. This finding is fairly similar to reports on bovine trypanosomiasis from different parts of Ethiopia: Dinede and Aki [15] (13.3%) and Mekuria and Gadisa [16] (12.41%) from north western Ethiopia; Desta et al. [17] (13.19%) and Begna et al. [18] (14.2%) from southern Ethiopia.

The prevalence of infection between sex categories was assessed and among 41 positive animals; 13 (12.15%) of them were female and 28 (13.66%) of them were male. Although, trypanosome infection in male was slightly higher than in female, no significant difference ( $P>0.05$ ) was observed between male and female cattle. This indicates that both female and male were equally susceptible to trypanosome infection. This result particularly coincides with reports of Daya and Abebe [19] and Gebreyohannes and Legesse [20] who obtained no significant difference in susceptibility of male and female cattle to trypanosome infection.

The proportion of *T. congolense* in all sites of this study was highest (85.36%). This result is generally in agreement with reports

from different parts of Ethiopia: Rowlands et al. [21], Teka et al. [22] and Woldeyes and Aboset [23] who reported 85.2%, 84%, 82.35% of the total trypanosomes detected were *T. congolense* respectively. The four sites in the current study have shown insignificant difference in trypanosome prevalence ( $P>0.05$ ) suggesting that the relationship concerning the constant change of vectors of the disease and similarity in other epidemiological factors.

A higher prevalence (15.00%) was seen in animals with poor condition than those with medium (12.82%) and good (12.93%) body condition, although, no significant difference was observed among the body conditions of cattle considered and infection with trypanosomes ( $P>0.05$ ). This result is in consistent with that of Abebe and Wolde [24] that indicated animals in poor body condition had higher trypanosome prevalence. The majority of the infected animals manifested clinically poor body condition, as trypanosomiasis is characterized by progressive weight loss [25]. However, poor body condition is not only a result of trypanosomiasis, and could result from other pathogens and nutritional stress. There was no significant difference observed in age groups in the study period but relatively higher infection rate was observed in middle age animals.

Parasitaemic animals had significantly lower ( $p<0.05$ ) mean PCV value (25.37%) than corresponding aparasitaemic (27.18%) ones. This result is in agreement with the work of Bekele et al. [26] who reported the mean PCV of parasitaemic animals to be lower than in a parasitaemic animals. Rowlands et al. [27] also indicated that as PCV increased the proportion of samples detected parasitaemic correspondingly decreased. Hence, the mean PCV could be an indicator of the health status of cattle population under study. Nevertheless, it is generally accepted that the mean PCV value is affected by many factors other than trypanosomiasis [28].

In this study, the entomological findings revealed three species of tsetse flies (*Glossina pallidipes*, *G. m. submorsitans*, and *G. tachnoides*) out of four tsetse fly species reported in western and southwestern part of Ethiopia [29, 30]. These three species of tsetse fly were also reported by Bezabih et al. [31]. The apparent density of *Glossina* species was 4.27 flies/trap/day. This result is in consistent with report from western part of the country by Fayisa et al. [32] who reported a tsetse fly density of 4.90 and Kassaye and Tsegaye [33] who reported 4.8 FTD. The proportion of female tsetse flies caught was higher (66.83%). Denu et al. [34] and Lelisa et al. [35] also concluded that the proportion of female tsetse fly was higher than that of males. This may be due to longer lifespan of female tsetse fly [36].

## Conclusion

Trypanosomiasis is an important threat to cattle production in Seyo district. Therefore, due attention should be given to the control of this devastating disease and its vectors in order to curtail its impact on the production and productivity of livestock.

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