

Assessment of Bovine Trypanosomiasis and Its Vector Infestation on Selected Villages of Salamago Woreda, Southern Ethiopia

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Abstract: Animal trypanosomiasis is a very important disease that affects the health and productivity of livestock in sub-Saharan Africa. In Ethiopia, animal trypanosomiasis is widely distributed across the tsetse infested belts found in the western and southern regions of the country. In these regions, about 220,000 Km² of fertile land is infested by *Glossina* species. Trypanosomiasis remains one of the biggest constraints of livestock productivity in sub-Saharan Africa. It is of particular concern in Ethiopia where crop production is largely dependent on animal traction power. A cross sectional study was conducted in selected villages of Salamago district, South omo zone, South Ethiopia Region. The study was conducted between November and April 2021 with the aim of assessing bovine trypanosomiasis prevalence, determining potential risk factors for the occurrence of trypanosomiasis and identifying trypanosome species responsible for trypanosomiasis in the study area. Three hundred eighty four cattle of different age, sex and coat hair colour were included in the study. A total of 384 blood samples were collected and examined using buffy coat technique for parasitological survey and the PCV value of each animal was also measured using hematocrit readers. A total of 40 traps were deployed for consecutive 72 hours in selected area of 9 kebeles and flies in each trap were identified and recorded. The result of this study demonstrated 5.98 % an overall prevalence of bovine trypanosomiasis. The prevalence recorded among different sex was 2.02% for males and 1.61% for females without statistically significant variation ($p>0.05$). The overall mean apparent density of flies was 2.2% flies/trap/day. The current effort in controlling bovine trypanosomiasis including its vector should be strengthened to the extent of tsetse fly eradication and further studies on the resistance of trypanocidal drugs should be recommended in the study area.

Key words: Trypanosomiasis • Prevalence • Risk Factor

INTRODUCTION

Animal trypanosomiasis is a very important disease that affects the health and productivity of livestock in sub-Saharan Africa. In Ethiopia, animal trypanosomiasis is widely distributed across the tsetse infested belts found in the western and southern regions of the country. In these regions, about 220,000 Km² of fertile land is infested by *Glossina* species. It is particularly important in Ethiopia where agriculture makes the backbone of the economy and crop production is largely dependent on animal traction power [1]. The presence of animal trypanosomiasis is a major constraint to the introduction of highly productive exotic dairy animals and draught oxen to lowland settlement and resettlement areas for the utilization of large land resources. Since more than 90

percent of crop production in Ethiopia is dependent on animal draught power mainly on ploughing oxen, many large fields lie fallow due to a lack of these animals in trypanosomiasis infested area, which worsens the food supply and living conditions in affected areas. Moreover new areas are being invaded and settled communities are being continually evicted by the advancing tsetse [2].

The different economically important animal trypanosome species in Ethiopia namely *Trypanosoma congolense*, *T.vivax*, *T.brucei*, *T.evansi* and *T. equiperdum* cause complex debilitating and often fatal diseases [3]. In Ethiopia, tsetse flies are confined to southwestern and northwestern regions between longitude 33° and 38°E and northwestern regions between longitude 33° and 38°E and latitude 5° and 12°N an area covers 220000 km². Five species of *Glossina* including *G.*

m. submorsitans G. pallidipes, G. tachinoides, G.f. fuscipes and G. longipennis have been recorded in Ethiopia [2]. Three elements influence the epidemiology of the disease, namely the distribution of the vectors, the virulence of the parasite (trypanosome) and response of the host. Though, the role of mechanical vectors in the transmission of African livestock trypanosomes has always been controversial relative to tsetse flies, their cyclical vectors, in recent experimental works it was successfully demonstrated that mechanical transmission of T. vivax to cattle was effected by African tabanids with high incidence rates of 63% by *Atylotus agrestis* and 75% with *Atylotus fuscipes* within 20 days [4]. Clinically, the disease is characterized by intermittent fever, anemia, rapid loss of body condition, emaciation, collapse and death in untreated animal [5, 6].

For determination of trypanosome infection status in rural African settings, microscopy-based techniques using direct observation of wet blood films, microscopic examination of Giemsa stained blood smears, or concentration techniques such as the Buffy Coat technique (BCT) and the Haematocrit Centrifugation Technique (HCT) are the most common methods of parasite detection and have been long considered the best diagnostic methods available [7].

General Objective:

- ▶ To assess bovine trypanosomosis and its infestation in selected villages of Salamago wereda.

Specific Objectives:

- ▶ To determine the assessment of bovine trypanosomosis found in the study area
- ▶ To estimate apparent tsetse fly density in the study area
- ▶ To identify the potential risk factors in the study area.

MATERIALS AND METHODS

Study Area: The study was conducted in South Ethiopia region, South Omo Zone at Salamago wereda, which was located 110 km from Jinka. The area of wereda is about 451,120km². According to the salamago wereda pastoral and rural development office (2019/2020), the climatic condition of the wereda ranges from arid to sub humid. The average temperature and humidity of the study area is 32°C and 977mm HG respectively. The grass and bush land and some domestic trees like acacia found in the study area.

Study Population: The study population constituted local zebu cattle (*Bos indicus*) kept under traditional husbandry practices. The predominant farming system in the study area is animal rearing. The study was conducted on 384 local cattle breeds selected from 20 kebeles in nine settlement areas of these animals, 45 were from Narmashiki, 40 were from Giyo pastoralists, 44 were from Omo-rombe, 50 were from Omo hana, 45 were from Gura, 40 were from Hailwuha, 32 from Moizo, 44 from Bongozo and 44 were originated from Maki. The age of study population was categorized as < year, 1- 5 year and >5 year. The body condition of the study population was categorized as poor, medium and good. The origin, age, sex and body condition were explanatory variables used to associate with assessment areas.

Study Design and Study Period: A cross-sectional study was conducted to determine the assessment of trypanosomiasis in the study area and samples collected in months of November and April 2021.

Sample Size and Sampling Procedures: The sample size required for the parasitological study was determined by using the formula for simple random sampling given here under with 95% level of confidence [8].

$$n = \frac{1.96^2 * p_{exp}(1-p_{exp})}{d^2}$$

Therefore, a total of 384 cattle were needed for the study and samples collected from those animals were examined. At nine selected kebeles, the study animals were selected by systematic random sampling technique from the cattle herds grazing in communal pasture lands. Cattle herds found in a district were the smallest sampling unit in this study. As it was an extensive production system, a herd was defined as those cattle grazing on the same communal pasture/field. The animals were selected randomly and restrained by pastoralists for sampling. Blood sample was collected by puncture of ear vein using lancet. Blood sample was collected into heparinized microhematocrit tubes and examined under microscope.

Entomological Survey: For the entomological survey, a total of 40 traps were deployed in 9 kebeles as described by Tsetse fly project. Acetone and cow urine were used as a bait to attract flies. The traps were deployed at an interval of about 200–250m apart and remained at one site for 72 h [9]. All trap sites were geo-referenced using hand held global positioning system (GPS) units. Tsetse and

other biting flies trapped were collected and counted. The apparent density was determined based on mean catches of flies in traps deployed and expressed as the number of fly catch/trap/day (FTD). Tsetse flies were identified to the species level while others were identified only to the genus level according to their characteristic morphological features. These glossina species were identified based on the difference on the markings of the back the abdominal segments, coloration of the tarsal segments and the size of fly. The subgenera of glossina are differentiated on anatomical features and are also broadly differentiated according to their habitats, thus the moristans group are classified as savannah -inhabiting species, palpalis group as riverine species and fusca group as forest inhabiting species [10].

Parasitological Study: For parasitological examination, blood samples were collected from marginal ear vein of 384 animals using heparinized capillary tubes which were sealed at one end with wax. The capillary tubes were filled to ¾th of their length and transferred to a haematocrit centrifuge and spun at 12,000 rpm for 5 min. The packed cell volume (PCV) was measured using a haematocrit reader for determination of the level of anemia that is PCV level below 24% is anemic. The capillary tubes were then cut using a diamond tipped pen 1mm below the buffy coat to include the upper most layers of the red blood cells and 3mm above to include the plasma. The content was expressed on to a clean microscopic slide, mixed well and covered with a 22×22mm cover slip. This wet smear was examined by a microscope using 40x objective lens for the presence of motile trypanosomes [11]. Confirmation of trypanosome species was done by examination of Giemsa stained thin smears at 100 x magnification [12]. During sampling data about the age, sex, coat colour and body condition score (BCS) of each animal was recorded on specially designed format. The BCS was recorded as “good”, “medium” or “poor” based on the appearance of ribs and dorsal spines according to the description given for zebu cattle.

Data Analysis: The collected data were analyzed using SPSS (version 20: 0). Prevalence was estimated as the proportion of trypanosome positive animals over examined. The difference in the prevalence of trypanosomosis (dependent variable) between the study areas, sex, age and cattle of different coat colors (independent variables) was analyzed by using univariable and multivariable logistic regression analysis. The association of trypanosomosis with anemia

(as determined by low mean PCV %) was evaluated by Student's t-test. PCV value cut off of 24% was used to determine the presence of anemia in the study animals. The apparent tsetse density (AD) was expressed as the number of flies per traps per day (FTD). Level of precision was held at 95% and $p < 0.05$ set for significance.

RESULTS

Entomological Result: A total of 40 traps were deployed in 9 of the study areas (kebeles) and about 405 flies were captured in 72 h. From these, 189 (47%) were tsetse flies of Glossina species, such as *G. pallidipes* 70(37%), *G. longipennis* 30(15%), *G. fuscipes* 41(21%) and *G. tachinodes* 48(25%) while 216 (73%) were other biting flies (Stomoxys and Tabanus). The overall apparent density of tsetse flies was 2.2F/T/D and of that of biting flies was 1.8F/T/D (Table 1).

Prevalence of Trypanosomosis: From total 384 cattle examined by using the buffy coat technique, 23(5.98%) animals were found infected by trypanosomes. The overall prevalence of bovine trypanosomosis in the study area was 23(5.98%). Out of the nine selected kebeles (peasant associations), Gura had the highest prevalence (22.2%) (Table 2).

Potential Risk Factors: Sex was one of the variables that were considered during the study period. Of 186 male and 198 females examined 3(1.61%) and 4(2.02%) were trypanosome positive respectively. As shown in Table 3 young cattle are the most infected and exposed age group for trypanosomosis as compare with adult cattle. The Color of the animals was also considered as variable during data collection to detect whether the color difference has role on fly attraction or not. Accordingly, white and red colored animals categorized as bright which are refractory to light; Black and brown colored animals were categorized as dark group and assumed as attractive for tsetse fly perch. However, out of total animals examined, 3(2.20%) on white and related, 4(2.22%) on red and related colored animals and 3(4.41%) on dark colored group were positive for trypanosomosis (Table 3).

Species of Trypanosomes Identified: Two species of trypanosomes, *Trypanosoma congolense* and *Trypanosoma vivax*, were identified in the study area. In all of the study kebeles, *T. congolense* was the predominant species which accounted for 58.6% of the overall infection. *T. vivax* was identified in 26.5% of the parasitaemic animals.

Table 1: Total number of Glossina and other biting flies caught in study area

Name of kebele	No of traps deployed	<i>G. pallidipes</i>	<i>G. longipennis</i>	<i>G. fuscipes</i>	<i>G. tachinodes</i>	Other biting flies (Tabanus and Stomoxys)
Narmashiky	4	6	-	3	4	24
Giyo pastoralist	5	7	2	4	5	22
Omo-hana	5	9	3	6	6	25
Omo-rombe	4	4	2	5	3	30
Gura	5	15	8	9	8	22
Hailuha	5	8	3	4	5	25
Moizo	4	6	4	3	4	27
Bongozo	4	8	3	4	5	21
Maky	4	7	5	3	4	20
Total	40 traps	70(37%)	30(15%)	41(21%)	48(25%)	216(73%)

Table 2: Prevalence of bovine trypanosomiasis based on kebeles (PA)

PAs	N	Positive	Prevalence (%)
Narmashiky	45	-	0
Giyo pastoralist	40	3	7.5
Omo-hana	50	5	10
Omo-rombe	44	-	0
Gura	45	10	22.2
Hailuha	40	3	7.5
Moizo	32	-	0
Bongozo	44	-	0
Maky	44	2	4.54
Total	384	23	5.98

Table 3: Association between prevalence of trypanosomiasis and risk factors

Risk factors		N	Positive	Percentage
sex	Female	198	4	2.02
	Male	186	3	1.61
Age	<1 year	14	1	7.14
	1≤5 year	172	3	1.74
	>5year	198	2	1.01
Coat color	Black and related	68	3	4.41
	Red and related	180	4	2.22
	White and related	136	3	2.20

Table 4: Status of anemia in trypanosomiasis positive and negative animals

PCV- value	No. examined	No. +ve	No. -ve
pcv<24	283	23	260
pcv≥24	101	0	101
Total	384	23	361

Hematocrit Result: The overall mean PCV value of all cattle was 23.9. The mean PCV value for the parasitaemic and a parasitaemic cattle was 22 and 24.5 respectively. Moreover, the study showed that 8.13% of the infected and 91.87% of uninfected cattle were found anemic based on a PCV cut off value of 24% [13].

DISCUSSION

The study showed that out of total 384 randomly selected cattle in the study area, 23(5.98%) of them were positive for trypanosome. High trypanosomiasis prevalence of 20% was reported from tsetse belt area

[2] as compared to the present study that is 5.98%. The variation in prevalence in the present study is due to the interventions for tsetse and trypanosomiasis control, which have been carried out by STEP program. The project applies a variety of tsetse fly control methods, such as 1% deltamethrin pour -on and spot-on at monthly interval, yearly spray of insecticides on forest areas and bush lands where high numbers of flies are believed to exist, traps and insecticide impregnated targets and ground spraying which significantly reduced the prevalence of disease in the study area. Another possible reason for the low prevalence of disease might be the prophylactic treatments with trypanocidal drugs, which obviously mask the epidemiological situation of the disease.

The trypanosomiasis prevalence recorded in Gura was higher than the remaining eight peasant associations. Generally, high prevalence of the disease was found in place where with highest tsetse fly density area hence, the highest fly density among the nine peasant associations was recorded in Gura kebele. This result agrees with previous result obtained by Thrusfield [9] who concluded that both the apparent density of the flies and prevalence of trypanosomes were closely related.

In the current study, the highest infection rate (22.2%) was recorded in Gura kebele. The prevalence among peasant associations in this study could be attributed to the tsetse fly and /or other biting flies' population in each peasant association which may dependent on micro climate, animal herd density, distance between herds and breeding site. During the study period, the prevalence of bovine trypanosomiasis was assessed between sexes of animals. The study shows that both male and female cattle were at most equally susceptible to trypanosomiasis infection. There was no significant difference between sex categories of study animals. This result agrees with previous results of Lejebo *et al.* [14] who reported no significant difference in susceptibility between the two sexes.

In present study entomological survey had also indicative that where tsetse flies catch was lower than biting flies. The tsetse flies dominant in the study area were glossina species such as *G.pallidipes*, *G.longipennis*, *G.fuscipes* and *G.tachinodes*. This is due to ecological adaptation of the vector which was mostly distributed around Rift valley connected with those in Omo River area [3].

The overall mean PCV value of all cattle examined during study period was 23.9. Parasitaemic animals had generally lower PCV than the corresponding aparasitemic ones. However, trypanosomosis infection and mean PCV value obtained in this study parasitaemic and aparasitemic cattle were in agreement with reports of Wondewosen *et al.* [15] in selected villages of Arbaminch, in which was stated that the average PCV of parasitologically negative animals was higher than the average PCV of parasitologically positive animals. This might be due to inadequacy of detection method or delayed recovery of anaemic situation after current treatment with trypanocidal drugs and may be other blood parasites infection, malnutrition associated with long draught in the area [16].

CONCLUSION AND RECOMMENDATIONS

The finding of the current study in assessment of bovine trypanosomiasis and its associated risk factors on nine selected peasant associations of salamago wereda indicated that overall prevalence of 5.98% and overall apparent fly density of 2.2 flies /trap/day during the period. Out of the nine peasant associations Gura kebele was found to have higher prevalence of trypanosomosis and higher apparent fly density. *G.pallidipes*, *G.longipennis*, *G.fuscipes* and *G.tachinodes* species of tsetse fly were identified in the study area. The age, coat color and sex were taken as a risk factors in the study area, but none of the factors were found to be significant. From both entomological and parasitological results, it concluded as low prevalence of the disease despite the presence of high number of both tsetse and biting flies was mainly due to effectiveness of one of control strategies that was spot on application of 1% deltamethrin together with regular trypanocidal drug treatment control strategies which implemented by southern tsetse eradication project.

Based on conclusion, the following recommendations are forwarded:

- ▶ Existing vector and parasite control interventions in the study areas need to be strengthened and the strategies should also consider the mechanical vectors as well.

- ▶ During control, special emphasis should be given to Salamago wereda, which had been subjected to control through STEP project and where the prevalence was noted to be significantly higher.
- ▶ Finally, the current effort in controlling bovine trypanosomosis including its vector should be strengthened to the extent of tsetse fly eradication.
- ▶ Further studies on the resistance of trypanocidal drugs should be conducted in the study area.

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