Vector Identification and Prevalence of Bovine Trypanosomosis in Etang Special District, Gambela Region, Ethiopia

Negesa Tola [1*] Kumisa Mideksa [1] and Mohammed Kedir [2]
1. School of Veterinary Medicine, Wollega University, Nekemte, Ethiopia P. O. Box 395
2. National Tsetse and Trypanosomosis Investigation and Control Center, Bedele, Ethiopia.

Abstract:- Bovine trypanosomosis causes serious economic losses from anemia, loss of body condition and emaciation. A cross sectional study was conducted in Etang special district four selected peasant association (PAs) from November 2016 to April 2017 to determine prevalence of bovine trypanosomosis and apparent density of its vectors. From 457 cattle blood sample collected by Simple random sampling and examined 16 (3.5%) were positive. The trypanosome species identified were *T. vivax* 13(81.25%) and *T. congolense* 3 (18.75 %). The prevalence in age category of young 4(2.58%) and adult 12 (3.39%) with no statistical significant (P=0.443). The prevalence recorded between body condition score in poor 12(6.12%), in medium 4(1.66%) and in good 0(0%) with statically significant (P=0.028). The mean PCV value recorded between parasitaemic (20.1) and aparasitemic (28.58) has statistically significant (P=0.002). The entomological survey was conducted by trap deployed for collection of vectors used 44 different traps in four PAs (Basil, Achewa, Ebago and Eliya). *Glossina* fly were not found but numerous biting fly collected were 1756 *Tabanus* and 52 *Stomoxy*. The overall apparent density of *Glossina* flies Zero (0) and biting fly (20.54) fly/trap/day recorded. This study confirmed trypanosomosome and abundant mechanical vectors are still challenge and loss of cattle production in study area. Therefore, strategic control and prevention mechanism of trypanosomosis and its vectors should be emphasized.

Keywords:- *Buffy Coat Technique, Etang, Traps, Trypanosome, Vectors Density*

I. INTRODUCTION

African *trypanosomosis (Nagana)* causes serious economic losses from anemia, loss of body condition and emaciation. It causes annual losses in cattle production were estimated in the range of US$ 1.0 - 1.2 billion in Sub-Saharan Africa. Bovine *trypanosomosis*, an important disease transmitted cyclically by Glossina (Tsetse flies) and mechanically by biting flies (*Tabanus* and *stomoxys*) [1-3]. Tsetse flies are hematophagous insect phylum arthropod, order dipteria, family Glossinidae and genus *Glossina* are biological vectors of *trypanosomosis* in livestock and human. The most *trypanosome* species affecting livestock in Ethiopia are *T. congolense*, *T. vivax* and *T. brucei*, in cattle, sheep and goat, *T. equiperdum*in horse (Dourine), *T. evansi* horses and camels (Surra) [4-6].

Nagana occurs where the tsetse fly exists in Africa, between latitude 15°N and 29°S and inhabits wide range of land covering over ~9 million kilometer square representing of 37 countries. According to *Glossina* habitat, grouped in to three types: fusca (forest), palpalis (riverine), and morsitans (savannah) areas [7, 8]. In Ethiopia, tsetse flies are confined southern and western regions between longitude 33^0 and 38^0 E and latitude 5^0 and 12^0 N. The infested areas were lowlands and river valley of Abay (Blue Nile), Baro, Didessa, Ghibe, Omo and five regions (Amhara, Benishangul-gumuz, Gambella, Oromia and SNNPR [9, 10].

There are five *species* of *Glossina* found in Ethiopia (*G. pallidipes, G. Morsitans submorsitans, G. fuscipes, G. tachynoides and G. longipennis*). *G. pallidipes* and *G. morsitans submorsitans*is with savanna grass land; *G. fuscipes* and *G. tachynoides*is along the river and *G. longipennis*is found in dense vegetation [11, 12]. Four tsetse-borne trypanosomes: *T. congolence, T. vivax* and *T. bruceibrucei* of livestock and *T. brucei rhodesiense* of humans (sleeping sicknes) were identified in Ethiopia. In this *T. vivax* was detected in almost all regions of the country below the 2500 meter above sea level [13-15].

Trypanosomosis has direct and indirect effects on the economics of the countries. Direct effect is infected livestock causes mortality, morbidity and infertility. Another indirect effect affected animals are unproductive in terms of milk, meat, traction, costs of control and prevention [16, 5]. The diseases are acute and chronic forms; acute is fatal if appropriate treatment is not established animals die in 2-3 weeks within Clinical signs of anemia, fever, abortion, roughness hair coat, loss of body weight, enlargement of peripheral lymph nodes [17,18].

Trypanosome can be confirmed by demonstrating parasites in the blood of infected animals and various techniques are available. In many field program monitoring cattle for infection screening is by wet blood films; thick and thin smear are to determine the species of trypanosome [19].

Trypanosomosis are an important disease of cattle and economic loss in different part of the country still [20, 41, and 42]. In Etang special district since this study conducted no work done on both prevalence of bovine *trypanosomosis* and apparent density of vector distribution. Therefore, the specific objectives of this study were:

- To investigate the prevalence of bovine *trypanosomosis and*

- To identify the distribution of vectors in study area.

II. MATERIALS AND METHODS

➢ *Description Study Area*

The study was carried out in Etang Special District, Gambela Region, South Western Ethiopia from November 2016 to April 2017 on Vectors Identification and Prevalence of Bovine Trypanosomosis. The District located 831 km from Addis Ababa, land cover is about 1737 km^2. Geographically found between latitude 08° 09' 93''- 08° 18' 67'' and longitude 34° 04' 20''- 34° 21' 40'', elevation 350-480 (m.a.s.l), temperature range 28°C- 43°C, mean annual rainfall was range 1000- 1500 mm. The district has population of animals estimated to be 23327 cattle, 10016 sheep, 14343 goats and 20802 poultry [21].

➢ *Study Population*

Animals used in this study were local zebu cattle (Bos indicus) which are usually kept under an extensive husbandry system. They were allowed to graze freely during the day and housed in constructed barns at night. Blood sample was taken randomly from all age group categorized as young (≤3 years old), adult (>3 years old) and both sexes of animals. Their body condition score were categorized as good, medium and poor [5, 22, 23].

➢ *Study Design and Sample size*

A cross-sectional study design was used to determine the prevalence of bovine *trypanosomosis* and identification of vectors distribution. At study area there was no previous study conducted on prevalence of bovine trypanosomosis and identification of its vector distribution. The desired sample size was calculated according to the formula given by Thrusfield [24]. The minimum sample size required was 384 animals but to improve the degree of precision a total 457 samples were taken from four different PAs.

➢ *Study Methodology*

- *Parasitological Study*

Blood sample were collected from 457 cattle by puncturing of the marginal ear vein with a lancet and drawn directly into heparinized capillary tube at least ¾th of volume and centrifuged with capillary hematocrit centrifuge at 12,000 rpm for 5 minutes. The Packed Cell Volume was calculated using the hematocrit reader which less than 24% were considered as anemic [25]. The capillary tubes were broken just 1mm below Buffy coat by using diamond penciling and expressed on microscopic slide, mixed and covered with 22x 22mm cover slip. It examined with light microscope using 40 x objectives to detect the presence of parasite [26, 2].

The positive sample were make thin smear fixed with methanol for 5 minute and stained by Giemsa's for 30 minute and examined using 100 x objective microscope. The species of trypanosome were distinguished by size of kinetoplast, position of the nucleus and length of the flagellum [27].

- *Entomological Survey*

A total of 44 traps were deployed at interval of 200-250 meter to determine apparent density of vector (f/t/d). During trapping acetone, octenol and cow urine were dispensed in open bottles displeased under each traps used as attractants. The altitude, latitude, longitude and temperature of each trap position were recorded with Global Positioning System (GPS) and collected after two days (48 hours). The captured flies were identified based on their morphological characteristics of size, colour and wing venation structure by hand lens. The fly caught was numerous of biting flies but no tsetse fly. The climatic condition of the district was 28-43 ^{0}C while survey done. If the ambient condition exceed (>35 ^{0}C) not favourable for tsetse activity or movement and increase their mortality [4].

➢ *Data Analysis*

The prevalence of trpanosomosis was calculated the total number of infected individuals divided by the total number of animals examined and multiplied by 100. The apparent fly density was calculated by f/t/d (fly/trap/days). The data Collected was interred to Microsoft Excel spread sheet and process of coding, handling and validating was done on this sheet. Coded was transferred to SPSS version 20.0 for analysis. Descriptive statistics, student t-test and chi-square test were used to express results. The analyzing association of disease with different risk factors (peasants association, age, sex and body condition score) was compared by chi-square test. The mean PCV of infected and non-infected animals were compared with student t-test and probability (P) value less than 0.05 was considered as statistically significant.

III. RESULTS

➢ *Parasitological Results*

A total of 457 cattle examined from four PAs; 16 (3.5%) were positive for *trypanosome*. There were two species of trypanosome identified; *T. vivax* (13/16) 81.25%, *T. congolense* (3/16) 18.75% and no mixed infection was observed. The prevalence of trypanosome in four PAs were; 2(2%) in Bazil, 4(3.17%) in Achewa, 4(3.7%) in Ebago and 6 (4.88%) in Eliya. The prevalence of trypanosome among sexes were; 12/291(4.12%) in female and 4/166 (2.41%) in male. The prevalence between age categories; young (≤3 years) 4/155 (2.58%) and adult (>3 year) 12/302 (3.97%) were recorded. Among body condition the prevalence of trypanosome were; 12/184(6.52%) in poor 4/237(1.69%) in medium and 0/20 (0%) in good were determined. Between packed cell volume (PCV) classified (≤ 24%) anemic and (>24%--48%) non anemic; the prevalence of trypanosome were 14/230 (6.08%) and 2/227(0.88%) respectively.

Table 1. The prevalence of cattle *trypanosomosis* in study area of PAs

Pas	Total cattle examined	Positive	Prevalence	P-value	95% CI
1. Bazil	100	2	2%	0.703	2.454-2.657
2. Achewa	126	4	3.17%		
3. Ebago	108	4	3.70%		
4. Eliya	123	6	4.88%		
Total	457	16	3.5%		

PAs = peasant association

Table 2. Prevalence of *trypanosomosis* in different risk factors

Risk factors	Category	No of cattle examined	No of cattle positive	Prevalence	P-value	95% CI
Sex	Female	291	12	4.12%	0.338	0.592-0.681
	Male	166	4	2.41%		
Age	≤ 3 year	155	4	2.58%	0.443	0.617-0.704
	> 3 year	302	12	3.97%		
BCS	Poor	196	12	6.12%	**0.028**	0.562-0.667
	Medium	241	4	1.66%		
	Good	20	0	0%		
Total		**457**	**16**	**3.5%**		

No = number, CI = confidential interval, BCS = body condition score

Table 3. Mean PCV of parasitemic and aparasitemic animals

PVC	No of animal examined	No of animal positive	Prevalence	Mean	P-value	95% CI
PCV ≤ 24% anaemic	230	14	6.09%	20.10%	**0.002**	1.45-1.54
PCV >25%-48% non-anaemic	227	2	0.88%	28.58%		
Total	457	16	**3.5%**	24.75%		

PCV= packed cell volume, No = number, CI = confidential interval

Table 4. The prevalence of *trypanosome* species in four PAs

Pas	Total Sampled	No of positive	*Spp*. of trypanosome		Prevalence	P- value	95% CI
			T.vivax	*T.congolence*			
1. Bazil	100	2	2(100%)	0 (0%)	2%	0.929	2.434-2.657
2. Achewa	126	4	3(75%)	1(25%)	3.17%		
3. Ebago	108	4	3(75%)	1(25%)	3.70%		
4. Eliya	123	6	5(83.3%)	1(16.7%)	4.88%		
Total	**457**	**16**	**13(81.25%)**	**3(18.75%)**	**3.5%**		

spp = species, *T.* = *trypanosome*

➢ *Entomological Results*

The entomological survey was conducted in the selected villages. According to vegetation type and has abundant population of cattle. Out of the 44 Traps were deployed; 10 in Bazil at (Woody Grass Land), 14 in Achewa at (Baro river), 10 in Ebago at (Gnimulu lake) and 10 in Eliya at (Baro river). The traps biated were collected after 48 hours. Then identified the fly caught were; no *Glossin*a (tsetse fly) and many biting flies caught in all villages. Those were 1756 Tabanus and 52 stomoxy. The apparent density of the flies overall Glossina zero and the biting fly was 20.54 fly/trap/days (f/t/d).

Table 5. Apparent density of fly caught at study site

PAs	No of traps deployed	Vegetation Type	*Glossina*	Total	f/t/d	Other biting flies			
						Tab.	*Stom*	total	f/t/d
Basil	10	WGL	-	-	-	264	6	270	13.5
Achewa	14	Baro river	-	-	-	535	14	549	19.6
Ebago	10	Gnimulu lake	-	-	-	179	9	188	9.4
Eliya	10	Baro river	-	-	-	778	23	801	40.05
Overall	**44**		**-**	**-**	**-**	**1756**	**52**	**1808**	**20.54**

WGL= woody grass land, f/t/d = fly per trap per days, *tab*. = *tabanus*, *stom*. = *stomoxy*

IV. DISCUSSIONS

The current study indicated that the prevalence of bovine trypanosomosis in Etang Special District Gambella Region was 16(3.5%). It was agree with findings reported 3.9% in Yayo Ilubabor, Ethiopia [26]. But this is lower than previous reported 16.93% in Horro Guduru, Ethiopia [27] and 18.1% in Abobo Disrtict Gambela Region, South Western Ethiopia [28]. When compared the prevalence in current study with in Abobo low. This shown that effect of parasite and vector control implemented in the adjacent district of Abobo by Bedele NTTICC [28].

During investigation two species of trypanosome identified were *T.vivax* (81.25%) and *T. congolense* (18.75%) which not significantly significant *(P=0.929).* This is agree with study reported in South Western Hawasa, Ethiopia *T.vivax* 62.5%, *T.congolence* 31.25% by Denbarga , Ando and Abebe [29] and Northern Western Ethiopia, *T.vivax* 56.55% and *T. congolenc*e 43.55% by Achenef and Admas [30]. The prevalence of *T.vivax was* higher than *T. congolense*. The confirmed species of *trypanosome* infection is clearly linked with vectors observed. Because of *T.vivax is* higher it could transmit mechanically by biting flies whereas *T.congolense* can transmit cyclically only by tsetse fly. The finding of this study agrees with idea of *T. vivax* recorded in apparent tsetse free area [15, 31].

When assessed the prevalence of cattle *trypanosomosis* between sexes of animals 12 (4.12%) of female and 4 (2.40%) were male. This is not statistically significance *(P=0.338).* It is similar with previous results obtained in Bench Maji, South Western, Ethiopia by Tadesse and Tsegaye [32], in Metekel and Awi Zone, North Ethiopia by Mekuria and Gadisaa [33], in Arbamich, Ethiopia by Teka *et al* [34]. The susceptibility of infection between sexes is equal but high number of population found in the district. Because the community was emphasized dairy farm rather than pharming the land.

The prevalence recorded between ages categorized was 2.58% in young 3.97 % in adult. It was not statistically significant *(P=0.443).* This result agrees with the previous reported by Dagnachew *et al.* [35, 36]. The adults are more affected than young animals. Because adult animals long distance travel for feed and water from home. The chance of adult contact with vector is more than young.

The assessed prevalence of *trypanosomosis* based body conditions score (poor, medium and good) 6.12%, 1.66% and 0% respectively. The highest prevalence observed in poor animals and has statistically significant *(P=0.028).* This result assent with prevalence reported 10.25%, 0.3% and 0% in poor, medium and good body condition score respectively by Girma *et al* [36]. This indicates factors such as diseases, nutritional imbalance and management system may have contributed for poor body condition.

The mean Packed cell volume (PCV) of parasitemic animals 20.52% and aparasitaemic 28.75% was statically significant *(P=0.002)* [37]. This agree with reported that mean PCV value of (21.52%) in parasitemic and 28.75% aparasitemic in Didesa District of Oromia Regional State, Ethiopia by Gamechu *et al* [38]. During study period about 50.33% sampled was PCV≤24% but more of them react negative for trypanosome. This may cause due to recent recovery treated with trypanocidal drugs, poor nutrition, helminthes infection and thick borne disease. From total sampled about 49.67% (PCV>24%-48) found in normal range but positive for parasite. This may due to recent infection occurred. This result consents with the previous study in East Wollega zone, Ethiopia by Garoma *et al* [39, 40].

While entomological survey only mechanical transmitters (*biting fly)* collected but not *Glossisa* (tsetse fly) observed. The apparent density of overall *Glossina* and biting flies obtained was zero (0) and (20.54) fly/trap/day respectively. This result agrees with the most abundant biting fly (*Tabanus* and *Stomoxy*) found at Debre Elias District, North-Western, Ethiopia by Achenef and Admas [30]. The reason of absence *Glossina* flies during survey done may due to high ambient temperature (28-43) ^{O}C of the district which not favorable for tsetse fly and control mechanism undertaken by Bedele NTTICC at adjacent districts.

V. CONCLUSION

The prevalence of bovine trypanosomosis 3.5% and the apparent density of vector 20.54 f/t/d in four selected village of Etang special district observed during study conducted. Among vector collected only biting fly were found but not gate *Glossina* species. The reason of tsetse fly absence may the environmental temperature not conducive for tsetse activity while study conducted. Two species of trypanosome infection prevalence identified were; *T. vivax* (81.25%) and *T. congolense* (18.75%). Higher prevalence of trypanosome infection was observed in poor body condition and low PCV animals. This study shown trypanosomosis and its vectors were still threat for livestock production and economic losses of the district by direct and indirect way.

Therefore, different strategic mechanism to control and prevention of trypanosomosis and its vector should be strengthened. Further investigation of trypanosome infection and vector survey should be conduct in the district.

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- *Availability of data and materials*

The data sets developed and analyzed by first author or from the corresponding authors up on request.

➢ *Authors' contributions*

NT, KM and MK participated in conception of the research idea, methodology and review of the draft manuscript. NT carried out the laboratory work, sample collection, analysis and write up of the first draft. All authors read and approved the final manuscript.

➢ *Ethics approval and consent to participate*

The study was conducted after obtaining ethical clearance permission letter from the Wollega University and Bedele NTTICC.

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