Research article
Volume 12:7, 2021

Journal of Veterinary Science and Technology

ISSN: 2157-7579 Open Access

EPIDEMIOLOGY OF BOVINE TRYPANOSOMOSIS IN GOMMA DISTRICT, SOUTHWEST ETHIOPIA

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Abstract

Trypanosomosis is protozoan disease that causes serious economic losses through reduced production and productivity in livestock sector, especially in Sub-Saharan Africa including Ethiopia. A cross-sectional study was conducted in Gomma district southwestern part of Ethiopia to determine the prevalence of bovine trypanosomosis using buffy coat technique. Types and population of trypanosoma vectors in area were also described. Accordingly, 384 cattle were tested and among the animals 15 (3.9%) were infected with the one or more trypanosoma species that included Trypanosoma vivax and Trypanosoma congolense. Body condition of the animal showed significant association (P<0.05) with trypanosome infection. Relatively higher prevalence (8.8%) was seen in animals with poor condition than that of those with good (1.4%) and medium (1.14%) body condition. Host factors like age and sex were not associated with infection rate. The mean PCV values of parasitologically negative (26.49%) animals were higher than that of positive ones (23.53%). A total of 175 tsetse flies were collected and the density of Glossina species was 1.458 fly/trap/ day. Based on this assessment two species of tsetse flies including Glossina morsitans and Glossina tachinoides were recorded from the area. The present study revealed that prevalence (3.9%) of trypanosomosis and apparent tsetse density in the study area was somewhat lower in comparable with nearby districts. This may be due to vector control programs practiced in the area. Therefore, further controlling of trypanosomosis and its vector control and prevention strategies should be strengthen and continued.

Keywords: Epidemiology • Monoconical trap • Prevalence • Trypanosomosis • Gomma district

Introduction

Trypanosomosis is a complex disease caused by unicellular parasites (trypanosomes) found in the blood and other tissues of vertebrates including cattle and man. It is a widely spread protozoan disease which affects cattle and other wide range of hosts in sub-Saharan Africa. The diseases are caused by flagellate protozoa called trypanosomes, which are transmitted by a number of different arthropod vectors [1].

Bovine trypanosomiasis continued to be the major constraints of livestock production in Sub-Saharan Africa, jeopardizing the lives of 55 million people. The risk of infection in humans as well as in domestic animals has greatly affected social, economic and agricultural development of communities within tsetse infested areas which roughly constitutes more than a third (10 million km2) of Africa between 14 N and 29 S of the continent.

The disease is very economical because of it highest prevalence in the most arable and fertile land with high potential for agricultural development in the South West and North West part of the country along the great river basins of Abay, Omo, Ghibe and Baro which are infested with vector tsetse fly [2]. There are also studies which showed the disease to be equally important in non-tsetse infested highland part of the country. The effects of trypanosomosis is not only the direct losses resulting from mortality, morbidity, infertility of the infected animals and costs of controlling the disease but also due to indirect losses, which include exclusion of livestock and animal power based crop production from the huge fertile tsetse infested areas [3].

According to several species of hematophagous tsetse flies of the genus Glossina are the vectors of African trypanosomosis and are responsible for cyclical transmission of the parasitic protozoan between numerous vertebrate hosts. The vector is distributed over wide range of habitats covering about 10 million square kilometers of

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Received: November 02, 2021; **Accepted**: November 16, 2021; **Published**: November 23, 2021

potential grazing lands in 37 countries which are rendered unsuitable for livestock breeding and farming across the African content exposing 160 million cattle to the risk of anemia, emaciation, and death and 55million people to the risk of fatal sleep [4].

In Africa, the primary vector for T.congolense, T. vivax, and T. brucei is the tsetse fly. The three main species of tsetse flies for transmission of trypanosomes are Glossina morsitans, which favors the open woodland of the savanna; G. palpalis, which prefers the shade habitat immediately adjacent to rivers and lakes; and G. fusca, which favors the high, dense forest areas.

However the distribution of trypanosomes is dynamic due to climatic change, ecological disturbances, and human interventions. Some tsetse infested areas are scarce in infrastructure and devoid of human settlements. In such areas sufficient information is lacking about the status of trypanosomosis. To facilitate the choice of suitable control methods and to help in planning for development programs in the area, even in already studied areas, updating the prevalence status of the diseases have paramount importance for understanding the epidemiology of the disease [5].

Livestock in study area plays substantial role in the livelihood of the farmer as they are integral to the agricultural activities through provision of milk and meat as well as drafting power. However, trypanosomosis was found to be one of the factors that hampered livestock rearing in the area and no study was done before. Therefore, the objectives of the present study were to determine the prevalence of trypanosomosis, and the apparent density of tsetse ascribed in the transmission of trypanosomosis in the study area.

Materials and Methods

Study Area

The study was conducted in four peasant association (PAs) of Goma district of JimmaZone, Southwest Ethiopia. Goma district is located at 7°49′N latitude and 36°39′E longitude with the total area of 1,230.16km2.The district bordered with Gumay district in north, Mana district in east, Limmu kossa in northeast, Gera district in southwest, Settema district in northwest and Seka chokorsa in south.

Aggaro is the town of the Goma district which is found 45 km and 386 km far from the Jimma Zone in west direction and Addis Ababa in south west direction respectively. The district has altitude ranging from 1387-2870 meters above sea level with the mean annual rainfall and temperature ranges between 800-2000mm and13.4^{o}c- 28.9^{o}c respectively. The Agro ecological interpretation of the study area is Highland (Dega) about 8%, Midland (Woynadega) 88% and Lowland (Kola) 4%. The district has livestock population of 27132cattle, 49311 sheep, 37131 Goats, 67935 poultry, 8506 Horses, 4513 donkey and 721 Mules.

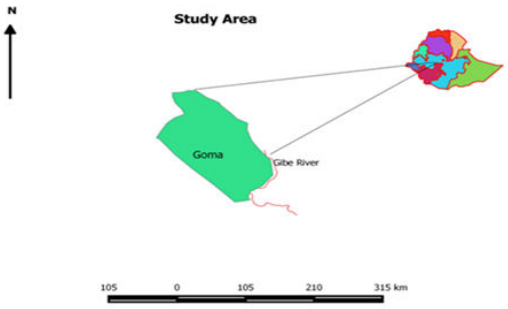

Figure 1: The map of study area.

Study Population

There is a total number of 27132 Bovine species in Goma district. From this total number of bovine species, there were a total of 15063 zebu cattle in the study area (Didessa Dako, Meti Koticha, Limmu Sappa and Choche Lami peasant association). The study animals include indigenous zebu breed of cattle selected from the four peasant associations of Goma district. A total of 384 cattle were selected and sampled during the study.

The study population constitutes of zebu cattle of various sexes, age groups and body condition scores and all cattle sampled for this study were kept under extensive management system. Their age was categorized into two age groups (<3 years, and greater than three years) based on dentition (De Lahunta et al.,1986)The body condition score was grouped into poor, medium, and good conditioned animals based on the appearance of ribs and dorsal spines applied for zebu cattle.

Study design

A cross sectional study was conducted on November 2018 to April 2019 to determine the current prevalence of bovine trypanosomosis and to identify the vectors involved in the epidemiology of the disease by selecting the district purposively as convenient and the PAs randomly.

Sample Size determination

The sample size was determined by the expected prevalence of bovine trypanosomosis to be 50% in the study area. The desired sample size for the study was calculated using 95% confidence interval and at 5% absolute precision. Accordingly, a total of 384 animals were required for the study.

$$N = \frac{1.962 Pexp\ (1-Pexp)}{d2}$$

Where: n = required sample size.

Pexp =Expected prevalence.

d =desired absolute precision.

The study animals were selected by using simple random sampling method by taking age, sex and body condition in to account.

Study Methodology

Sample Collection and Parasitological Examination

Blood samples were collected after properly securing the animal and aseptically preparing around the vein. In the present study a small quantity of paired blood samples were obtained from the marginal ear vein after pricking the vein with the tip of sterile lancet. The lancet must be cleaned with cotton after bleeding each animal to prevent cross contamination of the sample

Parasitological Examination

Buffy Coat technique: Buffy coat technique is used for diagnosing low parasitaemia, to identify trypanosome species and its quantification. Blood was collected by two heparinized microhematocrit capillary tubes up to 3/ 4th of its volume from each animal for thin smear preparation. One end of the tube was sealed with crystal sealant. The tube was placed in the microhematocrit centrifuge ensuring that the sealant is at the outer end. The blood in capillary tube was centrifuged at 12,000 rpm for 5 minutes. As the centrifugation process gets an end, the tubes were taken from the hematocrit centrifuge and the capillary tubes were cut using diamond pencil 1mm below the Buffy coat including the top layer of the of RBC.

Packed Cell Volume (PCV) Determination: After centrifugation at 12,000 ppm for 5 min in a microhaematocrit centrifuge, the capillary tubes were placed in a haematocrit reader and the length of the red cells column was expressed as a percentage of the total volume of blood. Animals with PCV less than 24% were considered to be anemic.

Entomological study

Entomological study was also carried out to assess the apparent density, species of tsetse and other biting flies in the study area. During entomological study 60 monotonically traps were deployed in selected grassland and riverside sites.

The apparent density was determined based on the mean catches of flies in traps deployed and expressed as the number of fly catch/ trap/day. Every trap was odor baited with acetone, octanol and cow urine, which was odor attractants for tsetse flies. The trap deployment time was 48 hours. After the flies captured in the collecting cage they were then sorted by sex, species, and sites and recorded. The species of tsetse was identified based on the characteristic morphology. Other biting flies were also separated according to their morphological characteristics such as size, color, proboscis and wing venation structures at the genus level.

Data Management and Analysis

Raw data generated for this study were entered into Microsoft Excel and the prevalence of ovine trypanosomosis in different age groups and sexes were analyzed by using SPSS 20 version Software.

Chi-square was used to compare the prevalence of trypanosome infection in different variables and to determine association between variables and comparison of PCV was determined by comparable t-test. In all cases differences between parameters were tested for significance at probability levels of 0.05 or less.

Results

Parasitological Findings

A Cross-Sectional study was conducted on 384 randomly selected cattle in Goma district from November 2018 to June 2019 .From a total of 384 sampled zebu cattle, 15 were found to be positive for trypanosome infection using Buffy coat technique. The overall prevalence was 3.9% There was no statically significant difference ($p>0.05$) observed between sex groups.

However, the disease was statistically significant among different BCS ($P <0.05$). The prevalence was not statically significant ($p >0.05$).However, the higher prevalence observed 4.7% in adult compared to young age category 1.9%.

Variables No	of examined	No of positive	Prevalence%	X2	p-value
Sex				0.216	0.642
Male	235	8	3.50%		
Female	167	7	4.50%		
BCS					
Poor	144	12	8.80%	13.572	0.001
Medium	182	2	1.10%		
Good	76	1	1.40%		
Age				1.591	0.207
Adult	278	13	4.70%		
Young	106	2	1.90%		
Total	384	15	3.90%		

Table 1: Association of different variables with the disease.

Hematological Result

The overall prevalence of Trypanosoma species were 7/384(1.8%) T.congolense, 8/384(2.1%) T.vivax and mixed infection was not detected. Among the Trypanosoma species examined the prevalence of T.vivax was found higher 8/15 (53.3%) than that T.congolense 7/15 (46.7%) and mixed infection of T. vivax and T.congolense not detected during the course of laboratory examinations.

PCV of individual animals was measured for the assessment of degree of anemia. A mean PCV of 23.53% and 26.49% were found for infected animals and non-infected animals respectively as indicated in Table-2.

Condition	Mean PCV	95% CI	SE	p- value
Infected	23.53%	23.44-23.54	0.024	0
Non infected	26.49%	26.48-26.26.5	0.01	

Table 2: Mean PCV in infected and non-infected cattle.

T. species	No of positive	Percentage X2		p-value
T. vivax	8	53.30%		
T.congolense	7	46.70%	384	0
Total	15	100%		

Table 3: Ratio of trypanosome species infection.

Among four Pas of the study area, the lowest prevalence of infection observed in Didessa Dako (2.8%) and the highest prevalence was recorded in Choche Lammi (5.4%) PAs in the study area as presented (Table 4). But, there was no statistically significant difference between the study areas (p >0.05). During the present survey, from total of 384 cattle examined, 157 where males and 227 of them where female animals. Of the female animals examined were 8(53.3%) positive for trypanosome infection while 7(46.7%) of the male animals where found infected as summarized in Table 5. However, statistically there is no significant difference in the infection rate between both sexes (Chi square=0.642, p>0.05%).

PAs	Number total examined	Number of positive%	Prevalence%	x²p-value
Limmu sapa	93(24.2%)	3	3.20%	
Meti koticha	92(24%)	4	4.30%	
Choche lami	92(23.9)	5	5.40%	
Didesa dako	107(27.8%)	3	2.80%	1.082 0.782
Total	384(100%)	15	3.90%	

Table 4: Prevalence of trypanosome infection in different village of Gomma District.

Sex group	Number of examined animal	Number of positive%	Prevalence%	x² p-value
Female	227	8	3.50%	
Male	157	7	4.50%	0.216 0.642
Over all	384	15	3.90%	

Table 5: Sex Wise Prevalence of Trypanosome infection in Gomma district.

The animals examined where categorized in different age groups as young (1-3) and adults greater than 3 years old. The trypanosome infection found in young group was 2(13.3%) and in the adult group was 13 (86.7%) in percentage as in indicated in Table 3. There is no statistically significant between infection rate among the different age groups (Chi square =1.591' p>0.05%).

Age group	No of animal examined	No of positive	Prevalence	x² p-value
Adult	295	13(86.7%)	4.70%	
Young	107	2(13.3%)	1.90%	1.591 0.207
Overall	384	15(100%)	3.9	

Table 6: Trypanosome infection in different age groups.

The prevalence of Trypanosomosis under different body condition groups was indicated. The infection rate of animals with poor condition was higher than that of animals with good body condition. As a whole, prevalence of Trypanosomosis in good body condition animal was lower when compared with poor body condition animal. This may indicate that other factors such as nutrition, disease and management system have contributed for poor body condition animals to be more susceptible.

Body condition	No of animal examined	No of positive	Prevalence%	x² p- value
Good	73	1(6.7%)	1.30%	
Medium	175	2(13.3%)	1.14%	
Poor	136	12(80%)	8.80%	13.572 0.001
Total	384	15(100%)	3.90%	

Table 7: Trypanosome infection in different body condition.

Entomological Result

A total of 218 flies were caught at the time of the study from different site. All of tsetse flies cough belongs to Glossina species and other biting flies; Stomoxys and Tabanids were cached. Out of the total flies, 143 were the Glossina morsitans, followed by 32 G.tachinoides with 1.458F/T/D and 26 Stomoxys and 17 Tabanid with 1.43 F/T/D. The highest fly density observed in Choche Lami 72(2.4F/T/D) and the lowest recorded in Didesa Dako 13(0.43 F/T/D).

Trapping site	No.of flies	No.of trap	Tsetse flies caught			Other biting flies			
			G.Mors	G.Tach	F/T/D	Stom	Tab	F/T/D	Total
Limmu S	35	15	29	6	1.16	5	2	0.23	42
Meti K	55	15	50	5	1.83	8	5	0.43	68
Choche L	72	15	54	18	2.4	11	7	0.6	90
Didesa D	13	15	10	3	0.43	2	3	0.16	18
Total	175	60	143	32	1.458	26	17	1.43	218

Limmu S= Limmu Sapa, Meti K=meti koticha, Choche L=Choche Lammi, Didessa D=Didesa Dako, G. mors= G.morsistans, G tach= G. tachnoids, stom=Stomoxys, tab=tabanoids, F/T/D=fly per trap per day

Table 8: Indicating fly catches in different area of survey sites in Gomma district.

Discussion

The study revealed that from a total of 384 randomly selected cattle in the study area, 15(3.9%) of animals were positive for trypanosomes. The related findings of 4.86%from Didesa district of Bunno Bedelle zone, and 5.33% from Haro Tatessa settlement areas of Bunno Beddelle zone were reported. And similar reports,2.86% for Dale Wabera District of Kellem Wollega Zone, 4.2% for Beddelle District and 1.3% Arbaminch Gamogofa zone, Southern parts of

Ethiopia.The current finding was significantly lower than the reports 16.92% from Guduru District, of Guduru, Horo Guduru Wollega, Ethiopia and(11.89%) from Benishangul Gumuze regional state, western of Ethiopia.

The relatively low prevalence of trypanosomosis in this study may be related to tsetse distribution and low fly–animal contact and parasite and vector control programs practiced in the area by Bedelle NTTICC annually. In Gomma district, every farmer in the tsetse belt area has trypanocidal drugs in his home that he injects his cattle by nonprofessional individuals. In another way, the low sensitivity of direct parasitological Buffy coat examination may contribute to low prevalence that chronic stage is characterized by low parasitaemic which is difficult to confirm by parasitological diagnosis. In very low sensitivity of the Buffy coat method, 50% of infected animals remained undetected using parasitological diagnostic tools as compared to the molecular analysis animals.

The parasitological examination revealed that among the different species detected in the study period. T.vivax 8(53.3%) was the most prevalent trypanosome species followed by T.congolense 7 (46.7%) and no mixed infection was detected. The present study in terms of trypanosome species is in agreement with that of the dominant trypanosome species from Guduru District, of Horo Guduru Wollega, Ethiopia which was T. vivax (66.15%) followed by T.congolense (33.84%), In Hawagalan district in which T. vivax was 45.85% followed by T.congolense 33.33%, East Wollega Zone (Sibu Sire) the respective ration between T.congolense and T.vivax was 3 and 64% respectively. This study revealed, the presence of T. vivax is an indicator of the importance of mechanically transmitted Trypanosoma in an area where tsetse control program is undertaken.

The high ratio of T. vivax may also be suggested that it has the ability to adapt and established itself in the absence of the tsetse flies and it transmitted by other biting flies. This has also been reported by Leak (1999); greater proportions of infection are transmitted mechanically rather than cyclically in such area (tsetse free) and T. vivax is highly transmitted in this manner than other trypanosome species.

In the present study, a relatively lower mean PCV values were observed in parasitaemic animals, but the difference is statically significant among aparasitaemic and parasitaemic animals. The result of this study was in accordance with Rowlands et al., 2001 who observed an increase in PCV value, the proportions of positivity decrease and hence mean PCV was a good indicator for the health status of animals in an endemic area. The lower mean PCV value in parasitaemic animals than the aparasitaemic animals is reported by several authors.

In this study the prevalence of bovine trypanosomosis between peasant associations was not significant; even though it is higher than others in Choche Lammi (5.4). This may be the result of uncontrolled animal movements between PA's by buying and selling cattle between the PAs. The present study also revealed that the prevalence of young animals (<3 years) was lower than that of adult (≥3) animals but the difference was not significant (p>0.05). This finding is in agreement with the previous works in which a higher prevalence of trypanosome infection was recorded in older animals This may be due to more exposure of adult animals to vectors of trypanosomes.

Higher prevalence (4.5%) was observed in male than in female animals (3.5%), but the difference was not significant (p>0.05). The similar result reported by different researchers. Therefore, they have an equal chance of coming in contact with the flies and allowed in the same ecology having a comparable degree to acquire infection. The possible suggestion to the present finding might be associated with the hardworking of male animals (Table 5).

The prevalence of trypanosomosis in those animals with poor body condition were significantly higher (P<0.05) than those in good body condition. Obviously, the disease itself results in progressive emaciation of the infected animals; nevertheless, non–infected animals under good body condition have well developed immune status that can respond to any foreign protein better than those non-infected cattle with poor body condition which can be immune-compromised due to other diseases or malnutrition, since malnutrition and concurrent infections depress the immune responsiveness in some cases.

In this study, the entomological survey revealed that two species of Glossina (G.morsitans, G.tachinoides) and two genera of biting flies (Tabanus, Stomoxys species) were detected in the selected four PA's of Gomma district. Out of 218 flies, 143tsetseflies G. morsitans was the dominant species tsetse fly species with 1.19 F/T/D and G.tachinoids 0.26F/T/D with an overall apparent density of 1.458F/T/D. The overall density of biting flies was 1.43F/T/D with 0.2F/T/D for Stomoxys and 0.14 F/T/D for tabanids. This result is lower than the report of at Arbaminch, Ethiopia, who reported14.97 F/T/D for tsetse and at Hewa Gelan, Oromia region Ethiopia, who reported 11.9 F/T/D and10.2 F/T/D for tsetse and Stomoxys respectively.

In the present study, the density of tsetse flies was lower because of the season that traps deployed on late dry season, which indicates low fly density. And maybe due to the use of insecticide-impregnated targets and insecticide-treated livestock undertaken in the area by NTTICC and the expansion of settlements and farmlands in the area at the expense of deforestation limits the tsetse and other flies habitats.

Conclusion

The study results revealed that bovine trypanosomosis and apparent tsetse density survey in four villages of Gomma district indicated that an overall 3.9% prevalence of the disease and density of tsetse flies with an overall apparent tsetse density of 1.458flies/trap/day. Higher prevalence of trypanosomosis infection was observed in animals with poor body condition and low PCV animals. From the total risk factors body condition found significant (P<0.005) and others are insignificant. In this study T. vivax (53.3%) and T.congolense (46.7%) are trypanosome species identified and on entomological survey, the species of tsetse fly identified was G. morsitans and G. tachinoides with Stomoxys and tabanids biting flies. Based on the conclusion, the following recommendations are forwarded:

- Strategic control of bovine trypanosomosis including vector control should be strengthened to improve livestock production and agricultural development in the area.

- Educating the public in the tsetse belt or affected areas of trypanosome to participate in control strategies.

Acknowledgement

The authors would like to thank Wollega University, School of Veterinary Medicine for funding to conduct the research, Administrations of the Eastern Wollega Zone, animal owners and all individuals who render help during the study period.

References

1. Fentahun Tewodros, Tekeba Mitiku, Mitiku Tadegegn, and Chanie Mersha. "Prevalence of bovine trypanosomosis and distribution of vectors in Hawa Gelan district, Oromia region, Ethiopia." Glob Vet 9 (2012): 297-302.
2. Teka, Wondewosen, Terefe Dechasa, and Wondimu Anteneh. "Prevalence study of bovine trypanosomosis and tsetse density in selected villages of Arbaminch, Ethiopia." J Vet Med Anim Health (2012): 36-41.
3. Getachew, Siyum, Tadele Kabeta, Zelalem Abera, and Benti Deressa. "Epidemiological survey of Bovine trypanosomosis in sayo district of kellem Wollega zone, Western Ethiopia." Am Eurasian J Agric Environ Sci 9 (2014): 67-75.
4. Simukoko Humphrey, Marcotty Tanguy, Vercruysse Jozef, and Bossche Pieter Van den. "Bovine trypanosomiasis risk in an endemic area on the eastern plateau of Zambia." Res Vet Sci 90 (2011): 51-54.
5. Murray, Max, ed. Livestock productivity and trypanotolerance: network training manual. ILRI (aka ILCA and ILRAD), 1983.

How to cite this article: Abera Dereje, Fetene Adugna, Beshir Ahmedin, Kebede Yilkal, Getachew Yitbarek. "EPIDEMIOLOGY OF BOVINE TRYPANOSOMOSIS IN GOMMA DISTRICT, SOUTHWEST ETHIOPIA." *J Vet Sci Technol* 12 (2021) : 39541