

Epidemiological Study of Bovine Trypanosomosis in Mao-Komo Special District, Benishangul Gumuz Regional State, Western Ethiopia

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Abstract: The cross sectional study was conducted in Mao-Komo special district of Benishangul Gumuz regional state from November 2010 to March 2011 to determine the current prevalence of bovine trypanosomosis in the area. Parasitological and hematological examinations were undertaken on randomly selected cattle. Up on the parasitological survey, blood samples of 385 cattle were examined using a buffy coat technique and the packed cell volume of each animal was also measured. The overall prevalence of trypanosomosis in the study area during the study period was 95(24.7%). The species involved in the infection were *Trypanosoma congolense* 60(63.2%), *Trypanosoma vivax* 13(13.6%), *Trypanosoma brucei* 11(11.6%) and mixed infection was 11(11.6%). The packed cell volume of parasitaemic and aparasitaemic animals during the study period were 18.12 and 25.79 with a significant difference ($P < 0.05$). The study also indicated variations in prevalence among different age groups and between both sexes which were statistically insignificant ($P > 0.05$). Infection in poor body condition animals were significantly higher than good body condition animals ($P < 0.05$). It is recommended to alleviate the existing conditions of trypanosomosis in the study area.

Key words: Aparasitaemic • Mao-komo • Packed cell volume • Prevalence • Trypanosomosis

INTRODUCTION

Trypanosomosis is one of the debilitating and killing heamo-protozoal diseases of domestic animals and humans, caused by infection with parasitic protozoa of the genus trypanosome [1, 2].

This disease restricts the keeping of domestic animals, which limits the development of mixed, arable and live stock farming by affecting the traction force they have [3,2]. The disease directly affects the milk and meat productivity of animals, reduces birth rates and increases abortion and mortality rates. All of these symptoms affect the herd size and herd composition [4].

According to food and agricultural organization [5], Trypanosomosis is probably the only that profoundly affects the settlement and economic development of the major part of Africa. This disease known as African animal trypanosomes(AAT), because it is most prevalent in Africa [6]. Trypanosomosis (nagana) which occurs in forty African countries with the exception of South Africa and Namibia, is probably the most important diseases of livestock in the continent [7].

In general the existence and severity of trypanosomosis risk determines size and structure of cattle herds. Trypanosomosis likely reduces the total production of livestock by 10-50% [8]. The majority of the farmers in sub-Saharan Africa is still farming with hand, mainly because of animal diseases, which is mostly trypanosomosis. Cross breed cattle cannot be introduced before tsetse is eradicated; because of the higher risk of trypanosomosis [2].

Trypanosomes are unicellular organisms which the trypanosome is classified as flagellate protozoa from the genus trypanosome of the family trypanosomatidae which belongs to the order Kinetoplastida of the class zoomastigophora. The zoomastigophora is classified under the phylum sarcomastigophora [9].

Trypanosomosis epidemiology and Its impact on livestock, especially cattle production is determined largely by the prevalence and distribution of the disease and its vectors in the affected area [10, 11].

Tsetse flies (*Glossina*) inhabit wide range of habitats covering over 10 million km², representing 37% of the African continent and affecting 37 countries including

Ethiopia. Approximately 30% of the total cattle population in the African continent and about 50 million people are exposed to animal trypanosomosis and human sleeping sickness, respectively [10].

A recent study has estimated the direct annual cost of Trypanosomosis to be about 1.34 billion dollars. 35 million dollars per year have been paid by African farmers on trypanocidal drugs to protect and cure their cattle. It is estimated that 7 million km² of tsetse infested area in Africa would be suitable for the livestock and mixed agriculture, if trypanosomosis could be controlled [12].

Tsetse flies in Ethiopia are confined to the southern, western and southwestern regions between longitude 33° and 38° E and latitude 5° and 12°N. Tsetse infested areas lie in the low lands and also in the river valleys of Baro, Akobo, Didessa, Abay (Blue Nile), Ghibe and Omo [12].

Currently, about 220, 000 km² areas in Ethiopia is infested with five species of tsetse flies namely *G. pallidipes*, *G. morsitans*, *G. fuscipes*, *G. tachinoides* and *G. longipennis* (Molalegne *et al.*, 2010). There are five economically important animal trypanosome species in Ethiopia. These are *T. congolense*, *T. vivax*, *T. brucei brucei*, *T. evansi* and *T. equiperdum*. The overall economic loss due to the disease is estimated to be between 1.408 and 1.540 million dollars annually [12].

Control system includes chemotherapy and vector control which involves removal of vegetation, killing of wild animals, spraying of insecticides, trapping, sterile insect technique (SIT). Among these techniques, chemical control of tsetse fly has been limited due to the non-specific enemies, while the sterile insect technique (SIT) has high cost and requires significant external support (ESTC,1997). The severities of the disease depend on the species and strain of the trypanosomes involved. The ability of trypanosomosis to change their surface coat continuously leads to the exhaustion of the antibody production by the host that causes immuno-suppression of the host [13].

Even if there has been a lot of research done in Metekel zone of Benishangul Gumuz region however, little is known about Assosa zone and Mao- Komo district specifically. Consequently, the objectives of the current study are:

- To assess the current prevalence of bovine trypanosomosis in Mao-komo special district
- To identify and determine the dominant trypanosomes species present in the study area
- To compute different parameters such as PCV in relation with trypanosomosis

MATERIALS AND METHODS

Study Area: The present study area is Benishagul Gumuz regional state in one of the region special district called Mao-komo. The region consists of three administrative zones, namely Assosa, Kemashi and metekel and twenty districts, of which two are special districts. The study area is located in low land area of Benishagul Gumuz. The altitude of a study area range from 960-2000m.a.s.l. border Oromia region in south-east, Sudan in the west and Gambella in the south direction. Mao-komo special district is situated in north east part of the Assosa town on 115 km and was located 9°45'N and 34°45' east. The area covers about 76,140 hectares of land with total population 40,000. Topography of the area is marked by hilly, steep slopes and flat surface of the land.

The area has sub-humid climate with moderate hot temperature with less variation in average temperature between day time and night. It receives high and reliable annual rain fall. The vegetation dominated by wooded, bamboo trees and savanna grasses. Bamboo is the most common woody vegetation in the district. The livestock management system is mixed farming system. The livestock species in the area are Bovine, Caprine, Ovine and Equine (donkey, Horse and Mule).The livestock population in the district estimated to be cattle 26,608, sheep 13,755, goats 12,845, donkeys 1,746, Mules 30 and chickens 45,902 [14].

Rain fall in the area is bimodal. The mean annual rain fall is 1180 mm recorded over year period at Mao-komo special district station with a range of 960 to 1400mm. The long dry season lasts from December to May. The area experiences a maximum temperature of about 32°C. The highest average monthly temperature occurs in May (29-32°C), where the mean temperature is 27.5°C. The coldest month is august when the average monthly minimum temperature is 17°C.

Study Design: Cross sectional study was conducted to determine prevalence of bovine trypanosomosis from November 2010 to March 2011. The study animals were classified in different body conditions (good, medium and poor) according to Nicholsan and Butterworth [15], age group (1-3 years and >3years) according to Molalegne *et al.* [10] and other factors include sex and origin to determine the prevalence bovine trypanosomosis. The study animals were zebu cattle under extensive traditional husbandry system. The animals graze the same agro-ecology without any supplementary feeding. The animals graze the communally owned pasture land throughout the year.

Sample Size and Sampling Methods: A total of 385 blood samples were collected from selected cattle in five villages of the district. The sample size was determined by using 95% level of confidence interval and expected prevalence of 50% of trypanosomosis with desired absolute precision of 5% and simple random sampling method was used [16].

Sample Collection and Parasitological Examination

Sample Collection: Paired blood samples were collected from ear vein of selected cattle after properly securing the animal and aseptically preparing around the vein by using sterile blood lancet needle and heparinized microheamatocrit capillary tube to its $\frac{3}{4}$ volume.

Thin Stained Blood Films: The technique of preparing thin blood films can detect about $2.5-5 \times 10^3$ trypanosome per ml of blood [17]. After Giemsa staining, smears are then observed under a microscope at 10 X eye pieces and oil emulsion [17].

Buffy Coat Dark Ground-phase Contrast Technique

(BCT): Following blood centrifugation at 12,000 rpm for 5 minute in heparinized microheamatocrit capillary tubes sealed in the Buffy-coat zone, the capillary tube is then cut using diamond pen 1mm below the Buffy coat to include the upper most layer of the red blood cells and 3 cm above to include the plasma. Using a haematocrit tube holder, the content of the capillary tube are expressed onto, slides mixed and covered with a covered slip (22x22cm). The preparation is then examined using a condenser with 40x objective and 10x eye pieces. The advantage of the condenser is that it allows the use of bright field, phase and dark ground illumination. The dark ground illumination makes it easy to recognize the trypanosomes by their fluorescing appearance and by their movement. *T.congolense* is recognized by its small size in relation to red blood cell diameter, its sluggish activity and its invariable attachment to the red blood cells. *T.vivax*, on the other hand, is seen large and striking apparent by the speed with which it traverses the microscopic field. *T.brucie* is distinguished from other species by large size and going round in circle in particular location. The Buffy coat technique is able to detect up to 2.5×10^2 trypanosome per ml of blood [17].

Data Analysis: During the study period, owners' name, address, animal sex, age and body condition were recorded using the animal blood sample collection format and entered into Microsoft Excel. Hematological and parasitological data were handled very carefully.

Data on individual animal and the entered data were transferred to SPSS version 16 software (SPSS Inc., Chicago, IL, USA) and scrutinized as described in the protocol of Thrusfield [16]. Chi-square was used to compare the prevalence of trypanosomosis in different variables and to determine relation between variables and the result. Data collected on PCV values were analyzed by ANOVA to compare the mean PCV values of parasitaemic animals against that of aparasitemic animals. In all cases difference between parameters were tested for significance at probability levels of 0.05 or less. The prevalence of bovine trypanosome infection was calculated as a number of parasitological positive animals as examined by Buffy coat method to the total population at risk [16].

RESULT

Parasitological Finding: Out of total 385 examined animals, 95 (24.7%) were infected with various species of trypanosomes. The highest and the lowest prevalence were recorded in Gure 24(25.3%) and Tongo 15(15.8%) villages respectively. However, there was no significant difference ($P > 0.05$) in the prevalence of trypanosomosis in the villages (Table 1).

Throughout the study, *T. cogolense*, *T.vivax*, *T. brucie* and mixed infections were observed. Out of 95 infected animals with trypanosome parasites, 60(63.2%) were infected with *T. congolense*, 13(13.6%) with *T.vivax*, 11(11.6%) with *T.brucie* and mixed infections were recorded for 11(11.6%). *Trypanosoma congolense* was the most infective species of trypanosomes in the study area followed by *T.vivax*, *T.brucie* and mixed infection and this arrangement was statistically significant ($P < 0.05$) (Table 2).

The prevalence of trypanosomosis is varying in both sexes; the trypanosome infection in female is slightly higher than in the male. The obtained results during examination were 51(53.7%) and 44(46.3%) in female and male respectively. However, this was not statistically significant ($P > 0.05$) (Table 3). In the present study, examined animals were categorized in different age groups as 1-3 years and greater than 3 years. Out of the sampled animals, 96(24.9%) were 1-3years old and 289(75.1%) were greater than 3years old. From 1-3years old (96) examined animals, 20(21.1%) were positive and out of >3years old (289) examined animals, 75(78.9%) were positive for the disease. The difference in the prevalence of bovine trypanosomosis due to differences in ages of the animals was not statistically significant ($P > 0.05$) (Table 3).

Table 1: Trypanosomosis prevalence in relation to origin

Origin/village	Number of animals examined	Number of positive (%)	χ^2 (P-value)
Tongo	77	15 (15.8)	3.49(0.479)
Tulu	77	18 (18.9)	
Wetse	77	17 (17.9)	
Gure	77	24 (25.3)	
Mimi-yakobo	77	21 (22.1)	
Total	385	95 (24.7)	

Table 2: Distribution of trypanosomes species in the study area

Parasite species	No of positive animals	Prevalence in%	χ^2 (P-value)
<i>T.cogolense</i>	60	63.2	3.44(0.00)
<i>T.vivax</i>	13	13.6	
<i>T.brucie</i>	11	11.6	
Mixed	11	11.6	
Total	95	24.7	

Table 3: The prevalence of trypanosomosis in relation with age and sex

Variable	No animal examined	No of positive	Prevalence in%	χ^2 (P-value)
Sex				
male	203	51	53.7	0.46(0.83)
Female	182	44	46.3	
Total	385	95	24.7	
Age				
1-3years	96	20	21.1	1.02(0.314)
>years	289	75	78.9	
Total	385	95	24.7	

Table 4: The prevalence of trypanosomosis in relation with body condition

Body condition	No of animals examined	No of positive	Prevalence in %	χ^2 (P-value)
Good	166	4	4.2	1.263(0.00)
Medium	53	3	3.2	
Poor	166	88	92.6	
Total	385	95	24.7	

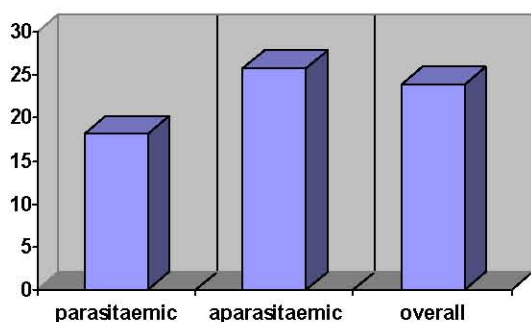


Fig. 1: Mean PCV of examined animals

The study also tried to categorize the study animals into different body conditions as good, medium and poor body condition. From the total 385 examined animals, 166(43.1%) were good and poor each in body condition,

while 53(13.8%) were medium in body condition. Out of infected animals, 88(92.6%) were with poor body condition, 4(4.2%) with good body condition and 3(3.2%) animals with medium body condition. From above result almost all of the infected animals were poor in body condition which is statically highly significant ($P<0.05$) (Table 4).

Hematological Finding: The mean PCV value for whole examined animals was 23.9 ± 5.5 SD. However, the mean PCV value for aparasitemic animals were 25.79 ± 3 SD and the mean PCV value of the parasitemic animals was 18.12 ± 4 SD. There was statistical significant difference in the mean PCV value between the non-infected and infected animals ($P<0.05$) (Fig 1).

DISCUSSION

The overall disease prevalence in the present study was 95(24.7 %). According to previous studies a prevalence of 45.1% [18] in Bambasi district and 26.3% [19] in and around Assosa were recorded in neighboring district which were higher than the present study. This difference is may be due to extensive or seasonal clearing of bushes, expansion of human and agricultural investment in the area affecting the tsetse ecology. However, Different prevalence studies were conducted in West and North West part of the country as 12.5% *T.congolense* at Meda jalala, Western Ethiopia [20], 17.2% in Metekel district [21] and 19.01% in Goro Abiy [22] indicates low prevalence than the present infection rate which is probably attributed to lower altitude and high tsetse fly infestation of this study area.

From the total prevalence of the disease, *T.congolense* accounts for about 63.2%, *T.vivax* for 13.6%, *T.brucie* for 11.6% and mixed species for 11.6% of the total positive sampled cattle. This indicates that difference in the distribution of parasite species is statistically highly significant ($P>0.05$) please discuss the reason behind this difference in the distribution of the species.

During the study, equal amount of samples were collected from each village to compare the prevalence among villages and there is no statistical significant difference in the prevalence among the origins because they are found in similar altitude (less than 2000m). The highest and the lowest prevalence were recorded in Gure 24(25.3%) and Tongo 15(15.8%) villages respectively. However, there was no significant difference ($P>0.05$) in the prevalence of trypanosomosis in the villages.

The predominant prevalence of *T. congolense* 60(63.2%) in present study was similar with previous result of Alekaw [23] at Pawe, North West Ethiopia (60.9%), Terzu [24] in selectsd sites of southern region (63.4%), Abebe and Jobre [25] in tsetse infested area of Ethiopia (58.5%) and Muturi [26] at Mereb Abaya, south Ethiopia (66.1%). According to Getachew [2] *T.congolense* and *T.vivax* are the most prevalent trypanpsomes that infect cattle in tsetse infested and tsetse free area of the country respectively. In the tsetse infested area of the country, the prevalence of *T.congolense* is found to be high and a considerable number of animals were also harboring *T.vivax*, which agree with the result of the present study.

The prevalence of trypanosomosis is varying in both sexes; the trypanosome infection in female 51(53.7%) is

slightly higher than in the male 44(46.3%) but the difference is statistically insignificant. The result agrees with the work of Getachew [27] in two districts of western Gojjem, Tefera [28] in Arba mich district, Adane [29] in and around Bahir Dar and Molalegne *et al.* [10] in Jabitehnan district of west Gojjam.

The prevalence study in different age groups in the area indicates the trypanosome infection rate is higher in adult animals and animals above two years of age. However, there is no statistical significant difference. This result is inline with the work of Alekaw [22] and Molalegne *et al.*, [10] who concluded that there is no statistical significant difference in infection rate between the age group.

Infection rate in poor body condition animals were significantly higher than good body condition animals. This is in agreement with Mussa [30] and Molalegne *et al.* [10]. This is due to development of anemia and progressive loss of body condition in chronic case.

According to Getachew [2], the development of anemia is the most reliable indicator of the trypanosome infection, but it also interferes with concurrent diseases and nutritional factors. The difference between mean PCV value of parasitemic and aparasitemic animals in the present study was recorded as, 18.12 ± 4 SD and 25.79 ± 3 SD respectively. There was statistical significant difference between the animals, which agrees with previous study of Haile [31], Alekaw [22], SRVL [32] and Molalegne *et al.*, [10] who reported that the mean PCV value of parasitemic animals were significantly ($P<0.05$) lower than that of aparasitemic animals.

CONCLUSIONS AND RECOMMENDATIONS

From the present study, high prevalence 95(24.7%) of trypanosomosis was recorded. Moreover, trypanosomosis is the major disease of animals in the study area, which potentially affect the health and productivity of cattle. Also, trypanosomosis was found to be negatively affect the PCV value and body condition score of infected animals. *T.congolense* accounts for high prevalence of the disease 60(63.2%) followed by *T.vivax* 13(13.6%), *T.brucie* 11(11.6%) and mixed infection was 11(11.6%) which mainly transmitted by tsetse flies. Based on the above conclusive remarks the following recommendations are forwarded:

- Strategic control of the disease including vector control should be strengthening to improve livestock production and agricultural development in the area.

- Major concern should be given on the identified species of trypanosome with the highest prevalence and control measures should be targeted accordingly.
- Research works on the biology of trypanotolerant animals and propagation of trypanotolerant breeds should be applied.
- Farmers in the area should be trained how to control the vector of the disease and provided with materials.

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