

Bovine Trypanosomosis in Selected Villages of Humbo District, Southern Ethiopia

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Abstract: A cross-sectional study was conducted from November 2010 up to March 2011 in Humbo district of Wolayta zone Southern Ethiopia to determine the prevalence of bovine trypanosomosis, to identify the prevailing species of trypanosomes and to assess the host related risk factors of the disease. Blood samples were collected from 246 randomly selected cattle of the study villages and evaluated through standard parasitological methods. The overall prevalence was 14.2%. *Trypanosoma congolense* was the predominant species in the area (65.7%). Statistically significant difference ($P < 0.05$) was observed in the prevalence among the species of trypanosomes. However, the variation between sexes and the different age groups were not statistically significant ($P > 0.05$). The mean packed cell volume (PCV) value of the infected animals was significantly ($P < 0.05$) lower ($20.2\% \pm 3.0$) as compared to non-infected animals ($26.5\% \pm 5.1$). Moreover, animals of various body conditions showed statistically significant difference ($P < 0.05$) in the prevalence of trypanosomosis. In conclusion, bovine trypanosomosis is economically important disease that affects the health as well as productivity of cattle in Humbo district. Hence, appropriate disease prevention and control methods should be undertaken to improve livestock production and agricultural development in the area.

Key words: Cattle • Humbo • Prevalence • Risk factors • Trypanosomosis

INTRODUCTION

Trypanosomosis is a disease caused by several species of protozoan parasites (Trypanosomes) found in the blood and other tissues of vertebrates including livestock, wildlife and people [1, 2]. African animal trypanosomosis remains one of the most prevalent and biggest constraints to the development of sustainable livestock production in the continent. It is one of the most important diseases of livestock which hampers agricultural production in sub-Saharan Africa including Ethiopia [3]. Tsetse flies occur in some 10 million square kilometer of Africa, affecting a total of 38 countries [4]. Currently, about 37% of the 147 million cattle in countries affected by tsetse are exposed to the disease. Africa produces 70 times less animal protein per unit area than Europe [5]. In Africa the overall loss (both direct and indirect) is estimated to be 500 billion USD a year [6].

Trypanosomes are predominantly haemoparasites though they can also exist in other tissues (skin, lymph nodes, CNS, etc.) where they can give rise to distinctive sequel of trypanosome infection. The most important

seriously pathogenic species to domestic livestock are *Trypanosoma vivax*, *T. congolense*, *T. brucei*, *T. evansi* and *T. equiperdum* [7].

Trypanosomosis constitutes the greatest constraint to the livestock and crop production and poses a serious threat to the lives and livelihood of entire communities. It is known that livestock in tsetse infested and free areas are the main sources of livelihood. But, trypanosomosis seriously affects the benefit to be obtained from this sub sector [8]. Livestock production in the countries of sub-Saharan Africa has remained essentially stagnant while populations have grown at unprecedented rates. Fast growing human population in the region requires food of animal origin at higher demand. This demand will insist for change in livestock production in order to meet consumption per capita. Increased levels of consumption can be achieved by increasing productivity of livestock. However, livestock resources are constrained due to diseases, primarily trypanosomosis [9].

Trypanosomosis of domestic livestock has been described as the plague of Africa, as it allows infected cattle to consume resources fodder and water without

being productive, in contrast with some other diseases from which die quickly, leaving resources available [7]. According to Swallow [10], tsetse and trypanosomosis cause reduced crop productions due to insufficient animal traction power, abandonment of settlements and massive human mobilization and affect the limited resources of the nations. In susceptible breed it is estimated that calving rates is reduced by 11-20%, calf mortality is increased by 10-20%, milk off take is reduced by 10-40% and traction power reduced by 33%.

There are five economically important animal trypanosome species in Ethiopia. These are *Trypanosoma congolense*, *T. vivax*, *T. brucei*, *T. evansi* [11] and *T. equiperdum* [12]. However, sleeping sickness might also have a considerable public health importance in the country. As far as the vector is concerned, there are as well five species of tsetse flies distributed along the lowlands of western, southern and southwestern part of the country. *Glossina M. submorsitans*, *G. pallidipes*, *G. fuscipes fuscipes* and *G. tachinoides* are the most important tsetse flies, while *G. longipennis* has a minor economic importance [11]. Large proportion of the southern part of Ethiopia is infested by tsetse flies and all livestock in here are victims of this disease.

The problem of trypanosomosis was also reported to be very serious in the study area. During a survey carried out by Sodo Regional Veterinary Laboratory, farmers reported that trypanosomosis is the most important constraint to livestock development in the area. Therefore controlling this economically important disease in this area could have enormous benefit to improve the livelihood of the rural population by boosting milk and meat production, improving the availability of ploughing oxen and increasing surplus capital from the sale of livestock and livestock products. In the case of trypanosomosis, treatment of cattle in Humbo district is generally carried out without preliminary diagnosis. It is estimated that in the district, almost 80% of all drug treatments were administered inappropriately, i.e. to cases perceived to be diseased with other than trypanosomosis (personal observation). In this particular situation, a rapid assessment of the present risk of tsetse – transmitted trypanosomosis in a cross sectional survey is needed. Therefore the objectives of the study were to determine the prevalence of bovine trypanosomosis, to identify the predominant species of trypanosomes and to assess the host related risk factors of the disease in Humbo district.

MATERIALS AND METHODS

Study Area Description: The study was conducted in five purposively selected villages of Humbo district namely: Mareka, Faricho, Ajaja, Bongota and Bissare. Humbo is one of the districts of Woliata Soddoo zone located along Abaya, 408 km away from Addis Ababa, 178 km from Hawassa and 18 km from the zone's town, Woliata Soddoo. The altitude Ranges from 1100 to 2355 m.a.s.l. The district covers a total area of 86,646 hectares. The area is sub divided into two ecological zones: lowland (kola) with an altitude below 1500 m.a.s.l and midland (weinadega) with an altitude range of 1500-2355 m.a.s.l.

Most of the livestock population is reared in lowland (Kola) ecological zone. The rain fall pattern is bimodal, a short rainy season runs from March to May and long rainy season runs from June to September. The mean annual rainfall is 50.4mm but again this varies according to ecological zone (lower in kola and higher in weinadega). The mean annual temperature of the district is about 19°C being maximum in February which is 29°C and minimum in August which is 15°C. The physical features of the district are 33% hilly, 59% plain and 8% forest land (mountain). The cattle population of Wolaita Sodo zone is 735,392 [13].

Study Population: The study population constitutes zebu cattle of various sexes, age groups and body condition scores managed under smallholder mixed crop-livestock farming system.

Study Design: A cross-sectional study was conducted in five purposively selected villages of Humbo district to determine the prevalence of bovine trypanosomosis, to identify the prevailing species of trypanosomes and to assess the host related risk factors of the disease.

Sampling Method and Sample Size Determination: Simple random sampling technique was followed to select the study animals. The desired sample size was calculated according to the formula given by Thrusfield [14] as follows:

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

Where,

n = The sample size

d = The desired absolute precision at 5 %

P_{exp} = The expected prevalence

Hence, with a 20% expected prevalence, 95% confidence level and 5 % precision, the sample size was calculated to be 246.

During sampling, age, sex and body condition of the animals were recorded. Body condition for each cattle was estimated based on Nicholson and Butterworth [15] ranging from score 1 (emaciated) to score 5 (obese).

Sample Collection and Parasitological Examination

Packed Cell Volume (PCV) Determination: Blood samples were collected from the marginal ear vein by pricking it with the tip of lancet after properly securing the animal and aseptically preparing area around the ear vein. The samples were collected using two haematocrit capillary tubes to the level of $\frac{3}{4}$ of the height and sealed with bee wax in one end. For the measurement of PCV using a micro-haematocrit centrifuge (Hawksley and Sons, UK), the capillary tubes were placed in micro haematocrit centrifuge with sealed end outer most. The specimens were allowed to centrifuge at 12,000 rpm for five minutes. After centrifugation, the capillary tubes were placed in a haematocrit reader. The length of the packed red blood cells column is expressed as a percentage of the total volume of blood. Animals with PCV less than 24% were considered to be anemic [16].

Buffy Coat Technique: Blood was collected from an ear vein using heparinized micro-haematocrit capillary tube and the tube was sealed. A heparinized capillary tube containing blood was centrifuged for 5 minutes at 12,000 rpm. After centrifugation, trypanosomes were usually found in or just above the buffy coat layer. The capillary tube was 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 of the capillary tube was expressed onto a slide and covered with cover slip. The slide was examined under x40 objective and x10 eye piece for movement of parasite [17]. Trypanosome species were identified according to their morphological descriptions as well as movement in wet film preparations provided by OIE [16].

Thin Blood Smear: A small drop of blood from a micro haematocrit capillary tube was applied to a clean slide and spread by using another clean slide at an angle of 45°. The smear was dried by moving it in the air and fixed for 2 minutes in methyl alcohol. The thin smear was flooded with Giemsa stain (1:10 solution) for 30 minutes. Excess

stain was drained and washed by using distilled water. Then it was allowed to dry and examined under the microscope (x100) oil immersion objective lens [16].

Data Analysis: The collected raw data and the results of parasitological and hematological examination were entered into a Microsoft excel spread sheets program and then was transferred to SPSS version 16 for analysis. The prevalence of trypanosome infection was calculated as the number of positive animals as examined by Giemsa stain of thin blood film and buffy coat method divided by the total number of animals examined at the particular time. Pearson's chi-square (χ^2) was used to evaluate the association of different variables with the prevalence of trypanosome infection. P-value less than 0.05 (at 5% level of significance) were considered significant in all analysis.

RESULTS

Parasitological Findings: Out of 246 examined cattle, 35 (14.2%) [95% Confidence Interval (CI), 9.9-18.6%] were positive for trypanosomosis. According to the sampled villages of the district, the highest prevalence was observed in Bongota village and the lowest in Mareka (Table 1); however, the differences were not statistically significant ($P>0.05$).

The most prevalent trypanosome species in the study area was *T. congolense* (65.7%; 95% CI, 50.0-81.4%) followed by *T. vivax* (20%; 95% CI, 6.8-33.3%) and mixed infection (14.3%; 95% CI, 2.7-25.9%) respectively (Figure 1). The observed difference in the prevalence between the species of trypanosomes was statistically significant ($P<0.05$).

Prevalence of Trypanosomosis Based on Body Condition Scores: Statistically significant difference ($P<0.05$) was observed in the prevalence of trypanosomosis among those animals with different body condition scores (Table 2).

Prevalence of Trypanosome According to Animal Sexes: The prevalence of trypanosomosis infection was a bit higher in female cattle than male ones (Table 3); however, the difference was not statistically significant ($P>0.05$).

Prevalence of Trypanosomosis According to Age: The prevalence of trypanosomosis was higher in 1-3 year and >3 years of age and the least prevalence was recorded in

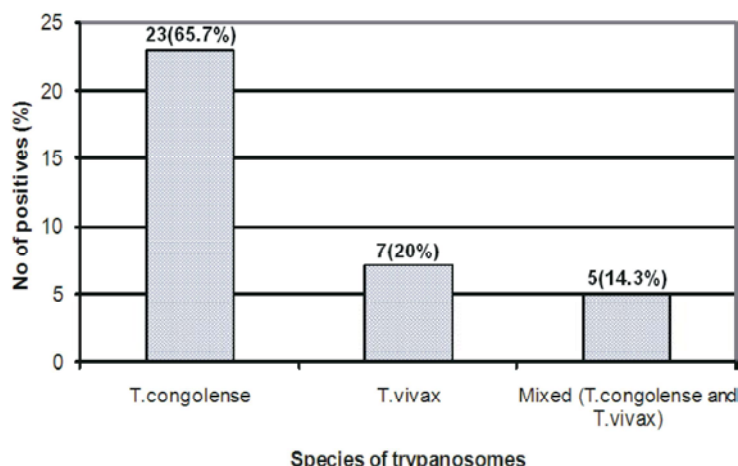


Fig. 1: Prevalence of bovine trypanosomosis in Humbo district based on the species of trypanosomes

Table 1: Prevalence of trypanosomosis in villages of the study area

Area	Total examine	No of positives	Prevalence (%)	[95% CI]	
				Lower bound	Upper bound
Mareka	49	4	8.2	0.5	15.8
Faricho	50	6	12.0	3.0	21.0
Ajaja	49	8	16.3	6.0	26.7
Bongota	49	11	22.5	10.8	34.1
Bissare	49	6	12.2	3.1	21.4
Total	246	35	14.2	9.9	18.6

($\chi^2=4.73$; $p=0.316$)

Table 2: Prevalence of trypanosomosis based on body condition score

Body condition	Total examined	No of positives	Prevalence (%)	[95% CI]	
				Lower bound	Upper bound
Good	148	6	4.1	0.9	7.2
Medium	58	15	25.9	14.6	37.1
Poor	40	14	35.0	20.2	49.8
Total	246	35	14.2	9.9	18.6

($\chi^2=34.97$, $P=0.000$)

Table 3: Prevalence of trypanosomosis based on sex

Sex	Total examined	No of positives	Prevalence (%)	[95% CI]	
				Lower bound	Upper bound
Male	139	19	13.7	8.0	19.4
Female	107	16	15.0	8.2	21.7
Total	246	35	14.2	9.9	18.6

($\chi^2=0.82$ $P=0.775$)

Table 4: Prevalence of trypanosomosis among the various age groups

Age group	Total examined	No of positives	Prevalence (%)	[95% CI]	
				Lower bound	Upper bound
<1 years	43	4	9.3	0.6	18.0
1-3 years	100	16	16.0	8.8	23.2
>3 years	103	15	14.6	7.8	21.4
Total	246	35	14.2	9.9	18.6

($\chi^2=1.12$, $P=0.571$)

those cattle with less than one year age (Table 4); nevertheless the variation in the prevalence among the age groups was not statistically significant ($P < 0.05$).

Hematological Findings: The mean PCV value of the infected animals was lower ($20.2\% \pm 3.0$) as compared to the mean PCV value of non-infected animals ($26.5\% \pm 5.1$) and there was statistically significant difference ($P < 0.05$) in the PCV values of infected and non-infected animals.

DISCUSSION

The overall prevalence of bovine trypanosomosis in the study area was 14.2% (95% CI, 9.9-18.6%) which is virtually similar with the result of Tewelde [18] at Keto settlement area of south western part of the country which is 15%. The present result is higher than the findings of Habtewold [19, 20] at Humbo Larena of Wolayita zone (9.3%) and Konso district (11.5%) respectively. The possible explanation to this difference could be that the Southern Valley Tsetse and Trypanosomosis Eradication (STEP) project practice is lacking in Bongota village which was one sampling area in Humbo district and this might have contributed to the higher prevalence of trypanosomosis in the present study. Daud and Molalegne [21] reported higher prevalence (24.7%) in Mao-komo special district of Benshangul Gumz regional state. This might be attributed to the differences in agroecology which favors tsetse flies.

Our result revealed that *T. congolense* was the predominant species (65.71%; 95% CI, 50.0-81.4%) in the study area. Closer results were reported by Muturi [22] at Meraba Abay, South Ethiopia (66.1%), Daud and Molalegne [21] at Mao-komo special district of Benshangul Gumz regional state (63.2%), Afework [2] at pawe, North West Ethiopia (60.9%) and Abebe and Jobre [24] for the tsetse infested area of Ethiopia (58.5%). Moreover the results of Tewelde *et al.* [25] at Kone (75%) and Village I (93%) settlement area of West Ethiopia, Woldeyes and Aboset [26] at Arba minch zuria wereda (85.2%) and Rawlands *et al.* [27] in the Ghibe Valley, South west Ethiopia (84%) had shown higher results than the present findings. These suggest that the major cyclical vectors or *Glossina* species are more efficient transmitters of *T. congolense* than *T. vivax* in east Africa [11]. According to Getachew Abebe [28], *T. congolense* and *T. vivax* are the most prevalent trypanosomes that infect cattle in tsetse infested and tsetse free areas of the Ethiopia respectively. The epidemiology of

trypanosomosis is determined mainly by the ecology of the tsetse fly, nevertheless the disease due to *T. vivax* is also based on the distribution of the mechanical vectors like *Tabanus* and *Stomoxys*. The density of tsetse population in the area and the level of their contact with the host, will determine the level of infection [29].

The prevalence of trypanosomosis infection was a bit higher in female animals (15%) than males (13.7%), though it was not statistically significant. This is in agreement with the findings of Molalegne *et al.* [30] and Daud and Molalegne [21]. The possible explanation for this slight difference might be associated with physiological variation between both sexes.

Age was assumed to be one of the risk factors in our study; accordingly, a higher infection rate was observed in adult animals and animals above one year of age in the study area. Similar results were reported by Daud and Molalegne [21] and Molalegne *et al.* [30]. This could be associated to the fact that older animals travel long distance for grazing and draught as well as harvesting crops in tsetse challenge areas. Rowlands *et al.* [31], in Ghibe Valley indicated that suckling calves don't go out with their dams but stay at home until they are weaned off. Besides, young animals are also naturally protected to some extent by maternal antibodies [32]. This could be the reason for lower prevalence of trypanosomosis that was observed in calves. *Trypanosoma congolense* is usually higher in adult animals than the young ones [33].

The prevalence of trypanosomosis in those animals with poor body condition were significantly higher ($P < 0.05$) than those in good body condition. This is in agreement with Molalegne *et al.* [30] and Daud and Molalegne [21] and Abiy [34]. 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 [35].

The mean PCV value of infected animals was found to be significantly lower ($20.2\% \pm 3.0$) as compared to the mean PCV value of non-infected animals ($26.5\% \pm 5.1$) which is similar to the results obtained by Molalegne *et al.* [30] and Daud and Molalegne [21], Haile [36]; SVRL [37] and Cherinet *et al.* [38]. Taking the PCV value 24-46% as normal for zebu cattle [39], 70% of the parasitemic and 40% aparasitemic animals have registered PCV values less than 24%. The resulting low PCV value may not solely be

due to trypanosomosis; however, the difference in mean PCV between parasitaemic and aparasitaemic animals indicates that trypanosomosis reduces the PCV values in infected animals. These might be exacerbated by other diseases that are considered to reduce the PCV values in infected animals in the study area such as helminthiasis, tick borne diseases and nutritional imbalances. This suggest that even anaemia is characteristic of trypanosomosis, other factors can also cause reduced PCV, yet some trypanosome infected animals can also keep their PCV within the normal range for a certain period of time. So, diagnosing of trypanosomosis on the basis of PCV is not accurate.

CONCLUSIONS AND RECOMMENDATIONS

The major species of trypanosomes in the study area were *T. congolense* followed by *T. vivax*. According to the host risk factors, the prevalence of bovine trypanosomosis was higher in males than in females, in older cattle than in younger and it was the highest in those animals with poor body condition. In general, bovine trypanosomosis is economically important disease that affects the health as well as productivity of cattle in Humbo district. Hence, appropriate disease prevention and control methods should be undertaken so as to improve livestock production and agricultural development in the area.

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