

The Prevalence of Bovine Trypanosomiasis in JabiTehnan District of Amhara Regional State, Ethiopia



Melak Wondie¹ and Tewodros Alemneh^{2*}

¹Woreta Town Office of Agriculture and Environmental Protection, Ethiopia

²University of Gondar, Ethiopia

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*Corresponding author: Tewodros Alemneh: Faculty of Veterinary Medicine, University of Gondar, Ethiopia, Tel: 251-920- 499-820; Email: tedyshow@gmail.com

Abstract

Cross sectional study was conducted in Jabi Tehnan District of West Gojjam Administrative Zone of Amhara Regional State, Ethiopia to determine the prevalence of bovine trypanosomiasis. In the parasitological survey, blood samples of 164 cattle were examined using a buffy coat technique. The Packed Cell Volume (PCV) value of each animal was also measured using hematocrit reader. The overall prevalence of trypanosomiasis was found to be 15.24% and it consists of 9.76% and 20.73% in Adankegne and Ergib peasants' association, respectively ($X^2=5.783$, $p=0.056$). The most positive cases were due to *Trypanosoma congolense* (*T. congolense*) (80%) followed by *Trypanosoma vivax* (*T. vivax*) (20%). The mean(PCV) values of parasitaemic and aparasitaemic animals during the study period were 20.75% and 25.07%, respectively. The variation in mean PCV values were statistically significant ($p=0.01$). The study also demonstrated statistically significant ($X^2=13.886$, $p=0.001$) variations in prevalence between sexes of cattle, which were 10.67% and 19.1% in female and male animals, respectively. The present prevalent study generated valuable information on the epidemiology of bovine trypanosomiasis in the study area and revealed that trypanosomiasis was an important disease affecting the livestock production.

Keywords: PCV; Prevalence; *Trypanosoma congolense*; *Trypanosoma vivax*; Bovine

Introduction

Livestock is backbone of the socio-economic system of most of the rural communities of Africa [1]. Ethiopia is known for its large and diverse livestock resource endowments. Livestock is primarily kept on small holdings where it provides drought power for crop production, manure for soil fertility and fuels, serves as a sources of family diet and sources of cash income (from sale of livestock and livestock products). Despite large livestock population, Ethiopia fails to optimally utilize this resource due to different constrains facing the livestock subsector. Shortage of nutrition, reproductive insufficiency, management constraints and animal disease are the major constraints [2]. One of the diseases hampering the livestock subsector is trypanosomiasis [3]. Trypanosomiasis is a complex disease of protozoa that is caused by different species of unicellular parasites (trypanosome) found in the blood and other tissues of vertebrates, including livestock, wild life and people [4]. Trypanosomiasis limited to the extension of natural herds particularly in Africa were the presence of the tsetse fly density access to woodland and savanna areas with good grazing potential [3]. It is a serious constraint to agricultural production in extensive areas of the tsetse infested regions which accounts over 10 million squares of the tropical Africa [5].

Ethiopia is one of the countries suffering from the impact of trypanosomiasis. In Ethiopia, it is estimated that some 10 to 14 million heads of cattle and an equivalent number of small ruminants together with a significant number of equines and camels, are exposed to the risk of trypanosomiasis [6]. Six species of trypanosomes are recorded in Ethiopia and the most important trypanosomes in terms of economic loss in domestic livestock are the tsetse transmitted species *T. congolense*, *T. vivax* and *T. brucei* [3].

Tsetse flies in Ethiopia are confined to western and south-western parts of the country between 33°C and 38°C E longitude and 5°C and 12°C N latitude. It is estimated to cover an area of 140,000, 220,000 km² [7]. Tsetse infested areas follow the major river systems; namely, Abay (Blue Nile), Baro, Akobo, Didessa, Ghibe and Omo river systems [8]. Five species of *Glossina* (*Glossina morsitans submorsitans*, *G. pallidipes*, *G. tachinozdes*, *G. fuscipes* and *G. longipennis*) have been recorded in Ethiopia [3]. According to National Tsetse and Trypanosomiasis Investigation and Control Center [7], tsetse transmitted animal trypanosomiasis still remains as one of the largest causes of livestock production losses in Ethiopia. The effects of trypanosomiasis is not only the direct losses resulting from mortality, morbidity, infertility of the

infested 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. Annual estimated losses for Ethiopia as a result of trypanosomiasis is roughly \$200 million, in terms of mortality and morbidity losses in livestock (excluding utilization of fertile land for crop and livestock production) and the costs included in controlling the disease [9].

The most prevalent trypanosome species in tsetse infested areas of Ethiopia are *T. congolense* and *T. vivax*. Rowlands et al. [10] reported a prevalence of 37% for *T. congolense* in South-eastern Ethiopia. Abebe and Jobre [11] reported an infection rate of 58% for *T. congolense*, 31.2% for *T. vivax* and 3.5% for *T. brucei* in Southern Ethiopia. In the same report it is also indicated that 8.71% infection rate was recorded in the highlands (tsetse free areas) of which 99% is due to *T. vivax*. Different workers [12-14] indicated a prevalence of 17.2%, 21% and 12% in Metekel district, in upper Didesa Valley and Southern Rift valley areas of tsetse transmitted regions, respectively, and the dominant species was *T. congolense*.

In the western part of Amhara Regional State bordering the Abay river basin, one of the north western tsetse belt areas of Ethiopia, tsetse transmitted trypanosomes are becoming a serious threat for livestock production and agricultural activity in particular. Reports made by the Regional Veterinary Laboratory in 1999 indicated the presence of tsetse fly transmitted

trypanosomiasis in three districts of the region (Bure, Jabi Tehnan, and Ankesha) bordering the Abay valley areas. A preliminary survey conducted in Demebecha district by the Ethiopian Science and Technology Commission and West Gojjam Veterinary Office in 2001 indicated a trypanosome infection rate of 23% with a dominant species of *T. congolense* and tsetse fly identified was *G. morsitans*. Therefore, this study was undertaken to determine the prevalence of bovine trypanosomiasis, to identify the dominant species of trypanosomes involved, and to assess the PCV values of cattle in relation to the risk factors associated with the disease.

Materials and Methods

Study area

The study was conducted in Jabi Tehnan district of west Gojjam Administrative Zone of Amhara Regional State. The district covers an area of 112,772.1 ha and bordered by Quarit and Dega Damot in East, Burie in West, Sekela in North, and Demebecha and Abay River in the South. The annual mean temperature for most part of the district is 14-32°C and the elevation varies from 1500-2300 mm above sea level (m a. s. l) with mean annual rain fall of 1250mm. The livestock populations that are found in Jabi Tehnan district include cattle, sheep, goats, horses, mule, donkey and poultry. Among these animals, cattle are the dominant species raised in the area. The cattle population in the district is estimated to be about 187,481 [15] (Figure 1).

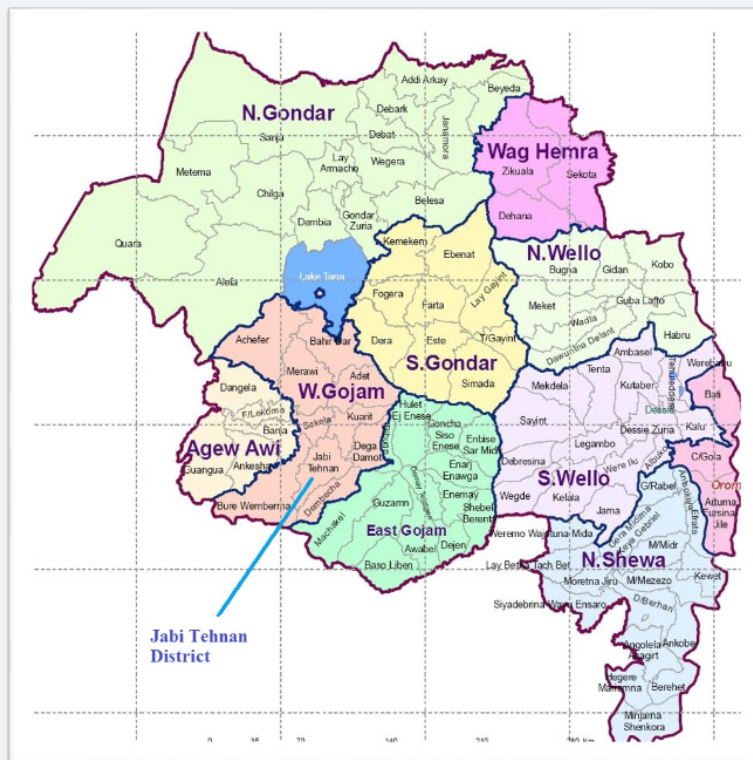


Figure 1: The arrow in the left shows the location of the study area within the Map of Amhara Regional State of Ethiopia. Adopted from [16].

Study animals

The study was conducted on local Zebu cattle. These animals were raised in different villages of Adankegne and Ergib of Jabi Tehnan district. The animals examined in this particular study were representing different Kebeles. Sex and body conditions of cattle were also being recorded accordingly.

Study design

The retrospective data of cross sectional survey was conducted to determine the prevalence of bovine trypanosomosis. The two sites were selected based on their higher prevalence of trypanosomosis than any other Kebeles of Jabi Tehnan district.

Sample size and sampling methods

The sample size was calculated using previous prevalence of 11.7% by [17] and desired absolute precision of 5% as per the standard procedure described by Thrusfield [18] shown below. An estimated minimum sample size of 159 cattle was obtained; however, we were able to examine 164 cattle for our study.

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

Where, n = required sample size; P_{exp} = expected prevalence; d = desired absolute precision

Study Method and Procedure

Buffy coat technique

Blood was collected from an ear vein using heparinized micro-hematocrit capillary tube and the tube was sealed. A heparinized capillary tube containing blood was centrifuged for 5 minutes at 12,000rpm. 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 on to slide, homogenized on to a clean glass slide and covered with cover slip. The slide was examined under x40 objectives and x10 eye piece for the movement of parasite [19].

Measuring of packed cell volume (PCV)

Blood samples were obtained by puncturing the marginal ear vein with a lancet and collected directly into a capillary tube. The capillary tubes were placed in micro-hematocrit centrifuge with sealed end outer most. The tube was loaded symmetrically to ensure good balance. After screwing the rotary cover and closing the centrifuge lid, the specimens were allowed to revolve at 12,00rpm for 5 minutes [4,20]. Tubes were then placed in hematocrit and the readings were expressed as a percentage of packed red cells to the total volume of whole blood. Animals with PCV ≤ 24% were considered to be anemic [21].

Data analysis

Row data on individual animals and parasitological examination results were inserted into MS Excel spread sheets to create a data-base. Students t-test were employed to compare between the two-independent mean PCV values of animals from an individual site (peasant's association). Chi-square test was also employed to assess the association between the risk factors and the disease. While analyzing data, p-values (p)<0.05 were registered as statistically significant. Otherwise, recorded as insignificant.

Results

Prevalence

Table 1: Prevalence of cattle Trypanosomes in selected areas of Jabi Tehnan district.

Study Area (Site)	Total Examined	Positive	Prevalence (%)	<i>T. vivax</i> (%)	<i>T. congolense</i> (%)
Adankegne	82	8	9.76	3 (37.5)	5 (62.5)
Ergib	82	17	20.73	2 (11.76)	15 (88.24)
Total	164	25	15.24%	5 (20%)	20 (80%)

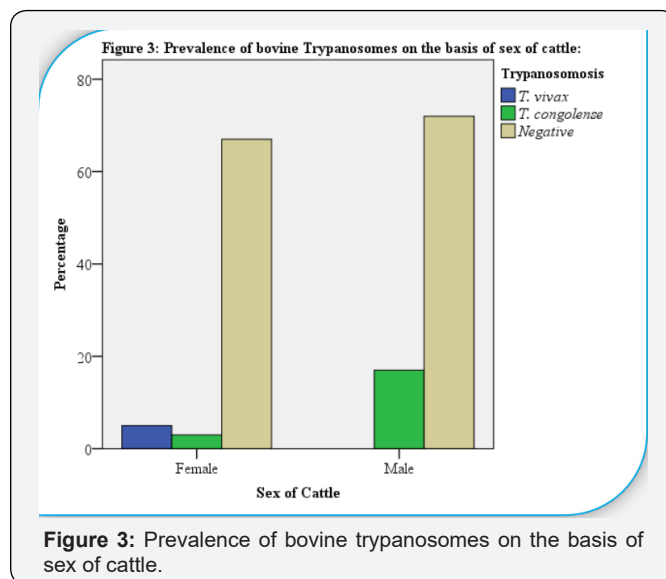
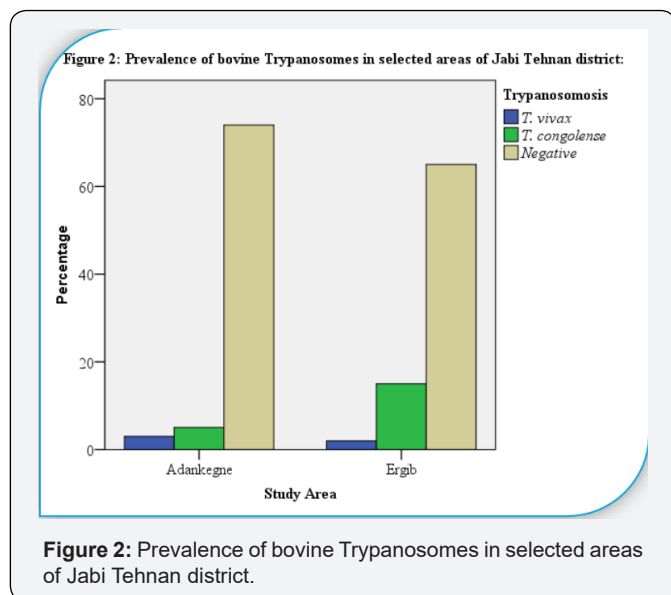
Table 2: Prevalence of bovine Trypanosomes on the basis of sex of cattle.

Study Area (Site)	Sex	Total Examined	Positive	Prevalence (%)	<i>T. vivax</i> (%)	<i>T. congolense</i> (%)
Adankegne	Female	42	3	7.14	3 (100)	-
	Male	40	5	12.5	-	5 (100)
Ergib	Female	33	5	15.15	2 (40)	3 (60)
	Male	49	12	24.49	-	12 (100)
Total		164	25	15.24%	5 (20%)	20 (80%)

Out of the total 164 (75 females and 89 males) cattle examined, 25 (15.24%) were found positive to trypanosomosis. The prevalence varied between different study areas, in which 9.76% (n = 8) and 20.73% (n = 17) were recorded at Adankegne and Ergib peasant's association, respectively. The variation in the

prevalence of bovine trypanosomosis between the study sites were not statistically significant (X²= 5.783; p = 0.056) (Table 1 and Figure 2). The most prevalent trypanosome species in the study area was *T. congolense* (80%) followed by *T. vivax*(20%) (Table 1 and Figure 2). The prevalence of bovine trypanosomosis

showed statistically significance difference between sexes of cattle, in which, higher in male animals (19.1%) as compared to females (10.67%) ($X^2 = 13.886$; $p = 0.001$) (Table 2 and Figure 3).



Hematological findings

The mean PCV values of cattle between parasitaemic and aparasitaemic animals were statistically significant ($p < 0.05$) and showed variation from 20.75% to 25.07%, respectively (Table 3).

Table 3: The Mean PCV comparison of parasitaemic and aparasitaemic cattle at Jabi Tehnan district.

Risk Factors	Sample Size	Mean PCV	95% CI	Std. dev.	df	t-value	P-value
Parasitaemic	12	20.75%	[6.42,7.87]	0.989	6	8.069	0.01
Aparasitaemic	152	25.07%	[8.09,8.42]	1.601	152	40.316	
Total 164							

Discussion

The study revealed that the prevalence of bovine trypanosomosis in the area was 15.24% (25/164) which was higher compared with the previous findings of Bitew et al. [17] in the same area (11.7%). The difference in prevalence might be due the site from which the blood samples were collected. However, there were tsetse control intervention, and continuous treatment of sick animals as well as deforestation for the cultivation of land. These activities could have led to the reduction of tsetse fly population along with the decline of tsetse borne trypanosomosis in the study area. But the continuous and longtime utilization of trypanocidal drugs particularly Diminazin aceturate in the study area contribute for the development of drug resistance, so that the prevalence of trypanosomosis was higher than the previous finding due to the above reasons.

In this study, two species of trypanosomes; namely, *T. congolense* and *T. vivax* were retrieved from inspected cattle. Majority of infections were also due to *T. congolense*. The higher proportion of *T. congolense* infection in the study area was in agreement with trypanosome species prevalence data from other tsetse infested region of Ethiopia where *T. congolense* is the most prevalent species in cattle [11]. In the same report it was also indicated that in tsetse free area of highlands, 99% of prevalence was due to *T. vivax* [12-14]. But in this study area, the

prevalence of *T. vivax* was less than *T. congolense* in both peasant associations because the two sites are located adjacent to tsetse infested belts. Leak [22] and Degneh et al. [23] also indicated that *T. vivax* was highly susceptible to treatment while the problems of drug resistance were higher in *T. congolense*.

In the current study, higher infection rate of trypanosomosis was detected in males (19.1%) as compared to in female cattle (10.67%) with statistically significant difference ($X^2 = 13.886$; $p = 0.001$). Different researchers work supported this finding [22-25]. Although the variation was not statistically significant, Yalew and Fantahun [26], and Teferi and Biniam [27] had also reported higher prevalence of bovine trypanosomes in males than in females ($X^2 = 0.85$, $p = 0.35$ and $X^2 = 0.10$, $p > 0.05$, respectively). According to Gemtessa and Dera [28], the higher prevalence of trypanosomes in males rather than in females might be related to the hardworking of male animals. Similarly, the variation in the prevalence between the two sexes might also be associated with that male animals travel longer distances to tsetse abundant areas for draught and ploughing purposes, and the journey creates stress leading to susceptibility to the infection [23,]. In contrast to this study, Kitila et al. [30] at Yayo District Illuababora Zone of Western Oromia and Tamirat et al. [31] at Enemorena Ener Woreda of Gurage Zone were found higher prevalence of bovine trypanosomosis in female cattle than males.

Comparing the mean PCV values of cattle, significantly ($p=0.01$) low PCV was recorded in parasitaemic animals (25.07%) (SD = 0.989; df = 6; t-value = 8.069) than in aparasitaemic animals (20.75%) (SD = 1.601; df = 152; t-value = 40.316). This finding was in line with previous works conducted at different regions of Ethiopia by many authors [22,25]. In the absence of other diseases causing anemia, a low PCV value of individual animals is a good indicator of trypanosome infection [23,32]. Trypanosomiasis might adversely lower the PCV values of infected animals [33]. A survey conducted in cattle in Hawagelan District of West Wellega Zone [34] revealed that the mean PCV of trypanosome infected animals was significantly lower ($20.8\pm 3.2\%$) compared to non-infected animals ($24.9\pm 3.8\%$). A later study in Northwest Ethiopia [35] in cattle experimentally infected with *T. vivax* isolates also showed that the mean PCV, Hb and total RBC count were lower ($p < 0.001$) in all infected groups than in non-infected control animals. In Nigeria, domestic ruminants that were naturally infected with trypanosomes had significantly lower ($p < 0.05$) PCV and RBC counts compared to uninfected animals [36]. Lower herd average PCVs for trypanosome-positive cattle compared to trypanosome-negative cattle have also been reported from Ghana [37], Zambia [32], Cameroon [38] and Gabon [39].

In spite of the fact that trypanosome infection has significant association with risk factors such as age and body condition scoring, as reported by many scholars, this study had not demonstrated and regarded as limitations.

Conclusion

From this study it is possible to conclude that trypanosomiasis is an important disease and a potential threat affecting the health and productivity of cattle. The major species of trypanosomes in the study area were *T. congolense* and *T. vivax*. To sum up, infection with trypanosomiasis negatively affects PCV and body condition of animals. This indicated that trypanosome infection of cattle causes loss of body weight and production. Trypanosomiasis control measures should be targeted on tsetse fly destruction and control methods such as pour-on and effective trypanocidal drug applications. Similarly, rearing or raising of trypanosomiasis resistance cattle breeds is now a day in practical. Otherwise, the problems will increase through the aide of global warming. In conclusion, further study on the occurrence of tsetse and trypanosomiasis at different season of the year at different altitudes and species of animals should be conducted.

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Conflict of Interest

Authors declare that no competing of interests in the publication of this work.

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