

Bovine Trypanosomosis in three districts of East Gojjam Zone bordering the Blue Nile River in Ethiopia

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Abstract

Background: Bovine trypanosomosis is a serious constraint to agricultural production in extensive areas of Ethiopia.

Methodology: A cross-sectional study was conducted to determine the prevalence of bovine infection with trypanosomes and to identify the prevailed trypanosome species in three districts of the East Gojjam zone bordering the Blue Nile River from March 2005 to February 2006. Cattle from 9 different localities were checked using microscopical examination of wet blood smears, thin and stained bloodsmears, and by blood centrifugation followed by the examination of the resultant buffy coats.

Result: Of the total 3,360 cattle investigated, 8.2% (3.5%, 11.6% and 9.4% from Dejen, Machakel and Baso-Liben districts respectively) were found to be infected with trypanosomes. Of the total 275 positive animals, 249 (90.5%) appeared to be infected with *Trypanosoma vivax*; 11 (4%) were infected with *T. congolense*; and 15 (5.5%) were infected with mixed infection of *T. vivax* and *T. congolense*. The prevalence of infection with *T. vivax* was significantly higher than that of *T. congolense* ($P < 0.001$). Taking 24-46% as normal PCV value, the mean PCV for the trypanosome-infected cattle (22.09%) was lower than those for the trypanosome-negative animals (26.03).

Conclusion: Trypanosomosis is a disease of considerable importance to the major economic districts bordering the Blue Nile River of the East Gojjam zone, Ethiopia, given the disease's potential to threaten the health and productivity of cattle in this region.

Key Words: Bovine; Trypanosomosis; East Gojjam; Blue Nile River; Ethiopia.

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Introduction

Bovine trypanosomosis is a serious constraint to agricultural production in extensive areas of the tsetse-infested Ethiopian lowlands. As a result of the trypanosomosis threat, a large proportion of the livestock population is found in the highlands that are assumed to be tsetse-free [1]. Although livestock trypanosomosis is a well-known constraint to livestock production in Ethiopia, little attention has been paid to the trypanosomosis situation in the Amhara Region in general and the East Gojjam zone in particular. Nevertheless, livestock are the backbone of the rural economy in this region where approximately one-third of Ethiopia's cattle, sheep and goat population is found. To clarify the trypanosomosis situation a survey was conducted to determine the prevalence and the seasonal changes of trypanosome infections in cattle in three districts bordering Blue Nile River in the East Gojjam zone, Ethiopia.

Materials and Methods

Study areas

The study areas were located in the Amhara Region of the East Gojjam zone, each an average of 300 kilometers northwest of the capital city, Addis Ababa. The elevation varies in these areas from about 700 to 2,500 meters above sea level. The climate in the study areas can be divided into three distinct seasons: a short rainy season or "belg" between late February and early May; a longer, more reliable rainy season or "kiremt" from June to September; and dry season or "bega" from October to May.

The study areas are densely populated with an estimated average human population density of about 100 persons per km². More than 90% of the population lives in rural areas and practice mixed farming, i.e., subsistence, rain-fed cropping combined with keeping of livestock. Livestock are the backbone of the rural economy in this region

where approximately one-third of Ethiopia's cattle, sheep, and goat population is found [2].

Samples were collected from cattle from the Dejen, Machakel, and Baso-liben districts of the East Gojjam zone bordering the Blue Nile River; each of these districts is located on the edge of the tsetsebelt (Figure 1). Chemotherapy is the only trypanosomosis control method used in the study areas. Veterinary supervision is inadequate, which may lead to the inappropriate use of drugs or use of drugs of substandard quality.

Figure 1. Map of Ethiopia indicating study sites.



Sample selection

A total of 3,360 cattle were selected with 1,120 from each study district. The cattle from all study districts were indigenous zebu. Three villages were identified in each district and visited at 4-month intervals in each season for one year. During each sampling, about 125 heads of communal cattle were selected in each village (3 villages/district) using a multistage random sampling technique [3].

Sampling and Diagnostic methods

The parasitological diagnostic tests used were those described by Paris *et al.* [4]. In brief, blood was collected from an ear vein into heparinized microhaematocrit centrifuge capillary tubes and transferred onto glass slides in order to make thick and thin blood smears. Each capillary tube was filled to its last third and sealed with a crystal seal at one end and centrifuged immediately in a microhaematocrit centrifuge for 5 minutes at 1500

rpm. After centrifugation, the packed cell volume (PCV) was determined. Animals with a PCV \leq 24% were considered to be anaemic. The buffy coat and the uppermost layer of red blood cells in each specimen were extracted, placed onto a microscope slide and examined under a phase contrast microscope with a x 40 objective lens for the presence of motile trypanosomes. The thick and thin blood smears were stained with Giemsa and examined under a light microscope using a x 100 oil immersion objective lens.

At the time of sampling, the owner, age, sex, and body condition of each animal were recorded. The body condition was scored using the method described by Nicholson and Butterworth [5].

Statistical analyses

Statistical analyses were conducted in Stata 7 (StataCorp. 2001). The seasonal variation and the prevailed species in the area were compared using Chi Square test and the PCV data were compared using the student t test.

Results

A total of 3,360 cattle were sampled. A total of 275 animals were found to be infected with trypanosomes. The average parasitological prevalence was 8.2% (95%CI, 7.25-9.11%) and the prevalence in each district was 3.5% (95% CI, 2.4-4.5), 11.6% (95%CI, 9.7-13.5) and 9.4% (95%CI, 7.7-11.2%) in the Dejen, Machakel, and Baso-Liben districts respectively.

The majority of infected animals 249 (90.5%) were infected with *T. vivax*. A total of 11 (4%) animals were infected only with *T. congolense* and the remainder 15 (5.5%) were co-infected with *T. congolense* and *T. vivax*. *T. brucei* was not detected in the study area (Table 1).

Table 1. Relative proportion of different trypanosome species at different study sites.

Districts	Positive cases	% positive	<i>T. vivax</i>	<i>T. congolense</i>	<i>T. congolense</i> and <i>T. vivax</i>	<i>T. brucei</i>
Dejen	39	3.5	39	-	-	-
Machakel	130	11.6	113	8	9	-
Baso-Liben	106	9.4	97	3	6	-
Total	275	8.2	249	11	15	-

The parasitological prevalence of trypanosomosis differed significantly between seasons ($P < 0.01$) with a higher prevalence of 12.4% (95%CI, 10.5-14.3%) during the early dry season (October-January) and lower prevalence 4.5% (95%CI, 3.3-5.7%) during late dry season (February-May) (Figure 2).

The prevalence of trypanosome infections did not differ between age categories ($P > 0.05$), sexes ($P > 0.05$) or coat colour ($P > 0.05$) (Table 2). The average PCV of the animals infected with trypanosomes was $22.09 \pm 3.9\%$. It was significantly lower ($P < 0.001$) than the average PCV of the animals that were parasitologically negative ($26 \pm 4.9\%$) (Figure 3).

Table 2. Bovine Trypanosomosis on age, sex and coat colour basis.

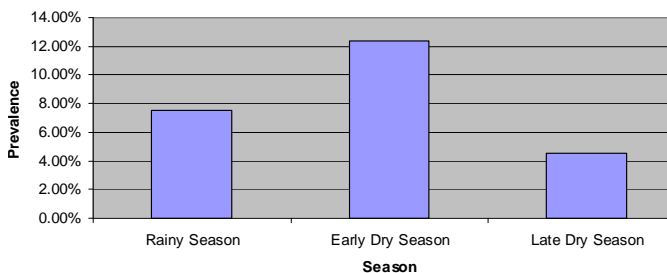
Status	Sex	
	Male	Female
Positive	151	124
Negative	1267	1818

Status	Age (Years)		
	<3	3-9	>9
Positive	60	179	36
Negative	596	2047	442

Status	Coat Colour		
	Black	Red	White
Positive	103	137	35
Negative	1095	1606	384

$P > 0.01$

Figure 2. Prevalence of Bovine Trypanosomosis on seasonal basis.



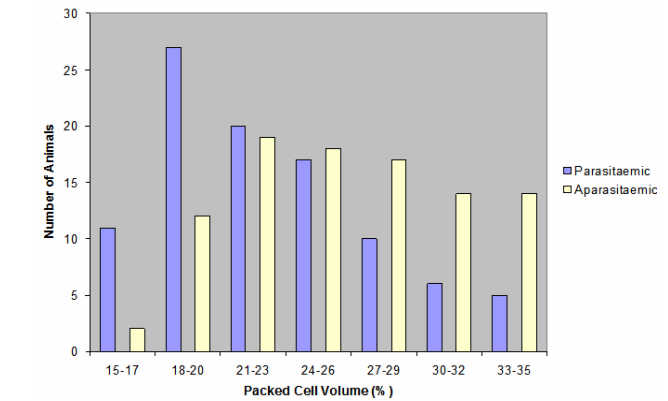
$P < 0.01$

Discussion

The results of the present study disclose that trypanosomosis is a major disease of cattle in the areas bordering the Blue Nile River of East Gojjam zone with an overall infection rate of 8.2%. Taking into account the low sensitivity of the parasitological diagnostic methods and the uncontrolled use of trypanocidal drugs, the real

prevalence of infection is probably substantially higher.

Figure 3. Packed Cell Volume (PCV) of infected and non infected animals.



$P < 0.01$

The average prevalence of trypanosome infections was comparable to the one observed by Abebe and Jobre [6] in the Gojjam and Gonder highlands.

Morphological identification of the species of trypanosomes involved in the study area was *T. vivax* and *T. congolense*. Infection due to *T. brucei* was not noted in this study; however, it is important to note that *T. brucei* are capable of invading extra vascular tissue and accumulate in loose connective tissue, which makes their detection in blood films difficult [7].

T. vivax was the predominant species identified in this study with a relative proportion of 90.5%, *T. congolense* 4%, while the remaining 5.5% were *T. vivax* and *T. congolense* mixed infection. This is attributed to the fact that as distance from the known tsetse infestation increases, *T. vivax* becomes more frequent and eventually predominates [8]. The findings of Langridge support of this conclusion: his tsetse and trypanosomosis survey of Gojjam province determined that of 600 cattle examined at Finoteselam, a neighbouring district to the present study area, 68 (11.3%) were positive for trypanosomosis, among which only 4 (5.8%) were due to *T. congolense* while the remaining 64 (94.2%) were due to *T. vivax* infections [9].

Even though no information was available on the presence of tsetse flies in the study area, the geographical location of the study site in relation to the Blue Nile River where *Glossina morsitans submorsitans* and *Glossina tachinoides* are

present [9] strongly supports the possible advancement of the fly and the trypanosome *T. congolense*. An epidemiologically important observation in this study is the infection of animals with the tsetse-transmitted trypanosome, *T. congolense*. The localities mentioned above are found near the Blue Nile River; therefore, it is very likely that tsetse flies migrate uplands, from their original habitat, following the river courses. The movement of tsetse away from their prime habitat when climatic conditions are not favorable in the surrounding areas has been described before [10]. Furthermore, the uncontrolled movement of cattle from neighboring areas of the West Gojjam with confirmed cases of *T. congolense* and *T. vivax* and from East Wollega (an area in the tsetse fly belt) may have contributed to the occurrence of *T. congolense* and for the maintenance of *T. vivax*.

In our study sites, the prevalence of trypanosome infections increased substantially (12.4%) during the early dry season (October-January). In the rainy season (June-September) and in late dry season (February-May), the prevalence of the disease was 7.5% and 4.5%. In support of this, Sinshaw and his colleagues [11] revealed that reproduction and development of biting flies is best suited to the climatic conditions prevalent during the heavy rainy seasons. This consequently leads to a high density of biting flies after the end of the heavy rainy seasons, thereby increasing the rate of spread of the disease.

PCV is the most reliable indicator of anaemia in Trypanosomosis [12,13]. Our observation that trypanosome infections result in a significant decline in PCV is in agreement with previous findings [14,15] which reported that Trypanosomosis caused depressed PCV levels in infected animals. Other factors such as malnutrition or other diseases may also affect the PCV and body condition. However, it is unlikely that the impact of those additional factors differs greatly between the parasitologically positive and negative animals. Hence, relative comparisons between the PCV and body conditions score of parasitological positive and negative animals can be made. From the present study it can thus be concluded that trypanosomosis is a major disease and a potential threat in affecting the health and productivity of cattle in the economically important districts of the East Gojjam zone, Ethiopia, bordering the Blue Nile River.

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Conflict of interests: The authors declare that they have no conflict of interests.