Epidemiology of Bovine Trypanosomosis in the Abay (Blue Nile) Basin Areas of Northwest Ethiopia

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Keywords

Cattle – *Glossina morsitans submorsitans* – Trypanosomosis – Epidemiology – Site factor – Altitude – Seasonal variation – Ethiopia.

Summary

The study was conducted between September 2003 and April 2004 in Denbecha and Jabitehenan *weredas* (districts) located in the lowland (< 1600 m) and midland (1600-2000 m) areas. It generated a baseline data on the epidemiology of trypanosomosis and community awareness regarding the disease in the Abay (Blue Nile) Basin areas of Northwest Ethiopia. A questionnaire survey revealed trypanosomosis to be the most important problem affecting animals and impeding agricultural activities in the areas. *Glossina morsitans submorsitans* was the only tsetse fly species prevalent along with other biting tabanid and muscid flies. The apparent fly densities (flies/trap/day) were significantly higher ($p < 0.05$) in the late rainy season (1.08, 8.78 and 91 for *G. m. submorsitans*, tabanids and muscids, respectively) than in the dry season (0.68, 0.35 and 7.33, respectively). The apparent density of *G. m. submorsitans* was significantly higher ($p < 0.05$) in the lowland areas than in the midland areas in both the late rainy season and the dry season. A total of 1648 cattle were examined for trypanosomosis with the buffy coat technique and the seasonal prevalence (17.07 and 12.35%, respectively) was significantly ($p < 0.05$) different. Infection rates were higher ($p < 0.05$) in the lowland areas, with 19.87 and 17.62%, than in the midland areas, with 13.39 and 6.54%, in the late rainy season and the dry season, respectively. The mean packed cell volume (PCV) values of parasitemic and aparasitemic animals during the late rainy season were 20.7 ± 3.5 and 26.6 ± 4.3 ($p < 0.001$), while they were 21.4 ± 3.6 and 26.6 ± 4.3 ($p < 0.001$) during the dry season, respectively. The regression analysis indicated that the herd average PCV decreased with the increasing prevalence of trypanosome infections in both seasons.

■ INTRODUCTION

Tsetse-transmitted trypanosomosis is a serious constraint to livestock production and agricultural development in Ethiopia. A total of 14.8 million cattle, 6.12 million sheep and goats, 1 million camels and 1.23 million equines are at risk of contracting trypanosomosis (17). Due to the advancement of tsetse flies into formerly free areas, an estimated 220,000 km^2 zone is presently affected by tsetse flies (26). These areas are located in the Baro/Akobo, Omo/Ghibe and Abay/Didessa Valleys along the large rivers of the country. They have the most arable soils with a high potential for agricultural development due to high annual rainfall (9). There are five economically important animal trypanosome species in Ethiopia: *Trypanosoma congolense, T. vivax, T. brucei brucei, T. evansi* (11) and *T. equiperdum* (6). The most prevalent trypanosome species in tsetse-infested areas of Ethiopia are *T. congolense* and *T. vivax*. Rowlands et al. (29) reported a prevalence of 37% for

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T. congolense in cattle in tsetse-infested Southwest Ethiopia. Abebe and Jobre (1) reported an infection rate of 58.5% for *T. congolense*, 31.2% for *T. vivax* and 3.5% for *T. brucei* in Southwest Ethiopia. In tsetse infested regions, different workers (2, 24, 34) indicated a prevalence of 17.2, 21 and 14% bovine trypanosomosis in the Southern Rift Valley, Metekel district, and Upper Didessa Valley, respectively, and the dominant species was *T. congolense.*

Disease surveys are lacking for the Abay Basin areas of Northwest Ethiopia. The knowledge of insect biology and ecology, and the status of the disease prevalence are very important for the control of tsetse transmitted trypanosomosis (12). The aims of the present study were to determine the seasonal prevalence of trypanosomosis, the apparent density, the distribution and the vector species, and to assess the community awareness regarding the effects of trypanosomosis and control methods.

■ MATERIALS AND METHODS

Study areas

The study was conducted in eight peasant associations of Denbecha and Jabitehenan *weredas* (districts) of the West Gojjam zone (10° 30' N and 37° 29' E) in Amhara Regional State of Northwest Ethiopia (Figure 1). The climatic conditions alternate between a long summer rainfall season (June-September) and a winter dry season (December-March), with a mean annual rainfall of 1200–1600 mm. The mean temperature is between 10 and 20°C and the altitude ranges from 1400 to 2300 m. Temechan and Bir tributaries in the West Gojjam zone join together before entering the main river (Abay) bordering the study sites. Ponds and marshes were also found in the lowland areas of the present study. The five different vegetation types, namely savannah, grassland, forest, riverine, and bushland, along with the recently expanded cultivated lands, are found. These vegetation types are mainly found in areas below 1700 m, whereas above this altitude the land is occupied by cultivated lands and small areas are left for grazing purposes.

Study design

The study was based on a questionnaire, and entomological and parasitological surveys. It was an epidemiological cross-sectional study covering two *weredas* in lowland (below 1600 m) and midland (1600–2000 m) areas during the two seasons of the year, i.e. the late rainy season (just after the main rainy season from September to November) and the dry season (December to March).

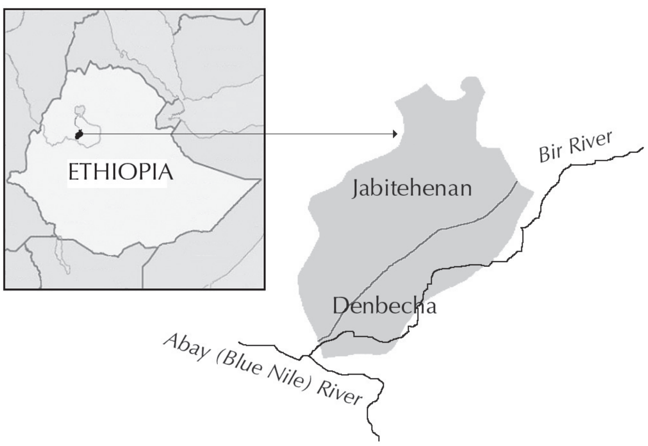

Figure 1: *Map of Ethiopia and the study districts (Denbecha and Jabitehenan).*

Questionnaire survey

To assess the perception of farmers on the occurrence of tsetse and trypanosomosis, livestock production constraints, socioeconomic status, herd composition and control methods of trypanosomosis, a questionnaire survey was undertaken. A total of 80 farmers selected randomly were interviewed in the study areas.

Entomological survey

The apparent density of tsetse flies and other biting flies in relation to season, altitude, trap and vegetation types were studied at selected sites of the areas. The apparent density was determined based on the mean catches in the traps deployed and expressed as the number of fly catch per trap per day (14). Entomological data were collected in both seasons. The flies were caught with monoconical, biconical, or NGU traps, baited with acetone and three-week-old cow urine (4). A total of 142 traps, 70 in the late rainy season and 72 in the dry season were deployed just before sunrise and kept in position for 72 h. The species of tsetse flies were identified based on morphological characteristics (8, 11, 13), and those of other biting flies according to their morphological characteristics such as size, color, wing venation structure, and proboscis at the genus level (37).

Parasitological survey

To determine the seasonal prevalence of trypanosomosis and to assess the risk factors associated with the disease, cattle blood samples were examined once during both seasons. The study animals constituted about 600 herds of 30,000 cattle in the study areas. The sampling strategy was a cluster sampling method (16) and herds were considered as clusters. The herd (locally called *Sheha* or *Akata*) is defined as a group of cattle owned by people living together in a village, whose animals share the same barn at night and the same grazing area and watering points. The sample size was determined based on the expected prevalence rate of 20% and absolute desired precision of 4% at confidence level of 95%. So the optimum sample size for this study was about 800, and 814 samples from 19 herds and 834 samples from 18 herds were taken during the late rainy season and during the dry season, respectively.

Blood samples were obtained from the ear vein of each animal using two hematocrit capillary tubes. They were examined for the presence of trypanosomes by the dark ground buffy coat technique (21, 27) and anemia was estimated by the packed cell volume (PCV) (38). Confirmation of trypanosome species was done using morphological characteristics (20). During sampling, age, sex, herd number and altitude of the settlement were recorded. The age was categorized into three groups (< 1 year, 1-3 years and > 3 years).

Data analysis

Stata version 7.0 software was used for the analysis and interpretation of the data (33). The apparent fly catches in relation to variables measured (season, altitude level, vegetation and trap types) were analyzed using the Kruskal-Wallis test. The prevalence of trypanosomosis in different variables (altitude level, season, sex and age) was compared with the chi^2-test. A multivariate computation was conducted by a logistic regression analysis in order to establish the effects of different risk factors (age, sex, altitude and season) compared with the odds ratio. Student's t-test and ANOVA were used to compare the mean PCVs of parasitemic and aparasitemic animals, and the effect of altitude on PCV values in both seasons. The relationship between herd prevalence of trypanosome infections and herd average PCV was examined by a regression analysis using the herd average PCV as the dependent variable, and the prevalence of trypanosome infections in a herd as the independent variable.

■ RESULTS

Questionnaire survey

Twenty percent of the respondents settled in the areas during the 1940s, 40% during the 1960s, 20% during the 1970s, 15% during the 1980s and 5% during the 1990s. The farmers still continue to settle in the lowland areas from the highland *weredas* of the West Gojjam zone and from the same *wereda* also. Respondents' livelihood was predominantly (97%) based on mixed crop livestock production systems. The average cultivated land and cattle holding per household were about three hectares and three cattle. The composition of livestock species in the lowland for cattle, small ruminants and equines was 75, 15 and 10%, while in the midland it was 60, 35 and 5%, respectively. The average cattle herd size was 43 and each herd included cattle from several owners (seven on average). The main livestock constraints as perceived by the respondents were livestock diseases, lack of grazing land and watering points, and scarcity of modern veterinary services. The main livestock diseases in order of importance were trypanosomosis, anthrax, pasteurellosis, blackleg, contagious bovine pleuropneumonia, internal parasites and external parasites.

According to 95% of the respondents, trypanosomosis (local name *Mich* or *Ghendi*) turned out to be the main problem affecting livestock productivity and agricultural activities. Almost all the respondents considered trypanosomosis as a disease of cattle mainly, followed by equines and small ruminants. The clinical signs of trypanosomosis, as known by the interviewed people, included rough hair coat, diarrhea, coughing, constipation, emaciation, weakness, reluctance to move, isolation from the herd, depression, abortion, inappetence, etc. The impacts of trypanosomosis were described by the respondents in the following sequence: loss of draft power, under cultivation, abortion, reduced fertility, cost of treatment, mortality, loss of milk and meat production, etc. With regard to the knowledge on transmission of trypanosomosis, 80% of the respondents indicated that the transmitter (vector) and cause of the disease were the environment, 15% believed that biting flies, locally called *Lesso* and *Wegie* (tabanids, muscids, tsetse flies), transmitted the disease, while 5% did not know anything about the cause and transmitter of trypanosomosis. The occurrence of trypanosomosis was high in areas bordering Abay Valley and its tributaries, Bir and Temechan. In the midland areas, 80% of the respondents revealed that their animals contracted trypanosomosis from the lowland areas of the river valleys, when animals moved for grazing and draft purposes. The only control method of trypanosomosis was the use of trypanocidal drugs. The application of flytraps and mobile targets, initiated by monks in the monastery with the assistance of FAO's Ethiopian Science and Technology Commission (ESTC) and the Amhara Region Bureau of Agriculture, was practiced for a limited period in 2003 (pers. commun.), and this activity created awareness on the control methods of trypanosomosis and tsetse flies. As a result the midland people decreased their animal movements into the lowland areas, particularly during the rainy season.

Entomological survey

A total of 13,927 flies were caught during the late rainy season and 1731 during the dry season. The tsetse flies accounted for 1.12 and 7.79%, tabanids for 8.45 and 4.27%, while muscids for 90.42 and 87.92%, during the late rainy and the dry seasons, respectively. The only tsetse fly species was *Glossina morsitans submorsitans.* The tabanid flies included species of *Tabanus, Haematopota* and *Chrysops*, while the muscids were mainly *Stomoxys* species. The mean catches of flies by three different types of traps (monoconical, biconical and NGU) during the first study season (late rainy season) are shown in Table I. There was a significant difference between trap types for the mean catches of flies ($p < 0.05$). Since the monoconical trap performed the best in the study areas, it was used for the determination of the apparent fly density and statistical description.

The apparent fly density (flies/trap/day) was 1.08, 8.78 and 91 for tsetse, tabanids and muscids in the late rainy season and 0.68, 0.35 and 7.33 in the dry season, respectively. There was a significant difference between the seasons in the apparent density of tsetse ($p < 0.05$) and also in other biting flies ($p < 0.005$). Altitude had a significant effect on the apparent density of tsetse in both seasons ($p < 0.005$) (Figure 2). Tsetse fly sexing in the study period

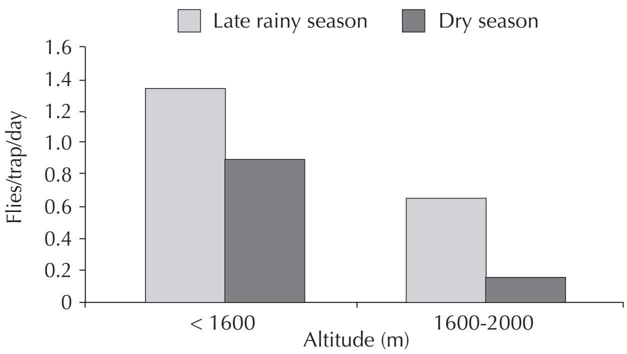

Figure 2: *Tsetse apparent density at different altitudes in the late rainy and dry seasons in the Abay Basin areas of Northwest Ethiopia.*

Table I

Mean fly catches using three trap types during the late rainy season

Trap type	Mean catches/trap					
	Tsetse	SD	Tabanid	SD	Muscid	SD
Biconical	2.29	2.44	13.76	31.63	145.47	168.31
Monoconical	3.22	2.76	26.36	46.49	274.31	382.00
NGU	1.51	2.46	11.70	41.03	131.77	377.14

SD = standard deviation

indicated that females were predominant during the late rainy season (88.78%) and during the dry season (53.33%). Female flies were caught at altitude levels up to 1780 m, while male flies were caught up to 1650 m.

Parasitological and hematological results

The overall prevalence of trypanosomosis during both seasons and the relative prevalence of different trypanosome species are shown in Table II. *T. congolense* was the most prevalent species, followed by *T. vivax* and *T. brucei*. Mixed infections of *T. congolense* and *T. vivax* were also recorded. The prevalence was significantly ($p < 0.05$) higher in the late rainy season than in the dry season. The frequency of infections in the dry season was 0.7 time lower than in the late rainy season.

The prevalence of trypanosome infection in cattle was 18.45% in males and 13.87% in females in the late rainy season, and 12.82 and 11.32%, respectively, during the dry season, but there was no significant difference between sex groups within the same season or between seasons. A higher infection rate (17.2%) was observed in older animals (> 3 years) compared to young animals (< 1 year) in which it reached only 11%. Finally, a relatively lower infection rate of 2.56% was observed in young animals (< 1 year), while in older animals (> 3 years) it reached 15% during the dry period.

The prevalence of trypanosome infection in the late rainy season varied significantly between the lowland and midland areas (19.87 and 13.39%, respectively; $p < 0.05$), and animals in the midland areas were by 0.7 time at a lower risk than those in the lowland areas (Table III). The predominant trypanosome infection was due to *T. congolense* at both altitude levels with 73.9 and 53.2% in the lowland and midland areas, respectively.

The prevalence of trypanosomosis in the dry season was significantly different in the lowland (17.62%) and midland areas (6.54%) ($p < 0.001$). The predominant trypanosome infection was due to *T. congolense* in the lowland areas with 94.8%, while the predominant one in the midland areas was due to *T. vivax* (53.8%). The herd mean prevalence of trypanosomes in the late rainy season was 16.02% and in the dry season 12.38% ($p < 0.05$), and the overall herd prevalence was 14.25%. All the sampled herds were positive for trypanosome infections.

The PCV values of parasitemic and aparasitemic animals were 20.7 ± 3.5 and 26.6 ± 4.3 during the late rainy season ($p < 0.001$), while they were 21.4 ± 3.6 and 26.6 ± 4.3 during the dry season ($p < 0.001$), respectively. The range of PCV values in parasitemic animals was from 11 to 35% and in aparasitemic animals from 14 to 43% in the late rainy season, while in the dry season the range was from 14 to 32% in parasitemic animals and 16 to 44% in

Table II

Prevalence of trypanosome infection in two seasons in the Abay Basin areas of Ethiopia

Season	Total cattle	*Trypanosoma* species (%)				Overall prevalence (%)	SD
		Tc	Tv	Tb	Mixed		
Late rainy	814	66.90	31.65	0.00	1.45	17.07	0.38
Dry	834	79.61	16.51	1.94	1.94	12.35	0.33
Total	1648	72.31	25.21	0.83	1.65	14.68	0.35

Tc = *T. congolense;* Tv = *T. vivax;* Tb = *T. brucei;* Mixed = *T. congolense* and *T. vivax*
SD = standard deviation

Table III

Prevalence of trypanosomes in cattle at different altitudes during the late rainy season and in the dry season in the Abay Basin areas of Northwest Ethiopia

Season (altitude)	Total	Trypanosome species (%)				Prevalence (%)
		Tc	Tv	Tb	Mixed	
LRS (< 1600 m)	463	62.56	23.04	0	0	19.87
LRS (1600–2000 m)	351	53.19	42.55	0	4.25	13.39
Total	814	66.90	31.65	0	1.43	17.07
DS (< 1600 m)	437	94.80	3.89	1.29	0	17.62
DS (1600–2000 m)	397	34.61	53.84	3.84	7.69	6.54
Total	834	79.61	16.50	1.94	1.94	12.35
Overall total	1648	72.31	25.20	0.82	1.65	14.68

Tc = *T. congolense;* Tv = *T. vivax;* Tb = *T. brucei;* Mixed = *T. congolense* and *T. vivax*
LRS = late rainy season; DS = dry season

aparasitemic animals. The PCV values of animals in the lowland areas were 24.8 ± 4.8 and in the midland areas 26.6 ± 4.4 in the late rainy season, while in the dry season they were 24.5 ± 4.1 in the lowland areas and 26.8 ± 4.1 in the midland areas.

The PCV value of the 19 herds (average 25.78%) varied significantly with the prevalence (mean 16.02%) during the late rainy season ($p < 0.002$) with a regression coefficient of –0.22. Similarly, during the dry season the average PCV value of the 18 herds was 25.68% and the mean prevalence was 12.38% ($p < 0.002$) with a regression coefficient of –0.17.

■ DISCUSSION

Over 97% of the interviewed farmers depended on mixed agriculture farming for their livelihood, which is consistent with the general situation of Ethiopia where over 80% of the population is engaged in a mixed farming system. The survey revealed that trypanosomosis was the most important problem for agricultural activities and animal production in the Abay Basin areas of Northwest Ethiopia settled since the 1960s. Similar results were reported in the western and northwestern parts of Ethiopia. Trypanosomosis occurs throughout the year but its incidence increases after the rainy season and after the short rainy season. Tewelde (34), Ngare and Mwendia (25), and Afewerk et al. (2) also reported similar results. The absence of tsetse control activities generally makes the farmers inclined to using chemotherapy.

Glossina m. submorsitans was the only species of tsetse fly found in the areas. The seasonal apparent differences might result from an absolute increase in the number of tsetse flies due to a favorable environment such as enough moisture, vegetation growth and suitable habitat, or the spread of flies from the rivers and thickets, where they usually inhabit during the dry season, to more open areas during the rain (4). Leak et al. (14) also cited the latter as a possible reason for the high densities of *G. pallidipes* obtained during the dry season when the traps were deployed in the Ghibe River Valley. The increases in the tsetse apparent density during the wet season have been reported in Ethiopia (19), Somalia (18), Cote d'Ivoire, Togo, Gabon and Zaire (14).

The results of the tsetse fly survey agreed well with the general knowledge on the ecology of tsetse species found in Southwest Ethiopia for the *morsitans* group. Typical habitat patterns were found in the study areas for the savannah species *G. m. submorsitans* that prefers savannah grass, riverine, and forest ecology. *G. m. submorsitans* was concentrated in the lowland areas as climatic conditions were more favorable. Some flies, however, were found as high as 1780 m. Earlier works (8, 10, 11) had established the tsetse geographical limit at 1600 m. Later, Tikubet and Gemechu (35) found the upper limit to be at 1700 m, and NTTICC (26) and Slingenbergh (32) reported the limit to be at 2000 m. A survey conducted by ESTC/SRVETEP (7) in Denbecha *wereda* indicated that the upper limit was below 1900 m. Earlier, *G. tachinoides* and G. *m. submorsitans* were caught by Langridge (11) in the Abay Valley areas. Tikubet and Gemechu (35) also reported *G. tachinoides* and *G. m. submorsitans* in the Abay and Didessa Valleys. Most of the tsetse flies in the present study were caught in the lowland areas and the apparent density decreased as altitude increased. This trend supports earlier works by Langridge (11), Tikubet and Gemechu (35), and Leak (12). Slingenbergh (32) discussed the invasion of *G. m. submorsitans* in the Upper Didessa Valley, and cited a USAID report (USAID, 1976) which suggested that the invasion of tsetse began during the 1970s and was responsible for an evacuation of the human population from the Didessa Valley at that time. The Didessa and Angar Rivers are both tributaries of the Abay (Blue Nile) River. Ford et al. (8) reported that 5902 km^2 of the river basin of the Angar, Didessa and Wama Valleys were infested by *G. m. submorsitans* and *G. tachinoides*. *G. m. submorsitans* has a wider spread habitat than *G. tachinoides* and *G. pallidipes,* and it is also an efficient vector of pathogenic trypanosomes to domestic livestock. The advance of *G. m. submorsitans* in the Abay Basin areas of Northwest Ethiopia as seen in the present study could have a great importance regarding the epidemiology of bovine trypanosomosis and human settlement. The reason for the absence of *G. tachinoides* in the present study is not clear.

NGU traps are efficient for savannah species (14), but in this study monoconical traps were the best of the three trap types used during tsetse fly sampling. When *Glossina m. submorsitans* was detected in Western Ethiopia (Gullele/Tolly area) (13), it was indicated that biconical traps were not efficient. The apparent densities of the tabanid and muscid flies were 6 flies/trap/day and 91 flies/trap/day, respectively, in the late rainy season, and 0.43 fly/trap/day and 7 flies/trap/day, respectively, in the dry season.

The higher prevalence of bovine trypanosomosis was found in the low altitude areas along the river valleys of Bir, Temechan and Abay compared to the mid altitude areas. The seasonal occurrence of the disease was also consistent with the general knowledge of the vectors of trypanosomosis and hence it was higher during the late rainy season.

The most prevalent trypanosome species in tsetse-infested areas of Ethiopia are *T. congolense* and *T. vivax*. Rowlands et al. (29) reported a prevalence rate of 37% for *T. congolense* in Southwest Ethiopia. Abebe and Jobre (1) reported an infection rate of 58.5% for *T. congolense*, 31.2% for *T. vivax* and 3.5% for *T. brucei* in Southwest Ethiopia. Different workers (2, 24, 34) reported prevalence rates of 17.2, 21 and 17.5% in Metekel district, Southern Rift Valley and Upper Didessa Valley of tsetse infested regions, respectively, and the dominant species was *T. congolense*. The prevalence of bovine trypanosomosis in the North Omo zone in the dry and wet seasons was 14.2 and 21.5%, respectively (24). The dominant trypanosome species was *T. congolense* (66.1%) followed by *T. vivax* (20.8%). The same trend was also reported by Rowlands et al. (30) in the Southern Rift Valley of Ethiopia. The predominance of *T. congolense* infection in cattle may be due to the high number of serodemes of *T. congolense* as compared to *T. vivax* and the development of a better immune response to *T. vivax* (12, 15). It may also suggest that the major cyclical vector is *G. m. submorsitans*, which is a more efficient transmitter of *T. congolense* than of *T. vivax* (11). In East Africa, *T. vivax* is generally less virulent (except in the hemorrhagic syndrome) than *T. congolense* and consequently cattle develop tolerance for *T. vivax* more readily and easily than for *T. congolense* (1).

There was a significant difference ($p < 0.05$) between the seasons as the prevalence of trypanosomosis was higher in the late rainy season (17.07%) than in the dry season (12.35%). The risks of trypanosomosis in cattle were 0.5 time lower in the dry season than in the late rainy season. The concurrent tsetse survey at the same time in the same altitude areas revealed that the apparent density was higher in the late rainy season than in the dry season. Muturi et al. (24) reported similar results in the North Omo zone, where the prevalence of trypanosomosis was higher in the wet season than in the dry season.

Rowlands et al. (28) in Ghibe observed that with a decrease in the PCV value, the proportion of infected animals increased and hence the mean PCV was a good indicator for the health status of herds in trypanosomosis endemic areas. The lower mean PCV value of parasitemic animals is reported by several authors (2, 14, 24, 34). Similarly, Van den Bossche and Rowlands (36) reported that the regression analysis of herd average PCV of parasitologically positive herds showed a decrease with the increasing prevalence of trypanosome infection. The development of anemia is one of the most typical signs of trypanosomosis caused by *T. congolense* in susceptible cattle breeds (22). Bovine trypanosomosis control aims at reducing the prevalence of infection with a concomitant increase in the herd average PCV (3). Therefore, the knowledge of the relationship between the prevalence of trypanosome infection and herd average PCV could be a useful tool to assess the impact of control interventions. However, the herd average PCV is affected by factors other than trypanosomosis (5). These confounding factors are not always identifiable but they are likely to affect both trypanosomosis positive and negative animals. Other factors considered to affect PCV values in animals in the study areas were helminthosis, tick-borne diseases and nutritional imbalances. On the other hand, most of the parasitemic animals in the lowland areas were in good body condition despite having low PCVs. This could be attributed to the fact that animals in low altitude areas had access to adequate nutrition due to the availability of sufficient pasture compared to animals in mid and high altitude areas.

■ CONCLUSION

Settlers in the Abay Basin (Denbecha and Jabitehenan) areas of Northwest Ethiopia considered trypanosomosis as the most important problem for agricultural activities and animal production. *G. m. submorsitans*, the only prevalent tsetse fly, advanced at an altitude as high as 1780 m, posing a risk to areas considered tsetse free by earlier studies. The prevalence of bovine trypanosomosis was found to be higher in the late rainy season than in the dry season. The prevalence was higher in low altitude areas compared to mid altitude areas in both seasons. The mean PCV values of parasitemic and aparasitemic animals were significantly different and the herd average PCV values were also negatively correlated to the herd prevalence.

Acknowledgments

We thank the Faculty of Veterinary Medicine of Addis Ababa University, Amhara Region Bureau of Agriculture, Amhara Region Agricultural Research Institute, Bahir Dar Veterinary Laboratory, Denbecha and Jabitehenan *weredas* Office of Agriculture, and Debre Genet Orthodox Church Monastery for their financial, logistic and other supports.

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Reçu le 08.03, 2005, accepté le 13.01.2006

Résumé

Shimelis Dagnachew, Sangwan A.K., Getachew Abebe. Epidémiologie de la trypanosomose bovine dans la région du bassin de l'Abay (Nil bleu), nord-ouest de l'Ethiopie

L'étude a été menée entre Septembre 2003 et Avril 2004 dans les districts de Denbecha et de Jabitehanan situés à basse (< 1 600 m) et moyenne altitudes (1 600–2 000 m). Les objectifs de cette étude ont été de générer des données épidémiologiques sur les tsé-tsé et la trypanosomose, et sur la connaissance de cette maladie par les communautés locales. Les résultats d'un questionnaire ont montré que la trypanosomose était le problème majeur affectant les animaux et entravant les activités agricoles de la zone. Le suivi entomologique a révélé la présence de *Glossina morsitans submorsitans*, seule espèce de glossine de la zone, ainsi que de tabanidés et de muscidés. Les densités apparentes (mouches/piège/jour) ont été significativement plus élevées ($p < 0,05$) à la fin de la saison des pluies (1,08, 8,78 et 91 respectivement pour *G. m. submorsitans*, les tabanidés et les muscidés) qu'en saison sèche (respectivement 0,68, 0,35 et 7,33). Dans les zones de basse altitude, la densité apparente de *G. m. submorsitans* a été significativement plus élevée ($p < 0,05$) que dans les zones de moyenne altitude à chaque saison. Un total de 1 648 animaux ont été examinés pour la trypanosomose par la méthode de centrifugation en tube microhématocrite ; les prévalences saisonnières ont été significativement différentes ($p < 0,05$) avec 17,07 p. 100 en fin de saison des pluies et 12,35 p. 100 en saison sèche. Les taux d'infection ont été plus élevés ($p < 0,05$) dans les zones de basse altitude (19,87 et 17,62 p. 100 respectivement à la fin de la saison des pluies et en saison sèche) que dans les zones de moyenne altitude (13,39 et 6,54 p. 100). Les valeurs moyennes de l'hématocrite des animaux infectés et apparemment non infectés ont été respectivement de $20,7 \pm 3,5$ et $26,6 \pm 4,3$ ($p < 0,001$) en fin de saison des pluies et de $21,4 \pm 3,6$ et $26,6 \pm 4,3$ ($p < 0,001$) en saison sèche. L'analyse de régression a montré qu'à chaque saison l'hématocrite moyen du troupeau diminuait quand la prévalence de la trypanosomose augmentait.

Mots-clés : Bovin – *Glossina morsitans submorsitans* – Trypanosomose – Epidémiologie – Facteur lié au site – Altitude – Variation saisonnière – Ethiopie.

Resumen

Shimelis Dagnachew, Sangwan A.K., Getachew Abebe. Epidemiología de la tripanosomosis bovina en las zonas de la cuenca Abay (Nilo Azul) del noroeste de Etiopía

El estudio se llevó a cabo entre septiembre 2003 y abril 2004, en las *weredas* (distritos) de Denbecha y Jabitehenan, localizados en las zonas de tierras bajas (< a 1600 m) y medias (1600-2000 m). Generó una base de datos primaria sobre la epidemiología de la tripanosomosis y la consciencia de la comunidad sobre la enfermedad en las áreas de la cuenca Abay (Nilo Azul) en el noroeste de Etiopía. Una encuesta mediante un cuestionario reveló que la tripanosomosis es el problema principal que afecta a los animales y dificulta las actividades agrícolas en el área. *Glossina morsitans submorsitans* fue la única especie de mosca tsé-tsé prevalente, junto con otros tabánidos picadores y moscas "múscidas". Las densidades aparentes de moscas (moscas/trampa/día) fueron significativamente más elevadas ($p < 0.05$) durante la estación lluviosa tardía (1,08, 8,78 y 91 para *G. m. submorsitans*, tabánidos y múscidos respectivamente), que durante la estación seca (0,68, 0,35 y 7,33, respectivamente). La densidad aparente de *G. m. submorsitans* fue significativamente más elevada ($p < 0,05$) en las zonas bajas que en las medias, tanto durante la estación lluviosa tardía como durante la seca. Un total de 1648 bovinos fueron examinados para la tripanosomosis, mediante la técnica de *buffy coat* y la prevalencia estacionaria (17,07 y 12,35% respectivamente) fue significativamente ($p < 0,05$) diferente. Las tasas de infección fueron superiores ($p < 0,05$) en las zonas bajas, con 19,87% y 17,62%, que en las zonas medias, con 13,39 y 6,54%, durante la estación lluviosa tardía y seca, respectivamente. Los valores del conteo de glóbulos rojos (PCV) de los animales parasitémicos y aparasitémicos durante la estación lluviosa tardía fue de $20,7 \pm 3,5$ y $26,6 \pm 4,3$ ($p < 0,001$), mientras que durante la estación seca fueron de $21,4 \pm 3,6$ y $26,6 \pm 4,3$ ($p < 0,001$), respectivamente. El análisis de regresión indicó que el promedio del PCV del hato disminuyó con el aumento de la prevalencia de las infecciones de tripanosomosis durante ambas estaciones.

Palabras clave: Ganado bovino – *Glossina morsitans submorsitans* – Tripanosomosis – Epidemiología – Característica del sitio – Altitud – Variación estacional – Ethiopía.