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Occurrence of Bovine Trypanosomosis, in the Blue Nile River Basin, Northwest Ethiopia

[1]Degu Fetehanegest, [1]Ayalew Berhanu, [2]Tewodros Fentahun and [1]Mersha Chanie

[1]University of Gondar, Faculty of Veterinary Medicine,
Unit of Veterinary Paraclinical Studies, P.O. Box 196, Gondar, Ethiopia
[2]University of Gondar, Faculty of Veterinary Medicine,
Unit of Basic Veterinary Sciences, P.O. Box 196, Gondar, Ethiopia

Abstract: A cross sectional study was conducted from October, 2010 to April, 2011 in three districts of West Amhara region located in the Abbay river basins namely Debre Elias, Dembecha, and Jabitehenandistrict, northwest of Ethiopia. The objectives of the study were to determine the prevalence rate of bovine Trypanosomosis and significance of associated risk factors in the study area. Blood samples were collected from 570 randomly selected local (zebu) breed of cattle in 8 Peasant Associations of three districts. The collected blood samples were examined using hematological and parasitological techniques (Buffy coat examination and thin blood smear). The overall prevalence of Trypanosomosis was found to be 6.49% and it consists of 5.62%, 3.75% and 10.56% in Debre Elias, Dembecha and Jabitehenan, respectively. *Trypanosome conglense*(5.26%) and *Trypanosome vivax* (1.23%) were the most common species encountered during study period. There were no statistical significance difference (P>0.05) between sexes, age, body condition and previously treated and untreated groups. But significance difference were observed in coat color of skin, altitude and districts (P<0.05). The mean PCV value of infected animals were (22.15±5.01SD) significantly (P<0.05) lower than that of non infected animals (26.21±5.1307 SD) and also the mean PCV value of animals in low land area was significantly different (P<0.05) from mid and highland areas. The study revealed that bovine trypanosomosis is more prevalent in low land and in black coat color skin of animals in the study area.

Key words: Bovine · Amhara Region · Occurrence · Trypanosomosis · West Amhara

INTRODUCTION

Tsetse transmitted animal trypanosomosis is a serious constraint to livestock production and agricultural development in the greater river basins due to its high prevalence in the most arable and fertile land of South West and North West part of the country following the greater river basins of Abay, Omo, Ghibe and Baro with a high potential for agricultural development [1]. In Ethiopia, a total of 14.8 million cattle, 6.12 million sheep and goats, 1 million camel and 5.23 million are at risk of contracting trypanosomosis [1]. Currently, about 220,000km^2 area is infested with tsetse flies namely *Glossinapallidipes, G.morsitans, G.fuscipes, G.tachinoidesand G. longipennis*. The most important trypanosome species affecting livestock in Ethiopia are *T. conglense, T.vivax* and *T.brucei* in cattle, sheep and goat, *T.evanisi* in camel and *T.equiperdum* in horse [2]. *The most prevalent trypanosomalspecies in tsetse infested areas of Ethiopia are T. conglense and T. vivax.*

In the west part of the Amhara regional state bordering the Abay river, one of the north western tsetse belt areas of Ethiopia, tsetse transmitted trypanosomosis is becoming a serious threat for livestock production and agricultural activity in particular [3]. Currently known sites of tsetse born trypanosomes are west Gojjam (Jabitchnan, Denbecha and bure), EastGojjam (Mechakel, Gozamen and Basoliben) and Awi (Ankesha), Guangua and Dangila) of the Abay (Blue Nile) river basins. Amhara Bureau of agricultural and rural development has already prepared a control program for tsetse and typanosomosis.

Corresponding Author: Tewodros Fentahun, University of Gondar, Faculty of Veterinary Medicine,
Unit of Basic Veterinary Sciences, P.O. Box 196, Gondar, Ethiopia.

The targets of the program are reducing the problem of tsetse trypanosomosis by 80% from the current status to improve the productivity of livestock and agricultural activity as well as facilitate access and provide live animals for marketing purposes and facilitating settlers from drought prone areas to their settlement sites suitable and profitable. Hence, assessment of bovine trypansomososis in tsetse infested areas regularly have a paramount importance both for determination of prevalence and measure any control trials and also to launch sustainable program. Therefore; the objectives of the study were to determine the status of bovine trypanosomosis in three districts of west Amhara region bordering the Blue Nile River and identify the major bovine infecting trypanosome species and significance of associated risk factors like altitude, body condition, coat color and other parameters.

MATERIALS AND METHODS

Study Area: A study was carried out in three districts of west Amhara region, Northwest part of Ethiopia. Agriculture is the only economic sector in the study area employing nearly 100% of the labour force [5].

Study Population: Based on 2010 census conducted by each district's Bureau of agricultural and rural development office, WARDO [5]; the total livestock population in the three districts is about 881,161 (262,369 in Dembecha, 161, 945 in Debre Elias and 456,851 in Jabitehenan). Out of the total livestock population, 404,890 cattle, 145,547 sheep and goats, 34,025 equine and 296, 703 poultry were recorded [5].

Study Design and Sample Size Determination: Across sectional study was conducted to assess the current status of vector borne trypanosomosis in each district from October, 2010 to April, 2011.Simple random sampling technique was used to select animals from the study population and 8 peasant associations (PA's) were selected purposively. During sampling the age and breed of animal, owner name, animal name, coat color and clinical signs were recorded. Body condition status of each animal was recorded based on criteria [6]. The sample size required for this study was determined based on sample size determination in random sampling for infinite population using expected prevalence of Bovine trypanosomoses in the area and 5% desired absolute precision according to Thrusfield [7].

Previous studies conducted in Dembecha [8] and in Jabitehenan [9], andrevealed a prevalence of 11.75%, for two study areas and 20% of expected prevalence for Debre Elias 20%, were used. Therefore, using the above expected prevalence for each district and 5% absolute precision at 95% confidence level, a total of 570 animals were selected.

Study Methodology

Parasitological Study: Blood samples were collected directly from the ear vein of the study animals into heparinized capillary tubes and were sealed with crystal seal. The heparinized capillary tube containing blood was then centrifuged for 5min. at 12,000rpm. After centrifugation, the PCV value of each animal was determined (estimated). The capillary tube was cut using adiamond tipped 1mm below the Buffy coat to include the upper most layers of the RBCS and 1cm above to include the plasma. The content of capillary tube was expressed on to slide, homogenized onto a clean glass slide and covered with cover slip. Then the slide was examined under 40 objective lense and x10 eyepiece for the movement of parasite [10].

For species identification, athin blood smear was prepared from the Buffy coat.Those samples that were positive on BC examination, stained with Giemsastain and examined under microscope using the oil immersion 100x [10].

Associated Risk Factors: Influence of risk factors associated with the animal like (age, sex, body condition, coat color and previous drug treatment) and location (altitude) were studied during examination of the animal. History of drug treatment to the animal was recorded based on duration of the time when treatment was given, type of trypanocidal drug given to the animal.

Data Entry and Analysis: Data collected from each study animal and laboratory results were coded into appropriate variables and entered in Microsoft excel spread sheet (MESS). All statistical analysis was performed using statistical packages (SPSS, version 17) software. The prevalence was calculated for all data as the number of infected individuals divided by the number of individuals sampled x 100. Categorical data were analyzed by using chi-square (χ^2) /Fishers' exact test, where as the student t-test used for comparison of mean PCV between infected and non infected groups with different altitudinal range.

RESULTS

Parasitological Findings: The overall prevalence of trypanosome species in the three districts was 6.49% (5.62%, 3.75% and 10.56 for Debre Elias, Dembecha and Jabitehenan) (Table 1). A statistical significance difference (P<0.05) was observed within three districts. Out of 570 animals examined, 30 (5.26%) were infected with *T. conglense* and 7 (1.23%) were infected with *T. vivax*as shown in Table 1.

Prevalence of Trypanosomosis with Associated Risk Factors: The trypanosomal infection was also observed between sex category and different age groups. Out of 570 animals examined, number of female and male animals infected with the parasite was found to be 20(8.58%) and 17(5.04%), respectively (Table 2). The prevalence is relatively high in females but the difference was not statically significance (P>0.05). The prevalence of trypanosomal species showed higher prevalence in adults and youngs 18(5.61%) and 19(1.73) respectively. But difference shows statically insignificance (p>05) with in age groups.

The prevalence of the disease was also observed between poor and good body condition animals. Animals with poor body condition were highly infected than good; the difference is not statistically significant (Table 2).

The prevalence of Trypanosomosis with respect to coat color showed a statistical significant difference (p<0.05). The prevalence is higher in black coats (12.4%) than red (5.17) and white (3.13%) (Table 2).

The prevalence of tryponosomal infection was analysed according to the agro ecological category of altitude. The prevalence was higher in low latitude areas (8.56%) compared to mid (8.56) and highland altitude (6.67) areas in the studied districts and the difference is statistically significance (P<0.05). (Table 2).

The prevalence of trypanosomal infection in previously treated and untreated animals also compared. The prevalence is high in treated animals (8.92 %) as compared to non treated (5.04%) with no significance difference (p>0.05) (Table 3). The two trypanocidal drugs isomethamidium (trypamidium) and diaminazeneaceturate (Berenil) were most commonly used drugs by the local farmers in the studied area.

Table1: Prevalence of trypanosome species in three sites of west Amhara region

Site	Total examined	*T.vivax* (%)	*T.congolense* (%)	Total positive	Prevalence (%)
Debre Elias	249	2(0.08)	12(4.82)	14	5.62
Dembecha	160	3(1.88)	3(1.88)	6	3.75
Jabitenan	161	2(1.24)	15(9.32)	17	10.56
Total	570	7(1.23)	30(5.23)	37	6.49

Fisher's exact = 0.029, P <0.05

Table 2: Prevalence of trypanosome species based on age group and sex categories

		Total examined	*T.vivax* (%)	*T.congolense* (%)	Total positive	Prevalence (%)	p-value
Sex							
	Male	337	3(0.89)	14(4.15)	17	5.04	0.09
	Female	233	4(1.72)	16(6.86)	20	8.58	
Age (years)	<1	3	0	0	0	0	0.67
	1-3	56	1(1.79)	4(7.14)	5	8.93	
	>3	511	6(1.17)	26((5.09)	32	6.26	
BCS	Poor	438	4(0.91)	26(5.93)	30	6.81	0.527
	Good	132	3(2.27)	4(3.03)	7	5.30	
Coat color	Black	129	1(0.78)	15(11.63)	16	12.40	0.007
	Red	348	5(1.44)	13(3.74)	18	5.17	
	White	93	1(1.08)	2(2.15)	3	3.23	
Altitude	<1600	161	2(1.24)	15(9.32)	17	10.56	0.037
	1600-2000	75	3(4)	2(2.67)	5	6.67	
	>2000	334	2(0.6)	1393.89)	15	4.49	
Treatment	Treated	213	4	15	19	8.92	
	Non treated	357	3	15	18	5.04	
	Total	570	7(1.23)	30(5.23)	37	6.49	

BCS = Body Condition Score, Fisher's test = 0.70 (Sex), Fisher's test = 0.80 (age), Fisher's test = 0.69 (BSC), χ^2 = 10.07 (Coat color), χ^2= 6.59 (Altitude), χ^2= 0.54 (Treatment)

Table 3: Mean PCV of infected and non- infected animals.

Condition	Number	Means PCV (%)	SD	SE	95% Cl
Infected	37	22.15	5.00	0.82	20.49-23.82
Non-infected	533	26.21	5.13	0.22	25.77-26.64
Total	570	25.95	5.22	0.22	25.52-26.37

P< 0.05

Table 4: Mean PCV of infected and non- infected animals in different altitude ranges

Altitude (Meter)		Number examined	Means PCV (%)	SD	SE	95% CI
<1600	infected	17	21.20	4.88	0.80	20.35-23.60
	Non infected	144	23.94	5.82	0.49	22.99-24.90
1600-2000	infected	5	25.20	4.66	2.08	19.42-30.98
	Non infected	70	26.79	4.18	0.50	25.59-27.78
>2000	infected	15	23.20	4.02	1.04	20.97-25.43
	Non-infected	319	27.11	4.67	0.27	26.59-27.12
	Total	570	25.95	5.22	0.22	25.52-26.37

P < 0.05

Hematological Findings: The PCV value in the sampled animals ranges from 12-44% and the mean PCV value the total animals was 25.95% ±5.22 SD (95% CI=22.44-23.41) (Table 4). The mean PCV value of infected animals (22.15 ±5.00SD) was lower than mean PCV of non infected animals (26.21 ±5.13SD).

The mean PCV value of animals both in low land and highland was also compared and the mean PCV value was lower in low land areas including good body condition animals in low land area (Tables 3 and 4).

DISCUSSION

The current studies on vector bovine trypanosomosis in three districts of west Amhara region revealed that slight decrease in prevalence from the previous study. Previousreports by Solomon [11] showed prevalence of 23.36% and 24.5% in Dembecha and Jabitehenan,respectively, Shimelis [4] with a total prevalence of 14.68% for Dembecha and Jabitehenan. But the new finding in these districts was 6.49% (5.62%, 3.75% and 10.56% for Debre Elias, Dembecha and Jabitehenan respectively). A slight decrease in prevalence from previous the study attributed to the control measure of bovine trypanosomosis through a strategic tsetse control by using odour baited and impregnated targets and traps along with treatments, and also expansion of agricultural activities along with increased human population causing destruction of tsetse habitats (forests). The prevalence in the three districts showed significant difference (P<0.05) and high prevalencewas observed in Jabitehenanwhich is also supported by previous study conducted by Molalegne *et al*. [9] with a prevalence of 11.75%. This may be due to the location of the area with an altitude of less than 1600m, so animals found in low land area has a close contact with the vectors throughout the year. A study conducted by Solomon and Fitta [12] reported there was a high prevalence in Pawi (20.7%) as compared to Jawi (11.1%) and Gangwa (5.8%).

Among the trypanosome species diagnosed, *T.conglense* was the predominant species (81.08%) followed by *T.vivax* (18.93%) with no mixed infection at all. Such a high ratio of *T. conglense* may suggest that the major cyclical vectors of *Glossinia* species (*G.tachinoide, morsitans* and other species) are more efficient transmitters of *T.conglense* than *T.vivax* [2]. The transmission of *T.conglense*is cyclical; it requires the presence of tsetse flies where as the transmission of*T.vivax* more readily transmitted mechanically by biting flies than tsetse flies. A similar finding by Molalegne *et al*. [9] also described the most prevalent trypanosome species in Jabitehenan was *T.conglense* (54.3%) followed by *T.vivax* (45.7%) and Solomon and Fitta [12] among trypanosomal species *T. conglense*(17.6%) was the most common followed by *T.vivax* (14.9%) and *T.brucei* (6%). The current study also agreed with the study conducted by Shimelis *et al*. [3] *Glossiniamorsitanssubmorsitans* is the only species of tsetse fly which is the major cyclical transmitter for *T.conglense* reported (found) in Dembecha and Jabitehenan.

The prevalence in sex groups also compared and it was higher in females than males but there was no significance difference (P>0.05). The prevalence may be due to female animal are more likely exposed to different stress factors parity age, abortion, milk yield and lactation time and gestation. These factors may suppress

the immune (defense) mechanism of animal which results in high infection rate.A similar finding also reported by Abebayehu *et al*. [13]. About 7 (3.46%) from a total of 202 female animals and 1 (1.02%) from 98 males were positive for bovine trypanosomosis. The statistical analysis showed that there was no significant difference (p>0.05) between the two sexes.

Based on the age groups of studied animals, young and adult groups of animals was highly infected than calves (<1year) but no significance difference was observed. Since adult animals traveled long distance for grazing, watering and draft as well as harvesting of crops to tsetse challenge area. Rowlands *et al*. [14] found a significant effect of age on the incidence of *T.conglense* infections in animals below 15 months of age with calves being the least infected young animals kept at homestead until weaned off. Calves were not allowed to move together with adult group and protective material immunity in high tsetse challenge areas which lowers the infection rate.

With no significance difference (P>0.05), the new finding indicates that the prevalence in poor body condition animals was higher than the prevalence in good body conditions. Abebayehu *et al*. [13] indicated that the prevalence of trypanosome infection in medium body condition was 1.88% and that of poor conditioned animals was 4.54% with no infection at all in good body condition animals. The difference was not statistically significant (p>0.05). The physiological status of the host, as well as nutritional and environmental factors, further play important roles in modulating the severity of the disease [15].

But in contrast to this finding, a highly significance difference (p<0.001) in the prevalence of Trypanosomosis between groups of good body condition and poor body conditions animals was reported by Solomon and Fitta [12] in Awi and Metekel zones north west of Ethiopia.

Prevalence was also observed between animals with different coatcolor. Animals with black coat color were found to be highly infected than red and white coat color with a statistical significance difference (P<0.05). For *Glossinia* species that are major transmitters of African animal Trypanosomosis,the strongest landing responses were found to be on black surfaces. Consequently traps are made to be blue on the outside to attract the maximum number of tsetse flies and black on the inside to maximize the proportion of tsetse that land on the entrapment area [16]. The present finding also agreed withthe above statement and the host preference of tsetse flies, Mostly tsetse flies favor and land on black objects so animals with black coat color were more susceptible.

The prevalence of Trypanosomosis in low land area was relatively higher, in area where there is high tsetse challenge. A study conducted by Solomon and Fitta [12] in Awi and Metekel Zones of north west Ethiopia, lowland area showed significantly (P<0.05) higher prevalence and animals in lowland was 3.03 times more likely to be infected than the mid land. It was also reported by Shimelis[4] the prevalence in low land area (<1600) was 18.77% and midland (>1600) was 9.75%. A similar finding was observed in the current study in the same districts, the prevalence in low land areas was higher than that of mid land and highlands. It was found in low land area (8.56%) followed by (6.68%) and (4.49) mid land and highlands respectively. The prevalence was statically significance (p<0.05).

The mean PCV value of animals was significantly vary between infected and non infected animals. A similar finding was reported by Solomon and Fitta [12] mean PCV value of infected and non infected animals was significantly different (P<0.05) where infected animals had low PCV value. Rowlands *et al*. [14] 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 the trypanosomosis endemic areas. In the absence of other diseases that causes anemia, the development of anemia is one of the most signs of Trypanosomosis caused by *T.conglense* in susceptible cattle breeds.

The PCV value also shows a significance difference (P<0.005) in low land and high land areas. The mean PCV in lowland area was (22.96 ±5.35) lower than the mid and highland areas (25.99 ±4.42) and (25.15 ±4.34) respectively. Shimelis[4] also reported that the mean PCV (%) value in low land area was lower than in midland both in the late rainy season and dry season with in the same study area and altitudinal range.

During field study, previously treated and untreated animals were also diagnosed and the observed result indicates that the prevalence in previously treated animals was (8.92%) higher than untreated groups (5.04%) no significance difference was observed. In areas of high trypanosome infection pressure, the farmers almost always prefer to use Trypanocidal drugs for both treatment and prophylaxis use for trypanosomosis [17].

Since drugs are expensive in local currency and are not always available when required, consequently under dosing is common and it is difficult to enforce any legistlation which drug to use in particular circumstances. The finding on the prevalence of previously treated animals in these districts might be due to these reported factors. This indicates that drug resistant trypanosomes was common and become challenging in tsetse infested area due to under dosing, frequently using of the same drug for many times. *T.conglense* was the predominant parasite that was diagnosed in treated groups of animals followed by *T.vivax*. This might be associated with occurrences of new infection or presence chemo resistance strains of *T.conglense* which is highly resistant to trypanocidal drugs unlike *T.vivax*which is more susceptible for trypanocidal drugs.

CONCLUSION

From the present study, it can thus be concluded that bovine Trypanosomosis caused by *T.conglense* and *T.vivax* is an important diseases and a potential threat in affecting the health condition and productivity of cattle in the economically important districts of west Amhara region northwest of Ethiopia. *Trypanosomeconglense* were the most commonly diagnosed parasite and followed by *T.vivax*. Bovine trypanosomosis negatively affects the PCV value of animal. Altitude and coat color found to be risk factors. A non significant variation was observed between poor condition animals and good condition animals but in animals' having poor body condition, the prevalence of was relatively higher.

Recommendations: Based on the overall study findings, the following recommendations are forwarded. Bothtrypanosomosis monitoring and integrated vector control should be strengthened in each district and odor baited (impregnated) target and trap deploying techniques should be demonstrated for local farmer in order to control seasonal fly infestation. Detail studies on economic impact of trypanosomosis and tsetse fly challenges should be conducted.Veterinarians should be assigned in each district to avoid irrational use of trypanocidal drugs and to provide a guide for appropriate treatment and control methods .To reduce the level of exposure, prophylactic treatments should be recommended for animals imported to tsetse infested zone which was bought from neighboring regions or travel to long distance crossing tsetse infested area.

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