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Research Article

Study on Prevalence of Bovine and Donkey Trypanosomiasis in Selected Two Districts of West Gojjam Zone, Amhara Region, Ethiopia

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Abstract

A cross sectional study was conducted in Denbecha and Jabi Tehnan Districts of West Gojjam Administrative Zone of Amhara Regional State, Ethiopia to estimate the prevalence of bovine and donkey trypanosomiasis. Blood samples of 162 cattle and 100 donkeys were collected and 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 1.91%, out of which 3.81% were from Denbecha but no positive cases (0%) was recorded in Jabi Tehnan. Species level prevalence showed that 2.47% and 1% were in bovine and in donkeys, respectively. The only identified species observed in the area was *Trypanosoma congolense.* The mean PCV values of parasitaemic and aparasitaemic animals during the study period were 21.8% and 31.6%, respectively. The variation in mean PCV values were statistically significant (p = 0.000) between infected and none infected. The study result did not show statistically significant variations in prevalence among selected factors such as between sexes, body condition scores, animal species, Woredas, PAs, age, and coat color of animals. This could be due to low prevalence of trypanosomiasis in the study area, which was only detected in one district. The present study finding may provide valuable information on the presence of the disease in the study area in spite of great effort on the control of disease by Finoteselam tsetse control and eradication center. It may further reveal that trypanosomosis is an important disease affecting the livestock production particularly in Denbecha area.

Keywords: Trypanosome; Bovine; Donkey; Prevalence; Jabi Tehnan; Denbecha; Buffy Coat; PCV

Introduction

Trypanosomosis is one of the major constraints to livestock development and agricultural production in Ethiopia mostly it is transmitted by tsetse flies but other biting flies also can transmit the disease. Tsetse transmitted trypanosomosis affects 37 sub Sahara African countries causing immense economic and social impact. Tsetse-borne trypanosomosis is a severe constraint to the livelihoods of poor livestock owners across ~10 million square kilometres of sub-Saharan Africa. In Ethiopia, trypanosomosis is one of the major constraints to cattle production with direct and indirect economical losses Approximately 220,000km^2 agriculturally suitable land in the South, West and Southwest Ethiopia is infested by tsetse flies. Almost all regions of the country are infested with mechanically transmitted trypanosomes. Around 14.8 million cattle, 14 million small ruminants, 7 million equines, and 1.8 million camels are at risk of contracting trypanosomosis at any time in the tsetse infested areas. The pathogenic trypanosomes in Ethiopia are *T. congolense, T. brucei, T. vivax, T. evansi,* and *T. equiperdum* [1].

In Ethiopia, significantly large numbers of works have been conducted to determine the prevalence of bovine trypanosomosis. However, the studies were limited in spatial scope and the results significantly vary between the studies. From the total positive bovines throughout the country, 45.5 and 44.3% of them accounted to *T. congolense* and *T. vivax*, respectively and the remaining accounted to *T. brucei* [2]. On my study areas 15.24% prevalence with 80%

T. congolense and 20% *T. vivax* was found in Jabi tehnan *woreda* [3] and in Denbecha woreda 8.6% prevalence was found from this 54.54% *T. congolense* and 45.45 were due to *T. vivax* [4].

For equine trypanosomiasis, little information and few studies were available in Ethiopia, and those scarce literature sources suggest that trypanosomiasis is one of the most important disease limiting animal productivity and agricultural development due to its high prevalence in the most arable and fertile land of South west and North West part of the country. The high disease challenges are in the greater river basins of Abay, Omo, Ghibe and Baro with a high potential for agricultural development [5]. About 10.7% of trypanosome prevalence in equines has previously been detected in Humbo, Kindo Koysha and Sodo zuria districts in Southern areas of Ethiopia. Two *Trypanosome* species were identified from equines: *T. congolense* 52.2% and *T. vivax* 26.1% [6]. Other study by Birhanu., *et al*. [7] showed that two donkeys were positive from 46 samples (4%), and seven donkeys were positive from 38 samples (18%) for *T. evansi* in Tigray and Afar regions, respectively. Similarly, 3 donkeys from 38 samples (8%) were positive for *T. vivax* in Afar region [7]. However, information on bovine and equine trypanosomiasis is very scarce in the present study area and justifies the rationale of the present study.

Materials and Methods

Study area

The study was conducted from November 2018 to April 2019 in two districts selected from West Gojjam zone, northern Ethiopia. West Gojjam is located about 407 km from Addis Ababa with latitude of 11°09'60.00"N and longitude of 37°14'60.00"E. This zone has 2,275,899 cattle and 295,509 donkeys [8] and mixed farming system is practiced. The selected districts has the following elevation; Finoteselam (Jabi Tehnan) 1917 meters above sea level with average annual temperature of 18.8°C and 1453 mm average rainfall and Denbecha has 2,090 masl with average temperature of 17.5°C and 1412 mm average rainfall. The above elevation is the elevation of the woreda cities but the elevation of the sampled area in Denbecha woreda were 1493 - 1540 masl and Jabi Tehnan woreda were 1468 - 1577 masl which was measured by me. The area has many forests.

Study animals and population

Animals sampled were local breeds of bovine and donkeys managed under extensive husbandry system. In this study 100 donkeys and 162 bovine were sampled for hematological examination from those 81 bovine and 50 donkeys were from Denbecha and the rest 81 bovine and 50 donkey were from Jabi tehnan.

Study design

A cross sectional study was conducted from October 2018 to April 2019 to determine the prevalence of trypanosome infections in bovines and donkeys on selected districts of West Gojjam based on hematological examination. The age of the selected animals were recorded by asking the owners, that animal greater than 1 year were selected for sampling and the body condition status of the animals was assessed based on the criteria of [9] for donkey and on bovine it was sampled according to [10] and scored as '1' (poor), '2' (moderate), '3' (good), '4' (fat) and '5' (obese). All the recorded samples were not having fat and obese score that they have poor, medium and good body condition.

Sampling technique and sample size determination

Animals were selected from the study population using simple random sampling technique and purposive sampling method was used. Kebeles under high tsetse infested were selected from the study area by taking information from Finoteselam tsetse control office. For sample size determination, since there was record of previous prevalence in the study area, the sample size was calculated according to Thrusfield [11] formula. In Denbecha woreda 8.6% bovine trypanosomiasis prevalence was found by Demelash., *et al*. [4] and in Finoteselam (Jabi tehnan) woreda 15.24% prevalence was found by Melak and Tewodros [3] on bovine. But papers on equine trypanosomiasis prevalence done in those areas were not found and 6.3% prevalence [12] done in Benishangul Gumuz having similar agro ecology and almost similar elevation above sea level was used.

On bovine to determine the total sample size the average of the two Woredas prevalence was used. i.e. (15.24+8.6) ÷ 2 = 11.92% and on equine 6.3% prevalence was entered in to Thrusfield formula with 5% absolute precision at 95% confidence interval.

$$n = \frac{[z^2 * Pexp\ (1-pexp)]}{d^2}$$

$$n = \frac{(1.96^2 * 0.119) * (1-0.119)}{0.05^2} = 162 \text{ bovine and}$$

$$n = \frac{(1.96^2 * 0.063) * (1-0.063)}{0.05^2} = 90.7 \text{ donkey}$$

Where, n = The sample size

Pexp = Expect prevalence

d = Desired absolute precision

z = Required confidence level, (Z = 1.96 for 95% confidence interval).

Finally, 162 sample sizes were divided in to two which is 81 from Denbecha and 81 from jabi tehnan. For equines the sample size were 90.7 but to make even number and fittest sample size it was rounded to 100 then 50 from Denbecha and 50 from Jabi Tehnan Woreda.

Blood sample collection and testing

In current study 162 cattle were randomly selected for the study of bovine trypanosomosis prevalence and 100 donkeys were selected for the study of donkey trypanosomosis. Blood sample from ear vein were collected using heparinized capillary tubes then the blood were centrifuged with micro hematocrit centrifuge to measure PCV then the capillary tube were broken from the level of Buffy coat by taking 1 mm below the red blood cells and the Buffy coat were made smear and examined under microscope.

Data analysis

Data collected from each study animal and laboratory analysis were coded and entered in a Microsoft Excel spreadsheet. All statistical analyses were performed using STATA version 11 software. The point prevalence was calculated for all data as the number of infected individuals divided by the number of individuals sampled multiplied by 100. The association between prevalence of trypanosome infection and different study variables (district, age, sex and BCS) was analyzed by Fisher exact test, whereas one way analysis of variance (ANOVA) was used to examine the differences in mean PCV (%) between trypanosome positive and negative animals, districts, male and female animals and different BCSs. In all the analyses, the confidence level was held at 95% and $P < 0.05$ was considered for significance.

Result

This study revealed that overall prevalence 1.91%, with the only species identified was *T. congolense* and none of other species were recorded. Trypanosomosis was found to be higher in Denbecha (3.81%) compared to Jabi tehnan woreda where no case was observed (0%). Between Peasant associations highest prevalence was obtained from Chava (5.06%) followed by Gedeb tanef (1.92%) but others from Jabi Woredas were negative. Prevalence of trypanosomosis in species level was higher in bovine (2.47%) than donkey (1%). Prevalence of trypanosomosis higher in male animals (2.70%), than female animals(0%); old animals(0%), than adult animals (1.82%), and 3.17% prevalence in young animals ; poor body condition scored cattle (3.77%), than good body condition score cattle 0%, and medium body condition scored (2.83%); the prevalence between color that was observed were black (1.85%), brown-gray (1.87%), and others were (1.98%).

Hematological survey

The mean PCV of the infected animals (21.8%), lower than non-infected animals (31.6%); cattle 28.6%, which is lower than donkey 36.0%.

Woreda Number of examined Number of positive prevalence (%)									
	Donkey	**Bovine**	**Total**	**Donkey**	**Bovine**	**Total**	**Donkey**	**Bovine**	**Total**
Jabi-ehnan	50	81	131	0	0	0	0	0	0
Denbecha	50	81	131	1	4	5	4.94	2	3.82
Total	100	162	262	1	4	5	0.4	1.5	1.91

Table 1: Prevalence in the two *woredas* in both species.

Factors	Number of examined	Number of positive	Prevalence (%)	Fisher exact	P-value
Woreda					
Jabi tehnan	131	0	0	0.060	0.024
Denbecha	131	5	3.81		
Kebeles/PA/					
Chava	79	4	5.06	0.269	0.150
Gedeb tanef	52	1	1.92		
Ergib- keberomeda	52	0	0		
Finoteselam	37	0	0		
Woinima	42	0	0		

Species					
Bovine	162	4	2.47	0.652	0.398
Donkey	100	1	1		
Sex					
Male	185	5	2.70	0.326	0.145
Female	77	0	0		
Age					
Young	63	2	3.17	0.651	0.547
Adult	165	3	1.82		
Old	34	0	0		
Colour					
Black	54	1	1.85	1.000	0.998
Brown-gray	107	2	1.87		
Others	101	2	1.98		
Body condition					
Poor BC	53	2	3.77	0.179	0.176
Medium BC	106	3	2.83		
Good BC	103	0	0		
PCV					
Anemic	15	5	33.33	0.000	0.000
Non anemic	247	0	0		

Table 2: Prevalence between different risk factors and their association.

Variables	Sample size	Mean	SD	F-value	p-value
Tryps status					
Negative	257	31.6	5.2	17.4	0.000
Positive	5	21.8	3.6		

Table 3: Association of PCV with tryps status.

Discussion

The present study revealed that from a total of 262 randomly selected animal's in the study area, 5 (1.91%) of animals were positive for trypanosomes from those 4 (2.47%) were bovines and 1 (1%) were donkeys in species levels. Similar findings of 1.6% from Awi zone [5] were reported. But this is lower than previous reports: 8.6% in Denbecha woreda [4] and 15.24% in Jabi Tehnan woreda [3] and also 11.7% in Jabi tehnan [13]. The relatively low prevalence of trypanosomosis in this study may be related to tsetse distribution and low fly-animal contact as well as due to the effects of parasite and vector control programmes practiced in the area. In both Denbecha and Jabi tehnan Woredas many farmers said that the burden of the disease decline due to reduction in forest density that the animals were grazing which is a place where fly live and multiply. Those farmers also said that they reduce the case by keeping animals having color out of black and near to black and the difference may be due to study season difference but one need to keep in mind that some reports could be exaggerated for instance the report by Melak and Tewodros [3] in which 15.2% was reported from low tsetse challenge area. Such high prevalence was not even reported from highly trypanosomiasis infected tsetse belt areas like Arbaminche and Wolaita. The study period also was not mentioned in the above report.

In another way low sensitivity of direct parasitological Buffy coat examination may contribute for low prevalence that chronic stage is characterized by low parasitemia which is difficult to confirm by parasitological diagnosis. In very low sensitivity of Buffy

coat 10^2 - 10^3 tripanosome parasite should be present per ml of blood to confirm the diagnosis compared to 1 trypanosome per ml of blood in PCR [14]. In this study the prevalence of bovine trypanosomosis between Woreda and PA prevalence associations was not significant; that Jabi tehnan woreda becomes negative and Denbecha is positive.

The animals examined were categorized in 3 age groups: 1 - 4 (young) age, 4 - 8 (adult) age, and ≥ 8 years old. The trypanosome infection prevalence was found to be 3.17% in young age group, 1.82% in adult age group and 0% in old animals as indicated on the above table. The high prevalence on young animals could be low immunity level that the prevalence decreases as age increase since resistance increase as age increase. Similar findings were also reported by Shimelis., *et al*. (2011) and Abdulwahid., *et al*. [15] Asosa District of Benishangul Gumuz Regional State, Western Ethiopia and in sire district, western Ethiopia, respectively but their age classification was different that they divide in to two age groups.

During the study period, the prevalence of bovine trypanosomosis was assessed between sexes of animals and there is no significant difference. Among 5 trypanosome positive animals; none of female animals were positive and 5 (1.91%) of them were male animals which could be related to high mobility of male animals and walking a long distance for plowing and high exposure to fly even they take young male animals to field not to make lone extra ox during plowing 2 ox's. Even though the trypanosome infection in male animals is higher than in the female animals; both sexes were equally susceptible to trypanosomosis infection. This result is similar with previous results of Demelash., *et al.* [4] and Molalegne., *et al*. [13] who obtained no significant difference in susceptibility between the two sexes.

The occurrence of disease in three different body condition (poor, good and medium) animals shows the highest prevalence in poor body condition (3.77%) followed by medium (2.83%) and good body condition (0%). This finding is consistent with the observations of Gamechu., *et al*. [16] and Addisu., *et al.* [6] but prevalence in good body condition was zero on this study.

In this study, there was a significant difference between mean PCV values of infected and non-infected animals. This factor may be related to the debilitating nature of the disease [17]. In the absence of other diseases causing anemia, a low PCV value of individual animals is a good indicator of trypanosome infection [18]. For this study cattle with PCV < 24% [19] and donkeys with PCV < 30 were considered as anemic [20] which is said to be the principal sign of trypanosomosis in livestock [18]. In the present study, the mean PCV value for the parasitemic animals was 21.8% while the mean PCV value for the aparasitaemic animals was 31.6%; which is similar with the report of [15] in Didesa district of Oromia Regional State, Ethiopia, in which was stated that the average PCV of parasitological negative animals was significantly higher than the average PCV of parasitological positive animals. Female animals had a significantly lower mean PCV than male animals. This finding is in agreement with that of Addisu., *et al* [6].

Identification of the species of trypanosomes involved in the study area was identified and found to be *T. congolense*. The detection of only *T. congolense* in this study agreed with the report of Solomon and Fitta [21] who reported higher proportion (77.6%) *T. congolense*. Such a high ratio of *T. congolense* may suggestive of presence of a biological vector (Glossina) in the study areas, whereas *T. vivax* is more readily transmitted mechanically by biting flies than tsetse flies. Langridge [22] have indicated that *T. vivax* is highly susceptible to treatment, while the problems of drug resistance are higher in *T. congolense* that in many African countries high proportion of drugs on *T. congolense* were not effective [23,24]. Multiple drug-resistant *T. congolense* was reported in South east Mali with isometamidium resistant *T. vivax* [25]. So trypanosome resistance on the area should be checked and on areas with confirmed resistance, an integration of trypanosomosis control should be implemented rather than chemotherapy as the sole strategy. By using multiple strategies aimed at lowering the risk of transmission by integrated vector control and supplementary health enhancing packages by increasing immune level of the animals in trypanosome infected animals would be of great benefit in terms of complete elimination of the resistant trypanosome populations from an area [26-36].

Conclusion and Recommendations

The study revealed that bovine and donkey trypanosomosis is prevalent in the study area especially Denbecha woreda was positive for trypanosome but Jabi tehnan woreda was negative. In this study *T. congolense* was the only species identified and it also was found only in Denbecha woreda. Higher prevalence of trypanosomosis infection was observed in animals with poor body condition and low PCV animals, suggesting the adverse effect of the disease on reducing PCV and body condition. None of the risk factors were found significant.

Based on the above conclusion, the following recommendations are forwarded:

- Strategic control of bovine trypanosomosis including vector control should be strengthened.
- Higher level policy makers should give raped responses to local problems such as for Finoteselam tsetse control eradication center and other institutions that it takes too long time to maintain if single equipment is out of function.
- Farmers should be educated about the risk of mass treatment that could lead to drug resistance.

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