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Epidemiology of Trypanosomosis in Cattle Population of Gojam Zones, North Western Ethiopia

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Abstract: Cross-sectional study was conducted in Gojam Zones of Amhara region Ethiopia from January-June 2020 to determine the prevalence of bovine trypanosomsis and to evaluate its association risk factors. Blood samples collected from 391 randomly selected cattle were subjected to parasitological and haematological analysis. For the parasitological survey, blood samples 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 trypanosomsis was 6.65%. The most common trypanosome species identified were *Trypanosomes congolense* 84.61% (22/26) followed by *T. vivax* 11.54% (3/26) and 3.85% (1/26) were mixed infection. The prevalence showed no significant difference in susceptibility between sex and age groups, but has significant difference in body condition and PCV status of animals. The overall anemia prevalence in the area was 39.9% (156/391). The anaemia prevalence was significantly higher in trypanosome positive cattle (73.08%) than in non infected animals (37.5%) ($P < 0.05$). The mean PCV value of the infected animals was lower (20.53% ± 2.39%) compared to non infected animals (29.09 ± 3.38%). There was statistically significant difference ($P < 0.05$) in the PCV values of infected and non infected animals. In general, this study divulges that trypanosomsis pretense a risk to cattle production and productivity in the area and also contributed to the occurrence of anemia.

Key words: Buffy Coat · Gojam · PCV · Trypanosomiasis

INTRODUCTION

Trypanosomsis is protozoan disease complex, which affects cattle and other wide range of hosts in sub-Saharan Africa. The disease may run from a chronic long lasting to an acute. The disease is mainly characterized by intermittent fever, progressive anemia and loss of condition [1]. As the illness progresses the animals weaken more and more and eventually become unfit for work, hence the name of the disease "N'gana" which is a Zulu word that means "powerless/useless" [2]. Trypanosomes are flagellated protozoan parasites that live in the blood, plasma, lymph and several tissues of their vertebrate hosts [3].

Hosts acquire infection principally via the bite of infected tsetse flies of the genus *Glossina* which are the vectors of African trypanosomsis and are responsible for cyclical transmission of the parasitic protozoan between numerous vertebrate hosts, other haematophagous insects like *Tabanus* and *Stomoxys* species also transmit trypanosomosis mechanically [4]. The vector is distributed over wide range of habitats covering about 10 million square kilometers of potential grazing lands in 37 countries which are rendered unsuitable for livestock breeding and farming across the African content [5].

In Ethiopia, trypanosomsis is one of the most important diseases that limit livestock productivity and agricultural development due to its high prevalence in the most arable and fertile and of south west and North West part of the country following the greater river basins of Abay, Omo, Ghibe and Baro [6]. Currently about 220, 000 km^2 areas of the above mentioned regions are infested by five species of tsetse flies, namely, *Glossina pallidipes*, *G. morsitans, G. fuscipes, G. tachinoides* and

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G. longipennis [7]. The distribution of trypanosomes is dynamic due to climatic change, ecological disturbances and human interventions.

In general, most of the studies conducted in Ethiopia to assess the prevalence and its risk factor is still scanty in various epidemiological areas of the disease. Even in already studied areas updating the prevalence and status of the disease have paramount importance for understanding the epidemiology of the disease, to facilitate the choice of suitable control method. The objective of this study was therefore to assess the prevalence of bovine trypanosomsis and to determine its associated risk factors in Gojam zones, Ethiopia.

MATERIALS AND METHODS

Study Area: The study was conducted in three district of Gojam Zone, Amhara region. Gozamen is one of the district of East Gojam zone of Amhara National Regional States. It is found at a geographical location of 10° 17'12"N latitudes and 37° 36'52"E longitudes and at a distance of 305 from Addis Ababa. It was found in 1200-3510 meter above sea level altitude. The average annual rainfall of the district was 1628 mm, Gozamen Woreda Agricultural and Rural [8].

Debre Elias is also found in west Gojam zone of Amhara National Regional States, located 340 Km away from the capital city, Addis Ababa with an altitude of 2300 masl and having an average temperature of 27°C. The area is predominantly rural and most residents live based on agriculture [9].

Dembecha is found in West Gojam Zone in Amhara Region, located at 10º30´01'' N, latitude and 37º29´03''E longitude. Which is located about 370 km from Addis Ababa. Had the mean annual rainfall of 1200-1600 mm and the mean temperature of the 10-20ºC and altitude ranges from 1400-2300masl. The livelihood of the society largely depends on mixed livestock and crop production [10].

Study Animals: The animals used for this study were local zebu cattle (*Bos indicus*); all cattle above 1 year of age were included in the study. Cattle in the districts are generally herded under the extensive grazing systems. Herds were composed of between as few as 2 cattle to >50 cattle. Their age was categorized into three age groups (<2 years, 2–5 years and greater than five years) based on dentition and the body condition score was grouped into cachectic, lean and good conditioned animals based on the appearance of ribs and dorsal spines applied for zebu cattle [11].

Sample Size Determination: The sample size was calculated according to Thrusfield [12]; at expected prevalence of 50% 5% (0.05) of precision, at 95% confidence interval in the study area. The animals were sampled randomly involving both sexes, all age groups and all types of body conditions. As a result a total of 391 cattle were sampled from three different districts at different kebeles. Owner's name, location, GPS coordinates, age (< 2 years, 2-5 years, > 5 years), sex, breed (zebu), PCV, body condition (cachectic, lean, good) and infection type (trypanosome species) were recorded.

Study Methodology

Packed Cell Volume (PCV) Determination: Blood samples for parasitological examination were obtained by puncturing the marginal ear vein with a lancet and collected directly into a pair of heparinised capillary tubes and sealed with crystal seal. After centrifugation at 12, 000 rpm for 5min in a microhaematocrit centrifuge, the capillary tubes were placed in a hematocrit reader and the length of the red cells column was expressed as a percentage of the total volume of blood. Animals with PCV less than 24% were considered to be anemic [13].

Buffy Coat Technique (BCT): In each of the kebeles, all animals were screened for trypanosomes using the Buffy - coat technique (BCT) [14]. Heparinized capillary tubes, containing blood samples, were cut using a diamond tipped pen 1mm below and 3mm above the buffy coat after centrifugation. The content of the capillary tube was expressed on to a glass slide, then covered with cover slip and examined under × 40 objectives and ×10 eye pieces for movement of parasite. Trypanosome species were identified according to their movement in wet film preparations as provided by OIE [13].

Data Management and Analysis: Data was analyzed using STATA version 13 (Stata Corp LP, Texas USA). Prevalence was analyzed by determining total positive cases out of the total number of animals sampled. Infection rate on the basis of sex, age and body condition was compared using Pearson Chi square (χ^2) test. Mean PCV in parasitemic and aparasitemic animals were compared using student *t*-test. Significance test was set at 5% alpha and 95 confidence interval where $p < 0.05$ indicates statistically significant.

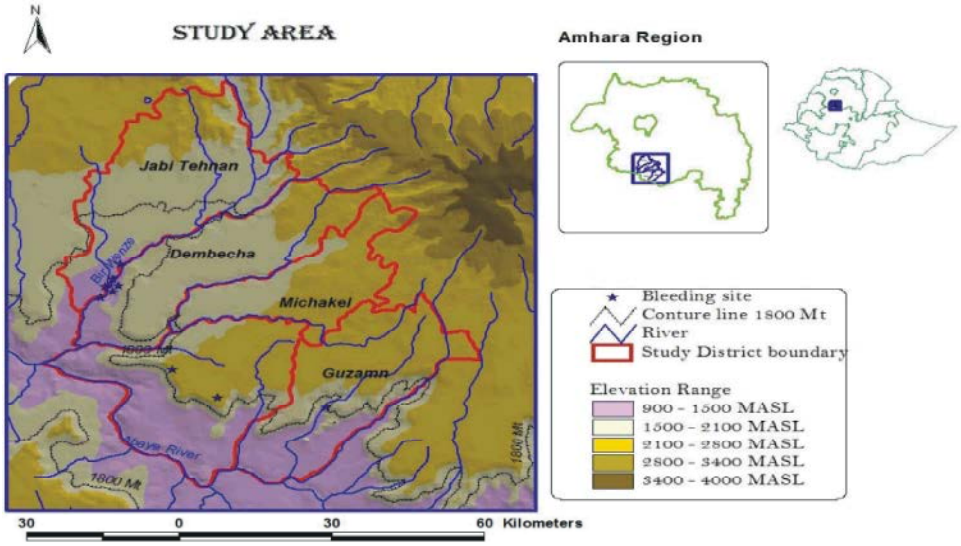

Fig. 1: Map showed study areas on the basin of Abay river

RESULTS

Parasitological Findings: Out of 391 cattle examined 6.65% (26/391) were found to be infected with trypanosomes. The prevalence in terms of trypanosome species was 5.63% (22/391) *T. congolense* and 0.77 % (3/391) *T. vivax* and their mixed infection was 0.25% (1/391).

Prevalence of Trypanosomsis based on various risk factors: The study revealed that, originally the disease distribution was slightly higher in Gosamen and Dembecha with 8.99% and 8.28% respectively as compared to D/Elias which was 3.45%.

Prevalence of trypanosomsis was higher in males (7.69%) as compared to female animals (5.46%). However, the difference was not statistically significant ($P > 0.05$). The highest prevalence was observed in the adult animals greater than 5 years old and the variation in prevalence between the different age groups was also not statistically significant ($P > 0.05$). The prevalence of trypanosomsis between body condition scores was 22.22% in cachectic, 7.19% in lean and 0.57% in good body conditioned animals and it was statistically significant ($P < 0.05$) as illustrated in Table 1.

PCV Status in Studied Area: The mean PCV value of 25.65% was registered during the study period. The most frequently recorded PCV value was 25% and recorded in 36 cattle from the overall targated animals in the study areas. The mean PCV values of cattle were statistically significant ($P = 0.0000$) which was 20.53% and 29.09% PCV positive and negative animals were registered, respectively (Table 2).

Dynamics of Trypanosome Infection Versus PCV Status: The overall anemia prevalence in the studied district was 39.9% (156/391). The anaemia prevalence was significantly higher in trypanosome positive cattle (73.08%) than in noninfected cattle (37.5%) ($P< 0.05$). Of 39.9% anaemia prevalence, 4.9% (19/391) was trypanosome infected animals. However, large number of animals 35% (137/391) had anaemia (PCV<24) without having trypanosome infection. Some animals 1.8% (7/391) were infected by trypanosome but their PCV was found normal as indicated in Table 3.

Fig. 2: Distribution of the species of trypanosomes among the infected animals

Fig. 3: Overall of PCV status in the study area

Table 1: Prevalence of bovine trypanosomsis based on various risk factors

Host and non host related risk factors	Number of examined cattle	Number of infected cattle	Prevalence (%)	χ^2	p-value
Origin				3.851	0.146
Gosamen	89	8	8.99		
D/Elias	145	5	3.45		
Dembecha	157	13	8.28		
Total	391	26	6.65		
Kebele				5.1774	0.27
Chimit	89	8	8.99		
Guia	73	3	4.11		
Gabigenet	72	2	2.78		
Melkacheba	88	9	10.23		
Addis zemen	69	4	5.8		
Total	391	26	6.65		
Sex				0.7784	0.378
Female	183	10	5.46		
Male	208	16	7.69		
Total	391	26	6.65		
Age				1.0473	0.592
<=2years	33	1	3.03		
2-5years	132	8	6.06		
>5years	226	17	7.52		
Total	391	26	6.65		
BCS				35.0994	<0.001
Cachectic	63	14	22.22		
Lean	153	11	7.19		
Good	175	1	0.57		
Total	391	26	6.65		
PCV Status				12.7865	<0.001
Anemic	156	19	12.18		
Non anemic	235	7	2.98		
Total	391	26	6.65		

Table 2: Mean PCV comparison between infected and noninfected animals

PCV status	Number	Mean	SD	t-test	P-value
Non - anemic	235	29.09	3.53148	25.3408	<0.001
Anemic	156	20.53	2.83173		

Table 3: Proportion of anaemia from trypanosome infected and uninfected cattle population

Trypanosome	Anemic	Frequancy	Perecentage	Percent share per strata
Infected	Positive	19	4.9	73.08
	Negative	7	1.8	26.92
Uninfected	Positive	137	35	37.5
	Negative	228	58.3	62.5

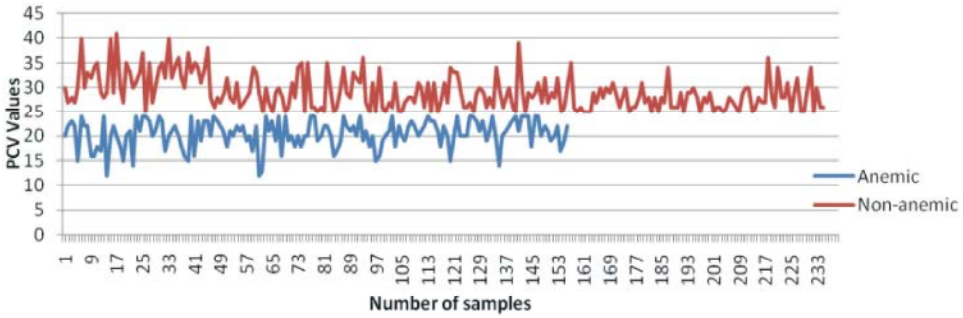

Fig. 4: A graph showing distribution of PCV status

DISCUSSION

The overall prevalence of bovine trypanosomosis in the study area was 6.65%. The finding of the current study is slighly in consistent with the studies conducted previously in Ethiopia by Tafese *et al.* [15] who studied prevalence of bovine trypanosomosis in East Wollega zone using buffy coat technique and found prevalence rate of 8.5% [16], who assessed cattle trypanosomiasis in the tsetse-free and the tsetse infested zones of the Amhara region of Northwestern Ethiopia using molecular diagnostic method, reported infection rates of 20.9% and 25.7%, respectively which is not in agreement with the current study conducted in Eastern and western Gojam zone of the same region. This variation might be attributed to geographical, seasonal and test method applied.

This study was also lower as compared to Shimelis *et al.* [17] in Dembecha and Jabitehenan (12%); and Yohanes [18] in Metekel district (17.20%). This difference emanates from many factors which could be due to parasitic and vector control programmes practiced in the area. Expansion of veterinary services up to peasant association and deforestation for crop cultivation and settlement might also have contributed to the low prevalence. The lower prevalence observed in this study could also be due to inadequacy of parasite detection method used. It was reported that the buffy coat microscopy technique is relatively an insensitive diagnostic method as it fails to detect 66% of infected cattle [19] when compared to molecular diagnostic techniques which permit precise identification of the parasite to species level and serological diagnostic methods are more sensitive [14].

Out of the 6.65% overall prevalence of trypanosome infection, 5.63% were due to *T. congolense*, 0.77% were due to *T. vivax* and 0.25% were due to mixed infecion. The finding of this study revealed, the total trypanosome positive animals 84.61% (22/26) were found to be infected with *T. congolense*, 11.54% (3/26) were infected with *T. vivax* and the remaining 3.85% (1/26) were infected with both. The higher proportion of T. Congolense in this study was coincide with the results of Woldeyes and Aboset [20] at Arba Minch Zuria districts (85.2%) and Rowlands *et al.* [21] in Ghibe valley, Southwest Ethiopia found a *T. congolense* infected proportion of (84%).

The predominance of T. congolense infection in cattle suggests that the major cyclical vectors or Glossina species are more efficient transmitters of *T. congolense* than *T. vivax* in East Africa [22] and also due to the high number of serodems of *T. congolense* as compared to *T. vivax* and the development of better immune response to *T. vivax* by infected animals. Different studies have indicated that *T. vivax* is highly susceptible to treatment while the problems of drug resistance are higher in *T. congolense* [23]. Trypanosoma congolense is mainly confirmed in the blood, while T. vivax also invade the tissues [24].

Animal wise study of trypanosomosis in different sex and age groups of cattle divulge significant variation was not observed ($P > 0.05$). This might be because of an equal chance of exposure to the parasite. This result is in agreement with the previous researches reported by Tafese *et al.* [15], Bekele and Nasir [25].

The overall anaemia prevalence in the studied areas were 39.9%. When infected and noninfected animals were compared, the anaemia prevalence was significantly higher in trypanosome positive cattle (19/26, 73.08%) than in non infected cattle (137/365, 37.5%) ($P < 0.05$). This finding was in agreement with previous reports [16, 25]. According to body condition compartementization cachectic animals were highly prone to the disease 22.22% (14/63) followed by lean 7.19% (11/153) when compared to good body conditioned animals 0.57% (1/175) which was statistically highly significant (p=0.000). The result is in line with the study of Shimels and Bosona [26] who reported poor body condition animals were significantly higher than that of medium and good body condition animals. This trypanosomsis is a chronic disease as stated by Urquhart *et al.* [27] the observed emaciation and weight loss might be caused by the disease itself.

Of 39.9% anemia prevalence, 4.9% was trypanosome positive animals. However, large number of animals, 35%, had anaemia without having trypanosomosis infection through buffy coat examination. This suggests that even though anaemia is characteristic of trypanosomosis, other factors are also anticipated to affect the PCV profile of animals. Diseases such as fasciolosis, gastrointestinal parasitism, vector borne diseases and nutritional deficiencies can also cause reduced PCV [28].

However, Some animals were infected by trypanosome but their PCV was normal and anaemia was not recorded in them. This might be due to some infected animals being able to keep their PCV within the normal range for a certain period of time. The appearance of parasitologically negative animals with PCV values of less than the threshold value set (24%) may be due to inadequacy of the detection method used [14], other anaemia causing diseases [28], or delayed recovery of the anaemic situation after current treatment with trypanocidal drugs.

The mean PCV value of parasitemic animals was found to be significantly lower (20.53% ±2.83173) than that of aparasitemic (29.09% ±3.53148) animals which is similar to the results obtained by Habtamu *et al*. [29]. Low PCV value may not solely be due to trypanosomosis. However, these factors are likely risks for both parasitaemic and nonparasitaemic animals. Therefore the difference in mean PCV value between parasitemic and aparasitemic animals indicates that trypanosomosis is involved in reducing the PCV values in the infected animals.

CONCLUSION

The current study revealed that trypanosomosis is an important disease and a potential threat that affects the health and productivity of cattle in the area. The major species of trypanosomes in the study area were *T. congolense* followed by *T. vivax*. Body conditions showed significance difference amongst the parameters which is due to chronic nature of the disease as stated by Urquhart *et al.* [27]. Nearly 40% of the sampled animals had a PCV value of below 24% and were thus considered as anaemic. The anaemia prevalence was significantly higher in trypanosome positive cattle than in noninfected cattle. The mean PCV value of parasitemic animals was significantly lower (20.53% ± 2.83173) than that of aparasitemic (29.09% ± 3. 53148) animals. This indicates that infection with trypanosomosis negatively affects PCV profile of animals. Therefore, awareness creation, appropriate control and prevention strategies should be designed and implemented to minimize its effect on livestock production and productivity in the studied area.

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Availability of Data and Materials: The data sets used and/or analyzed during the current study available from the corresponding author on reasonable request.

Consent for Publication: Not applicable.

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