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Research Article

Prevalence of Bovine Trypanosomosis and Apparent Density of Tsetse Flies in Nonno District, Western Shewa zone, West Ethiopia

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Abstract: Across-sectional study was conducted from January to May, 2018 to assess the prevalence of bovine trypanosomosis and apparent density of tsetse flies. To assess the prevalence of bovine trypanosomosis the buffy coat technique method was used and the mono pyramidal and Biconical baited traps was used to assess the flies densities in six peasant associations of Nonno district of west shewa zone ,west Ethiopia. The overall prevalence rate of bovine trypanosomosis recorded in the district was 4.23% in which the blood sample collected from 544 selected animals. During this study period *Trypanosoma congolense* was the dominant species 15 (65.22%), while the low infection was mixed infection of *Trypanosoma congolense* and *Trypanosome vivax* (8.7%) were the encountered parasitological infection rate of the district. The highest prevalence 7 (9.58%) of the disease was recorded in Biftu jalala peasant association while the lowest 2(1.69%) was recorded in Mitari Ebani peasant association.The mean PCV of parasitemic animals was significantly lower (22.39%) than the aparasitemic animals (28.83%) ($p<0.05$). There were statistically significant difference ($P<0.05$) in prevalence of the disease in body condition. The highest prevalence (18.46%) was recorded in poor body condition animals. The overall apparent densities of the tsetse flies were 2.72 f/t/d. The G. *fuscipes fuscipes* and *G. pallidipus* were tsetse flies species caught during the study period. Generally, the study concludes that tsetse flies were an important vector for the epidemiology of bovine Trypanosomosis in the district. Therefore, Vector and disease control and prevention methods should be undertaken to improve livestock production and productivity in the study area.
Keywords: Nonno,Ethiopia, PCV, Trypanosomosis, Prevalence.

INTRODUCTION

African trypanosomosis is one of the major constraints of animal production in sub- Saharan African countries including western and southwestern parts of Ethiopia (Auty, H. *et al.*, 2015). Vector borne trypanosomosis is excluding some 180, 000 -200, 000 km2 of agriculturally suitable land in the west and southwestern parts of the country (Enwezor, F. N. C. *et al.*, 2009).

Trypanosomosis is disease caused by unicellular parasites, trypanosome, found blood and other tissue of vertebrates; including livestock, wild life and people (Oyda, S., & Hailu, M. 2018; Kacho, B. B., & Singh, B. 2017). It is a serious disease in domestic livestock causing a significant negative impact on food production and economic growth in many parts of the world, particularly in sub-Saharan Africa. Its epidemiology and impact on livestock production are largely determined by the prevalence and distribution of the disease and its vectors in the affected area (Uilenberg, G., & Boyt, W. P. 1998).

This disease is transmitted mainly by tsetse flies (Cyclically), biting flies (Mechanically) and by other means of transmission. The most important species that infected cattle include *Trypanosomacongolense*, *T. brucei*and *T. vivax*. Mechanically transmission is particularly important in relation to *T. vivax* and *T. evansi* particularly on the fringe of tsetse areas. It can also occur in the presence of biting. Trypanosomosis is prevalent in two main regions of Ethiopia i.e. the North West and the southwest regions. In Ethiopia, trypanosomosis is one the most important disease limiting livestock productivity and agricultural development due to its

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high prevalence in the most arable and fertile land of south west part of the country following the grater basins of Abay, Omo, Ghibe, Didessa and Baro with a high potential for agriculture (Abebe, G. 2005).

The economic burden of trypanosomosis is not only due to the direct losses resulting from mortality, morbidity and infertility of the infected animals but also it is due to the indirect losses like exclusion of livestock and anima; power based crop production from the huge fertile tsetse infested areas. In Ethiopia, about 5.5 million heads of cattle are exposed to the risk of trypanosomosis. Nevertheless, in Nonno district the magnitude of trypanosome infection and the distribution of its vectors are not well known except complaints from farmers of the area.

Therefore, the objective of the study was

- To determine the prevalence of bovine Trypanosomosis
- To identify vector species and their apparent density
- To assess the risk factors associated with the disease and collecting baseline data to control the vectors.

MATERIALS AND METHODS

Study Area

The study area is located in Oromia regional state, West Shewa zone. The mean annual rain fall in Nono district ranges from 1000-1500 mm.The annual temperature ranges from 22-31°C.The areas have got a number of wild animals, such as African buffaloes,Bush pigs, warthog, bush buck, kudu, hippopotamus, crocodiles, hyena, antelopes and snakes which are claimed to serve as sources of food for the vector of trypanosomes.

Study Population:

Study animals were zebu cattle kept under extensive traditional husbandry condition. The animals graze the communally owned pasture land throughout the year. They are managed under the same agro-ecology without any additional supplementary feedings. The district has 33 peasant associations and animal population estimated to be 183,386 cattle, 13, 230 sheep, 28,958 goats, and 20,065 equine.The study was conducted on 544 local breed cattle selected from six peasant associations in the district. Of these animals, 75 were from Biftu-Jalala, 95 were from Gololle, 86 were Hallo-Dinki, 97 were from Jiru-Gemachu, 118 were from Mitari-Ebani and 75 were from Taltalle. The origin, sex and body condition score of the animals were explanatory variables used to associate with prevalence rate (NBLF. 2014).

Study Design:

Cross-sectional study was conducted to determine the prevalence of bovine trypanosomosis and apparent density of vectors (tsetse population).

Sample Size and Sampling Method:

The simple randomsampling technique was applied to collect from the ear vein. The sample size can be determined based on the study type and sampling method for investigation, 95% confidence interval, 5% desired absolute precision and 50% average prevalence (Thrusfield, M., & Christley, R. 2005).

Study Methods

Entomological Survey:

For the entomological study, tsetse flies and other flies were collected from selected sites of the study area. The altitude levels, Peasant Associations, numbers of traps, tsetse species caught, other biting flies, days and vegetation types were recorded during the sampling period. The flies were caught with traps baited with acetone, octenol and cow urine. In the selected sites of the study area, about 60 baited traps were deployed at 200-250 meters interval at side of river and woody grass land and kept in position for 48 hours. During trapping, acetone and octenol was dispensed from open vials through an approximately, ’O’- sized hole while cow urine from open bottles into which a quarter of tissue paper was used. All odors were placed on the ground about 30cm upwind of the trap. The underneath of each pole was smeared with grease in order to prevent the ants climbing up the pole towards the collecting cage that could damage the tsetse flies. The different fly catches in each trap were counted and identified; the species of tsetse flies and other biting flies were identified based on their morphological characteristics such as size, color and wing venation structure (Walle R, D. 1997).

Determination of Packed Volume:

The capillary tubes were placed in micro haematocrit centrifuge with sealed end outer most. The tube was loaded symmetrically to ensuring good balance after screwing the rotators cover and closing the centrifuge lid, the specimens were allowed to centrifuge at 12, 000 revolutions per minute for 5 minutes. Tubes were then placed in a haematocrit and readings were expressed as a percentage of red blood cells to the total volume of whole blood. Animals with PCV<24% were considered to be anemic (Morag, G. K. 2002).

Buffy Coat Technique:

A small blood was collected from an ear vein using heparinized microhaematocrit capillary tube. A haematocrit tube with a whole blood sample and end was sealed with haematocrit clay. The tube was centrifuged at 12000 revolutions per minute for five minutes. After centrifugation trypanosome were usually found in or just above the buffy coat layer. The capillary tube was cut using a diamond tipped pen 1 mm bellow the buffy coat to include the upper most layers of the red blood cells and 1 mm above to include the plasma. The content of capillary tube was expressed on to side, homogenized on to clean side and covered with cover slip. The slide was under x40 objective x10eye piece for the movement of the parasites (Codjia, V., & Mulatu, W. 1993; Paris, J. *et al.*, 1982).

Data Management and Analysis:

The prevalence was calculated as the number of infected individuals divided by the number of total examined and multiplied by 100. Statistical analyses were conducted using STATA version 12.0 software. Descriptive statistics were used to summarize data. The association between the prevalence of trypanosome infection and risk factors were assessed by logistic regression, whereas the two group mean comparison (t-test) was used to assess the difference in mean PCV between trypanosome positive and negative animals. The test result was considered significant when the calculated p-value was less than 0.05. The density of fly population was calculated by dividing the number of flies caught by the number of traps deployed and the number of days of deployment and expressed as fly /trap/ day (FTD).

RESULTS

Entomological survey

A total of 326 tsetse flieswere caught during study period. The overall apparent density of tsetse flies was 2.72 f/t/d. Two tsetse species have been identified. 180(55.21%) were *Glossinafucipesfuscipes*and 46(44.78%) were *Glossinapallidipes*. From overall the study sites, the highest (3.73 f/t/d) in Biftu-jalalapeasant associations. From total tsetse flies trapped females occupied larger proportion and out of 326 tsetse flies caught, 227(69.63%) flies were female while the rest 99(30.37%) were male(Table 1).

Parasitological Findings

The overall prevalence of bovine trypanosomosis in the study area was 4.23%. The prevalence of bovine trypanosomosis in each peasant association was determined to be 9.58% in Biftu-Jalala, 6.66% in Taltalle, 4.12% in Jiru-Gemachu, 3.48% in Hallo-Dinki, 2.1% in Gololle and 1.69% in Mitari-Ebani. Among those six peasant associations, BiftuJalala peasant association showed the highest prevalence rate (9.58%) and the lowest being in Mitari-Ebani (1.69%) as shown in (Table 2). *T.congolence*was dominant species with a proportion of 15(65.22%), followed by *T.vivax*6(26.08%) and *T. congolence, T. vivax* mixed infection 2(8.7%) (Table 3).There was statisticallysignificant difference (P<0.05) in prevalence of infection between body condition score and highest prevalence rate of 18.46% in poor body condition score (Table 4).

Hematological Findings

The mean PCV value for the parasitemic cattle was 22.39+3.75 SD while the mean PCV value for the aparasitaemic cattle was 28.83+4.52 SD. There was statistically significant difference (P<0.05) in mean PCV value between parasitaemic and aparasitaemic cattle (Table 5).

Table 1: Apparent density of flies in different PA’s in Nonnodistrict.

PAs	No of trap deployed	G.pallidipes		G.f.fuscipes		Total	FTD
		M	F	M	F		
BiftuJalaala	20	17	46	22	64	149	3.73
Hallo Dinki	15	11	27	10	21	69	2.3
Taltalle	25	12	33	27	36	108	2.16
Total	60	40	106	59	121	326	2.72

PAs: Peasant associations,FTD: Fly per trap per day, F: female, M: male

Table 2: Overall prevalence of Bovine trypanosomosis in different PA’s of Nonno district.

Peasant association	Number of animal examined	Infected animals	Non Infected animals	*Trypanosome spp.* Identified			Prevalence (%)	X^2	p-value
				T.c	T.v	Mixed			
BiftuJalala	73	7	66	6	0	1	9.58	9.32	0.097
Gololle	95	2	93	1	1	0	2.1		
Hallo dinki	86	3	83	2	1	0	3.48		
JiruGemmachu	97	4	93	3	1	0	4.12		
MitariEbani	118	2	116	1	1	0	1.69		
Taltalle	75	5	70	2	2	1	6.66		
Total	544	23	521	15	6	2	4.23		

T.c:*Trypanosomacongolense, T.v: Trypanosoma vivax and Mixed:T. congolense, T.vivax*

Table 3: Distribution of Trypanosomosis species in different peasant associations.

Peasant association	***Trypanosome spp*. Identified(n=23)**			Total
	T.c	T.v	Mixed	
BiftuJalala	6(26.08%)	0(0.0%)	1(4.35%)	7(30.43%)
Gololle	1(4.35%)	1(4.35%)	0(0.0%)	2(8.7%)
Hallo dinky	2(8.7%)	1(4.35%)	0(0.0%)	3(13.04%)
JiruGemmachu	3(13.04%)	1(4.35%)	0(0.0%)	4(17.39%)
MitariEbani	1(4.35%)	1(4.35%)	0(0.0%)	2(8.7%)
TaltalleBerre	2(8.7%)	2(8.7%)	1(4.35%)	5(21.73%)
Total	15(65.22%)	6(26.08%)	2(8.7%)	23(100%)

T.c:*Trypanosomacongolense*, T.v: *Trypanosoma vivax*and Mixed: *T.congolense*,*T. vivax*

Table 4: Prevalence of Trypanosomosis in relation to sex and body condition score of the animals.

Variables	**Examined animal**	**Positive animals**	**Prevalence rate (%)**	X^2	**p-value**
Sex					
Male	303	14	4.62	0.26	0.61
Female	241	9	3.73		
Body condition					
Good	104	2	1.92	36.98	0.00
Medium	375	9	2.4		
Poor	65	12	18.46		
Total	544	23	4.23		

Table 5: The mean packed cell volume of examined cattle in Nonno district

Group	**Observations**	**Mean PCV**	**SE**	**SD**	**95% CI**
Aparasitemic	521	28.83	0.19	4.52	28.44…29.22
Parasitemic	23	22.39	0.78	3.75	20.76…24.01
Total	544	28.55	0.2	4.67	4.55…8.32

SD= Standard Deviation, SE= Standard Error,PCV=Packed cell volume

DISCUSSION

The present study revealed that from a total of 544 randomly selected cattle's in the study area, 23 (4.23%) of the animal were positive for trypanosomes. This finding was lower than the previously reported infection rate of 18.5% in Arba-minchzuria district (Teka, W. *et al.*, 2012), 11.7% in Abay Basin northwestern Ethiopia (Bitew, M. *et al.*, 2011), 20.4% in Wolyta and Dawero Zone of Southern Ethiopia (Miruk, A. *et al.*, 2008), 16.9% in Sayo, district, kellemWollega, Western Ethiopia (Getachew, S. *et al.*, 2014) and 29% prevalence in Gawo-Dale, West Oromia (NTTICC. 2004). The lower prevalence in the current study might due to the use of prophylactic and trypanocidal drugs, application of relatively designed method of tsetse fly control and expansion of cultivation land in the area which in directly affects its vectors.

This study shows that, *T.congolence* was dominant species with a proportion of 15 (65.22%), followed by *T.vivax* 6 (26.08%) and *T.congolence*, *T. vivax* mixed infection 2(8.7%).This results in agreement with the predominance of *T.congolense* infection in cattle as compared to *T. vivax* and may be due to the development of better immune response to *T. vivax* by infected animal. Moreover, the most prevalent trypanosome species in tsetse infested area of Ethiopia are *T. congolense* (Muturi, K. S. *et al.*, 2000).

During the study period, the prevalence of bovine trypanosomosis in their different body condition scores (Good, medium and Poor) animals shows that statistically significant difference ($P<0.05$). The prevalence of trypanosomosis in those animals with poor body condition (18.46%) was higher than those in medium(2.4%) and good(1.92%) body condition. Similar findings were reported in Abay (Blue Nile) base areas of Northwestern, Ethiopia (Shimelis, D. *et al.*, 2008) in Bure district, western Ethiopia (Mezene, W. *et al.*, 2014). On another hand disagreement with the study in Metekel and Awi zone of North West Ethiopia (Mekuria, S., & Gadissa, F. 2011). Obviously, the disease itself result in progressive emaciation of infected animals; never less, non-infected animals under good condition have well developed better immune status that can respond to any foreign protein better than those non infected cattle with poor body condition which can be immune compromised due to other disease or malnutrition, since malnutrition and concurrent infections depress the immune responsiveness in some cases (Collins, F. M. 1994).

In this study, the occurrence of the disease between the sex of animals, shows that no statistical significance (P>0.05) variation. Among 23 trypanosome positive animals, 14(4.62%) of them were male animals and 9(3.73%) of them were female animals. The higher infection rate in male may be attributed to stress factors related to work load that Oxen are mostly used for drought purpose and they walk long distance to arrive at areas where ploughing the land, which having a high risk of tsetse flies challenge.

The present study indicated that the difference between mean PCV values of parasitaemic (22.39%) and aparasitaemic (28.835) cattle of the study area was significant (P<0.05). This result was in agreement with the previous work done in BiloNopha district,south west Ethiopia (Tekalegn, D., & Kumela, L., 2018; Sinshaw*et et al.*, Sinshaw, A. *et al.*, 2006). Being intracellular blood parasites, trypanosomes result in lowering PCV of cattle because they lyses and destruct the red blood cells. The appearance of trypanosomosis in negative animals with PCV values of less than the threshold values (25%) may be due to the inadequacy of detection method used or delayed recovery of aneamic situation after current treatment with trypanocidal drugs Or due to be anaemic by other complicative cause like malnutrition. Parasitaemic animals with PCV values greater than 25% might be thought of recent infection. Trypanosome infection and mean PCV values obtained in this study in the parasitaemic animals was found to be highly associated. Different authors in southern, northwestern and southwestern Ethiopia (Bekele, J. *et al.*, 2010; Rowlands, G. J. *et al.*, 1993) also reported similar results. The mean PCV can be affected by many factors including helminth parasites infections, nutritional deficiencies and blood parasites, other than trypanosomosis, however, these factors are likely to affect both trypanosomosis positive and negative animals (Tasew, S., & Duguma, R. 2012; Van den Bossche, P. R. G. J., & Rowlands, G. J. 2001).

The risk of trypanosomosis is also influenced by apparent density of the tsetse flies and type of vector prevailing in the area. In this study, the entomological findings revealed that two species of *Glossina*(*Glossinapallidipes,and G. fuscipesfuscipes*) out of five reported inEthiopia. The overall apparent density of Glossina species was 2.72 flies/ trap/ day. These findings lower than the previous report 11.9 f/t/d from Hewa-Gelan district, Oromia region, west Ethiopia (Fentahun, T. *et al.*, 2012), 4.3 f/t/d/ from Lalo-Kiledistrict,KellemWollega Zone, Western Ethiopia (Olani, A., & Bekele, D. 2016).The result also higher than the previous report 1.15f/t/d for tsetse in East Wollega zone (Tafese, W. *et al.*, 2012) and 1.35 f/t/d in southern rift valley of Ethiopia (Bekele, J. 2004). Higher percentage of female (69.63%) tsetse flies was caught than males (30.36%) that are in line with various reports from different parts of Ethiopia (Haile, G. *et al.*, 2016; Lelisa, K. *et al.*, 2015). This could be adhered to longer lifespan of female tsetse flies than males (Dyer, N. A. *et al.*, 2008; Caljon, G. *et al.*, 2014).

CONCLUSION AND RECOMMENDATIONS

The present study indicated that Trypanosomosis is one of the most important constraints for livestock production in the area. Thus, strategic control of bovine Trypanosomosis including integrated and sustainable vector control should be strengthened to improve livestock production and agriculture development in the area.

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