MedCrave
Step into the World of Research

International Journal of Vaccines and Vaccination

Epidemiology of Cattle Trypanosomosis and Its Vector Density in Bullen District

Abstract

The study was conducted in Bullen district of Metekele zone, Benishangul Gumuz Regional State, Western Ethiopia between April 2013 and July 2013 to assess trypanosomosis prevalence, prevailing trypanosomes species, risk factors and vector density. Buffy coat technique and hematological procedures was used to analyze blood samples collected from (n= 394) randomly sampled local zebu cattle. Traps were deployed to catch flies during the survey. A trypanosomosis prevalence of 22/394(5.6%) was found. *Trypanosoma vivax* 14/22(63.6%) and *Trypanosoma congolense* 8/22(36.4%) were identified with no mixed infections. Mean packed cell volume (PCV) value of parasitaemic animals was lower (24.86% ± 5.50) than aparasitaemic animals (26.54% ± 5.00) and the variation was not statistically significant (p>0.05). Out of the total animals examined, 34.8% (137/394) were found anemic. Interestingly, 31.47% of the anemic animals were aparasitaemic whilst 3.29% were parasitaemic. However, the anemia distribution was higher (59.09%) in infected animals than in non-infected ones (33.33%). The study sites, body conditions, age categories and gender groups were found statistically not significant (p>0.05) risk factors for trypanosomosis prevalence. The entomological survey identified *Glossina tachinoides* in the area with mean apparent density as determined by fly/trap/day (F/T/D) of 0.72. Biting flies such as stomoxys, haematopota and tabanus were also collected with mean apparent density with F/T/D of 2.22, 0.41, and 0.28, respectively. To sum up, the study showed the prevalence of trypanosomosis in the area warranting the need for developing controlling strategies in the district to overwhelm its negative economical impacts.

Keywords: Bullen district; Cattle; PCV; Prevalence; Risk factor; Trypanosome; Tsetse fly

Research Article

Volume 2 Issue 6 - 2016

Asmamaw Aki[1], Yismashewa Wogayehu[2], Kafyalew Chirkena[3], Gashaw Beyene[2], Etsegenet Tekeba[2], Getachew Teka[4]* and Getachew Dinede[2]

[1]*Regional veterinary Diagnostic laboratory, Asossa, Ethiopia*

[2]*Ministry of Livestock and Fisheries, Epidemiology Directorate, Ethiopia*

[3]*Ministry of Livestock and Fisheries, Veterinary Public Health Directorate, Ethiopia*

[4]*Oromia Regional State Bureau of Livestock and Fisheries, Ethiopia*

***Corresponding author:** Getachew Dinede, Ministry of Livestock and Fisheries, Epidemiology Directorate, Addis Ababa, Ethiopia, E-mail: dinedegech@gmail.com

Received: August 26, 2016 | **Published:** September 26, 2016

Introduction

In Ethiopia, tsetse transmitted animal trypanosomosis is a serious constraint to livestock production and agricultural development [1,2] exorcising farmers and livestock keepers out of areas having very high potential for growth, and forcing them to live on a highly degraded highlands of the country. The problem caused by tsetse and trypanosomosis is not only limited to inflicting diseases but also leading to significant negative impacts such as losses due to mortality and morbidity in domestic animals, cost of livestock treatment and tsetse control, and getting rid of draught animals from their infestation areas [3].

Ethiopia lies in the Eastern African tsetse belt and about 200,000 Km^2 of this area is believed to be infested by tsetse flies (NTTICC, 1996). These areas are primarily situated along the larger river valleys in the country comprising Abay basin, Baro/Akobo, Omo/Ghibe and Didessa Rivers whereby abundant rainfall is present with fertile soils. The arable land remains uncultivated throughout the year due to the tsetse and trypanosomosis impact. In this area, an estimated 14.8 million cattle, 6.12 million sheep and goats, 1 million camels and 1.23 million equines are at risk of contracting trypanosomosis.

In the Abay basin areas of northwest Ethiopia, tsetse transmitted trypanosomosis is one of the most economically important diseases impeding the development of livestock and agricultural farming activity which requires development of proper surveillance and control strategy. Benishangul-Gumuz regional state pertains to the area of North west part of the country and nearly 31,000 km^2 or 62% of the region's total land area is believed to be infested with tsetse fly (NTTICC, 1996). Despite this fact, very scant information is available about the disease epidemiology and its vector with unpublished baseline data in the Bullen district. The aims of the present study were, therefore, to assess the epidemiology of trypanosomosis and its vector density in five kebeles of the Bullen district of Metekele zone, Benishangul Gumuz Regional State, Western Ethiopia.

Materials and Methods

Study area

Studies were conducted in five kebeles of the Bullen district including Bullen town, Emange, Doshe, Baruda and Bakuji accounting for 45% of the total district area coverage. The district has a total of 19 kebeles covering an area of 3252.397km^2 with a human population of 46,920. It lies at latitude of 10°, 36' and 15.1, and longitude of 036^0 and 04'52.1''E. It has an altitude of 1465m above sea level. Its annual average temperature is 29.5^0c and its rainfall range is 900-1100mm [4]. Mixed agriculture is a common practice with livestock population of 47218 cattle, 6367 sheep, 16392 goats, 5211 equines, 51089 poultry and 1420 beehives [5].

Study animals

Local zebu cattle (*Bos indicus*) of all ages, both genders, and all body conditions, which are reared in the study kebeles were included in the study. They usually use common grazing areas during the day and rest at their respective owner's stable at night.

Study design and sampling techniques

It was a cross-sectional study whereby the study kebeles were selected purposively for their expected trypanosomosis importance. The study cattle were sampled randomly at their grazing area. Sample size was obtained using Thrusfield [6] procedures assuming 50% expected prevalence, 95% confidence level and 5% level of significance. At sampling, age and body condition estimation was practiced as per De-Lahunta et al. [7] and, Nicholson et al. [8] techniques, respectively.

Study procedures

Measuring PCV: Marginal ear vein blood was collected using heparinized capillary tubes. The tubes were sealed at one end using sealant, put in haematocrit centrifuge and centrifuged at 12,000 rpm for 5 minutes. Subsequently, the tubes were placed in the haematocrit reader to measure the length of packed red blood cells that is used as its percentage of the total volume of blood. Animals with PCV less than 24% were considered to be anemic [9].

Detection of parasites by dark contrast buffy coat technique: The centrifuged tube was cut using a diamond tipped pen 1 mm below the buffy coat to include the upper most layers of the red blood cells and 3 mm above to include the plasma. Fluid was poured onto a glass slide, covered with cover slip, and then examined microscopically for movement of parasite using a 40X objective lens and 10X eye piece [10].

Entomological survey: During the study three types of traps were used comprising of 8 monopyramidals, 11 monoconicals, and 4 biconicals. Grease was used for polishing trap poles to prevent ants and other insects from entering.The traps, which were odor baited with acetone and cow urine, were installed at about 100m distances apart from each other for a total of 72 hours at rivers and vegetation covered areas where flies are supposed to inhabit frequently. The fly density and distribution was calculated as the number of flies caught per trap per day [11,12]. Tsetse classification was performed using characteristic morphology and their gender was differentiated using enlarged hypophageum. Likewise, other biting flies were differentiated based on their size, color, proboscis and wing venation structures at the genus level [1,13].

Data analysis: Raw data was entered into Microsoft Excel spreadsheets and analyzed using STATA version 11.0. Trypanosomosis association with the variables (gender, ages, body conditions and sites) was computed using Pearson's chi-square (χ^2). Mean PCV comparison between parasitaemic and aparasitaemic animals was evaluated using *t*-test. Prevalence was calculated as the percentage of infected animals, as indicated by dark contrast buffy coat procedures, out of the total animals examined. At confidence level of 95%, p-value of less than 0.05 was considered statistically significant.

Results

Distribution of trypanosomes

Out of total animals examined, 22/394(5.6%) was infected with trypanosomes. In the area, *T. vivax* and *T. congolense* were diagnosed as cattle pathogenic trypanosome species during this study, and their proportion was 14/22(63.6%) and 8/22(36.4%) respectively. However, mixed infections were not detected (Table 1).

Table 1: Distribution of trypanosomes in cattle population of Bullen district.

Trypanosomes	No. Positive	Prevalence (%)	χ^2	p-Value
T. congolense	8	36.4	7.95	0.043
T. vivax	14	63.6		
Total	22	100		

PCV and anemia findings

The study indicated an overall mean PCV value of 26.45 ± 5.04 SD. The work also demonstrated that it was 26.54 ± 5.00 SD for aparasitaemic animals and 24.86 ± 5.50 SD for parasitaemic animals having **no** statistically significant distribution between uninfected and infected animals ($p>0.05$) (Table2). Among the total animals examined 34.77% (137/394) were found anemic out of which only 3.29% (13/394) were found to be positive for trypanosomes; whereas 31.5% (124/394) were trypanosomes free. However, the prevalence of anemia was higher (59.09%) in infected than in non-infected cattle (33.33%) ($p<0.05$) (Table 3).

Table 2: Mean PCV comparison between parasitaemic and aparasitaemic cattle in Bullen district.

Status	Frequency	Mean	SD	*t*-Test	p-Value
Parasitaemic	22	24.86	5.5	1.5228	0.1286
Aparasitaemic	372	26.54	5		
Total	394	26.45	5.04		

Table 3: Anemia distribution in cattle population of Bullen district.

Status		Frequency	Percent	Percent Share Per Strata
Parasitaemic	Anemic	13	3.29	59.09
	Non-anemic	9	2.28	40.09
Aparasitaemic	Anemic	124	31.47	33.33
	Non-anemic	248	62.94	66.66

Trypanosomosis association with the identified risk factors

Although there was no significant association between sites, male verses female, age, or body condition ($p > 0.05$), there were trends. The highest and the lowest prevalence were recorded in Bullen town 9 (7.76%) and Bakuji 1(2.5%) respectively. The prevalence of trypanosomosis was slightly higher 13 (5.70%) in females than in males 9(3.61%). Likewise, the highest prevalence was registered in animals of ages greater than 5 years (11.36%), and the least (3.54%) in those between ages 2 and 5 years. Prevalence was highest (7.6%) in medium and lowest (2.86%) in poor body conditions. The summary of study sites, gender, age groups and body conditions on trypanosomosis is presented in Table 4.

Entomological findings

Overall, 167 flies were captured during the study period from different sites. Tsetse flies account for 33 (19.76%) of the total whereas other biting flies covers 80.24% comprising of 102(61.07%) stomoxys, 13 (7.78%) tabanus and 19(11.37%) haematopota (Table 5). Of the 33 tsetse flies captured, 75.76% were females. Only *G. tachinoides* were identified in the survey site with the overall apparent density of 0.72 (F/T/D). The highest fly density was observed in Bakuji 42(4.2 F/T/D) and the lowest recorded in Emange 19(3.16 F/T/D).

Table 4: Trypanosomosis association with study sites, gender and age and body condition in Bullen district.

Risk Factors	No. Examined	No. Positive	Prevalence (%)	p-Value	χ^2
Sites					
Bullen Town	116	9	7.76		
Emange	64	4	6.25		
Doshe	78	2	2.58	0.203	1.62
Baruda	96	6	6.25		
Bakuji	40	1	2.5		
Total	394	22	5.6		
Gender					
Male	166	9	3.61		
Female	228	13	5.7	0.89	0.02
Total	394	22	5.6		
Age (years)					
≤2	96	8	8.33		
2-5	254	9	3.54	0.18	1.76
≥5	44	5	11.36		
Total	394	22	5.6		
Body Condition					
Good	188	8	4.25		
Medium	171	13	7.6	0.46	0.54
Poor	35	1	2.86		
Total	394	22	5.6		

Table 5: Flies distribution in the study sites of Bullen district.

Sites	Total Flies	Total Traps	Tsetse Flies					Biting Flies		
			Number	Species	M	F	*F/T/D	Stomoxys	Tabanus	Haematopota
Bullen Town	32	5	1	*GT	2	5	0.7	22	1	2
Emange	19	3	2		0	2	0.33	12	2	3
Doshe	34	5	3		3	9	1.2	14	3	5
Baruda	40	5	4		0	1	0.1	30	5	4
Bakuji	42	5	5		3	8	1.1	24	2	5
Total	167	23		33	8	25	0.72	102	13	19

*F/T/D=fly per trap per day, GT=*Glossina tachinoides*, M=male, F=female

Discussion

This study showed an overall cattle trypanosomosis of 5.6%. Comparable research works have reported similar prevalence findings in various parts of Ethiopia. Tilahun et al. [14] revealed trypanosomosis prevalence of 6.34% while studying cattle trypanosomosis, and its vector density and distribution in Dale Sadi district, Kellem Wollega Zone, western Ethiopia. Lelisa et al. [15] indicated a prevalence of 5.43% during his research activity on prevalence of bovine trypanosomosis and apparent density of tsetse and other biting flies in Mandura district, Northwest Ethiopia. Aki et al. [16] reported a prevalence of 5.58% in cattle population of Pawe district of Benishangul Gumuz Regional State, Western Ethiopia. These equivalent findings in different parts of the country could be related to the similarities of the areas in their environmental settings such as availability of hosts, altitudes that affects ambient temperature and tsetse population density [17].

This research indicated that *T. vivax* and *T. congolense* were the trypanosomes distributed in the study area having a proportion of 14/22(63.6%) *T. vivax* and 8/22(36.4%) *T. congolense.* Similarly, research results showing predominance of *T. vivax* were demonstrated in different areas of the country. For example, 80% of *T. vivax* was reported by Bishaw et al. [18] during his study of prevalence of bovine trypanosomosis in Wemberma district of West Gojjam zone, Northwestern, Ethiopia. Likewise, 81.82% *T. vivax* was found by Lelisa et al. [15] work on prevalence of bovine trypanosomosis and apparent density of tsetse and other biting flies in Mandura district, Northwest Ethiopia. Dinede et al. [19] showed the predominant prevalence of *T. vivax* 48/52(92.30%) while dealing with epidemiology of cattle trypanosomosis and associated anemia in Mandura district. This higher prevalence of *T. vivax* might be attributable to the widespread of mechanical vectors (biting flies) in the area and their capability of disease transmission.

This study indicated an overall mean PCV value of 26.45±5.04 SD. It was found 26.54±5.00 SD and 24.86±5.50 SD for aparasitaemic and parasitaemic animals, respectively. It was observed that PCV profiles were not significantly affected in animals harboring trypanosomes. This finding was in disagreement with previous reports [19-21].

This study showed that the anemic distribution in the cattle population of the study area was 34.77%(137/394). A large proportion of uninfected animals were found anemic 31.5% whilst only 3.29% (13/394) of anemic animals were found positive for trypanosomes. However, the prevalence of anemia was higher (59.09%) in infected than in non-infected cattle (33.33%) ($p < 0.05$). These results were in agreement with earlier works [16,19,22,23]. As it has been indicated in this study, some animals were found anemic even if they were free of trypanosomes infection. This might be attributed to their current recovery from infection. It could also be because of the poor sensitivity of the buffy coat method for trypanosomes diagnosis (Murray et al. 1997). This procedure is effective at the early stages of the infection where a large numbers of parasites are circulating in the peripheral circulation. At the latter phase when the disease progresses into chronic state, however, the trypanosome count sharply drops in the circulation making too difficult to detect with the routine buffy coat procedures. It is indicated that 50% of infected animals escaped detection using the buffy coat procedure as compared to molecular diagnosis [24]. The anemia in animals, which were not detected as positive for trypanosomes, could possibly be induced by other factors like hemoparasites, blood sucking vectors and malnutrition [25].

In this study, it was demonstrated that the highest prevalence site was Bullen town 9 (7.76%) and the lowest Bakuji 1(2.5%). It was also shown that trypanosomosis infection was slightly higher 13 (5.70 %) in females than in males 9(3.61%). Likewise, the highest prevalence was registered in animals of ages greater than 5(11.36%), and the least (3.54%) in those between ages 2 and 5. Further, the study showed that it was highest (7.6%) in medium and lowest (2.86%) in poor body conditions. However, the variables under concern such as study sites, gender, age classification and body conditions were not found to be a factor for being susceptible to trypanosomosis. These research outcomes were in concordance with reports by groups of researchers in different parts of the country [15,19,26].

In the entomological survey, a total of 167 flies were captured from different study sites. Tsetse flies account for 33 (19.76%) of the total whereas other biting flies covers 80.24% comprising of 102(61.07%) stomoxys, 13 (7.78%) tabanus and 19(11.37%)

haematopota. Of the 33 tsetse flies captured, 75.76% were females. Only *G. tachinoides* were identified in the survey site with the overall apparent density of 0.72 (fly/trap/day). Similar findings were demonstrated in the prior researches. Aki and Dinede (2016) identified *G. tachinoides* with higher apparent density of 5.03(fly/trap/day) as the only prevailing tsetse fly during their research on trypanosomosis in cattle population of Pawe district of Benishangul Gumuz Regional State, Western Ethiopia. Dinede et al. [19] showed *G. tachinoides* as the sole tsetse fly in their study area while assessing the epidemiology of cattle trypanosomosis and associated anemia in Mandura District.

This study revealed the impact of trypanosomosis on the PCV of infected animals in lowering its value-causing anemia. Gender, age groups, body conditions nor study sites were proven to be significant risk factors for trypanosomosis distribution. The entomological survey showed *G. tachnoides* as the only prevailing tsetse fly during the study period, though; other mechanical vectors like stomoxys, tabanus and haematopota were also captured as these flies can also aid in the transmission of the disease. In summing up, trypanosomosis is an endemic disease in the district having an adverse impact on agricultural production systems which implies the demand for setting comprehensive control strategies to alleviate its negative effects [27].

Acknowledgements

We are very much grateful to Asossa Regional Veterinary Diagnostic, Surveillance, Monitoring and Study Laboratory for funding the study.

References

1. Langridge W (1976) Tsetse and Trypanosomosis survey of Ethiopia Ministry of overseas Department. UK. pp. 1-40
2. Abebe G (2005) Review article: Trypanosomosis in Ethiopia. Ethiopian Journal of Biomedical Science 4(1): 75-121.
3. Awoke K (2000) Study of trypanosomosis and its Vectors in Humbo and Merabo Warheads. Ethiop Vet J 4: 1-61.
4. NMSA (2015) Monthly report on temperature and Rainfall. National Meteorological Services Agency, Asossa, Ethiopia.
5. CSA (2014) Federal Democratic Republic of Ethiopia Central Statistical Agency. 2: 1-194.
6. Thrusfield M (2005) Veterinary Epidemiology. (3rd edn), Blackwell Science Ltd, Oxford, UK.
7. De-Lahunta A, Habel RE (1986) Teeth. Applied veterinary Anatomy, p: 4-16.
8. Nicholson MJ, Butterworth MH (1986) A guide to condition scoring of zebu cattle. International Livestock Centre for Africa, p. 1-29.
9. OIE (2008) Standardized techniques for the diagnosis of tsetse transmitted trypanosomosis. OIE Terrestrial Manual, Rome, Italy.
10. Paris J, Murray M, Mcodimba F (1982) A comparative evaluation of the parasitological technique currently available for the diagnosis of African Trypanosomosis in cattle. Acta Trop 39(4): 307-316.
11. Leak SGA, Woume KA, Colardeue C, Duffera W, Feron A, et al. (1987) Determination of tsetse challenge and its relationship withtrypanosomosis prevalence. In: livestock production in tsetse infested areas of Africa. ATLN, p. 43-52.
12. Leak SGA (1999) Tsetse biology and ecology; their epidemiology and control of Trypanosomosis, CABI, pp. 152-210.
13. Fisher MS, Say R (1989) Manual of Tropical Veterinary Parasitology. Parasitology 100(3): 500.
14. Tilahun Z, Jiregna D, Solomon K, Haimanot D, Girma D, et al. (2014) Prevalence of Bovine Trypanosomosis, its Vector Density and Distribution in Dale Sadi District, Kellem Wollega Zone, Ethiopia. Acta Parasitologica Globalis 5(2): 107-114.
15. Lelisa K, Damena D, Kedir M, Feyera T (2015) Prevalence of Bovine Trypanosomosis and Apparent Density of Tsetse and Other Biting Flies in Mandura District, Northwest Ethiopia. Veterinary Science & Technology 6: 3.
16. Aki A, Dinede G (2016) Trypanosomosis in Cattle Population of Pawe District of Benishangul Gumuz Regional State, Western Ethiopia: Anemia, Vector Density and Associated Risks. Researcher 8(3): 60-66.
17. MacLennan KJR (1980) Tsetse transmitted trypanosomosis in relation to the rural economy. Wild Animal Review 36: 2-22.
18. Bishaw Y, Temesgen NY, Alemu S (2012) Prevalence of bovine trypanosomosis in Wemberma district of West Gojjam zone, North West Ethiopia. Ethiop Vet J 16(2): 41-48.
19. Dinede G, Aki A (2016) Epidemiology of Cattle Trypanosomosis and Associated Anaemia in Mandura District. Nat Sci 14(5): 85-90.
20. Kenaw B, Dinede G (2015) Trypanosomosis and its Associated Risks in Cattle Population of Dangur District of Benishangul Gumuz Regional State, Western Ethiopia. European Journal of Applied Sciences 7(6): 291-296.
21. Kenaw B, Dinede G, Tolosa T (2015) Bovine Trypanosomosis in Asossa District, Benishangul Gumuz Regional State, Western Ethiopia: Prevalence and Associated Risk Factors. European Journal of Applied Sciences 7(4): 171-175.
22. Bekele M, Nasir M (2011) Prevalence and host related risk factors of bovine trypanosomosis in Hawagelan district, West Wellega zone, Western Ethiopia. African Journal of Agricultural Research 6(22): 5055-5060.
23. Biyazen H, Duguma R, Asaye M (2014) Trypanosomosis, Its Risk Factors, and Anaemia in Cattle Population of Dale Wabera District of Kellem Wollega Zone, Western Ethiopia. Journal of Veterinary Medicine p. 6.
24. Simukoko H, Marcotty T, Vercruysse J, Van den Bossche P (2011) Bovine trypanosomiasis risk in an endemic area on the eastern plateau of Zambia. Research in Veterinary Science 90(1): 51-54.
25. Van den Bossche P, Rowlands GJ (2001) The relationship between the parasitological prevalence of trypanosome infections in cattle and helped average packed cell volume. Acta Tropica 78(2): 163-170.
26. Ayele T, Ephrem D, Elias K, Tamiru B, Gizaw D, et al. (2015) Prevalence of Bovine Trypanosomosis and its Vector Density in Daramallo District, South Western Ethiopia. J Vet Adv 2(6): 266-272.
27. Rhodesia (1996) Annual Report on Tsetse and Trypanosomosis Control, for the year ending 30th Sept 1969. CABI p.11-15.