

Full Length Research Paper

Prevalence of bovine trypanosomiasis in Dara District Sidama Zone, Southern Ethiopia

Migbaru Keffale Bezabih^{1*}, Zerihun Shabula² and Nateneal Tamerat Beyene²

¹Department of Biomedical Science, College of Veterinary Medicine, Haramaya University, P.O. Box 301, Haramaya, Ethiopia.

²Southern Nations Nationalities and Peoples Region, Sidama zone, Dara District Agricultural Office, Ethiopia.

Receive 30 September, 2015; Accepted 11 December, 2015

A cross sectional study was conducted in five selected peasant Associations of Dara Woreda of Southern Ethiopia from October, 2013 to June, 2014 to estimate the prevalence of bovine trypanosomiasis and to identify the prevalent trypanosome species, and the risk factors of the disease. Blood samples were collected from the ear vein of randomly selected 384 cattle. Thin blood smear and buffy coat techniques are employed to detect the presence of the parasite and the PCV was measured to evaluate the anemic condition of the animals. Out of the total number of cattle examined, 57 were found to be positive for Trypanosomiasis giving the overall prevalence of 14.8%, out of which 47.6% *Trypanosoma congolense*, 33.3% *Trypanosoma vivax*, 9.5% *Trypanosoma brucei* and 9.5% mixed infection (*Trypanosoma congolense* and *Trypanosoma vivax*) were identified. The maximum prevalence 28.4% was observed in Safa followed by Adame, Odola, Machisho and Kumato with the prevalence of 19.8, 11.5, 10.1 and 4.9%, respectively. Animals were grouped into three age categories, calves < 1 year, young 1 to 3 years, Adult >3 years with the prevalence of 4.2, 8.5 and 20.5% respectively. Based on the body condition score, the prevalence of 8, 13 and 25.2% was recorded in good, medium and poor conditioned animals, and it was higher in females 15.7% than males 12.4%. The statistical analysis showed a significant association in the variation of age categories, body condition and among peasant associations ($p < 0.05$). The result also showed a significant difference in packed cell volume (PCV) values between infected and non-infected cattle. In conclusion, the study showed that disease was higher in the area and had significant effect on the body condition and development of anemia. Therefore, the responsible organizations and the community should work on the control and prevention activities of the disease in environmental friendly manner.

Key words: Cattle, Dara, prevalence, *trypanosoma*, trypanosomiasis

INTRODUCTION

Trypanosomiasis is the wide spread protozoan parasitic disease affecting cattle and other wide range of host,

including humans in Sub-Saharan Africa. The course of the disease may run from an acute and rapidly fatal to a

*Corresponding author. E-mail: migkafe@gmail.com. Tel: +251910083862/+251919125288.

chronic long lasting one depending on the parasite-host interaction and the disease is characterized by intermittent fever, progressive anemia, loss of body condition of susceptible hosts, and this lead to heavy mortality if animals are untreated (FAO, 2005). Trypanosomosis in Africa livestock producers and consumers causes an estimated US \$ 1 billion loss each year. It is a severe problem to agricultural production in widespread areas of the tsetse infected regions that accounts for over 10 million km² of the tropical Africa (Maudlin et al., 2004).

The disease occurs in some 240,000 km² area of Ethiopia and about 10 to 14 million heads of cattle and a significant number of small ruminants and equines are under serious risk of contracting the disease of which 20,000 heads die every year (Solomon, 2006). Currently the country is infested with five species of tsetse flies namely *Glossina pallidipes*, *Glossina moristans*, *Glossina fuscipes*, *Glossina tachinoides* and *Glossina logispenis* (NTTICC, 2004). In Ethiopia, the most important trypanosome species that affects cattle, sheep and goats are *Trypanosoma congolense*, *Trypanosoma Vivax* and *Trypanosoma brucei* but *Trypanosoma evansi* and *Trypanosoma equiperdium* are for camel and equines respectively (Abebe, 2005).

Trypanosomiasis can be transmitted through cyclical or mechanical transmissions. In cyclical transmission there is always development and replication of parasite in intermediate hosts (tsetse flies) species like *Glossina m. submorsitans*, *G. pallidipes*, *Glossina fuscipes fuscipes* and *Glossina tachinoides*. These species of tsetse flies are distributed along the lowlands of western, southern and southwestern part of Ethiopia (wondewosen et al., 2012). The disease is also transmitted mechanically by biting flies of the genus *Tabanus*, *Haematopota*, *Chrysops* and *Stomoxys*. This type of transmission has caused the spread of *T. evansi* and *T. vivax*, which is found outside the tsetse belt areas (Oluwafemi et al., 2007). However, in very acute infections with highly susceptible exotic, animals infected with *T. vivax* can also pass through the placenta into the fetus in pregnant animals. As a result some cows abort and some calves are born before birth time (Abebe and Jobre, 1996).

In Ethiopia, trypanosomiasis is one of the most important disease limiting livestock productivity and agricultural development due to its high prevalence in the most arable and fertile land of south west and Northern part of the country following the greater river basins of Abay, Omo, Ghibe and Baro (Abebe and Jobre, 1996). The most estimates of the economic loss attributable to trypanosomiasis infection are based on the cost of mortality, reduced weight gain in animal grown for meat, reduced milk yield, draught output and impact on fertility (FAO, 2005). In addition to these, the disease is also responsible for an annual loss of millions of dollars in livestock production as a result of the cost related to treatment, prevention and vector control efforts

(Samuel et al., 2001).

In Southern Nations Nationalities and people's regional state, animal trypanosomiasis results to socio-economic impact through debilitation and deaths of untreated animals and reduces production and productivity of affected animals (Waldeyes and Aboset, 1997); however the disease had not yet been assessed and there is no documented baseline data in Dara district. Therefore, this study was conducted to estimate the prevalence of trypanosomiasis and to identify the prevalent trypanosome species and the possible risk factors of the disease.

MATERIALS AND METHODS

Study area

The study was conducted in five purposively selected peasant associations (PAs), namely Safa, Adame, Odola, Machisho and Kumato found in Southern Nations, Nationalities, and Peoples' Region (SNNP) region, Sidama zone, Dara Woreda which is situated at 365 km from Addis Abeba and 76 km from Hawassa. The woreda is found in 6.47°N and 38.33°E and covers 27,000 hectare total area, which is sub-divided into 37 PAs. The altitude of the woreda ranges from 1400 to 2800 m.a.s.l and mean rain fall is 1200 to 1700 mm. The temperature of the woreda ranges from 20°C to 27°C. In the area mixed farming system is practiced and the grazing land is covered by different vegetation types mainly savanna grassland forest, and bush lands (MARDO, 2011). Livestock population of the woreda are 21456 bovine, 5985 caprine, 8279 ovine, 2861 equine and 6468 poultry (CSA, 2012).

Study animal

The study was carried out on 384 indigenous Zebu cattle of both sexes; age groups and body condition of the animal were also considered. The animals in area mainly depend upon communal grazing fields and crop residues as feed source and watering points are the Gidawo and Buna rivers which are infested with tse-tse flies.

Sampling methods and sample size determination

A cross-sectional study using simple random sampling technique was employed to determine the prevalence of bovine trypanosomiasis in the study area. The 5 PAs were selected purposively based on the availability of transportation and logistics as well as their agro ecological representativeness of 37 PAs of the district. From each selected PA, the farmers as well as the study animals were selected randomly in each household. During sampling, PAs, age, sex and body condition score (BCS) of the animal were recorded. The body condition score was grouped in to good, medium and poor conditioned animals based on the appearance of ribs and dorsal spines applied for zebu cattle (Nicholson and Butterworth, 1986). Age of the animal was estimated by dentition (De-lahunta and Habel, 1986) and owner's information. The sample size (n) was calculated according to the formula given by Thrusfield (2005), considering 50% expected prevalence (p), 95% confidence level and 5% desired absolute precision (d).

$$N = \frac{(1.96^2 \times P)(1-P)}{d^2}$$

Table 1. Prevalence of trypanososis and identified trypanosome species in the study area.

Peasant associations	No of examined	<i>T. congolense</i> (%)	<i>T. vivax</i> (%)	<i>T. brucei</i> (%)	<i>T. congolense</i> and <i>T. vivax</i> (%)	Total positives	Prevalence (95%CI)	χ^2 (Pvalue)
Safa	74	10 (47.6)	7 (33.3)	2 (9.5)	2 (9.5)	21	28.4 (18.5-40)	20.6 (0.004)
Adame	81	8 (50.0)	5 (31.25)	2 (12.5)	1 (6.25)	16	19.8 (11.7-30.1)	
Odola	78	3 (33.3)	3 (33.3)	2 (22.2)	1 (11.1)	9	11.5 (5.4-20.8)	
Machisho	69	3 (42.8)	2 (28.6)	1 (14.3)	1 (14.3)	7	10.1 (4.2-19.8)	
Kumato	82	2 (50.0)	1 (25.0)	1 (25.0)	-	4	4.9 (1.3-12)	
Total	384	26 (45.6)	18 (31.6)	8 (14.0)	5 (8.8)	57	14.8 (11.4-18.8)	

Study design

The study was conducted by using simple random sampling techniques in order to determine the prevalence of trypanosomiasis in bovine species at study area. It was performed by parasitological survey and hematological procedures. Blood samples were obtained by puncturing the marginal ear vein with lancet.

Thin blood smear

A small drop of blood from a micro-haematocrit capillary tube was applied to a clean slide and spread by using another clean slide at an angle of 45 degree. The smear was dried by air and then fixed for 2 min in methyl alcohol. The thin smear was flooded with Giemsa stain 1:10 solution for 30 min. Then it was allowed to dry standing up right on the rack and examined under microscope oil immersion (100) objective lens (OIE, 2008).

Packed cell volume (PCV)

Blood was directly collected into heparinized capillary tubes, and the tubes were then sealed at one end with crystal seal. The capillary tubes were placed in micro-hematocrit centrifuge and allowed to centrifuge at 1500 revolution per minute (rpm) for 5 min. The centrifuged capillary tubers were placed on hematocrit reader, and measured for PCV. Animals with PCV less than 24% were considered to be anemic (OIE, 2008).

Buffy coat techniques

The capillary tubes were cut at 1 mm below the buff coat to include the upper layer of red blood cell and expressed onto a slide and then covered with cover slip, the slide was examined under 40x objective lens. Trypanosome species were identified according to their morphological descriptions of Giemsa stained blood film as well as movement in wet film preparations provided by Radostits et al. (2007).

Data analysis

The collected raw data and the results of parasitological and hematological examination were entered into a Microsoft excel spread sheet. Then the raw data was summarized using statistical package for the social sciences (SPSS) version 20. The presence of association between the prevalence of the diseases and the risk factors such as PAs, age, sex and body condition score were assessed by using chi-square test (χ^2). Mean PCV values of parasitaemic and non- parasitaemic animals were compared by independent t test. P-values less than 0.05 were considered as significant.

RESULT AND DISCUSSION

Out of the total of 384 cattle examined, 57 were positive for Trypanosomosis hence the overall

prevalence of the study area was 14.8%. This result is closely related with the result of 14.2% reported in Arbaminch (Abraham and Tesfaheywet, 2012). The maximum prevalence was observed at Safa peasant association (28.4) followed by Adame (19.8%). This might be due to their location around Gidawo and Buna river belts respectively, where there is high tsetse flies distribution whereas Odola, Machisho and kumato showing 11.54, 10.14 and 4.88% respectively showed statistically significant difference ($p < 0.05$). From the total trypanosome species identified, *T. congolense* 26/57(45.6%) was the most prevalent followed by *T. vivax* 18/57(31.6%) and *T. brucei* 8/57(14.0%) and 5/57(8.8%) mixed (*T. congolense* and *T. vivax*) infection. According to this result *T. congolense* was the dominant species in the study area (Table 1).

This finding is in agreement with the reports of Takile et al. (2014) with 53.33, 30 and 16.66% of the infections were due to *T. Congolense*, *T. Vivax* and *T. brucei* respectively, and also the reports of Habtamu et al. (2014) showed *T. congolense* (63.64%) followed by *T. vivax* (27.27%) and *T. brucei* (9%). The predominance of *T. congolense* infection in cattle suggests that the major cyclical vectors or *Glossina* species are more efficient

Table 2. Prevalence of Trypanosomiasis based on animal's age, sex and body condition.

Variables	No. of examination	No. of positives (%)	(95% CI)	χ^2 (P-value)
Age				
<1 year	48	2 (4.2)	0.5-14.5	13.6 (0.01)
1-3 years	117	10 (8.5)	4.2-15.2	
>3 years	219	45 (20.5)	15.4-26.5	
Sex				
Female	287	45 (15.7)	11.7-20.4	0.63 (0.43)
Male	97	12 (12.4)	6.6-20.6	
BCS				
Good	112	9(8)	3.7-17	13.36 (0.001)
Medium	196	22 (13)	8.3-19.0	
Poor	103	26 (25.2)	17.2-34.8	
Total	384	57 (14.8)	11.7-18.8	-

Table 3. Comparison of mean PCV between parasitaemic and aparasitaemic cattle.

Condition	No. examined	PCV <24%	PCV >24%	Mean PCV (95% CI)	t-test (p-value)
Parasitaemic	57	39 (68.4)	18 (31.6)	22.7 (22.2-23.2)	7.5 (0.001)
Aparasitaemic	327	63 (19.3)	264 (80.7)	25.9 (25.5-26.2)	
Total	384	102 (26.6)	282 (73.4)	25.4 (25.1-25.7)	

transmitters of *T. congolense* than *T. vivax* in East Africa and also due to the high number of serodemes of *T. congolense* as compared to *T. vivax* and the development of better immune response to *T. vivax* by infected animals (Leak et al., 1999).

In the present study, higher prevalence was observed in females (15.7%) than males (12.4%) which is in agreement with the reports of Feyissa et al. (2011) with 15 and 13.7% in female and males respectively but there was no significant difference ($P > 0.05$) (Table 2). The possible explanation for relative increment of prevalence in female animals might be due to physiological differences (Torr et al., 2006).

Based on age category, 4.2, 8.5 and 20.5% prevalence was observed in animals less than one year, between one and three years and above three years of age respectively which revealed significant variation between calves less than one year and >3 years of age ($p < 0.05$) (Table 2). This could be associated to the fact that adult animals travel long distance for grazing and draught as well as harvesting crops in areas of high tsetse challenge than calves (Ayele et al., 2012) which is supported by the results of Rowlands et al. (1995) in Ghibe valley which indicated that suckling calves don't go out with their dams but graze at homesteads until they are weaned off. Also, Fimmen et al. (1999) suggested that young animals are slightly protected by maternal antibodies.

In this study, out of the total animals examined, 26.6% were anemic having PCV <24 and 73.4%. On the other hand, out of the total 57 parasitaemic animals, 68.4% were anemic (PCV<24) and only 31.6% were not; whereas from 327 aparasitaemic animals only 19.3% were anemic (PCV<24) but 80.7% were not anemic. There was significant difference between the mean PCV values of parasitaemic and aparasitaemic animals ($t=7.5$, $p < 0.05$) (Table 3). This lower PCV was reported in previous studies in different parts of the country like Nigatu (2004) and Abraham and Tesfaheywet (2012). This might be due to trypanosome infection which produces erythrophagocytosis anemia (destruction of red blood cells) carried out by enzymatic and immunological mechanism during infection in parasitaemic animals (Budovsky et al., 2006).

Conclusion

Trypanosomiasis is one of the major constraints of cattle production as well as agricultural productivity in the Dara woreda due the reduction of milk yield, loss of body condition, stunted growth in young animals, and low output of draught power. The result revealed that *T. congolense* was the most prevalent species in the study area and the infections significantly affect the PCV values

and body condition. Therefore, economical and environment friendly community based tsetse fly and trypanosomiasis control program should be designed and implemented in the area.

ACKNOWLEDGEMENT

The authors would like to thank Dara woreda animal health clinic workers, and Soddo Regional Veterinary Laboratory and Soddo Regional tsetse control project for allowing them use the laboratory equipment, reagent and technical support during the field work.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

REFERENCES

- Abebe G (2005). Trypanosomiasis in Ethiopia. *Ethiop. J. Biol. Sci.* 4(1):75-121.
- Abebe G, Jobre Y (1996). Trypanosomosis: A threat to cattle production in Ethiopia. *Rev. Med. Vet.* 147(12):896-902.
- Abraham Z, Tesfaheywet Z (2012). Prevalence of Bovine Trypanosomosis in Selected District of Arba Minch, Snnpr, Southern Ethiopia. *Global Vet.* 8(2):168-173.
- Ayele T, Ephrem D, Elias K, Tamiru B, Gizaw D, Mebrahtu G, Mebrat E (2012). Prevalence of Bovine Trypanosomosis and its Vector Density in Daramallo District, South Western Ethiopia. *J. Vet. Adv.* 2(6):266-272.
- Budovsky A, Prinsloo I, El-On J (2006). Pathological developments mediated by cyclophosphamide in rats infected with *Trypanosoma lewisi*. *Parasitol. Int.* 55(4):237-242.
- Central Statistical Authority (CSA) (2012). Federal Democratic Republic of Ethiopia Agricultural sample report on livestock and livestock characteristics. Addis Ababa, Ethiopia. pp. 9-22.
- De-lahunta A, Habel RE (1986). *Applied veterinary anatomy*. W.B. Saunders Company. pp. 4-6.
- FAO (2005). The influence of trypanosomosis on African animal production. *Anim. Zootechnol.* pp. 1-2.
- Feyissa B, Samson A, Mihreteab B (2011). Bovine Trypanosomosis in Selected Villages of Humbo District, Southern Ethiopia. *Global Vet.* 7(2):192-198.
- Fimmen HO, Mehltz D, Horchiners F, Korb E (1999). Colostral antibodies and Trypanosome Congolese infection in calves. *Trypanotolerance Res. Appl. GTZ* 116:173-178.
- Habtamu B, Reta D, Mebratu A (2014). Trypanosomosis, Its Risk Factors, and Anaemia in Cattle Population of Dale Wabera District of KellemWollega Zone, Western Ethiopia. *J. Vet. Med.* 1-6.
- Leak SD (1999). *Tsetse Biology and Ecology: The role in the Epidemiology and control of trypanosomosis*. CAB international. Wallingford, UK. pp. 152-210.
- Maudlin IA, Holmer PH, Milor MA (2004). *The typanosomosis*, Centre for Agricultural Bioscience International, Egham.
- Ministry of Agriculture Rural Development Office (MARDO) (2011). Annual report on general agricultural activities, Dara district Agricultural and Rural Development Office.
- Nicholson MJ, Butterworth MH (1986). *A guide to scoring of zebu cattle*, International Livestock Centre for Africa, Addis Ababa.
- Nigatu SD (2004). Epidemiology of bovine trypanosomosis in the Abbay Basin areas of Northwest Ethiopia. Msc thesis, FVM, AAU, DebreZeit.
- NTTICC (2004). National Tsetse and Trypanosomosis Investigation and Control Centre annual report: Bedelle, NTTICC, Addis Ababa.
- OIE (2008). "Standardized techniques for the diagnosis of tsetse transmitted trypanosomiasis," in OIE Terrestrial Manual, OIE, Rome, Italy. P 49.
- Oluwafemi RA, Ilemobade AA, Laseinde EAO (2007). The Impact of African animal trypanosomosis and tsetse on the livelihood and wellbeing of cattle and their owners in the BICOT study area of Nigeria. *Sci. Res. Essays* 2:380-383.
- Radostits OM, Blood DC, Gay CC, Hinchcliff WK, Constable PD (2007). *Veterinary medicine. A textbook of the diseases of cattle, sheep, pigs, goats and horses*, 10th edn., Saunders Ltd, Edinburgh.
- Rowlands GJ, Mulatu W, Authie E, Leak SGA, Peregrine AS (1995). Epidemiology of bovine trypanosomosis in the Ghibe Valley, South-west Ethiopia. *Acta Trop.* 53:135-150.
- Samuel WM, Margo JP, Kocan AA (2001). *Parasitic diseases of wild mammals*, 4th edn., Blackwell Publishing Company, Malden.
- Solomon M (2006). Tsetse control or eradication (strategy action plan of the SNNPRS. In Tsetse and trypanosomosis control approaches and southern Tsetse and trypanosomosis control actor's forum establishment, proceeding of the regional work shop, Hawassa. pp. 61-63.
- Takile D, Deresa B, Abdurahaman M (2014) Prevalence of Bovine Trypanosomosis in Guto Gida District of East Wollega Zone, Oromia Regional State, Ethiopia. *Global J. Inc. (USA)* 14(2):4-10.
- Thrusfield M (2005). *Veterinary Epidemiology*. 3rd ed., UK, Blackwell science Ltd, pp. 233-250.
- Torr SJ, Mwangiro TNC, Hall DR (2006). The effects of host physiology on the attraction of tsetse (Dipteral: Glossinidae) and Stomoxys (Dipteral: Muscidae) to cattle. *Bull. Entomol. Res.* 96(1):71-84.
- Waldeyes G, Aboset G (1997). Tsetse and Trypanosomiasis distribution, identification and assessment of socio-economic viability of new vector control approaches in Arbaminchzuria woreda. Ethiopian Veterinary Association Proceeding of the 11th Conference. pp. 143-154.
- Wondewosen T, Dechasa T, Anteneh W (2012). Prevalence study of bovine trypanosomosis and tsetse density in selected villages of Arbaminch, Ethiopia. *J. Vet. Med. Anim. Health* 4(3):36-41.