Prevalence of Bovine Trypanosomosis in Abeshige District of Gurage Zone, South Western Ethiopia

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Abstract: A cross sectional study was conducted from November 2014 to May 2015 in Abeshige district of Gurage Zone in Southwestern Ethiopia with the objectives of estimating the prevalence and identifying the species of trypanosomes. A total of 498 blood samples were collected and tested using conventional thin smear and buffy coat techniques. The result revealed an overall prevalence rate of 12.4% trypanosomosis. There were no significant difference in prevalence between animals of different location, age, sex and breed ($p>0.05$). The mean PCV of parasitemic animals (24.5%) was significantly lower than that of aparasitemic animals (29%) ($p<0.05$). The most commonly encountered trypanosome species among parasitemic cattle was *T. congolense* (67.7%) followed by *T. vivax* (29%) and mixed (*T. congolense* and *T. vivax)* (2.3%) infections. In conclusion, the result indicated trypanosomosis to be a major livestock production challenge in the study area that warrant control strategies.

Keywords: *Bovine trypanosomosis; Buffy coat; Thin smear; PCV*

Introduction

Bovine trypanosomosis causes a significant loss in animal production and greatly hampers agricultural development in Africa (Uilenberg, 1998). The existing threat of Africa animal trypanosomosis ranked among the top priority cattle diseases on sustainable livestock production and mixed farming system which present a major constraint in the development of the African continent (Abenga *et al*., 2002; Samdi *et al*., 2010a). These constitute a major threat to achieving food security in several parts of Sub-Saharan Africa and Ethiopia (Samdi *et al*., 2010b). In Ethiopia, animal trypanosomosis is one of the most important diseases limiting livestock productivity and agricultural development due to its high prevalence in the most arable and fertile land of Southwestern and Northwestern part of the country following the greater river basins of Abay, Omo, Ghibe and Baro (Shimels *et al.,* 2005). Over 6 million heads of cattle and equivalent number of other livestock species are at risk of contracting the diseases. More than 20,000 heads die per annum and annual loss attributed to the diseases is estimated to be over US$236 million. Loss due to reduced meat and milk production and draft power is not included in this figure (OAU, 2002).

In Ethiopia, the most important trypanosome species affecting livestock are *T. congolense, T. vivax and T. brucei* in cattle, sheep and goats, *T. evansi* in camels and *T. equiperdem* in horses (Getachew, 2005). Although trypanosomosis is considered as an important disease of cattle in the region (Terzu, 2004) no study has yet been carried out on the epidemiology, prevalence and economic significance of bovine trypanosomosis in Abeshige district of Gurage Zone, Ethiopia. Therefore, the objective of this study was to estimate the prevalence of bovine trypanosomosis and identify species of trypanosomes affecting cattle in selected *Kebeles* of the study area.

Materials and Methods

Description of the Study Area

Abeshige district is located 165 kms South of Addis Ababa in Gurage Zone of Southern Nations Nationalities and Peoples Regional State, Ethiopia. The altitude of the study area ranges from 1001-2000 masl. It is located at latitude of 8° 20' 0" N, and longitude of 37° 40' 0"E longitude. It is characterized by minimum and maximum temperature ranging from 15.5-25^{o}C and the mean annual rainfall of 801-1400mm.The farming system is characterized by a mixed crop-livestock production system with the estimated population of 48,455 cattle, 2,615 sheep, 9,083 goats, 7,702 equine and 44,381 poultry (ADFDO, 2006). The district is divided into 26 *rural* k*ebeles*. Three *Kebeles* were selected for the purpose of the study by simple random sampling technique.

Study Animals

The study was conducted on cattle reared under extensive production system with consideration of different risk factors like age, sex and breed. The study

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animals were classified into different age groups according to the descriptions of Nicholson and Butterwarth (1986). Animals between one and three year of age were considered as young and those above three years as adults.

Study Design

A cross-sectional study was conducted from November 2014 to June 2015 to estimate the prevalence of bovine trypanosomosis in selected *rural kebeles* in the study areas.

Sampling Method and Sample Size Determination

Animals were sampled from the three *rural kebeles* based on proportional bases. At the *rural kebele* level, animals were selected by simple random sampling using lottery method. The number of cattle sampled from a particular herd in a given *rural kebele* depends on proportional weighting. The sample size was determined using the equations given by Thrusfield (2007) whereby:

$$n = \frac{Z^2 . PQ}{e^2}$$

Where, Q = 1-P
Z = 1.96
e = precision error (0.05); P = expected prevalence of about 50%.

Accordingly, a total of 384 animals were randomly selected. However, to avoid loss of sample units and to increase precision, additional 114 samples were collected. Thus, the total sample size was 498.

Parasitological Diagnosis

Blood samples were collected into two heparinized haematocrit capillary tubes from each animal from ear vein punctured by sterile lancet. The tubes were filled with blood to3/4 of their heights and sealed at one end with crystal sealant. The capillary tubes were then loaded on the microhematocrit centrifuge machine symmetrically and centrifuged at 1200 rpm for 5 minutes. Packed cell volume (PCV) was determined using hematocrit reader. Animals with PCV <24% were considered as anemic (Murray *et al.,* 1983). After the PCV was read, capillary tubes were broken 1mm below the buffy coat and the content were transferred on microscopic slides, mixed and covered with a 22x22 mm cover slip. Then it was examined using ground buffy coat technique to detect the presence of the parasites (Paris *et al*., 1982). For preparation of the thin smear, first the slide was polished with dry and clean cloth. The blood in microhematocrit capillary tube was expressed approximately 20 mm away from one end on the slide. The spreader (another slide) was placed on a head of the drop of the blood approximately at an angle of 45°. The spreader slide was drawn back to make contact with blood. Then, the blood was allowed to run to both ends of the spreader slide and spread the blood along the slide with steady motion. The slide was dried by waving it in the air and fixed for 5 minute with methyl alcohol. The smear was flooded with Giemsa staining solution for 45 minute. Excess stain was drained and washed off by using distilled water and allowed to dry for examination. Microscopic examination was made under oil emersion objective (Losos, 1986; Losos and Kede, 1972).

Data Processing and Analysis

The data collected were entered and managed in Microsoft excel. Coded data was transferred to Stata version 11.0 statistical software (STATA, 4905 Lakeway Drive, College Station, Texas, USA) program for analysis. The prevalence of the disease was determined by dividing the number of positive samples by the total number of samples tested for the disease. Chi-square test was used to assess if there was a statistically significant difference in infection among explanatory variables. The mean PCV of parasitemic and aparasitemic animals were compared using *t*-test to assess whether the means of two groups are statistically different from each other. P-value less than 0.05 was considered significant.

Results

Trypanosome Prevalence and Species

The overall prevalence recorded was 12.4% [CI: 10.7-14.1] (n=62). No statistically significant difference was observed between the three *rural kebeles* (p>0.05) (Table 1).

Table 1. The prevalence of trypanosomosis in the study area

Rural kebele's	No. of cattle examined	Total Positive	Trypanosome species			Prevalence (%)	X^2	p-value
			T. c[1]	T. v[2]	Mixed (T.c/T.v)[3]			
Nachakulit	166	24	15 (62.5)	7 (29)	0	14.4		
Kulit-2	166	24	14 (58.3)	5 (20.8)	2 (8.3)	14.4	2.183	0.336
Hudade-4	166	19	13 (68.4)	6 (13.6)	0	11.4		
Total	**498**	**62**	**42 (67.7)**	**18 (29)**	**2 (3)**	**12.4**		

T.c[1]= Trypanosoma congolense, T.v[2]=Trypanosoma vivax, T.c and T.v[3] = mixed.

Most of the infections in trypanosome positive animals were due to *Trypanosoma congolense* followed by *Trypanosoma vivax* and the rest were mixed infections of the two (Table 1). Relatively numerically higher prevalence was recorded among male animals than that of females, but the difference between sex groups was not statistically significant (p>0.05) (Table 2). The infection rate in adult cattle was slightly higher than the young but it was not significant (p>0.05).

Table 2. Prevalence of trypanosome infection among age, sex and breed

Risk factor	Number of cattle Examined	No. of Positive samples	Prevalence (%)	χ^2	p-value
Sex					
Female	264	25	9.4	5.35	0.461
Male	234	37	15.8		
Age					
Young (1-3years)	245	27	11		
Adult (>3 years)	247	35	14.2	2.183	0.336
Breed					
Local	423	51	12	1.241	0.987
Crossbreed	75	11	14.6		

Hematological Findings

Among a total of 498 animals examined, 12.2% of the animals were anemic (Table 3). There was strong statistical difference between the mean PCV of parasitemic and aparasitaemic animal (p<0.01).

Table 3. Mean PCV of parasitemic and aparasitemic animals

Conditions	No. Examined	No. examined PCV (%) ≥24	No. examined PCV (%) <24	Mean PCV (%)	t- test	p- value
Parasitemic	62	34 (54.8)	28 (45.2)	24.5	13.342	0.003
Aparasitemic	436	403 (92.4)	33 (7.5)	29		
Total	**498**	**437 (87.7)**	**61 (12.2)**	**26.25**		

Discussion

The overall prevalence indicated the disease to be an important constraint in livestock production in the study area. The prevalence value of the present study is in agreement with the 12.4% prevalence in Metekel and Awi Zones in northwestern Ethiopia (Solomon and Fitta, 2010) and 12.41% in Hawa Gelan in Oromia Region (Tewodros *et al*., 2012). However, the present prevalence is higher as compared to the studies conducted previously in different part of Ethiopia *(*Basaznew *et al.,* 2012; Teka *et al*., 2012; Zelalem *et al*., 2014; Amanuel *et al*., 2015; Gamechu *et al*., 2015; Reta *et al*., 2015). Prevalence of 9.1% by Abenga *et al.* (2001) and 2.2% by Samdi *et al.* (2011) from Nigeria, Kaduna state central abattoir was also reported. In contrast to the present result, higher prevalence was previously reported in different parts of Ethiopia (Shimelis *et al*., 2001; Dawud and Molalegne, 2011; Abraham and Tesfaheywet, 2012; Thomas *et al*., 2006). Similarly, higher prevalence of 46.8% reported by Sam-Wobo1 *et al.* (2010) and 31.62% by Ayodele *et al.* (2013) also were reported from Ogun and Jos States of Nigeria, respectively. The differences in the prevalence of the disease reported from different regions might be due to the variability in agro-ecology of the study areas and difference in season during data collection (Thomas *et al*., 2006). The identified *Trypanosoma* spp. was *T. congolense, T. vivax* and mixed infections. This findings were similar with results reported from different areas in Ethiopia (Abraham and Tesfahiwot, 2012; Wagari *et al*., 2012; Gamechu *et al*., 2015). Prevalence rate of 33.33% for *T. congolense* (Tewodros *et al*., 2012), 28.89% for *T. vivax* (Gamechu *et al*., 2015) and 2.27% (Reta *et al*., 2015) for mixed (*T. congolense* and *T. vivax)* reported from other parts of the country also confirms the importance of this parasite in hampering animal productivity. The differences in prevalence rate among the studies might be due to the fact that *T.congolense* requires an absolute presence of the biological vector (*Glossina* spp.), whereas *T. vivax* is more readily transmitted mechanically by biting flies than tsetse flies (Langridge, 1976) and also *T. congolense* is mainly confined to the blood, while *T. vivax* and *T. brucei* can also invade the tissues (Hoare, 1972). *T. vivax* is highly susceptible to treatment while the problems of drug resistance are higher in *T. congolense* (Leak, 1999).

The hematological findings showed that mean value in parasitemic animals was much lower than the

aparasitemic animals ($p<0.05$). This finding is in agreement with the previous result reported by Cherinet *et al.* (2006), Abebayehu *et al.* (2011) and Abraham and Tesfaheywet (2012). The parasitemic cattle with mean PCV <24% in this study could be due to direct impact of the disease since trypanosomes destroy RBC membranes resulting in early removal of the defective cells by the reticulo-endothelial system of the animals and therefore result in anemia (Murray *et al.*, 1977; Afework *et al.*, 2000).

Absence of difference in prevalence of the infection between sex groups is in agreement with that reported previously in the country (Abebayehu *et al.*, 2011). This result is also similar with previous results of Terzu and Getachew (2008) and Teka *et al.* (2012) who obtained no significant difference in susceptibility between the two sexes. This might be due to similar exposure of both sexs to the flies in grazing areas (Muturi, 1999; Terzu, 2004; Nega *et al.*, 2004). Similarly, age wise prevalence difference observed was also insignificant indicating that both young and adult animals are equally exposed to the fly in the field. Tethered young animals were also infected by the infection showing the flies are also found around homestead, but with low density relative to the grazing area (Fimmen *et al.*, 1999). On the other hand, the prevalence of the disease in local breeds was slightly lower than the in crossbreeds, although not statistically not significant ($p>0.05$). This might be due to the fact that both local and cross breed cattle are grazing together and have probability of equal exposure (Quadeer *et al.*, 2008).

Conclusion and Recommendations

In the present study, two species of trypanosomes were identified. *T. congolense* was the predominant species in the area followed by *T. vivax* and mixed infection (*T. congolense* and *T. vivax).* The 12.4% prevalence of bovine trypanosomosis suggests that the disease remains to be the major threat to livestock production. Therefore, appropriate control through different chemotherapeutic and chemoprophylactic drugs as well as tsetse control programs should be designed in order to reduce the impact of trypanosomosis in the study area. An active and continuous surveillance is also needed for better understanding of the epidemiology of the trypanosomosis. Further study should also be conducted in order to identify potential tsetse fly species in the study area.

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Conflict of Interests

The authors declare that they have no competing interests.

References

Abebayehu Tadesse, Eset Hadgu, Brhanu Mekbib, Rahmeto Abebe & Solomon Mekuria (2011). Mechanically transmitted bovine trypanosomosis in Tselemty Woreda, Western Tigray, and Northern Ethiopia. *Agricultural Journal,* 6: 10-13.

Abenga, J. N., Enwezor, F. N. C., Lawani, F. A. G., Osue, H. O. & Ikemereh, E. C. D. (2001). Trypanosome Prevalence in Cattle in Lere Area in Kaduna State, North Central Nigeria. *International Journal of Animal Veterinary Advances*, 2(2): 47-50.

Abenga, J. N., Ewenzer, F. N. C., Lawani, F. A. G., Ezebuiro, C., Sule, J. & David K. M. (2002). Prevalence of trypanosomiasis in trade cattle at slaughter in Kaduna state, Nigeria. *Journal of parasitology,* 23: 107-110.

Abeshige District Finance and Development Office (ADFDO) (2006). Abeshge district finance and Economic Development Office, Welkite Ethiopia.

Abraham Zekarias and Tesfaheywet Zeryehun (2012). Prevalence of Bovine Trypanosomosis in Selected District of Arba Minch, SNNPR, Southern Ethiopia. *Global Veterinaria*, 8, 168-173.

Afework Yohaness, P.H. Clausen, Getachew Abebe, Tilahun Getachew & Mehlitz D. (2000). A prevalence of multiple drug-resistant *T. congolense* population in village cattle of Mekele district, North-Wet Ethiopia. *Acta Tropica*, 76: 231-138.

Amanuel Dawit, Tadele Alemayehu, Kassahun Bekele, Tilahun Zenebe, Girma Kebede and Tadele Kabeta (2015). Prevalence of Bovine Trypanosomosis, and it's Associated Risk Factors in Abaya District, Borena Zone, Ethiopia. *Nature and Science*, 13: 64-70.

Ayodele, O.M., Akinyemi, F., Charles, D., Kim, P., Michae, V. (2013). A longitudinal survey of African animal trypanosomiasis in domestic cattle on the Jos Plateau, Nigeria: prevalence, distribution and risk factors. *Parasites and Vectors*, 6: 239.

Basaznew Bogale., Kebede Wodajo and Mersha Chanie (2012). Occurrence and Identification of Bovine Trypanosomosis in Genji District, Western Ethiopia. *Acta Parasitologica* Globalis, 3 (3).

Dawud Ali & Molalegne Bitew (2011). Epidemiological study of Bovine Trypanosmosis in Mao- Komo Special District, Benishangul-Gumuz Regional State Western Ethiopia. *Global Veterinaria*, 6: 402-408.

Fimmen, H.O., Mehlitz, D., Horchiner, F. & Korb, E. (1999). Colostral antibodies and *Trypanosoma congolense* infection in calves. Trypanotolerance research and application. GTZ, No.116, Germany, pp: 173-187.

Gamechu Feyisa, Aynalem Mandefro, Birhanu Hailu, Gamechu Chala & Gezahegne Alemayehu (2015).

Epidemiological Status and Vector Identification of Bovine Trypanosomiosis in Didessa District of Oromia Regional State, Ethiopia. *International Journal of Nutrition and Food Science*, 4(3): 373-380.

Getachew Abebe (2005). Trypanosomosis in Ethiopia, Addis Ababa University, Faculty of Veterinary Medicine, DebreZeit, pp: 18-20.

Hoare, C. A. (1972). The trypanosomiasis of mammals, Oxford: 1st Ed. London, UK, Blackwell Scientific. Publications, pp: 749.

Langridge, W. P. (1976). A tsetse and trypanosomosis survey in Ethiopia, Ministry of overseas development, United Kingdom.

Leak, S. G. A. (1999). Tsetse Biology and Ecology; their role in the epidemiology and control of trypanosommiasis.CAB International Wallingford (UK).

Losos, G. J. (1986). Infectious tropical diseases of domestic animals. Longman, UK, 186 p.

Losos, G. J. I. & Kede, B. O. (1972). Review of pathology of disease in domestic and laboratory animals caused by *T. vivax, T. brucei, T. rhodesiense* and *T. gambiense. Journal of Veterinary Pathology,* 9: 1-17.

Murray, M., Murray P. K. & McIntyre, W. I. M. (1977). An improved parasitological technique for the diagnosis of African trypanosomisis. *Transaction of the Royal Society of Tropical Medicine and Hygiene*, 71: 325-326.

Murray, M., Murray, P. K & McIntyre, W. I. M. (1983). An improved parasitological technique for the diagnosis of African trypanosomosis. *Transactions of the Royal Society of Tropical Medicine and Hygiene,* 71**,** 325-326.

Muturi, K. (1999). Epidemiology of bovine trypanosomosis in selected sites of the Southern Rift Valley of Ethiopia. Msc thesis, Addis Ababa University with Freie Universitants, Berlin.

Nega Tewolde, Getachew Abebe, Eilser, M., Dermott, M. C., Grierner, J., Afework, M., Kyule, M., Munstermann, S., Zessin K. H. & Clausen, P. H. (2004). Application of field methods to assess Isometamedium resistance of trypanosome in cattle in Western Ethiopia. *Acta Tropica*, 90: 163-170.

Nicholson, M. J. & Butterworth, M. H. (1986). A guide to condition scoring of zebu cattle. International Livestock Centre for Africa (ILCA).

Organinization of African Union (OAU) (2001). Trypanosomosis, Tsetse and Africa. The year book report (2001).

Paris, J., Murray, M. & Mcodimba, F. (1982). A comparative evaluation of the parasitological technique available for the diagnosis of Trypanosomosis in Cattle. *Acta Tropica*. 39: 1-11.

Quadeer, M.A, Danbirni, S, Usman, M, Akogun, O.B., Gundiri, M. A. & Bobbo, A. G. (2008). Prevalence of bovine trypanosomosis in Bassa Local Government Area, Plateau State, Nigeria. *Nigerian Journal of Parasitology*, 29: 136-13.

Reta Duguma, Senbeta Tasew, Abebe Olani, Delesa Damena, Dereje Alemu, Tesfaye Mulatu, Yoseph Alemayehu, Moti Yohaness, Merga Bekana, Antje H., Emmanuel, A., Vincent, D. & Luc, D. (2015). Spatial distribution of Glossina spp. and *Trypanosoma* spp. in south-western Ethiopia. *Parasites and Vectors,* 8: 1-10.

Samdi, S. M., Abenga, J. N., Attahir, A. & Wayo, B. M. (2010a). Constraints in the Control of African Trypanosomiasis: The Prevailing Factors in Curmin Kaduna. *Advanced International Journal of Animal Science and Veterinary,* 2: 31- 36.

Samdi, S. M., Abenga, J. N., Attahir, A. & Wayo, B. M. (2010b). Impact of Trypanosomiasis on Food Security in Nigeria. *Advanced International Journal of Animal Science and Veterinary,* 2: 47- 50.

Samdi, S. M., Fajinmi, A. O., Kalejaye, J. O., Wayo, B., Haruna, M. K., Yarnap, J. E., Mshelia, W. P., Usman, A. O., Hamra, S. M., Jijitar, A., Ogunwole, R., Ovbagbedia, R. P. & Bizi, R. (2011). Prevalence of trypanosomosis in cattle at slaughter in Kaduna centeral abbatoir, Nigeria. *Asian Journal of Animal Science*, 5: 162-165.

Sam-Wobo1, S. O., Igenezoa, A. J., Idowu, O. A., Otesile, E. B., Ekpo, U. F. & Kehinde, O. O. (2010). Bovine trypanosomosis and its impact on cattle in derived savanna areas of Ogun State, Nigeria. *Journal of Public Health and Epidemiology*, 1: 43-47.

Shimelis Dagnachew, Aran K. & Getachew Abebe, (2005). Epidemiology of tsetse transmitted trypanosomosis in Abay (Blue Nile) basin of North West Ethiopia, *In: Proceedings of the 28th meeting of the International Scientific Council for Trypanosomosis.*

Shimelis Dagnachew, Aran K. S. & Getachew Abebe (2001). Epidemiology of bovine trypanosomosis in the Ghibe valley settlement area of Nono district, South West Ethiopia. *Ethiopia Veterinary Association Journal,* 12: 243.

Solomon Mekuria & Fitta Gadissa (2010). Survey on bovine trypanosomosis and its vector in Metekel and Awi zones of northwest Ethiopia. *Acta Tropica*, 117: 146-151.

Teka Wondowsen, Dechasa Terefe & Anteneh Wondimu (2012). Prevalence study of bovine trypanosomosis and tsetse density in selected villages of Arbaminch, Ethiopia. *Journal of Veterinary Medicine and Animal Health*, 4: 36-41.

Terzu Daya (2004). Seasonal Dynamics of Tsetse and Trypanosomosis in selected sites of Southern Nation, Nationalities and Peoples Regional State (SNNPRS), Ethiopia. Msc thesis, Addis Ababa University, Faculty of Veterinary Medicine, Debre Zeit, Ethiopia, pp: 1-180.

Terzu Daya and Getachew Abebe (2008). Seasonal Dynamics of Tsetse and Trypanosomosis in selected sites of Southern Nation, Nationalities and Peoples Regional State, Ethiopia. *Ethiopian Veterinary Journal*, 12: 77-92.

Tewodros Fantahun, Mitiku Tekeba, Tadegegn Mitiku & Mersha Chanie (2012). Prevalence of Bovine Trypanosomosis and Distribution of Vectors in Hawa Gelan District, Oromia Region Ethiopia. *Global Veterinaria*, 9: 297-302.

Thomas Cherenet, Sani, R.A., Speybroeck, N., Panandam J.M., Nadzr, S. & Van den Bossche, P. (2006). A comparative longitudinal study of bovine trypanosomiasis in tsetse-free and tsetse-infested zones of the Amhara region, northwest Ethiopia. *Veterinary Parasitology*, 140: 251-258.

Thrusfield, M. (2007). Veterinary Epidemiology 3rd ed., Blackwell Scientific, London, pp: 225-228.

Uilenberg, G. (1998). A field Guide for diagnosis, treatment and prevention of African animal trypanosomosis. Adapted from the original edition by Boyt. W. P. Food and Agriculture organization of United Nations (FAO), Rome, pp: 43-135.

Wagari Tafese, Achenef Melaku & Tewodros Fentahun (2012). Prevalence of bovine trypanosomosis and its vectors in two districts of East Wollega Zone, Ethiopia. Journal of Veterinary Research, 79(1) 4 pages. doi: 10.4102/ojvr.v79i1.385.

Zelalem Abera, Merga Fekadu, Tadele Kabeta, Girma Kebede and Tesfaye Mersha (2014). Prevalence of Bovine Trypanosomosis in BakoTibe District of West Shoa and Gobu Seyo Districts of West Wollega Zone, Ethiopia. *European Journal of Biological Sciences*, 6: 71-80.