

Study on Prevalence of Bovine Trypanosomosis and Tsetse Density in Kindo Koysha Woreda of Wolaita Zone, Ethiopia

Abayneh Acha Ajubo

Hawassa University School of Veterinary Medicine, Ethiopia

***Corresponding Author:** Abayneh Acha Ajubo, Hawassa University School of Veterinary Medicine, Ethiopia

Abstract: A cross-sectional study was conducted from December 2011 to April 2012 to estimate the prevalence of Bovine trypanosomosis to identify the dominant trypanosomes species, to assess vector density magnitude and to identify the species of tsetse fly (*Glossina* species) in Kindo Koysha woreda, Wolaita zone, Southern Ethiopia. The study involved 229 local cattle of different age group and both sexes. The buffy coat method was used for determination of prevalence and identification the trypanosoma species and NGU and biconical traps baited with attractants (acetone cow urine) were deployed to study the vector density. The overall prevalence of trypanosomosis was 6.1%. *Trypanosoma congolense* and *T.vivax* were the species identified with 4.4%, 1.8% prevalence respectively. All potential risk factors included in the study: age, sex, coat color, body condition and Kebele (locality) were not significantly associated ($P>0.05$) with trypanosoma status of the study animal. Mean PCV of parastemic animals (20.9%) was lower compared to mean PCV of (24.1%) aparasitemic cattle ($p<0.01$) the overall apparent density of tsetse and biting flies were 0.2 and 0.12 flies per trap per day respectively. The present study revealed that bovine trypanosomosis is still endemic and causes production loss in the study area despite attempts to control it. Measures which may help reduce the effect of trypanosomosis are suggested.

Keywords: Biting fly, Cattle, Ethiopia, Kindo Koysha, Omo belt, Trypanosomosis, Tsetse fly

1. INTRODUCTION

Trypanosomosis is a parasitic disease caused by unicellular protozoan parasites of the genus trypanosoma and family trpanosomatidae. They multiply in blood stream, lymphatic vessels and tissue, including cardiac muscle and the central nervous system (Soulsby, 1992). Trypanosomosis is transmitted by tsetse flies (*Glossina* spp) are believed to be the most important infectious disease holding back development of livestock production in Africa (Itard, 1981).

Trypanosomosis is one of the major constraints on animal production in areas of Africa which have the greatest potential for significant increases in domestic livestock productivity (D'Ieteren *et al*, 1998). Tsetse flies occur over some 10 million square kilometer of Africa (Jordan, 1986) affecting a total of 38 countries. Currently, about 37% of the 147 million cattle in countries affected by tsetse are exposed to the disease. Africa produces 70 times less animal protein per unit area than Europe (Nantulya, 1986). In Africa the overall loss (both direct and indirect) is estimated at US 500 billion dollars a year (ILRAD, 1993/94).

In Ethiopia above 14 million heads of cattle are exposed to the risk of trypanosomosis, 20,000 heads of which die every year. Taking 200 birr per animal, the total loss will be 4,000,000 birr per year (Asfaw, 1986). In the years 1978-1982 a total of 9,675,575 doses of trypanocidal drugs were purchased with 17,920,780.70 birr (MoA, 1982/3). Although tsetse flies have existed in Ethiopia for a very long time, it has been noted that by early explorer, who lost their transport animals in the fly challenge belts. In 1885 Donalds and Smith made the earliest record of Gendi (Nagana) in their transport animals which were crossing tsetse fly belts in southern Ethiopia (MacLennan, 1980). Later in 1895 Corti identified an insect collected in 1893 by Captain Bottogo, along the Walmal River which is the upper tributary of Shebelle River (Langridge, 1976).

In 1962, the cattle survey in Southern Ethiopia by the livestock division, established that bovine Trypanosomosis had become a major cattle disease in the Omo valley. It was stated that the problem

of trypanosomosis is the main cause of decline in the number of cattle and particularly draught oxen (Abebe and Jobere, 1996).

Report from the tsetse infested area of Ethiopia indicated that *T. congolense* is the most prevalent trypanosome species (Abebe and Jobre, 1996; Rowland *et al.*, 1993).

Currently the livestock production and productivity of southern region is highly affected by the high incidence of the trypanosomosis. The communities in the region in general and in the low lands lying along Ghibe and Omo river basins in particular expend a lot of money to purchase trypanocidal drugs. Moreover, currently high mortality was registered around Chida of Konta woreda (SRVL, 2005) and in Zima Waruma a low land areas of Loma woreda, Southern Ethiopia.

Therefore, taking in to an account the above mentioned statements, the following objectives were designed to conduct studies:

- ❖ To determine the prevalence of bovine trypanosomosis on the basis of age, sex and color of the animals and on area basis.
- ❖ To determine the dominant species of trypanosomes affecting cattle in study area.
- ❖ To identify fly species capable of transmitting trypanosomosis and to determine their abundance in the study area.

2. MATERIAL AND METHODS

2.1. Study Area

The study was conducted from December 2011 to April 2012 in three localities (Fajena mata, Mundena and Mashenga, and Molticho and Hanaze) in Southern Nations Nationalities and People Region (SNNPR) Wolaita zone, Kindo Koysha Woreda, located 397km south of the capital, Addis Ababa. The elevation varies from about 700m to 2200meters above sea level. The Woreda has three agro-ecological zones namely lowland (kola), mid land(woyna dega) and highland(dega), of wich, 54% kola ,7% dega, and 39% woyna dega. The woreda borders Omo River to the West.

The total area of the woreda is 50093 km square, of which forest covers 4957 hectares, cultivated land 35,696 hectares and grassland 6529 hectares . The annual temperature varies from 25-40 and annual rain fall is 400mm-1400mm.

The study area is sparsely populated with an estimated average population density of about three people per kilometer square. More than 90% of the population lives in rural areas and practice mixed farming, i.e., subsistence; rain fed cropping combined with keeping of live stock. Livestock are the backbone of rural economy within the area.

2.2. Study Animals

The study involved 229 local cattle of different ages and both sexes owned by local farmers. The cattle were reared with the traditional extensive grazing system. Farmers in study area are aware of the disease trypanamosis and inject their animal with drugs which are usually obtained from illegal source.

2.3. Study Design

The study was a cross-sectional study in which blood sample were collected for examination of trypanosomosis and data regarding age, sex, body condition were collected at the time of sampling. NGU traps were deployed to determine the fly catch per trap per unit time. Body condition was scored using the method described by Nicholson and Butterworth (1986).

2.4. Sample Size and Sampling Method

A total of 229 cattle were selected from three localities (PAs) in the study area. The three villages were identified and selected based on convenience and animals from each locality were selected randomly to be included in the study.

A 95% confidence interval and 5% precision and estimated or expected prevalence (SRVL) were used to determine the sample size for this particular study. The sample size was determine using the following formula (Thrustfield, 1995)

$$n = \frac{1.96^2 P_{exp} (1 - P_{exp})}{d^2}$$

n=required sample size d=desired absolute precision P_{exp}=expected prevalence

2.5. Parasitological and Hematological Techniques

The parasitological diagnostic tests used were those described by Paris *et al.*, (1982). In brief, blood was collected from an ear vein into heparinized micro haematocrit centrifuge capillary tubes and transferred onto glass slide in order to make thick and thin blood smears. Each capillary tube was filled to its last third and sealed with crystal seal at one end and centrifuged immediately in a micro haematocrite for five minutes at 1500rpm. After centrifugation, the packed cell volume (PCV) was determined. Animals with PCV less than or equal to 24% were considered to be anaemic (Radostitis *et al.*, 2007).

Buffy coat and the upper most layers of red blood cells in each specimen were extracted, placed on to a microscopic slide and examined under phase contrast microscope with a X40 objective for the presence of motile trypanosomes. The thick and thin blood smear were stained with Giemsa and examined under light microscope using X100 oil immersion objective.

2.6. Entomological Survey

Fly survey was conducted in Kindo Koysa Woreda following Omo river tributaries and savannah grassland. NGU and biconical traps baited with attractants acetone and cow urine were deployed at an interval of about 200-250 meters along riverine vegetation and savannah grassland. 18 NGU and 12 biconical were deployed for three consecutive days in the study area.

The coordinates of the site were recorded with a global positioning system (GPS). The apparent density of fly was calculated as the mean number of flies per trap per day.

2.7. Statistical Analyses

Raw data generated from this study were entered into Microsoft Excel database and the prevalence of bovine trypanosomosis in different age groups, color groups, sex, body condition and different localities or sites were analyzed using chi-square (χ^2) or Fisher's exact test. Mean PCV values between parasitemic and aparasitemic cattle were compared using t-test.

3. RESULTS

3.1. Parasitological Prevalence

A total of 229 cattle were examined using the buffy coat method for the presence of trypanosoma in their blood. Of the total animals examined 14 (6.1%) were positive for the parasite. *Congolense* and *Trypanosoma vivax* were the species identified with 4.4% and 1.8% prevalence respectively (Table 1).

Table 1. Prevalence of trypanosoma by species of parasite (n=229).

Species of trypanosome	No. of infected	Prevalence	95% CI
<i>T. congolense</i>	10	4.4%	1.7-7.0
<i>T. vivax</i>	4	1.8%	0.0- 3.5
Overall	14	6.1%	3.0- 9.2

3.2. Effect of Potential Risk Factors on Trypanosoma Prevalence

All potential risk factors included in the study: age, sex, coat color, body condition and Kebele (locality) were not significantly associated ($p > 0.05$) with trypanosoma status of the animals (table 2).

Table 2. Prevalence of trypanosoma in cattle with associated risk factors (n=229).

Factors	Level	Number of observations	Positive	Prevalence(95% CI)	P-value
Age	≤ 5 years	105	7	6.7%(1.8-11.5)	0.748
	≥ 5 years	124	7	5.6%(1.5-9.7)	
Sex	Male	79	6	7.6%(1.7-13.5)	0.479
	Female	150	8	5.3%(1.7-9.0)	
Coat color	Black	36	4	11.1%(0.6-21.6)	0.283

	Red	152	9	5.9%(2.1-9.7)	
	White	41	1	2.4%(0.0-7.2)	
Body condition	Poor	90	9	10.0%(3.7-16.3)	0.104
	Medium	116	5	4.3%(0.6-8.0)	
	Good	23	0	0%(0)	
Locality	Fajena mata	78	5	6.4%(0.9-11.9)	0.845
	Mundena and Mashinga	81	4	4.9%(0.2-9.7)	
	Moliticho and Hanaze	70	5	7.1%(1.0-13.3)	
Overall		229	14	6.1%(3.0-9.2)	

3.3. Effect of Parasitemia on Packed Cell Volume (PCV)

Packed cell volume of all 229 study animals was determined. Of the examined animals 61.1% (140) were anaemic with a PCV \leq 24 (Van den Bossche and Rowlands, 2001). Interestingly all the infected animals had PCV \leq 24 with a mean value of 20.9 there was significant difference in PCV between trypanosome infected non- infected cattle. Mean PCV parasitemic animals (20.9%) was significant lower compared to the corresponding values (24.1%) in aparasitemic cattle ($p < 0.01$) (table 3). of the 215 trypanosoma negative cattle 126(58.6%) were anemic with PCV \leq 24.

Table 3. Mean PCV of parasitemic and aparasitemic animals

Trypanosoma status	No. of observations	Mean PCV(SD)	p- value
Positive	14	20.9%(2.0)	0.001
Negative	215	24.1%(3.7)	
Overall	229	23.9%(3.7)	

3.4. Entomological Survey

It was shown that from 30 traps deployed for three consecutive days at three PA's in the study district, a total 29 flies were caught. Of these 18(62%) belonged to *Glossina* species, the remaining 11(38%) were *Stomoxys*- a genius of biting flies. The overall fly density of tsetse and biting flies were 0.2 and 0.12 flies per trapper day, respectively (Table 4).

Table 4. Fly catch per trap per 3 days

PA	Village/site	Altitude	Lat.	Long.	No. of trap	Duration of trap deployment	Vector catch		
							Tsetse spp.	Number of <i>Tabanus</i> spp.	Number of <i>Stomoxys</i> spp.
Moliticho & Hanaze	Kecha	1120	06.54.611	037.28.833	10	3 days	G.p(3)& G.f(7)	0	6
Fajena mata	Boke	750	06.54.820	037.27.555	10	3 days	G.p(5)	0	2
Mundena & Mashinga	Gamo River Gorge	1200	07.01.105	037.53.442	120	3 days	G.p(3)	0	3

Where, PA=Peasant association, Lat. =Latitude, Long. = Longitude, G.p=*Glossina pallidipes*, G.f= *Glossina fuscipes*

4. DISCUSSION

The overall prevalence of cattle trypanosomosis found in the present study (6.1%) was less than previous reports from different corners of the country. Rowland *et al.* (1993) reported 37% prevalence of *T.congolense* and Abebe and Jobore (1996) recorded 58.5% prevalence for *T.congolense* and 31.2% for *T.vivax*. Similarly higher prevalence was recorded by Takele (1985) in Gamo gofa (32%), Getachew (1975) in west Gojjam (33%), Amenu (1997) in Arbaminch zuria and Boreda abaya (42.6%), Amare (1995) in Damote woyde woreda of Wolaita (40.5%), Haile (1996) in North Omo (35.5%) and Mesfin (1998) in kindo Koysa (37%). The reason for this difference may be associated with the decrease in the degree of tsetse infestation due to control measure taken. Additionally, this may be due to the continuous control effort being under taken which gradually decreasing the prevalence of the disease. Widespread use of trypanocidal drugs in the area might have also

contributed to the low prevalence. In addition season of the study (dry season) might have contributed to the finding of low prevalence. Season may also differ among years. It is also possible that the continuous human settlement might have led to destruction of bush lands and forest with resultant destruction of the normal ecology of tsetse flies and there by decrease the vector density and hence infection level.

Among trypanosomosis species, *T.congolense* (71%) was the most common followed by *T.vivax* (29%). similar proportion trend was reported by Mamoudou *et al* (2006). Such a high ratio of *T.congolense* may also suggest that the major cyclical vector *Glossina* species (*G.tachiniod* and others) are more efficient transmitters of *T.congolense* than *T.vivax* in East Africa(Landgridge,1979). Since the transmission *T.congolense* is cyclical, it requires the presence of tsetse flies, where as *T.vivax* is more readily transmitted mechanically by biting flies than tsetse flies. *T. congolense* and *T.vivax* are most prevalent trypanosomes that infect cattle in the tsetse infested and tsetse free area of Ethiopia, respectively. In one study only *T.vivax* was recorded from apparently tsetse free study area (Getachew, 1975).

No difference in prevalence of cattle trypanosomosis could be identified between age group. These might be due to all age groups are driven to pasture and watering that they has equal chance to get tsetse fly and biting flies on grazing. This result is in accordance with early reports Damo western Ethiopia (Rowland *et al.*, 1993).

The prevalence of trypanosomes infection 7.6% in male and 5.3% female showed insignificant variation that sex did not justify a relationship with occurrence of infection. This finding coincide with the result of Getachew (1993), Tefera(1994), Adane(1995), Wellide *et al.*,(1979) who obtained no significant difference in susceptibility between male and female in response to the infection with *T.vivax* and *T.congolense*. This is due to the fact that cattle are driven to pasture and watering regardless of sex and allowed in the same ecology having comparable degree to acquire infection. A similar result was reported by Dangnachew *et al.*, (1988) who demonstrated about 18.45% for male and 13.8% for female in sexes in late rainy season in Abay (Blue Nile) river basin and 12.8% for male and 11.32% for female in dry season without significant variation. The result of this study showed that mean PCV value of 20.1% for parasitemic and aparasitemic animal respectively. The study also tried to indicate the difference between mean PCV values of infected and non infected bovine in the study area. Mean PCV of infected and non-infected animals were significantly different ($p<0.05$), where infected groups had low mean PCV value. The current finding is in agreement with many different research reports. The mean PCV value of parasitemic animals is found to be significantly lower than that of aparasitemic animals and this result is similar to the results obtained by Haile (1996) and SRVL (2006). Taking the PCV value 24-46% as normal for zebu cattle (Blood *et al.*, 1989) 58.6% of aparasitemic animals have registered PCV value less<24%. This suggests that even though anemia is characteristics of trypanosomosis, other factors can also cause reduced PCV. So while diagnosing trypanosomiasis on the basis of PCV one should take various anemia casing agents in to consideration. Anemia can occur because of other causes such as nutritional deficiency, worm infestation and other hemoparasites (Radostitis *et al.*, 2007). It was shown the development of anemia is most reliable indicator of the progress of the trypanosome infection (ILRAD, 1993/94; Getachewu, 2005). In animal absence of other diseases causing anemia, however, low PCV value of an individual animal is a good indicator of the presence of a trypanosome infection (Radostitis *et al.*, 2007). The result of entomological survey indicated that, out of 18 tsetse flies (*G. pallidipes* and *G. fuscipes*) caught drug three days of trap deployments; biconical trap caught 38.9% of flies while NGU trap caught 61.1% of the flies. Therefore, NGU trap caught more fly than biconical trap. Biconical trap caught more *G. fuscipes*, than *G. pallidipes* while NGU trap caught more *G. pallidipes* than *G. fuscipes*. Rowlands *et al.*, (1993) and Awoke (2000) reported that NGU traps as most efficient for *G. Pallidipes* than biconical traps by 12 and 7 times at Humbo and Merab Woreda, respectively.

Entomological survey results also indicated that *G. pallidipes* and *G. fuscipes* were the dominant tsetse fly species with an overall apparent density of 0.2 flies per trap per day, while the apparent density was 0.12 and 0.08 for *G. pallidipes* and *G. fuscipes*; respectively. The decrease in the number of tsetse flies at study is due to the sparsely wooded dry grass steppes were annihilated by fire and the survey period was hot season in that the high temperature increase trypanosome infectivity and shorten their development cycles.

5. CONCLUSIONS AND RECOMMENDATIONS

The result of the present study revealed that trypanosomosis is still an important problem for agricultural activity and animal production at study district. The study also demonstrated two species of tsetse flies i.e. *G. pallidipines* and *G. fuscipes* and a biting fly (*Stomoxys*) capable of transmitting mechanically transmitted trypanosomes are prevalent in the area. The study demonstrated that cattle with trypanosomosis suffer more from anaemia compared to parasitologically negative animals.

Based on the above results the following recommendations are forwarded:

- Further study on the occurrence of tsetse and trypanosomosis at different seasons of the year at different altitude, different species of animals associated with ecological factors (topography, vegetation, climate, tsetse situation and wild life) is recommended.
- Trypanosomosis control efforts to further suppress the disease and the fly vectors in the study area are recommended.
- The government should enforce drugs legislation policies to limit the provision of drugs to professionals.
- Development the awareness of the livestock owners about the effects of the disease and misuse of veterinary drugs, and involve them in the diagnosis, report and control of such economically important disease is essential.

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