Global Veterinaria 5 (4): 215-219, 2010
ISSN 1992-6197

Prevalence of Small Ruminant Trypanosomosis and Tsetse Fly Challenge in Upper Didessa Valley, Ethiopia

Samson Leta and Frehiwot Mesele

Adami-Tullu Agricultural Research Center, Ziway, Ethiopia

Abstract: A cross-sectional study was conducted in five PAs of the southwestern Ethiopia to determine prevalence of trypanosomosis in small ruminants and apparent fly density. Blood samples from 654 goats and 66 sheep were collected and examined using conventional hematological and parasitological techniques. Among the small ruminants examined during the study period 3.75% (95% CI: 2.358 - 5.141) were infected with trypanosomes. The result showed higher prevalence rate of trypanosomosis in sheep 4.5% (95% CI: 0 - 9.71) than in goats 3.7% (95% CI: 2.22 - 5.11). Most of the infections were due to *Trypanosoma congolense* (63%). Statistically insignificant difference was obtained in prevalence rate on the basis of species and sex, but statistically significant difference ($P<0.05$) was obtained in prevalence rate among different coat colors and the mean PCV value between parasitemic and aparasitemic small ruminants. The fly survey revealed that *Glossina tachinoides* and *G. morsitans submorsitans* were the prevailing tsetse fly. The fly/trap/day was significantly higher 58.8 for *G. tachinoides* and 0.95 for *G. m. submorsitans*. In conclusion, trypanosomosis in sheep and goats is an important disease and small ruminants may serve as a potential reservoir of infection to the epidemiology of the disease.

Key words: *Trypanosoma congolense* · *Glossina tachinoides* · *G. morsitans submorsitans* · Reservoir

INTRODUCTION

Africa hosts 205 and 174 million sheep and goats representing approximately 17 and 31% of the world total small ruminant population, respectively. The population of small ruminants in sub-Saharan Africa is estimated to be 274 million [1, 2]. The small ruminant population in Ethiopia is 24 million sheep and 18 million goats. Small ruminants mostly owned by smallholder farmers for whom this resource is critical for nutrition and income generation. Low cost of production requirement of little land and higher prolificacy made them attractive asset for development. They are well adapted to hot and dry conditions and provide golden opportunity to alternatively exploit potential of lowland areas [1, 2].

In spite of the presence of large number of small ruminant population, Ethiopia fails to optimally utilize this resource as the sector is suffering from lower productivity. Among many factors which limit the economic return from small ruminant production diseases stands in the front line [3]. One of such diseases that hamper small ruminant productivity is trypanosomosis. In Ethiopia, 6.12 million small ruminants are at risk of contracting trypanosomosis [4]. A small ruminant, especially goats has been reported to be resistant to trypanosomosis [5]. However, several studies conducted on the prevalence of small ruminant trypanosomosis in Ethiopia, Kenya and Nigeria revealed that small ruminants acquire infection resulting in economic losses [6]. Despite their use as a living bank for small holder rural farmers in the southwestern Ethiopia enough works had not been performed which estimates the problem of small ruminant trypanosomosis.

The Objectives of this Study Were:

- To determine the prevalence rate of small ruminant trypanosomosis in the study area
- To determine the apparent fly density and species of the vector involved in the transmission

Corresponding Author: Samson Leta, Adami-Tullu Agricultural Research Center, P. O. Box 35, Ziway, Ethiopia. Tel: +251 464 41 91 01, Fax: +251 464 41 91 08, Mob: +251 911056020, E-mail: samiwude@gmail.com.

MATERIALS AND METHODS

Study Area and Animals: Study on prevalence rate of small ruminant trypanosomosis was carried out in purposively selected five tsetses infested PAs of Illubabor zone of the Oromia regional state, in Upper Didessa valley (Harro Tatessa new settlement area). The area is situated in southwestern Ethiopia which is located at 08°33'50''N- 08°56'35''N and 036°25'14''E-036°42'00''E. The altitude ranges from 1270 -2000masl. The mean annual temperature ranges from 15-25°c. The agro-climate condition of the area falls with in tropical sub humid climates as the area has 7-8 humid months and means annual rainfall greater than 1400mm [7]. The settlement areas found near Didessa river which is the major tsetse and trypanosomes belts. Animals involved in the study were indigenous breeds of small ruminants (sheep and Goats) of all ages and both sexes.

Study Design, Sample Size and Sampling Method: A cross-sectional investigation of small ruminant trypanosomosis was carried out in purposively selected PAs from November 1, 2007 to March 31, 2008. During the same period 30 monoconical traps were deployed for tsetse fly trapping in four PAs. The sample size is determined according to the formula given by Thrushfield [8] ($n = 1.96^2$ X P exp. (1-P exp.) / d^2). But hence the number of sheep in the study area is very few, all accessible sheep were sampled. Thus 655 goats and 66 sheep were examined. Simple random technique was use to determine goats to be sampled to represent all study population.

Study Methods and Procedures:

Parasite Survey: the buffy coat, the hematocrit centrifugation (HCT) and thin blood film methods were used according to the procedure given by Parries *et al*. [9] and Murry *et al*. [10].

Animal Coat Color Classification: a visual color classification was performed which involves stating for each animal the main coat color. Animals that have black and grey coat color were categorized to black. Animals that have dark brown, light brown and fawn coat color were classified in to brown. Animals that have pale, white and other light colored coat were classified in to light color category. If a second color present the predominant coat color was selected.

Vector Survey: trap deployment sites were selected to represent all habitats that could be related to fly multiplication, behavior, feeding and other related aspects and the monoconical traps were deployed. Acetone, octenol and cow urine were used as attractants. The poles of traps were greased to prevent fly predators like ants. Traps were allowed to stay at the site of deployment for a period of 48 hours before collection. After 48 hours of deployment, the catches of each trap was sorted by fly tribe, then counted and identified. Tsetse fly species was identified based on morphological characteristics given Mulligan [11].

Data Analysis: Data was coded in to SM Excel spreadsheets program to create a database. Descriptive statistics such as mean, range, frequency and percentage were used to analyze the data using Stata software [12].

RESULTS

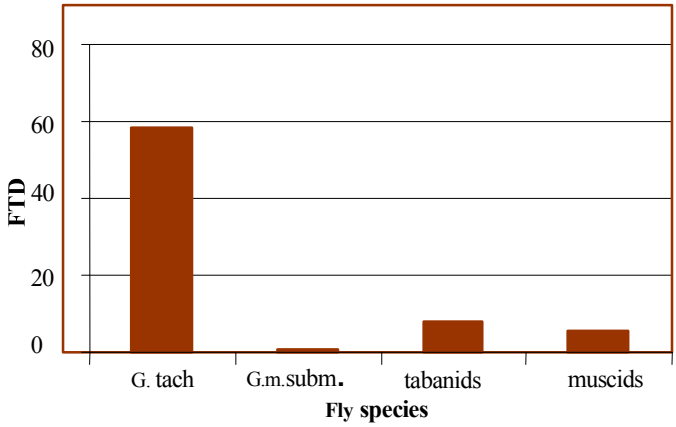
Parasitological Findings: The overall prevalence rate of small ruminant trypanosomosis during the study period was 3.75% (95% CI: 2.358 - 5.141). The result showed higher prevalence rate of trypanosomosis in sheep 4.5% (95% CI: 0.000 – 9.710) than in goats 3.7% (95% CI: 2.220-5.110) but the difference is statistically insignificant. The predominant trypanosome species found were *T. congolense* (66.7%, 33.3%) followed by *T. vivax* (20.8%, 0%), *T. brucei* (8.3%, 33.3%) and mixed infection of *T. congolense and T. vivax* (4.2%, 33.3%) in goats and sheep, respectively. The difference is statistically significant ($P<0.05$). Table 1 shows the effect of different risk factors on the prevalence rate and the major trypanosome species encountered.

Hematological Findings: Trypanosome infection reduced the mean PCV levels in both species. The lower PCV due to trypanosome infection pronounced more in goats (24.6%) than sheep (26.2%). The mean PCV values of parasitaemic and aparasitaemic small ruminants during the study period were 24.3 and 26.3% in sheep and 21.3 and 24.8% in goats respectively (Figure 1). The difference is statistically significant ($P<0.05$). The range of PCV values in parasitemic sheep and goats was from 21- 29% and 17- 37% and in aparasitemic sheep and goats was from 15- 41% and 13- 38%, respectively.

Table 1: Prevalence rate and trypanosomes species with different risk factors

Variables	No.xamined	Result				Prevalence rate (%)	95% CI
		T.c	T.v	T.b.	T.c+T.v		
Species							
Sheep	66	1	0	1	1	4.5	0.00-9.710
Goat	654	16	4	3	1	3.7	2.220-5.110
Sex							
Male	69	0	1	0	0	1.4	0.00-5.27
Female	651	17	3	4	2	4	0.00-11.90
Age							
< ½ yr	181	1	0	0	0	0.6	0.00-1.80
1-1½ yrs	255	6	2	1	1	3.9	0.00-11.30
>1½ yrs	284	10	2	3	1	5.6	2.61-21.20
Coat color							
Black	22	2	0	1	0	13.6	0.00-22.35
Brown	190	2	2	2	1	3.7	1.10-11.30
Light color	511	13	2	1	1	3.3	1.92-22.60
Over all	720	17	4	4	2	3.5	2.358-5.141

Keys: *T.c = T. congolense, T.v =T.vivax, T.b = T.brucei*



Keys*: G.tach = Glossina tachinoides, G.m.subm.= G.morsitans submorsitans*

Fig. 1: FTD of tsetse and biting flies in Haro Tatessa new settlement area

Fly Survey: A total of 4481 tsetse and biting flies were caught during the study period (during the dry season). Tsetse fly accounted for 82.2% (1.27% *G.m.submorsitans* and 80.9% *G.tachinoides*) and biting flies for 17.8%, (tabanids 10.6% and muscids 7.2%). The tsetse fly species detected was G*. m. submorsitans and G.tachinoides.* The tabanid flies included *Tabanus, Hematopota* while the Muscids were *Stomoxys*. The fly/trap/day was 58.8, 0.95, 7.9 and 5.73 for *G. tachnoides, G. m.submorsitans*, tabanids and muscids respectively (Figure 1).

DISCUSSION

The prevalence rate of small ruminant trypanosomosis in the current study averaged 3.75%. This is fairly in agreement with the previous investigations [5, 13-15]. The most prevalent trypanosome species was *T. congolense* the difference was statistically significant. This is in agreement with previous works by Hunduma [14], Junior [15] and Takele [16]. This is because the grazing areas were invaded by *G.m.submorsitans* which is an efficient transmitter of *T. congolense*. Further-more, the most prevalent trypanosome species in tsetse-infested areas of Ethiopia are *T. congolense* and *T. vivax* [5]. Rowlands *et al*. [17] reported a prevalence rate of 37% for *T. congolense* in southwest Ethiopia. Getachew and Yilma [18] reported an infection rate of 58.5% for *T. congolense*, 31.2% for *T. vivax* and 3.5% for *T. brucei* in southwest Ethiopia.

The lower prevalence rate in this study may be due to the decrease in fly population during the dry season. The self-cure phenomenon following infection would also contribute to the decrease in prevalence rate [19]. The low prevalence rate in sheep and goats might also because; tsetse and biting flies prefer cattle than other domestic animals [20]. In a mixed farming system in the study areas whereas different species of animals are kept together in a communal grazing land, tsetse and biting flies would preferably attack cattle, leaving most of the small ruminants uninfected. Another factors contributing to this include the low feeding success of tsetse on sheep and goats, illustrated previously by blood-meal analysis in Gambia [6]. This may be related to their smaller body size and anti-feeding behavior such as leg kicks and skin rippling.

Different workers have reported a low prevalence rate in small ruminants previously. Defly *et al*. [21] found that prevalence in trypanotolerant cattle was 3 times than in sheep and goats kept in the same area, but there was no difference between the trypanosome prevalence of sheep and goats. Kalu and Lawani [22] observed a prevalence of 5.3, 1.2 and 0.7% in cattle, sheep and goats, respectively. In this study statistically insignificant difference were observed in prevalence rate between sheep and goat. This agrees with the former studies by Mohammed [13] and Junior [15]. In southwest tsetse-infested area of Ethiopia Hunduma and Getachew [23] has reported a prevalence rate 5.1% (7.6% in sheep and 3.6% in goats).

Statistically insignificant difference was also obtained in infection rate between females (4%) and males (1.45%) this is also in agreement with the previous studies by Mohammed [13], Hunduma [14] and Junior [15]. This study also revealed that age had significant effect on the prevalence rate because statistically significant result was obtained among age groups. The significant difference might be due to the grazing pattern difference among different age groups. In the study area lambs and kids usually roam around homestead this reduce contact with tsetse flies, in addition their body size is too small to be attacked by tsetse flies.

There was a significant difference in prevalence rate between small ruminants coat color. Former studies conducted to study coat color to their attractiveness to tsetse species revealed that black and red colors have been found to be more attractive, but the strongest landing responses were found to be on black surface [24]. Statistically significant difference was also obtained in mean PCV value between parasitemic and aparasitemic small ruminants. As anemia is the classical symptom of the disease pathogenicity, the low PCV in parasitemic animals could have contributed in reducing the mean PCV. Difference in PCV of small ruminants due to trypanosomosis in ruminants is available in various studies carried out so far [14, 15, 21, 25].

The fly survey showed *Glossina m. submorsitans* and *G. tachinoides* were the species of tsetse fly found in the areas with a higher FTD for *G.tachinoides* (58.8) and lower FTD for *G.m.submorsitans* (0.95). There was significant difference between FTD of *G.m.submorsitans* and *G. tachinoides* this might be due to an absolute increase in the number of *G. tachinoides* due to favorable environment such as enough moisture, vegetation growth and suitable habitat in the study area. The result of tsetse fly survey agreed well with the general knowledge on the ecology of tsetse species found in southwestern Ethiopia for the riverine group. Typical habitat pattern were found in the study area for the riverine species *G. tachinoides* that prefers for riverine and forest ecology. On the other hand, the savanna were the *G. m. submorsitans* usually inhabits was not favorable because of high human activities the savanna was usually cultivated after tsetse control was under taken in 2004. Slingenbergh [26] discussed the invasion of *G. m. submorsitans* in to the upper Didessa valley.

In conclusion, trypanosomosis in small ruminant is important disease, it has a negative effect on PCV hence and the disease could limit the productivity of small ruminants. In addition, from analysis of the findings risk factors like sex, age and coat color may also have an association with the disease.

REFERENCES

1. Oyeyemi, M., 2002. Response of Multiparous and Primiparous West African Dwarf Goats (*Capra hircus* L.) to Concentrate Supplementation. Veterinarski Archiv., 72: 29-38.
2. Yibeltal, M., 2005. A Seroprevalence of Small Ruminant Brucellosis in Selected Sites of Afar and Somali regions, Ethiopia. DVM Thesis, Addis Ababa University, Faculty of Veterinary Medicine, Debre zeit, Ethiopia.
3. Firew, T., 1999. Livestock Production, Management and Utilization. Unpublished report, Mekelle University, Mekelle, Ethiopia.
4. Ministry of Agriculture, 1995. Development Strategy. Ethiopian Ministry of Agriculture, Addis Ababa, Ethiopia.

5. Getachew, A., 2005. Trypanosomosis in Ethiopia. Addis Ababa University, Faculty of Veterinary Medicine, Debre zeit, Ethiopia.
6. Snow, W., T. Wacher and P. Rawlings, 1996. Observations on the Prevalence of Trypanosomosis in Small Suminants, Equines and Cattle in Relation to Tsetse Challenge, in the Gambia. Veterinary Parasitol., 66: 1-11.
7. Central Statistical Authority, 1998. Federal Democratic Republic of Ethiopia Central Statistical Agency, Report on Livestock and Livestock Characteristics Agricultural sample survey 1997/98, Addis Ababa, Ethiopia.
8. Thrusfield, M., 1995. Veterinary Epidemiology. 2nd ed. Black well Science, Great Britain.
9. Paris, J., M. Murray and F. Mcodimba, 1982. A Comparative Evaluation of the Parasitological Technique Currently Available for the Diagnosis of African Trypanosomosis in Cattle. Acta Trop.
10. Murry, M., P. Murry and W. McIntyre, 1977. An Improved Technique for the Diagnosis of African Trypanosomosis. Trans. R. soc. Trop. Med. Hyg., 71: 325-326.
11. Mulligan, H., 1970. The African Trypanosomosis. George Allen and Unwin Ltd, London.
12. Stata Corporation, 2000. Westata Version 9.0 for Windows 95/98/NT. University Drive East College Station, Texas, USA.
13. Mohammed, S., 1995. Small Ruminant Trypanosomosis: Prevalence and Evaluation of Field Diagnostic Method in Wolaita. DVM Thesis, Addis Ababa University, Faculty of Veterinary Medicine, Debre zeit, Ethiopia.
14. Hunduma, D., 2003. Prevalence of Trypanosomosis in Small Ruminant in Southwest Ethiopia (Didessa and Ghibe valleys). DVM Thesis, Addis Ababa University, Faculty of Veterinary Medicine, Debre zeit, Ethiopia.
15. Junior, J., 2005. Small Ruminant Trypanosomosis in and around Mizan Teferi. DVM Thesis, Addis Ababa University, Faculty of Veterinary Medicine, Debre zeit. Ethiopia.
16. Takele, A., 1985. Survey of Trypanosomiasis and its Economic Impact in Gamo Gofa. DVM Thesis, Addis Ababa University, Faculty of Veterinary Medicine, Debre zeit, Ethiopia.
17. Rowlands, G., W. Mulatu, E. Authie, S. Leak and A. Peregrine, 1993. Epidemiology of Bovine Trypanosomosis in the Ghibe Valley, Southwest Ethiopia. Acta Trop.
18. Getachew, A. and J. Yilma, 1996. Trypanosomiasis: A Threat to Cattle Production in Ethiopia. Revue Med. Vet., 147: 897-902.
19. Gardiner, R., 1989. Recent Studies of the Biology of Trypanosoma Vivax. Advances in Parasitol., 28: 229-317.
20. Kniepert, F., 1981. Preference Behaviour of Female Tabanids (Diptera, Tabanidae) on the Host, Z. Angew. Entomol., 91: 486-510.
21. Defly, A., K. Awuome, K. Bokavi, M. D'Ieteren, G. Grundler, M. Handlos, P. Itty, S. Leak, J. Maehl, K. Mawuena, G. Morkramer, S. Nagda, R. Paling, J. Rarieya, W. Thorpe and J. Trail, 1988. Effect of Trypanosome Infection on Livestock Health and Production in Togo. In proceeding of Livestock Production in Tsetse Affected Areas of Africa (ILCA/ILRAD), Kenya, pp: 251-256.
22. Kalu, U. and F. Lawani, 1996. Observations on the Epidemiology of Ruminant Trypanosomosis in Kayo Ttate. Trop. Med., 49: 213-217.
23. Hunduma, D. and A. Getachew, 2005. Small Ruminant Trypanosomosis in the Southwest of Ethiopia. Small Ruminant Research, Department of Parasitology, Faculty of Veterinary Medicine, Addis Ababa University, Debre Zeit, Ethiopia.
24. Green, C., 1993. The Effects of Odours and Target Color on Landing Responses of Glossina Morsitans Morsitans and Glossina Pallidipes. Bulletin of Entomological Res., 83: 553-562.
25. D'Ieteren, M., K. Awuome, K. Bokavi, S. Chema, C. Colardelle, L. Coulibaly, A. Defly, A. Feron and G. Grundler, 1988. Trypanosome Infections and other Factors Influencing PCV in Livestock. In proceedings of Livestock Production in Tsetse Affected Areas of Africa (ILCA/ILRAD), Kenya, pp: 61-167.
26. Slingenbergh, J., 1992. Tsetse Control and Agricultural Development in Ethiopia. Wild Animal Review, FAO, 70: 30-36.