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

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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
MATERIALS AND METHODS

Study Area and Animals: Study on prevalence rate of small ruminant trypanosomosis was carried out in purposively selected five tsetse 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 -2000 masl. The mean annual temperature ranges from 15-25°C. The agro-climate condition of the area falls within 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 monoclonal traps were deployed for tsetse fly trapping in four PAs. The sample size is determined according to the formula given by Thrushfield [8] (n = 1.96² X P exp. (1-P exp.) / d²). 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 used 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 monoclonal 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: 0.000 – 9.710) 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

<table>
<thead>
<tr>
<th>Variables</th>
<th>No. examined</th>
<th>T. c</th>
<th>T. v</th>
<th>T. b</th>
<th>T. c+T. v</th>
<th>Prevalence rate (%)</th>
<th>95% CI</th>
</tr>
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<tbody>
<tr>
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<td></td>
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<tr>
<td>Sheep</td>
<td>66</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
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<td>0.00-9.710</td>
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<tr>
<td>Goat</td>
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<td>16</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>3.7</td>
<td>2.220-5.110</td>
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<td>1</td>
<td>0</td>
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<tr>
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<td>17</td>
<td>3</td>
<td>4</td>
<td>2</td>
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<td>0.00-11.90</td>
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<td></td>
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<td></td>
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<tr>
<td>&lt; ½ yr</td>
<td>181</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.6</td>
<td>0.00-1.80</td>
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<td>6</td>
<td>2</td>
<td>1</td>
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<td>3.9</td>
<td>0.00-11.30</td>
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<tr>
<td>&gt;1½ yrs</td>
<td>284</td>
<td>10</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>5.6</td>
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<td>Black</td>
<td>22</td>
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<td>0</td>
<td>1</td>
<td>0</td>
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<td>Brown</td>
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<td>2</td>
<td>2</td>
<td>1</td>
<td>3.7</td>
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<td>2</td>
<td>1</td>
<td>1</td>
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<td>17</td>
<td>4</td>
<td>4</td>
<td>2</td>
<td>3.5</td>
<td>2.358-5.141</td>
</tr>
</tbody>
</table>

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

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. tachinoides, 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

5. Getachew, A., 2005. Trypanosomosis in Ethiopia. Addis Ababa University, Faculty of Veterinary Medicine, Debre Zeit, Ethiopia.
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.