Prevalence of Bovine Trypanosomosis and Vector Distributions in Chewaka Settlement Area of Illubabor Zone, Southwestern Ethiopia

Kumela Lelisa, Delesa Damena, Senbeta Tasew, Mohamed Kedir and Mulisa Megersa

National Tsetse and Trypanosomosis Investigation and Control Center, Bedele Tsetse (1)
National Animal Health Diagnostic and Investigation Center, Sebeta, Ethiopia (2)
Jigjiga University, College of Veterinary Medicine, Jigjiga, Ethiopia (3)

Abstract: A cross-sectional study was conducted from December 2014 to January 2015 in Chewaka settlement area southwestern Ethiopia with the aim to determine the prevalence of bovine trypanosomosis and to assess apparent densities of vectors. Buffy coat technique was used for the determination of prevalence of trypanosomosis while baited mono pyramidal traps were used for the vector survey. A total of 566 cattle were randomly selected from the study population and examined for the parasitological study. Among trypanosome species identified Trypanosoma congolense (64%) was the predominant species followed by T. vivax (28%) and T. brucei (8%). Significantly higher trypanosome prevalence (14.8%) was observed in animals with poor condition than that of those with medium (2.23%) and good (5.05%) body condition. Higher infection rate was recorded in male (5.06%) than female (3.48%) cattle. Statistically significant difference (P<0.05) was observed with the mean PCV values between aparasitaemic (25.26%±4.73) and parasitaemic animals (19.24%±5.84). Among 1919 flies collected, the highest fly density recorded was Glossina species (14.43 fly/trap/day) and followed by Stomoxys (2.47 flies/trap/day) and Tabanus (0.23 fly/trap/day). Two species of tsetse fly: G. tachinoides (13.75 flies/trap/day) and G. morsitans submorsitans (0.68 flies/trap/day) were identified from the study area. In conclusion trypanosomosis and tsetse control methods should be expanded to reach all infested areas in sustainable manner besides participatory extension packages to create public awareness.

Key words: Biting fly • PCV • Tsetse Fly • Vector Control

INTRODUCTION

Trypanosomosis is a complex protozoan disease caused by different species of flagellated unicellular parasites belong to genus Trypanosoma and found in the blood and other tissues of vertebrates including livestock, wild life and human being [1-3]. Trypanosomosis limits livestock production particularly in Africa as tsetse flies are usually occupying places with good grazing potential like woody land and savannah areas [4, 5]. The disease is a major constraint in production of cattle, sheep, goat, equines and, in some regions, in camels and pigs [6]. Generally there is a great threat of trypanosomosis which impedes the economic development of African continent and also poses a major human health threat [5].

In Ethiopia, six species of trypanosomes are recorded and the most important trypanosomes in terms of economic loss in domestic animals are tsetse transmitted species particularly T. congolense, T. vivax and T. brucei. Tsetse flies in Ethiopia are confined to southwestern and northwestern regions between longitude 33° and 38° E and latitude 5° and 12° N which cover an area of 220,000 km². Tsetse infested areas lie in the low lands and also in the river valleys of Blue Nile, Baro, Akobo, Desser, Ghibe and Omo [5, 7]. Consequently, new areas are being invaded and settled communities are being continually evicted by the advancing tsetse belt. Five species of Glossina (G. m. submorsitans, G. pallidipes, G. tachinoides, G. f. fuscipes and G. longipennis) have been recorded in Ethiopia [5]. Hitherto, tsetse transmitted animal trypanosomosis remain as one of the largest causes of livestock production losses in Ethiopia [8].

Currently, trypanosomosis is found to be one of the factors impeding livestock production and productivity in western and south western parts of Ethiopia. An understanding of the prevalence of the disease and
magnitude of the vector population is important to design appropriate control strategies. Therefore, this research was conducted with the aim to estimate the prevalence of bovine trypanosomosis and relative abundance of vector species in Chewaka Settlement Area, Ilubabor zone, Southwestern Ethiopia.

MATERIALS AND METHODS

Study Area: The study was carried out in Chewaka settlement area of Ilubabor zone, southwestern Ethiopia located in Didessa river valley. The climate alternates with long summer rain fall and winter dry season with mean annual rain fall 800mm and the altitude range between 1000-1800 m.a.s.l with daily temperature of 37-42°C. The vegetation type of the area is characterized by riverine vegetations, savannah and woody grass lands.

Study Design and Sample Size Determination: A cross-sectional study was conducted in four purposively selected villages of Chewaka settlement area. Simple random sampling technique was followed to select the study animals. The number of animals required for the study was determined using the formula given by Thrusfield [9] for simple random sampling. The size of sample was determined using 95% level of confidence, 50% expected prevalence and 0.05 desired absolute precision. Therefore, a total of 384 cattle were needed for the study; nevertheless the samples number increased to 566 for better precision. The sex, body condition and origin of animals were explanatory variables used to associate with the prevalence. Body condition for each cattle was categorized as good, medium and poor based on the body condition score used by Nicholson and Butterworth [10].

Survey of Trypanosomes: Blood samples were collected randomly from cattle of the four peasant associations during the study periods. Blood samples were collected into heparinized microhaematocrit tubes (Deltalab S.L, Barcelona, Spain) after piercing the ear vein using lancet. Then one end of the capillary tube was sealed with sealant (Hawksley Ltd, Lancing, UK) and spun at 12, 000 rpm for five minutes. Then packed cell volume (PCV) was calculated using haematocrit reader. The capillary tubes were then broken just below buffy coat and expressed on microscopic slide, mixed and covered with a 22x 22mm cover slip. Then it was examined with 40X objective of microscope using dark ground buffy coat technique to detect the presence of the parasites [11]. Thin smear was made and stained with Giemsa staining methods from buffy coat positive samples for the confirmation of trypanosome species. Examination was performed by light microscopy under 100X magnification [1].

Entomological Study: A total of 56 baited mono pyramidal traps were deployed along suitable tsetse habitats to assess the apparent densities, distributions and species of tsetse flies and other biting flies involved in transmission of trypanosomes. All traps were baited with acetone, Octenol (1-3-Octane) and old cow urine filled in separated bottles. Traps were labeled and deployed at an interval of 200-250 meters. The coordination and altitude of each trap were recorded using a Global Positioning System (GPS). After 48 hours of trap deployment time the cages were collected and captured flies were counted, identified and sexed according to morphological characteristics [12].

Data Management and Analysis: The data collected was analyzed using SPSS version 20 statistical software program. The infection rate was calculated by dividing the proportion of cattle infected by the total number of cattle examined multiplied by 100. The association between the prevalence of trypanosome infection and risk factors were assessed by chi square test, whereas one way ANOVA was used to assess the difference in mean PCV between trypanosome positive and negative animals. A statistically significant association between variables was set at P-value < 0.05 with 95% confidence level. Finally, the density of fly population is calculated by dividing the number of flies caught by the number of traps deployed and number of days of deployment and expressed as flies/trap/day (FTD).

RESULTS

Parasitological Findings: Out of the total 566 cattle examined 24 (4.24%) cattle were found to be positive for trypanosomosis. The prevalence was varying from 2.50% in Danena kebele to 5.6% in Buneya. Significantly higher prevalence of trypanosisis (14.8%) was seen in animals with poor condition than those with medium (2.2%) and good (5.1%) body conditions. Even though, no significant difference was observed in prevalence between sex groups (P> 0.05) higher infection rate was found in male (4.8%) than female (3.5%) cattle (Table 1).
Table 1: Prevalence of bovine trypanosomosis and associated risk factors in Chewaka settlement area

<table>
<thead>
<tr>
<th>Risk Factors</th>
<th>No. of animals examined</th>
<th>No. of Positive</th>
<th>$\chi^2$</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>336</td>
<td>16 (4.76%)</td>
<td>0.81</td>
<td>0.41</td>
</tr>
<tr>
<td>Female</td>
<td>230</td>
<td>8 (3.48%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Body Condition</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good</td>
<td>198</td>
<td>9 (4.55%)</td>
<td>17.58</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Medium</td>
<td>314</td>
<td>7 (2.22%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poor</td>
<td>54</td>
<td>8 (14.8%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PAs</td>
<td></td>
<td></td>
<td>2.76</td>
<td>0.43</td>
</tr>
<tr>
<td>Buneya</td>
<td>161</td>
<td>9 (5.6%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chefe Megertu</td>
<td>115</td>
<td>6 (5.2%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dabena</td>
<td>120</td>
<td>3 (2.5%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dire Misoma</td>
<td>170</td>
<td>6 (3.5%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2: Mean PCV values of aparasitaemic and parasitaemic animals

<table>
<thead>
<tr>
<th>Variable</th>
<th>No. of animals examined</th>
<th>Mean PCV</th>
<th>SD</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aparasitaemic</td>
<td>542</td>
<td>25.24</td>
<td>4.74</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Parasitaemic</td>
<td>24</td>
<td>19.42</td>
<td>5.89</td>
<td></td>
</tr>
</tbody>
</table>

Table 3: Prevalence and mean PCV values in relation to Trypanosomal species identified

<table>
<thead>
<tr>
<th>Trypanosome species</th>
<th>Infection rate</th>
<th>Prevalence (%)</th>
<th>Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trypanosoma brucei</td>
<td>2</td>
<td>8.3</td>
<td>23.5 ± 0.71</td>
</tr>
<tr>
<td>Trypanosoma congolense</td>
<td>15</td>
<td>62.5</td>
<td>17.67 ± 5.3</td>
</tr>
<tr>
<td>Trypanosoma vivax</td>
<td>7</td>
<td>29.2</td>
<td>22.0 ± 6.76</td>
</tr>
<tr>
<td>Total</td>
<td>24</td>
<td>19.42</td>
<td>4.24 ± 5.89</td>
</tr>
</tbody>
</table>

Table 4: The distribution and apparent densities of vectors of trypanosomosis in Chewaka settlement area

<table>
<thead>
<tr>
<th>Tsetse species caught</th>
<th>G.m.m.</th>
<th>G. tach.</th>
<th>Other Biting flies</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$\delta$</td>
<td>$\varpi$</td>
<td>T</td>
</tr>
<tr>
<td>Dabena</td>
<td>15</td>
<td>5</td>
<td>55</td>
</tr>
<tr>
<td>Dire Misoma</td>
<td>14</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Buneya</td>
<td>14</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Chefe Megertu</td>
<td>13</td>
<td>3</td>
<td>12</td>
</tr>
<tr>
<td>Total</td>
<td>56</td>
<td>9</td>
<td>67</td>
</tr>
</tbody>
</table>

Hematological Findings: The mean PCV of parasitaemic and aparasitaemic animals was 19.24% ± 5.84 SD and 25.26% ± 4.73, respectively (Table 2). Out of the infected animals, cattle infected with *T. congolense* had lower (17.7 ± 5.3) mean PCV followed by *T. vivax* (22.0 ± 6.76) and *T. brucei* (23.5 ± 0.71). Species level of trypanosome infection revealed that *T. congolense* (n=15, 62.5%) was the major species identified followed by *T. vivax* (n=7, 29.2%) and *T. brucei* (n=2, 8.3%) (Table 3).

Entomological Findings: In this study two species of tsetse flies, *Glossina m. submorsitans* and *G. tachnoides* were identified in the study area. Other biting flies particularly of genus *Stomoxys* and *Tabanus* were also recorded during the study period. A total of 1919 flies were caught during the study period of which 1616 (84.21%) were tsetse, 277(14.43%) were *Stomoxys* and 26 (1.36%) were *Tabanus*. The relative abundance of *Glossina* species and other biting flies are shown in Table 4.

DISCUSSION

The present study revealed an overall prevalence of bovine trypanosomosis to be 4.4% in Chewaka settlement area. Similar findings were report from Arbaminch area (4.43%) by Teka et al. [13] and in Didesa District of Oromia Regional State, Ethiopia (4.86 %) by Fayisa et al.
Sex was not a significant predictor of trypanosome infection in cattle from Chewaka District, although male animals had apparently higher infection rates as compared to females. This finding coincides with the earlier report by Tekle et al. [13] and Tamiru et al. [25] who observed no significant difference in susceptibility between sex groups. The possible explanation for this might be due to the fact that in the study area male animals are mainly used for the purpose of draft power and this expose the animal to suitable vectors during ploughing.

The present study revealed that *T. congolense* was the predominant trypanosome species identified in the study area (62.5%). This finding was in agreement with previous studies conducted in western [26, 27] and in Northwest part of the country [20]. Other researchers had also reported *T. vivax*, *T. congolense* and *T. brucei* as a major cause of bovine trypanosomosis from western and south western part of Ethiopia [28, 29]. This may be attributed to the presence of high apparent density of tsetse flies that are biological and/or mechanical vector of trypanosomes [30].

In this study, the entomological findings revealed presence of two species of *Glossina* (*Glossina m. submorsitans* and *G. tachnoides*) and two genera of biting flies *Stomoxys* and *Tabanus*. This finding was in agreement with the findings of Efrem et al. [31] Gimbi district of Western Oromia who found the tsetse flies (*Glossina morsitans submorsitans* and *Glossina tachinoides*) along with other biting flies like *Tabanus*, *Haematopota* and *Stomoxys* species. Similarly in other studies conducted in Sayo District of Kellem Wollega Zone three species of *Glossina* (*G. tachnoides*, *G. m. submorsitans* and *G. pallidipes*) were identified by Getachew et al. [16] and *G. pallidipes*, *G. m. submorsitans* and *G. f. fuscipes* along with other biting flies (Tabanids and muscids) by Denu et al. [32] in three districts of Southwest Oromia, Ethiopia.

The overall apparent density of *Glossina* species was found to be 14.43 flies/ trap/ day. This finding was lower than the report of Getachew et al. [16] and Degnah et al. [33] who found an overall apparent density of 4.08 flies/trap/day and 4.5 flies/trap/day respectively. This might be due to presence of favorable environmental conditions like moistures, rivers and forests which provide suitable habitat for the flies. Several reports conducted in western and south western part of the country have indicated presence of high apparent density of *Glossina* species [34-37]. Sex composition of the flies observed in this study revealed that female tsetse flies were more predominant than male. The high proportion of

[14]. However the findings of the present study were much lower than some earlier researches conducted in different parts of the country [15, 16]. In another way low sensitivity of direct parasitological buffy coat examination may contribute for low prevalence that chronic stage is characterized by low parasitemic which is difficult to confirm by parasitological diagnosis. Due to very low sensitivity of buffy coat method 50% of infected animals remain undetected as compared to the molecular diagnosis [17].

In this study significantly higher prevalence of trypanosomosis infection was recorded in animal with poor body condition (14.8%) compared to animal with medium and good body conditions. This result was in agreement with the observations of Fayisa et al. [14] who found the highest prevalence of trypanosomosis in animals with poor body condition. Even though other factors such as malnutrition or other concurrent diseases may also affect the PCV and presence of trypanosome infections resulted in a significant decline in PCV and body condition score. However, it is unlikely that the impacts of those additional factors differ greatly between the parasitologically positive and negative animals [18]. In this study the prevalence of trypanosome infection among peasant associations was not significant and this might be due to similar agro-ecology and abundance vectors in all peasant associations. On the other hand the difference might be attributed to uncontrolled animal movements between peasant associations coupled with favorable environment for the vectors and availability of their preferred hosts, which is not necessarily domestic livestock [19] as the area is endowed with different wild animals.

Significant difference in mean PCV values of parasitaemic and aparasitaemic cattle observed in this study (P < 0.05). PCV is one of the indicators of haemoparasitic infections and hence the anemic status of sampled animals showed reduced PCV values. The mean PCV was decreased with increasing prevalence of infection. In support of the present study, similar result was also reported by earlier researchers in different parts of the country [20, 21]. Rowlands et al. [22] reported that the increased intensities of trypanosomosis had resulted in decreased PCV values and stated that mean PCV was a good indicator for the health status of herds in trypanosomosis endemic areas. The development of anemia is one of the most typical signs of trypanosomosis caused by *T. congolense* in susceptible cattle breeds [23, 24]. But anaemic condition could also be incriminated to numerous blood parasites other than trypanosomes.
females, most probably attributed to the fact that they live longer (Mean female fly life span being eight weeks, but only four weeks in males); hence more females could be caught [31]. Furthermore it was also described that female flies could comprise an average population of about 70% to 80% [38].

In conclusion the present study indicated that tsetse transmitted trypanosomosis is a potential threat for livestock production in the area. Thus, trypanosomosis and tsetse control strategies should be in place to reach all infested areas in sustainable manner besides participatory extension packages to create public awareness. Further epidemiological investigation is also a needed to synchronize control efforts at national level.

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REFERENCES


