Prevalence of Trypanosomosis and its Vectors in Ilu Aba Bor Zone, Algae Sachi District, South Western Ethiopia

Tsefaye Eshete, Gebeyehu Chali, Temesgen Wakshum, Yosef Deneke, Dagne Guta, Solomon Tafa and Garoma Desa

Abstract: A cross-sectional study was carried out from November to April 2016 to determine the prevalence of trypanosomosis and trypanosome vectors in Ilu Aba Bor zone Algae Sachi District. The methods employed during the study were deploying trap for the collection of tsetse flies and buffy coat technique for parasitological study. About 60 traps were deployed for 48 h for collection of tsetse fly and other biting flies. Among the five species of tsetse flies commonly found in Ethiopia only Glossina pallidipes were captured in the study area. The overall apparent density of tsetse flies trapped was 2.8% flies/trap/day and the highest prevalence found in wayu peasant association (PA). Other biting flies caught were Stomoxys and Tabanus. Blood samples collected randomly from 406 cattle were assessed for trypanosoma species by buffy coat technique. Trypanosoma species faced in the study area were Trypanosoma congolense (54.7%), Trypanosoma vivax (28.6%) and Trypanosoma brucei (16.6%) with the overall Trypanosomosis prevalence of (10.3%). Anemic cattle with Packed Cell Volume less than 24% were mainly endangered of Trypanosomosis and significantly different P<0.05. Poor body conditioned and female cattle were the most susceptible for Trypanosomosis and significantly associated with poor body conditioned (P<0.05) but not with sex. Generally, the study concludes that tsetse flies were an important vector for the epidemiology of bovine Trypanosomosis in Alge Sachi District. Therefore, vector and disease control, prevention methods and further studies should be undertaken to improve livestock production and productivity in the study area.

Key words: Alge Sachi • Buffy Coat • Glossina • Pcv • Trypanosoma

INTRODUCTION

Trypanosomosis is a widely spread protozoan disease complex which affects cattle and other wide range of hosts in sub-Saharan Africa. It is a protozoal disease caused by different species of unicellular parasites found in the blood and other tissues of vertebrates including livestock, wild life and people. Bovine trypanosomosis is one of the diseases that are caused by flagellated protozoan parasites belong to the genus Trypanosomes [1].

In Ethiopia, trypanosomosis is one of the most important diseases that limit livestock productivity and agricultural development due to its high prevalence in the most arable and fertile land of part of the country following the greater river basins of Abay, Omo, Ghibe...
and Baro. Currently about 220,000 km² areas of the above-mentioned regions are infested by five species of tsetse flies, namely, Glossina pallidipes, G. morsitans, G. fuscipes, G. tachinoides and G. longipennis. More than 10 million heads of cattle in Ethiopia are at risk of variable degrees of trypanosomosis at any time of the year, of which six million are tsetse borne [2].

Currently six species of trypanosomes are recorded in Ethiopia and the most important trypanosomes in terms of economic loss in domestic livestock are the tsetse transmitted species:

Trypanosome congolence, Trypanosome vivax and Trypanosome brucei. Tsetse flies in Ethiopia are confined to southwestern and northwestern regions between longitude 33° and 38° E and latitude 5° and 12°N covers an area of 220,000 km² [3]. Tsetse infested areas lie in the low lands and also in the river valleys of Abay (Blue Nile), Baro, Akobo, Didessa, Ghibe and Omo. Consequently, new areas are being invaded and settled communities are being continually evicted by the advancing tsetse.

The disease is mainly characterized by intermittent fever, progressive anemia and loss of condition of susceptible hosts which if untreated leads to heavy mortalities [4]. Several species of hematophagous tsetse flies of the genus Glossina are the vectors of African trypanosomosis and are responsible for cyclical transmission of the parasitic protozoan between numerous vertebrate hosts. The vector is distributed over wide range of habitats covering about 10 million square kilometers of potential grazing lands in 37 countries which are rendered unsuitable for livestock breeding and farming across the African continent exposing 160 million cattle to the risk of anemia, emaciation and death [5].

A number of studies have been so far undertaken in different parts of the country to determine the magnitude of this economically important disease. Nevertheless, there are no published studies which assess the cattle (Bos indicus), which are usually kept under an extensive husbandry system.

Study Area: The study was conducted in Alge Sachi District of Elu Aba Bor Zone of Oromia regional state, Western Ethiopia, from November to April 2016. The altitude of the area ranges from 1250 to 1800 m.a.s.l. The mean minimum and maximum temperature are 11.0-15.5°C and 26.1-34°C, respectively. The agro climate of the area alternates between long summer rain fall (June to September) and winter dry season (December to March) with annual rainfall ranging from 1300 to 2000 mm. The livelihood of the society largely depends on mixed livestock and crop production.

Study Animal: The animals used for this study were all age, body condition and non-select of sex of local zebu cattle (Bos indicus), which are usually kept under an extensive husbandry system.

Sampling Method and Sample Size Determination: The animals were sampled randomly involving both sexes, all age groups and all types of body conditions.
The desired sampling size was calculated according to the formula given by Thrusfield, [8]:

\[ N = \frac{(Z_x)^2 P_{exp} (1-P_{exp})}{D^2} \]

\( N \) = the required sample size  
\( P_{exp} \) = the expected prevalence rate (15%)  
\( Z_x \) = the values of the required confidence interval (1.96)  
\( D \) = desired absolute precision (5%)

In the study area 15% expected prevalence was considered in sample size determination and also the other determinants considered in sample size determination are 95% confidence interval and 5% desired absolute precision. Hence, the sample size required as per the above formula was 200 but to increase precision total of 406 cattle were sampled for the study.

Tsetse Distribution: Accurate information on the distribution of the tsetse fly is of paramount importance to better control of animal trypanosomosis. Three tsetse fly attractants (acetone, octenol and cow urine) were used [9].

Study Methodology

Packed Cell Volume (PCV) Determination: Blood samples were obtained by puncturing the marginal ear vein with a lancet and collected directly into a pair of heparinised capillary tubes. After centrifugation at 12,000 rpm for 5 min in a micro hematocrit centrifuge, the capillary tubes were placed in a hematocrit reader and the length of the red cells column was expressed as a percentage of the total volume of blood. Animals with PCV less than 24% were considered to be anemic and greater than 25% was unanemic [10].

Buffy Coat Technique: Heparinized capillary tubes, containing blood samples, were cut using a diamond tipped pen 1 mm below and 3 mm above the buffy coat after centrifugation. The content of the capillary tube was expressed on to a glass slide, then covered with cover slip and examined under ×40 objectives and ×10 eye pieces for movement of parasite [5].

Data Analysis: The total prevalence rate was calculated by dividing the number of positive results of animals to the total number of animals tested in the area. Appropriate, descriptive and Chi square (\( X^2 \)) were calculated using SPSS software and the pattern of mean packed cell volume (PCV) values were calculated by using t-test formula, the prevalence rates of bovine trypanosomosis between different ages, body condition and sexes of animals and distribution of species of trypanosomes in the areas was compared. Infection rate on the basis of sex, age and body condition was compared using test (chi-square).

RESULTS

Parasitological Findings: Out of 406 cattle examined 42 (10.3%, 95% CI: 7 -13) were found to be infected with trypanosomes. The prevalence of Trypanosomosis was significantly high in Adere followed by that of Wayu and the highest prevalence on the basis of species was T. congulence followed by T. vivax.

Risk Factor Variable: The prevalence of trypanosomosis was higher in females as compared to male animals. However, the difference was not statistically significant (P > 005). The prevalence of trypanosomosis between body condition scores was highest in poor and it was statistically significant (P < 005).

Result of Packed Cell Volume (PCV): The lowest and highest PCV value of the study area respectively was 17 and 36. Trypanosomosis was significantly associated with anemic than unanemic animals.

<table>
<thead>
<tr>
<th>Spp of Trypanosomosis</th>
<th>Pas</th>
<th>Total examined</th>
<th>No.of positive</th>
<th>T. congulence</th>
<th>T. vivax</th>
<th>T. brucei</th>
<th>Prevalence%</th>
<th>( \chi^2 )</th>
<th>P - value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adere</td>
<td>109</td>
<td>17</td>
<td>9</td>
<td>5</td>
<td>3</td>
<td>15.6</td>
<td>9.3</td>
<td>0.023</td>
<td></td>
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<tr>
<td>Mogu</td>
<td>127</td>
<td>5</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>3.9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wayu</td>
<td>80</td>
<td>10</td>
<td>6</td>
<td>4</td>
<td>-</td>
<td>12.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S. geji</td>
<td>90</td>
<td>10</td>
<td>7</td>
<td>1</td>
<td>2</td>
<td>11.1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>406</td>
<td>42</td>
<td>23(54.76%)</td>
<td>12(28.6%)</td>
<td>7(16.7%)</td>
<td>10.3</td>
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</tr>
</tbody>
</table>

Table 1: The prevalence of Trypanosomosis in different area with respective species
Table 2: The prevalence of Trypanosomosis in different risk factors

<table>
<thead>
<tr>
<th>Risk factor</th>
<th>No. of examined animal</th>
<th>No. of infected animal</th>
<th>Prevalence %</th>
<th>$\chi^2$</th>
<th>P- Value</th>
<th>Odds ratio (CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>172</td>
<td>15</td>
<td>8.7</td>
<td></td>
<td></td>
<td>1.3(0.7-2.6)</td>
</tr>
<tr>
<td>Female</td>
<td>234</td>
<td>27</td>
<td>11.5</td>
<td>0.9</td>
<td>0.6</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calve</td>
<td>81</td>
<td>6</td>
<td>7.4</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Young</td>
<td>95</td>
<td>9</td>
<td>9.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adult</td>
<td>230</td>
<td>27</td>
<td>11.7</td>
<td>1.3</td>
<td>0.52</td>
<td>1.2(0.6-2.3)</td>
</tr>
<tr>
<td>B. condition</td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Poor</td>
<td>20</td>
<td>7</td>
<td>35</td>
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<tr>
<td>Medium</td>
<td>241</td>
<td>23</td>
<td>9.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good</td>
<td>145</td>
<td>12</td>
<td>8.25</td>
<td>13</td>
<td>0.001</td>
<td>0.2(0.06-0.5)</td>
</tr>
<tr>
<td>Total</td>
<td>406</td>
<td>42</td>
<td>10.30</td>
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<td></td>
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</tbody>
</table>

Table 3: Prevalence of bovine Trypanosomosis based on PCV value

<table>
<thead>
<tr>
<th>PCV</th>
<th>Total examined</th>
<th>No. Infected</th>
<th>Prevalence</th>
<th>Mean</th>
<th>Min</th>
<th>Max</th>
<th>St.Dev</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;24 anemic</td>
<td>178</td>
<td>32</td>
<td>17.9%</td>
<td>25.9</td>
<td>17</td>
<td>36</td>
<td>3.99</td>
<td>0.003</td>
</tr>
<tr>
<td>&gt;24unanemic</td>
<td>228</td>
<td>10</td>
<td>4.37%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>406</td>
<td>42</td>
<td>10.3%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 4: Prevalence of Tsetse distribution in different peasant associations

<table>
<thead>
<tr>
<th>Pas</th>
<th>No. of $G. pallidipes$</th>
<th>FTD %</th>
<th>Tabanus</th>
<th>FTD %</th>
<th>Stomoxy</th>
<th>FTD %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mogu</td>
<td>65</td>
<td>2.16</td>
<td>-</td>
<td>-</td>
<td>95</td>
<td>3.16</td>
</tr>
<tr>
<td>Adere</td>
<td>71</td>
<td>2.36</td>
<td>50</td>
<td>1.66</td>
<td>37</td>
<td>1.2</td>
</tr>
<tr>
<td>Wayu</td>
<td>111</td>
<td>3.7</td>
<td>-</td>
<td>-</td>
<td>108</td>
<td>3.6</td>
</tr>
<tr>
<td>Sibo-Genji</td>
<td>95</td>
<td>3.17</td>
<td>35</td>
<td>1.16</td>
<td>57</td>
<td>1.9</td>
</tr>
<tr>
<td>Total</td>
<td>342</td>
<td>2.85</td>
<td>85</td>
<td>0.7</td>
<td>297</td>
<td>2.47</td>
</tr>
</tbody>
</table>

**Tsetse Distribution:** In this study District, $G. pallidipes$ covered a vast area with high apparent densities and followed by Tabanus and Stomoxy.

**DISCUSSION**

Trypanosomosis is a major constraint to the utilization of large land resources and also affect livestock, particularly cattle which play a vital role in the agricultural economy of Ethiopia. The overall prevalence of bovine trypanosomosis in the study area was 10.3% (95% CI:7-13). This result was in close agreement with the finding of Duguma et al. [11] who reported a Trypanosoma species prevalence of 9.66%, from south Western Ethiopia.

The prevalence rate in this study was considered to be low when compared with earlier reports from other parts of Ethiopia reporting prevalence of 20.9% and 25.7%, by Cherenet et al. [12] and Yibrah [13] respectively. This result was also lower as compared to Abebe and Jober [14] at Dembecha district (17.67%) and Yohanes [15] in Metekel districts, Northwest Ethiopia (17.20%).

This result was higher as compared to Habtamu et al. [16] who report prevalence of (2.86%) in Dale Wabera District of Kellem Wollega Zone, Western Ethiopia, Desa et al. [17] (4.15%) at Gari settlement area of East Wollega and Ayana et al. [18] who report prevalence of (2.10%) in Amhara region, Northwest Ethiopia.

The variation of trypanosome prevalence reported by different authors from different areas could be due to parasite and vector control programmes practiced in the area, study period, season (during late rainy season it is obvious that the population of flies increases). Due to this farmers inject their animals with trypanocidal drugs and also use insecticide spray in this season better
than any other time to minimize the effect of the disease. In addition, expansion of veterinary services up to peasant association and deforestation for crop cultivation and settlement might also have contributed to the low prevalence.

During the study period prevalence of bovine trypanosomosis was assessed between sexes and among 42 positive animals 27 (11.59%) of them were female and 15 (8.57%) of them were male animals, but not statistically significant. This result is in agreement with previous result of Abebe [19], Terefa [20], muturi, [21] and Leak [22] who obtained high prevalence on female than male but no significant difference between the sexes groups. The Possible suggestion for increase of prevalence in female animal in this finding could be due to that; female animals were used for milking purpose and travel long distance to area of tsetse challenge for grazing.

It was also tried to assess the relationship of infection with age category of sampled animals. As a result, among the age groups the highest prevalence was recorded in adult cattle (11.7%) followed by young cattle (9.5%) with no significant differences of variation. This finding was in line with previous report of Yibrah [13] who report higher prevalence in adult animals. This prevalence variation has likely occurred as the husbandry system reflect young animals are less exposed since they are kept close to the homestead where tsetse habitat has been destroyed, suckling calves are not allowed to go out with their dams until they are weaned off. Young animals are also naturally protected to some extent by maternal antibodies [23].

Out of the 10.3% overall prevalence of trypanosome infection, 5.66% were due to *T. congolense*, 2.95% were due to *T. vivax* and 1.7% were due to *T. brucei*. The finding of this study showed that of the total trypanosome positive animals 54.7% were found to be infected with *T. congolense*, 28.6% were infected with *T. vivax* and the remaining 16.6% were infected with *T. brucei*. In the current study mixed infection was not detected. The higher proportion of *T. congolense* in this study was in agreement with the previous results of Abebe and Jobre [14] with finding of (66.1%). Moreover, the results of Duguma *et al.* [11] (85.2%) and Rowland *et al.* [24] in Ghibe valley, Southwest Ethiopia (84%), had also shown higher results of *T. congolense*.

The predominance of *T. congolense* infection in cattle suggests that the major cyclical vectors or Glossina species are more efficient transmitters of *T. congolense* than *T. vivax* in East Africa [25] and also due to the high number of serodems of *T. congolense* as compared to *T. vivax* and the development of better immune response to *T. vivax* by infected animals. Different studies Rowland *et al.* [24] have indicated that *T. vivax* is highly susceptible to treatment while the problems of drug resistance are higher in *T. congolense* and *T. congolense* is mainly confirmed in the blood, while *T. vivax* and *T. brucei* also invade the tissues. *T. congolense* and *T. vivax* are the most prevalent trypanosomes that infect cattle in tsetse infested and tsetse free areas of the Ethiopia, respectively [26].

The prevalence of Trypanosomosis under different body condition groups indicated statistically significant difference with higher infection rate in poor body conditioned than medium and good body conditioned cattle. The less infection in the good body condition animals might be related to that well-nourished animals have good level of immunity and are in a better position to resist infection, moreover there is a very rare possibility of re-establishment of infection in animals with good body condition [27].

From the total of 406 examined animals, 178 (17.9%) were anemic having PCV < 24.0%. On the other hand among 228 non-parasitized animals 10(4.4%) had PCV < 24. The prevalence of trypanosomosis in anemic animals was significantly higher than that of unanemic animals taking the PCV value 24 to 46% as normal for zebu cattle [28]. This finding was in agreement with previous reports of Bekele and Nasir [29] and Mihret and Mamo [30] at Hawagelian district and East Gojjam respectively. This suggests that even though anemia is characteristic of trypanosomosis, other factors are also anticipated to affect the PCV profile of animals. Diseases such as fascioliosis, gastrointestinal parasitism, vector-borne diseases and nutritional deficiencies can also cause reduced PCV [31].

A total of 342 tsetse flies were trapped. Only one species (*G. pallidipes*) was identified in the study area with 2.86% catches per trap per day of tsetse flies. Other biting fly’s were also caught (85) *Tabanus* (297) *Stomoxys*. This result is not agreed with the previous report from Gowo District of West Oromia by Bedaso [32] and Senbata [33] who report overall FTD 18.9%. This could be because of the number of traps deployed, the site of trap installation, the months of study, control activities, etc.

**CONCLUSION**

The study revealed that tsetse fly and trypanosomosis were the most important constraints for agricultural activity and animal production in Alge Sachi District, Elu Awa Bor zone, Oromia Regional State.
Respondents’ testimony shows that there have been improvements in the situation of the disease and its impact since the establishment of control program in the area. The most widely distributed and dominant trypanosome and tsetse fly species in Alge Sachi District was *T. Congolese* and *G. pallidipes* respectively. Significant reduction in the level of PCV was observed due to the disease.

From the above conclusion, the following points were recommended for further attention. Although farmers’ perceptions shows observable improvements, since the fly density and the prevalence of trypanosomosis is still significant, the control program should be intensified. Study on the socio-economic impact of the disease and control program being implemented should be undertaken. Continuous community awareness creation should be conducted on advantage of tsetse fly control program and disadvantage of locally injection of trypanocidal drugs.

**REFERENCES**