Prevalence of Bovine Trypanosomosis in Lalo Kile District, Kelem Wollega Zone, Oromia Regional State, Western Ethiopia

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Abstract: A cross sectional study was carried out to determine the prevalence of bovine trypanosomosis and tsetse apparent density using parasitological and entomological survey in Lalo kile district of Western Ethiopia from November 2011 to June 2012. The Parasitological survey was conducted on 408 animals during the study period. The prevalence of bovine trypanosomosis during the study period was 6.86% of which Trypanosoma congolense infection was 5.15% and Trypanosoma vivax infection was 1.7%. The prevalence was 9.44% for males and 3.43% for females with statistically significant difference (P<0.05) during study period. There was no statically significant difference among age groups (p>0.05). Glossina morsitans sub-morsitans and Glossina pallidipes, Tabanus, Haematopota and Stomoxys were caught. The entomological survey showed that the apparent densities of different flies in study area were 4.08 fly/trap/day for Glossina morsitance sub-morsitans, 2.65 fly/trap/day for Glossina pallidipes, 3 fly/trap/day for Stomoxys, 0.82 fly/trap/day for Tabanus and 0.73 fly/trap/day for Haematopota. In the present study, the mean PCV values for parasitaemic and aparasitaemic animals was 23.214 +3.27 and 25.466+4.249 (p<0.005) respectively. The overall mean PCV values were significantly different between aparasitaemic and parasitaemic animals (p<0.005). The present study spawned valuable information on the epidemiology of bovine trypanosomosis in the study area. Although the present study revealed low prevalence, implementing control of trypanosomosis with an integrated approaches have paramount importance in the study sites.

Key words: Tsetse flies - Dara Jarso - Udo Denta

INTRODUCTION

Livestock are the main stay of the vast majority of African people. They contribute a large proportion of the continent’s gross domestic product (GDP) and constitute a major source of foreign currency earning for a number of countries. Livestock production, indeed, contributes to improve food security and poverty alleviation in developing world. However, animal diseases, lack of improved stock, poor food resources and other multifaceted problems limit the potential of livestock [1].

Tsetse-transmitted trypanosomosis (Nagana) is one of the most important constraints to agricultural development in the sub-humid and humid zones of Africa. The rural community, which occupies 70% of the human population in Africa, has suffered severely from animal and human diseases transmitted by tsetse fly. The vector occupies nearly one third of well-watered agricultural land with suitable pastures for livestock in the continent. The genus Glossina occurs over some 11 million km² of Africa [2].

The devastating effects of tsetse-transmitted trypanosomosis on the livelihoods of African communities have reached unprecedented levels across much of sub-Saharan region. Researches on the socio-economic impacts of the disease have revealed that, over 3 million heads of various livestock species in Africa are lost per year by deaths due to trypanosomosis. Furthermore, over 35 million doses of trypanocidal drugs are bought annually to treat animals against the disease and more than 70 million heads are at risk of contracting the disease, so that total direct and potential losses attributable to the disease worth over 4.5 billion dollars per year [3].

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Ethiopia is chiefly an agricultural country whose economy is largely dependent on crop and livestock production. Besides its direct contribution in terms of GDP and foreign earning, livestock provides virtually all the draught power for cultivation and transportation of agricultural crops and people in rural of the country [4].

In Ethiopia the most important trypanosome species affecting livestock in Ethiopia are Trypanosoma congolense, Trypanosoma vivax, Trypanosoma brucei, in cattle sheep and goat, Trypanosoma evansi in camel and Trypanosoma equiperdum in horse [5].

Trypanosomosis is among the most important problem impeding agricultural activity and the production potential of livestock population in Africa including Ethiopia [6]. Trypanosomosis is one of the most livestock problems in Lalo kile districts. For these inhabitants, the district is potentially productive place for agricultural activities and raise livestock. Unfortunately, the area is infested with medium to high tsetse transmitted trypanosomosis. As a result, the people suffer from low level of draught power and productivity that is manifested by low level of meat, milk and other animal products that compromise the socio-economic and nutritional status of inhabitants.

Understanding epidemiology of the disease facilitates the choice of suitable tsetse and trypanosomosis control methods but systemic studies have not yet been carried out on the epidemiology and economic significance of bovine trypanosomosis in the study sites. Therefore, objectives of the study were to determine the prevalence of bovine trypanosomosis, assess apparent density, distribution and species of tsetse flies and to establish potential risk factors associated with vector and the disease in the area.

**MATERIALS AND METHODS**

**Study Area:** The study was carried out from November 2011 to June 2012 on the prevalence of bovine trypanosomosis and tsetse apparent density in Lalo kile district namely Dara Jarso, Udo Denta and Adama, Kelem Wollega zone, Oromia Regional state. This area is situated about 510 km West of Addis Ababa. The zone in which the study area is situated is bordered by: Gambella regional state to the south, Benishangul Gumuz regional state to the west, West Wollega zone to the north and Illubabor to the east. According to the survey report of NTTICC [7], seven districts of Kellem Wollega (namely Anfillo,Sayo, Hawa Gelan, Yemalegi walal,GawoDalle,Dalle Sadie and Lalo kile) which lie between 08°N 25’ 56” to 08°N 58’05” and 034°E 33’41” to 035°E 28’48” geographical positions are infested by tsetse flies.

The area has temperature range of 15-31 °C with more variation in average temperature between days and nights. It receives rainfall ranging from 1000-1500 mm[8].

**Study Methodology:** Cross-sectional study was conducted to determine the prevalence of bovine trypanosomosis and tsetse population and other biting flies. The methods used in this study include entomological and parasitological surveys.

**Entomological Survey:** To assess the apparent densities and species of tsetse flies and other biting flies the entomological data were collected in late rain season along the suitable tsetse habitats. These include livestock grazing areas, watering points, wild game reserve areas, savanna grass land and sub-savanna area of dense river side forests in the Districts. Monopyramidal traps baited with acetone, octenol and cow urine were deployed at an interval of about 100-200 meters along riparian vegetation
to assess the fly density [10]. The coordinates of each trap position were recorded with a Global Positioning System (GPS).

In all study sites a total of 36 Monopyramidal traps were deployed early in the morning and maintained in position for 48 hrs at three different peasant associations (PAs). The cages from these traps were emptied. Caught tsetse flies and other biting flies were counted, identified and sexed for the tsetse fly, other biting flies according to their morphological characteristics such as size, color, wing venation structure and proboscis at the genus level [11].

**Parasitological Survey:** To determine the prevalence of bovine trypanosomosis, cross sectional parasitological survey was conducted. Blood was taken from each animal into heparinized hematocrit tubes from the cattle ear vein and examined for trypanosomes using the buffy coat technique (BCT) [12]. The Packed Cell Volume (PCV) was read and recorded for each sample. The Trypanosomes positive buffy coat samples were analyzed and Trypanosome species were identified based on their morphological structure from Giemsa-stained thin films. A sample was considered positive for trypanosomiasis when Trypanosome was detected in the BCT.

**Data Management and Analysis:** Data collected from vector fly and trypanosome infection survey was entered into Ms excel spreadsheet program to create database. For the analysis of data statistical software program (SPSS 16.0) was used. Data collected on PCV values was analyzed by paired sample t-test to compare the mean PCV values of parastaemic and non-parastaemic animals. In all cases differences between parameters were tested for significance at probability levels of 0.005. The collected data from cattle (sex, age, PCV level) and from different sites on tsetse (tsetse species, count) were entered in to Excel software. Prevalence (counting positive per total number of cattle examined) was used to analyze flies trapped per trap per day and trypanosomosis data.

**RESULTS**

**Tsetse Prevalence and Density Survey:** To assess tsetse apparent density and species prevailing as well as other biting flies in the study area 36 Monopyramidall traps were deployed in the late rain season. A total of 813 flies were caught in the Lalo kile district studied. The trapped tsetse flies were *Glossina morsitance submorsitans*, *Glossina pallidipes* and other biting flies like Stomoxys, Tabanus and Haematopota. A total of 485 tsetse flies were trapped which are 294 *G. m. submorsitans*, 191 *G. pallidipes* and a total of 216 Stomoxys, 59 Tabanus and 53 Haematopota were caught during the study period.

The apparent densities of 4.08 for *G. m. submorsitans*, 2.65 for *G. pallidipes*, 0.82 Tabanus and 0.73 Haematopota were recorded. Higher Fly per trap per day (FTD) catch for tsetse flies were obtained from Dara jarso (2.75); followed by Adama (2.375) and Udo Denta (1.61) PAs. A total of 485 tsetse flies caught during the late rainy seasons were subjected for sexing. Accordingly, 17.32% (84/485) males and 82.68% (401/485) were females. At all sites in each PAs female tsetse flies were trapped than males.

**Glossina. pallidipes** and other biting flies like Stomoxys, Tabanus and Haematopota. A total of 485 tsetse flies were trapped which are 294 *G. m. submorsitans*, 191 *Glossina pallidipes* and a total of 216 Stomoxys, 59 Tabanus and 53 Haematopota were caught during the study period.

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**Parasitological Survey:** The overall prevalence of Trypanosome infection was 6.86% (28/408) in the Lalo kile District, of which 5.15% (21/408) were *T. congolence*, 1.7% (7/408) were *T. vivax* and there was no mixed species encountered.

Assessment of each PAs for *Trypanosoma* species prevalence was conducted 9.72% (14/144) at Adama, 5.83% (7/120) at Udo Denta and 4.86% (7/144) at Dara Jarso. Prevalence of *T. congolence* and *T. vivax* in cattle of different sex and age groups in Lalo Kile Districts of Western Ethiopia was evaluated. Overall prevalence was 0.74% (3/408) in females and 4.41% (18/408) in males for *T. congolence*, 0.74% (3/408) in females, 0.98% (4/408) in males for *T. vivax* and none mixed species were detected.

Based on age; 15 young animals examined were not positive for trypanosomes, but in animals greater than 3 year old 7.5% (12/160) and in animals 1-3 years 6.87% (16/233) prevalence was recorded.

**Hematological Findings:** In the present study the mean PCV values for parasitaemic and aparasitaemic animals during the study period was 23.21±3.270 and 25.36±13.745
Table 3: Prevalence of trypanosomes in male and female animals

<table>
<thead>
<tr>
<th>Sex</th>
<th>Infected</th>
<th>Total</th>
<th>T. c</th>
<th>T. v</th>
<th>Prevalence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>22</td>
<td>233</td>
<td>18</td>
<td>4</td>
<td>9.44</td>
</tr>
<tr>
<td>Female</td>
<td>6</td>
<td>175</td>
<td>3</td>
<td>3</td>
<td>3.4286</td>
</tr>
<tr>
<td>Total</td>
<td>28</td>
<td>408</td>
<td>21</td>
<td>7</td>
<td>6.86</td>
</tr>
</tbody>
</table>

$X^2 = 23.214$, df=2, $P=0.000$, T.c= T. congolence, T.v= T. vivax

Table 4: Prevalence of trypanosomes in different age groups

<table>
<thead>
<tr>
<th>Age</th>
<th>Infected</th>
<th>Total</th>
<th>T. c</th>
<th>T. v</th>
<th>Prevalence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;1 year</td>
<td>0</td>
<td>15</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1-3 years</td>
<td>16</td>
<td>233</td>
<td>12</td>
<td>4</td>
<td>6.87</td>
</tr>
<tr>
<td>&gt;3 years</td>
<td>12</td>
<td>160</td>
<td>9</td>
<td>3</td>
<td>7.5</td>
</tr>
<tr>
<td>Total</td>
<td>28</td>
<td>408</td>
<td>21</td>
<td>7</td>
<td>6.86</td>
</tr>
</tbody>
</table>

$X^2=0.571$, df= 1 $P=0.450$

Table 5: Mean PCV values of aparasitaemic and parasitaemic animals

<table>
<thead>
<tr>
<th>Number</th>
<th>Mean PCV</th>
<th>SD</th>
<th>Std. Error</th>
<th>95% CI Mean</th>
<th>t</th>
<th>P. value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aparasitaemic</td>
<td>380</td>
<td>25.36</td>
<td>3.745</td>
<td>.218</td>
<td>25.0</td>
<td>116.831</td>
</tr>
<tr>
<td>Parasitaemic</td>
<td>28</td>
<td>23.21</td>
<td>3.270</td>
<td>.618</td>
<td>21.9</td>
<td>37.565</td>
</tr>
<tr>
<td>Total</td>
<td>408</td>
<td>25.21</td>
<td>3.75</td>
<td>.524</td>
<td>24.8</td>
<td></td>
</tr>
</tbody>
</table>

(p<0.005, 95% CI=24.4-25.8) respectively. The overall mean PCV values were significantly different between aparasitaemic and parasitaemic animals (p<0.005).

**DISCUSSION**

The entomological survey indicated that the apparent densities of different flies during the study period was 4.08 fly/trap/day for G. m. sub-morsitans, 2.6 fly/trap/day for G. pallidipes, 3 fly/trap/day for Stomoxys, 0.82 fly/trap/day for Tabanus and 0.73 fly/trap/day for Haematotopa. The mean catches of tsetse fly were 6.74 fly/ trap/ day. In this District tsetse flies have high density and two species were identified (G. m. sub-morsitans and G. pallidipes). This could suggest an absolute increase in the number of tsetse flies due to favorable environment such as enough moisture, vegetation growth and suitable habitat or spread of flies from the rivers and thickets where they usually inhabit during dry season to more open areas, thereby increasing relative density. Glossina Pallidipes is more efficient in the transmission of trypanosomosis and the potential occupation of the savannah wood land in the valley than other Morsitans groups [2]. But when compared with other works in west Oromia, completely disagree in flies species reported by NTTICC [7] G. pallidipes, G. m. sub-morsitans, G. fuscipes and G. tachinoide species were reported in Gawo Dale District. Glossina morsitans sub-morsitans were found to be restricted almost to the savannah vegetation and thus its distribution is highly dependent on the season and vegetation cover.

According to Msangi and Leak [13, 14] showed, female flies would comprise 70-80% of the mean population, so that the sex ratio of current study was in agreement with the previous report (82.68%). The result of tsetse fly survey agrees with the general knowledge on the ecology of tsetse species found in Southwest Ethiopia. Typical habitat pattern was found in the study area for the savannah species (G. m. submorsitans and G. pallidipes) which prefers the savannah grass land, Acacia and Combrutum trees. The savannah species, G. m. submorsitans and G. pallidipes were concentrated in the savannah. The apparent density of 2.4 G. pallidipes, 0.1 G. fuscipes in wet season were reported by Msangi [13] in southern rift valley of Ethiopia and the mean fly catch of G. pallidipes 1.42 and G. fuscipes 0.29 at Ghibe valley by Leak et al. [14].

The result of this study indicates that the prevalence of pathogenic trypanosomes in Lalo Kile District is high i.e. a prevalence of 6.86%, which confirms the result of different works in Ethiopia. A prevalence of 13.44% in Gawo Dale district [15], 17.2% in Metekel [16] and 17.5% in the Upper Didessa of tsetse infested regions [17], 25% in Gawo Dale district (NTTICC, 2004), 29% along the escarpment of the Upper Didessa Valley [18] were reported. The species of tsetse fly caught in the area are savanna types, which have long contact time with host.
The dominant trypanosomes species in upper Didessa of tsetse infested regions was T. congolense [17] which is similar with the current result in Lalo kile Districts. The proportion of trypanosomes species in this study were 75% for T. congolense and 25% for T. vivax. There was no mixed infection detected in the current study.

The 75% prevalence for T. congolense in the present study was higher than the reports of 37% in southern Ethiopia [19], 58.5% in tsetse infested areas of the country [20], 66.17% in Southern Rift Valley [21], 71.8% in the Gowo Dale district [15], 72.3% in Gowo Dale District [22] but lower than the report of 84% in Gibe by Muturi [23] and Rowlands et al. [21].

The 25% prevalence for T. vivax in this study was higher than the 10.7% in Gowo Dale [15], 14% prevalence in Gibe [23] and Rowlands et al. [21], 20.8% in Southern Rift Valley of Ethiopia during the late rainy season [21].

The predominance of T. congolense infection in cattle may be 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 the infected animal [24]. In cattle G. pallidipes and G.m. sub-morsitans are efficient in the transmission of T. congolense than T. vivax in Africa [25]. Similarly, in the present study G. m. submersitans caught might increase the infection due to T. congolense.

Different workers reported that higher prevalence was observed in male cattle than in female [16, 17, 23]. In the present study, sex was found to be the risk factor i.e, it was higher in male animal than female animal which has statically significant difference (p<0.005). It was in agreement with the previous study and the possible suggestion to this finding could be that male animals are more used for draught purposes, travel long distances to an area of tsetse challenge for grazing or plowing and stressed by draught power and as a result the risk of contracting trypanosomosis is high.

In this study age was a risk factor as a higher prevalence was observed in adult animals and animals below one years of age in the study area were found none infected. This could be associated to long distance travel for grazing as well as for draught in areas of high to tsetse challenge. This is in agreement with Fimmen et al. [26] who stated that calves and young animals have low prevalence. In Lalo kile district suckling calves didn’t go out with their dams but graze at homesteads until they are weaned off. This could result in nil prevalence in calves. Trypanosoma congoense infection is usually higher in adult animals than young [21, 27], found that cows > 9 years old had 1.2 times higher trypanocidal drug treatment than < 3 years old animal. This is an indication of higher risk of trypanosomosis in adult animals than the young/calves.

Trypanosome infection and mean PCV obtained between parasitaemic and aparasitaemic animals had statistically significant difference. It was in agreement with the previous work done in Ghibe, Southwest Ethiopia where treatment was given for animals with PCV value of less than 26% and for positive animals [28]. The authors indicated that in an increase in PCV value, the proportion of positivity decreases and hence mean PCV was a good indicator for the health status of the herd in an endemic area. The lower mean PCV value in parasitaemic than aparasitaemic animals was reported by several authors [16, 17, 23].

As anemia is the classical sign of the disease pathogenicity [12, 29] the low PCV in parasitaemic animals could have contributed in reducing the mean PCV for cattle. The difference in mean PCV between parasitaemic and aparasitaemic animals indicates that, trypanosomosis involves in reducing the PCV values in infected animals.

CONCLUSION AND RECOMMENDATIONS

The results of the present study revealed that trypanosomosis is the most important problem for agricultural activity and animal production in the Lalo kile district and the situation is getting worse as the control and prevention of trypanosomosis is facing a challenge due to limitation of vector control activities. Two species of tsetse flies i.e. G m. submersitans and G. pallidipes and biting flies such as Tabanus, Stomoxys and Haematopota were caught. These flies are very important for cyclical and mechanical transmission of the disease. T. congolense was found to be most prevalent trypanosome species in the area. Therefore, Designing and implementation of control strategies of trypanosomosis focusing on sustainable, community based, simple, cost effective, environmentally friendly, integrated approach should be undertaken in the Lalo kile districts, proper and strict follow-up of trypanocidal drugs treatment should be conducted by professionals and supervision of the field personnel by experts should be practiced and further studies should be carried out in the area of assessing the diurnal activity pattern of tsetse fly and drug resistance which will have essential roles for overall control of tsetse transmitted trypanosomosis in Lalo kile districts of western Ethiopia.
ACKNOWLEDGEMENTS

The authors immensely thank Wollega University for financial support during conducting this research. Managers and technical staff of Bedele Regional Veterinary Laboratory and Agricultural and Rural development Office of Lalo kile district are acknowledged for their invaluable support and collaboration during the study period.

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