Epidemiology of Bovine Trypanosomosis in Assosa, North-West Ethiopia

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Abstract: Cross-sectional study was conducted in Assosa district of Benishangul Gumuz Regional State, North West Ethiopia from November 2011 to March 2012. The objective of this study was to assess the prevalence and incriminated species of bovine trypanosomosis and its possible association with different risk factors. In this parasitological survey, blood samples of 385 cattle were examined using buffy coat technique. The packed cell volume (PCV) value of each animal was also measured using hematocrit reader. In the present study, the overall prevalence of bovine trypanosomosis was found to be 22.6%. The most positive cases were recorded due to T. congolense (58.6%), followed by T. vivax (17.2%), T. brucei (10.3%), T. congolense and T. vivax (10.3%), T. congolense and T. brucei (2.3%) and mixed infection of the three species (1.1%) respectively. The PCV value of parasitmic animals is slightly lower than that of aparasitmic animals which is statistically significant (P < 0.05). It was found that the prevalence was higher in older age groups when compared to other age groups. This was, however, not statistically significant (x² = 0.37). Similarly, no statistically significant association between the two sexes was found (x² = 0.817). The owners’ interviews revealed that trypanosomosis was considered a major problem in the study area. From this study, it is possible to conclude that trypanosomosis is an important disease and a potential threat to the health and productivity of cattle in the study area. The species of trypanosomes that affect cattle in the study area include: T. congolense, T. vivax and T. brucei.

Key words: Bovine - Trypanosomes - PCV - Prevalence - Assosa - Ethiopia

INTRODUCTION

Trypanosomosis is a disease of paramount importance both to human and livestock that causes negative impact on food production and economic growth in many parts of the world, particularly in Sub-Saharan Africa [1, 2, 3]. It is caused by unicellular parasites (Trypanosomes) found in blood and others tissues of vertebrates including human, livestock and other wild life [2, 3].

Its epidemiology and impact on cattle production is determined largely by the prevalence and distribution of the disease and its vectors in the affected area [8]. Epidemiologically trypanosomes are distributed in the tropical Africa in the latitude of 14°N and 29°S where they are associated with their vectors Glossina, the tsetse fly [7]. The vectors tsetse fly (Glossina species) inhibits wide-range of habitats in African continent and affecting 37 countries including Ethiopia. According to Feyesa [9], the general distribution of tsetse flies is determined principally by climate and influenced by altitude, vegetations and the presence of suitable host animals. Currently, about 220,000km² area is infested with tsetse flies namely Glassina species [10].

In Ethiopia, Trypanosomosis is one of the most important disease limiting livestock production and agricultural development due to its high prevalence in the most arable and fertile land of South-west and North–western part of the country. According to Getachew [6], T. congolense and T. vivax are the most prevalent trypanosomes that infect cattle in tsetse-infested and tsetse free areas of the country respectively. The prevalence of T. congolense is found to be high in tsetse-infested areas of the country and a considerable number of the animals were also harboring T. vivax.
Trypanosomosis is transmitted cyclically by tsetse flies, mechanically by other biting flies and also by other means of transmission [2]. The three main species of tsetse flies for transmission of trypanosomosis are Glossina morsitans, which favors the open land of the savanna; Glossina palpalis, which prefers the shaded habitats immediately adjacent to rivers and lakes; and Glossina fusca, which favors the high dense forest areas. The most important mechanical vectors are flies of the genus Tabanus, but Haematopota, Liposoria, Stomoxys and Chrysops flies have also been implicated. In Africa, both T. vivax and T. brucei can spread beyond the “tsetse fly belts”, where transmission is principally by tabanid and hippoboscid flies. The vector for T. vivax in the western Hemisphere remains unknown, but several species of hematophagous (especially tabanid and hippoboscid) flies are believed to serve as mechanical vectors. With the single exception of T. equiperdum of equines which is venereal disease, all species have an arthropod vector in which transmission is either cyclical or non-cyclical [7].

The clinical sign manifestation depends on the species and strains of trypanosomes, vectors and resistance of affected breed of infected animal. The major signs are anemia, generalized enlargement of superficial lymph node/Lymphadenopathy, lethargy and progressive loss of body condition. Fever and loss of appetite occur intermittently during parasitic peaks, the latter becoming marked in the terminal stages of the disease [7]. Photophobia and excessive lacrimation due to T. vivax will occur. Trypanoresistant breed can be recovered provide that the nutrition condition is good and the infection severity is low [12].

In Ethiopia, the disease is economically important; and livestock found below 2000 meters contour are exposed to various level of trypanosomases risk [13]. As a result, a total of 14.8 million cattle, 6.12 million sheep and goat, 1 million camels and 1.3 million equine are at risk of constructing trypanosomes in Ethiopia. Accordingly, the overall economic loss due to the disease was estimated to be between US$1408 and 1540 million annually [14]. The previous study in the North-western parts of the country indicated a prevalence of 24.7% [15] in Mao-Komo special district and 45.1% [16] in Bambasi district of Assosa Administrative Zone was recorded

On the bases of the above existing facts and information, the study was aimed at achieving the objective of estimating the prevalence and incriminated species of bovine trypanosomosis and its possible association with different risk factors.

MATERIALS AND METHODS

Description of Study Area: The present study was conducted on the prevalence of bovine trypanosomosis in Assosa district of Benishangul Gumuz Regional State, which is located in the West and North-western part of Ethiopia, between latitude 9° and 11°North and longitude 34° and 35°East. Assosa is the capital city of Benishangul Gumuz Regional State and it is about 675 km from Addis Ababa. It has common boundaries with Amhara and Oromia in the north, Sudan in the west and Gambela in the South. According to the Assosa district Agricultural and Rural Development Office, the district is divided in to 78 peasant associations (PA) with total populations of 92,144. The district is located in 580-1500 meter above sea level, wet temperature of 19°C-34°C. The average rain fall is 900-1200mm annually and the total area of the district is about 2317km². The total livestock of the region is estimated as: 309,629 cattle, 58767 sheep, 200 470 goat 559 horses, 30 952 donkeys, 1394 mules, 15 camels and 981,196 poultry [17].

Study Population: The study animals were cattle in different PA of the Assosa district under extensive management system including both sexes and all ages. Indigenous Zebu breeds are the vast majority of animals included in the study though there are a few exotic breeds which are under intensive management system.

Study Design: Cross-sectional study was the design used for this survey. The study subjects which include all age groups and both sexes were the ones randomly selected for the study. The study animals were classified in different body conditions (good, medium and poor) according to [18], age groups (<2, 2-7 and >7yrs) according to Nicholson and Butterworth [19] and other factor including breed (local and exotic breed) was also used to classify the studied animals.

Sample Size Determination: A total of 385 blood sample were collected from cattle of selected 11 PA of the district. The sample size was determined by using 95% level of confidence interval and expected prevalence of 50% trypanosomosis with desired absolute precision of 5% and simple random sampling method was used [20]. The formula used is shown below:
N= \frac{(1.96)^2 \cdot \text{Peep}(1 - \text{Peexp})}{d^2}

Where:
N= required sample size
Peep= expected prevalence
d^2 = desired absolute precision

RESULTS

Overall Parasitological Findings: A total of 385 cattle were selected randomly from the selected 11 PA of the district and cross-sectional study was conducted from November 2011 to March 2012 and examined for trypanosomosis. About 87 (22.6%) animals were infected with various species of trypanosomes out of the total examined animals.

Throughout the study, T. congolense, T. vivax, T. brucei and mixed infections were observed. From the 87 infected animals, 51 (58.6%) were due to T. congolense, 15 (17.2%) were due to T. vivax, 9 (10.3%) were due to T. brucei, 9 (10.3%) were due to mixed infection of T. congolense and T. vivax, 2 (2.3%) were due to mixed infection of T. congolense and T. brucei and 1 (1.1%) were recorded for mixed infection of T. congolense, T. vivax and T. brucei. The most infective species of trypanosomes in the study area was T. congolense and followed by T. vivax, T. brucei and mixed infections respectively (Table 1).

Prevalence Within the Sexes: The prevalence of trypanosomosis is varying in both sexes; infection in male is being slightly higher than in the female. The obtained result reveals that 50 (57.5%) male and 37 (42.5%) female animals were infected with trypanosome infection and the prevalence of 22.9% and 22.3% was recorded in male and female respectively. However, this was not statistically significant (P > 0.05) (Table 2).

Prevalence among Age Groups: Out of the 385 examined animals, 59 were less than < 2 years, 319 were 2-7 years and 7 were the animals with greater than 7 years old age. From the < 2 years (59) sampled animals, 9 (15.3%) were positive, 2-7 years (319) sampled animals, 76 (24.2%) were positive and from the >7 years old (7) sampled animals, 2 (1.8%) were positive for the disease. The current prevalence within the age groups was 15.3%, 23.8% and 28.6% in animals with <2 years, 2-7 years and >7 years old respectively which has statistically insignificant difference (P > 0.05) (Table 2).
Table 1: Proportion of trypanosome species in the study area.

<table>
<thead>
<tr>
<th>Trypanosomes spp.</th>
<th>No. of positive animals</th>
<th>Prevalence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T. congolense</td>
<td>51</td>
<td>13.2</td>
</tr>
<tr>
<td>T. vivax</td>
<td>15</td>
<td>4</td>
</tr>
<tr>
<td>T. brucei</td>
<td>9</td>
<td>2.3</td>
</tr>
<tr>
<td>T. congolense and T. vivax</td>
<td>9</td>
<td>2.3</td>
</tr>
<tr>
<td>T. congolense and T. brucei</td>
<td>2</td>
<td>0.5</td>
</tr>
<tr>
<td>T. congolense, T. vivax and T. brucei</td>
<td>1</td>
<td>0.3</td>
</tr>
<tr>
<td>Total</td>
<td>87</td>
<td>22.6</td>
</tr>
</tbody>
</table>

Table 2: Prevalence of bovine trypanosomosis between sexes and among age groups

<table>
<thead>
<tr>
<th>Variables</th>
<th>No. of animals examined</th>
<th>No. of positive animals</th>
<th>Percentage (%)</th>
<th>Prevalence (%)</th>
<th>x² (P-value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>218</td>
<td>50</td>
<td>57.5</td>
<td>22.9</td>
<td>0.053 (0.817)</td>
</tr>
<tr>
<td>Female</td>
<td>166</td>
<td>37</td>
<td>42.5</td>
<td>22.3</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>385</td>
<td>87</td>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;2 years</td>
<td>59</td>
<td>9</td>
<td>15.3</td>
<td>15.3</td>
<td>2.36 (0.307)</td>
</tr>
<tr>
<td>2-7 years</td>
<td>319</td>
<td>76</td>
<td>82.9</td>
<td>23.8</td>
<td></td>
</tr>
<tr>
<td>&gt;7 years</td>
<td>7</td>
<td>2</td>
<td>1.8</td>
<td>28.6</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>385</td>
<td>87</td>
<td>100</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3: Prevalence of trypanosomosis in relation with body condition

<table>
<thead>
<tr>
<th>Body condition</th>
<th>No. of examined animals</th>
<th>No. of positive animals</th>
<th>Percentage (%)</th>
<th>Prevalence in %</th>
<th>x² (P-value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor</td>
<td>48</td>
<td>33</td>
<td>37.9</td>
<td>68.8</td>
<td>75.23 (0.000)</td>
</tr>
<tr>
<td>Medium</td>
<td>256</td>
<td>49</td>
<td>56.3</td>
<td>19.1</td>
<td></td>
</tr>
<tr>
<td>Good</td>
<td>81</td>
<td>5</td>
<td>5.8</td>
<td>27.8</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>385</td>
<td>87</td>
<td>100</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 4: Prevalence of trypanosomosis according to PCV value

<table>
<thead>
<tr>
<th>PCV value</th>
<th>Positive result</th>
<th>Negative result</th>
<th>Total</th>
<th>Prevalence (%)</th>
<th>x² (P-value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;25%</td>
<td>75</td>
<td>50</td>
<td>125</td>
<td>60</td>
<td>144.8 (0.000)</td>
</tr>
<tr>
<td>≥25%</td>
<td>12</td>
<td>248</td>
<td>260</td>
<td>4.6</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>87</td>
<td>298</td>
<td>385</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Prevalence Within Body Conditions:** Out of the 385 examined animals, 48 (12.5%) were poor, 256 (66.5%) were medium and 81 (21%) were good in body condition. Among the infected animals, 33 (37.9%), 49 (56.3%) and 5 (5.8%) were poor, medium and good in body condition respectively. In relation to the total number of infected animals, the prevalence of the disease is high in the animals with poor body condition which is statistically significant (P < 0.05) (Table 3).

**Hematological Findings:** The other category study considered in this study was recording of PCV value of individuals. From the 385 examined animals, 125 (32.5%) were recorded with PCV value of less than 25% and 260 (67.5%) animals were recorded with PCV value of greater and/or equal to 25%. Out of the infected animals, 75 (86.2%) cattle were with PCV value of less than 25% and cattle with greater and/or 25% PCV value were about 12 (13.8%). The above result indicates that there was statistically significant difference in PCV value between the infected and non-infected animals (P < 0.05) (Table 4).

**Results of Questionnaire Survey:** A questionnaire format was also distributed to get additional information from the owners about the seasonality of the disease, risk factors and its socio-economic impacts. Out of the 55 selected respondents, 40 (72%) owners responded that presence of the disease is detected by coughing, loss of feed intake
and rough hair coat; and the rest 28% (15 / 55) owners depend on loss of body condition to detect the disease. In about 69% (38 / 55) respondents, peak season of the disease is during rainy season, but 17 respondents’ response revealed occurrence of the disease is high during the onset of rainy season.

In case where the infection occurred, they would take the diseased animal to the veterinary clinic immediately in of 83.6% (46 / 55) owners, but 9 owners would delay to take their animals to the veterinary clinic for further detection of the disease.

Twenty four respondents reported that there was immediate response following trypanocidal therapy, while 20 and 11 owners responded that there was delayed response to treatment and recurrence of the same clinical sign in a few weeks or some months later respectively. Also 39 owners lost their cattle due to bovine trypanosomosis.

Response of the 30 owners revealed US$1, while according to 15 and 10 respondents, cost per single treatment per animal is about US$1.2 and US$0.75 per single treatment per animal respectively.

**DISCUSSION**

This study was aimed to investigate the prevalence of bovine trypanosomosis and different risk factors. The overall prevalence of the disease in the present study was 22.6%. According to the previous study, a prevalence of 24.7%[15] in Mao-Komo special district and 45.1%[16] in Bambasi were recorded in neighboring districts which are higher than the present study. This reduction in prevalence may be due to extensive or seasonal clearing of bushes, human expansion and agricultural investment in the area affecting the tsetse ecology; and seasonal factor may also be among the risk factors involved in reduction of the trypanosomosis prevalence.

From the total prevalence in this study, *T. congolense*, *T. vivax*, *T. brucei*, *T. congolense* and *T. vivax*, *T. congolense* and *T. brucei* and mixed infection of *T. congolense*, *T. vivax* and *T. brucei* accounts for about 51 (58.6%), 15 (17.2%), 9 (10.3%), 9 (10.3%), 2 (2.3%) and 1 (1.1%) of the total positive samples respectively. This revealed that the distribution of the parasite species is statistically highly significant difference (P < 0.05). The predominant prevalence of *T. congolense* 58.6% in present study was similar with the previous result of Abebe and Jobre [21] in tsetse-infested areas of Ethiopia (58.5%). A similar proportional trend was also reported by Afework [22] at Pawe, North-west Ethiopia (60.9%), Terzu [23] in selected sites of Southern region (63.4%) and Muturi [24] at Mereb Abaya, South Ethiopia (66.1%). This increased proportion of *T. congolense* indicates that the area is highly infested with tsetse flies. Because, according to Getachew [6], *T. congolense* and *T. vivax* are the most prevalent trypanosomes that infect cattle in tsetse-infested and tsetse free areas of the country respectively, which the result of the present study agrees with.

The prevalence of the parasite is varied between sexes in this study, in male (22.9%) being slightly higher than in the female (22.3%), but statistically insignificant. This might be due to the fact that both sexes have virtually similar exposure to flies in grazing areas and also the disease is sex independent. The result agrees with the work of Adane [25] in and around Bahir Dar and Molalegne et al.[13] in Jabi Tehenan district of west Gojjam.

The prevalence of bovine trypanosomosis was studied in different age groups of cattle. However, there is no statistically significant difference (P > 0.05), which may be because of an equal chance of exposure to the parasite. This result also agrees with the work of Alekaw [26] and Molalegne et al.[13] who concluded that there is no statistically significant difference in infection between the age groups, yielding a conclusive remark that the disease is age independent. Similar findings were also reported by Cherent et al. [27] and Habtamu, [28] in the Jawi district of the Amhara region, Ethiopia.

On the other hand, considering body conditions, the infection in animals with poor body condition was significantly higher than good body condition animals. This was in agreement with Abiy[29]. On one hand, the disease itself results in progressive emaciation of the infected animals; on the other hand non-infected animals under good body condition are with good immune status that can respond to any foreign protein better than those non–infected cattle with poor body condition which can be immune compromised due to other diseases or malnutrition, since malnutrition and concurrent infections depress the immune responsiveness in some cases [30]. This might be the indication of association between the parasite and animals body condition.

According to Getachew (2005), the development of anemia is the most reliable indicator of the trypanosome infection. The prevalence of the present study indicates that 75 (86.2%) animals are those recorded with PCV value of less than 25% out of the 87 infected animals and the...
PCV value of the rest 12 animals is greater or equal to 25%. There was statistically significant difference between the animals, which agrees with the previous study of Alekaw [26] and Molalegne et al.[13] who reported that the mean PCV value of parasitismic animals were significantly (P < 0.05) lower than that of aparasitismic animals. This may indicate the strong association of the infection and PCV value.

The overall results of questionnaire survey indicated the trypanosomosis was considered as a major problem in the study area which causes economic loss due to cost of treatment and death of the animals. This is in line with Taylor [1], trypanosomosis in domestic livestock and costs of treatment or controlling the disease causes a significant negative impact in food production due to indirect losses.

Seasonality of the disease is at the introduction of heavy rain and during rainy season. This might be due to occurrence of tsetse flies and other biting flies in large numbers. This agrees with Feyesa, [9], the general distribution of the tsetse flies is determined principally by climate and influenced by altitude, vegetation and the presence of suitable host animals.

Response to the treatment varies among the treated animals. Some animals give response after the few days of the treatment while response in some animals is delayed and some animals show the same clinical sign after cured from the first infection which might be due to drug resistance. Response of the owners revealed US$1 per single treatment per animal and most of the owners lost their cattle due to the disease. This agrees with NTTICC, 2002 [14], which shows the overall economic loss of the country due to the bovine trypanosomosis.

CONCLUSIONS

Bovine trypanosomosis was a threat to livestock production and productivity in the study area. It was also evidenced that local farmers were very curious of Trypanosomosis threat. Overall, a high prevalence of the disease was recorded in the study area with high occurrence of T. congolense, followed by T. vivax and T. brucei in decreasing order revealing a remarkable degree of mixed infections. Trypanosomosis was also negatively related to PCV and body condition of study animals. Integrated control of Tsetse and trypanosomosis through vector control, chemotherapy and prophylaxis and use of trypanotolerant animals necessitate to tackle the high burden posed by the disease in the area.

REFERENCES