Prevalence of Bovine Trypanosomiasis and Associated Risk Factors in East Wollega Zone, Western Ethiopia

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Abstract: Across sectional study was conducted from November 2013 up to April 2014 in Eastern Wollega Zone of Oromia region state, western parts of Ethiopia to determine the prevalence of bovine trypanosomosis and assess associated risk factors. Simple random sampling was used to select the study animals and peasant associations. Out of 384 cattle examined in the six peasant associations, 36 (9.38%) were positive for trypanosomosis. The infection was found in all the six peasant associations (64 animals were examined in each one). The highest prevalence of the disease was recorded in Fromsa 9 (14.0%) while the lowest prevalence was at Garuma 3 (4.68%). Out of 36 positive cases, 25, 11 and 7 were T. congolense (69.4%), T. vivax (30.6%) and mixed infection (19.4%). Among the assessed associated risk factors, body condition score and PCV value were statistically significant between the disease (P<0.05). However, in sex, age and peasant associations (PAs) were no statistically significant difference (P >0.05). The result of the present study concluded that bovine trypanosomosis was found to be the major constraints that hinder livestock productivity in study area. T. congolense and T. vivax species were responsible for the infection. Thus, proper control strategies and prevention method against the parasite and their vectors should be strengthened to minimize bovine trypanosomosis.

Key words: Bovine Trypanosomosis • Buffy Coat • Prevalence • Eastern Wollega Zone • Ethiopia

INTRODUCTION

Ethiopia owns large livestock population of which Cattle accounts 44.3 million [1]. In the country, Cattle are important source of income for rural communities and are one of the nation’s major sources of foreign currency from export. However, this great potential is not properly exploited. This is because of endemic disease burdens, traditional management system, inferior genetic makeup coupled with malnutrition and absence of well-developed market infrastructure [2].

Of the diseases that cause serious problems, parasitism represents a major impact on livestock production in the tropic [3]. Among the parasitic disease trypanosomosis is among serious disease constraints to livestock production which causes a serious and often fatal disease of livestock. It is rightfully considered as a root cause of poverty in the continent [4]. Most African trypanosomes are transmitted by tsetse flies, which inhabit many parts of the continent that extend about 15°N and 20°S of the equator [5]. Tsetse transmitted trypanosomosis is continues to be the major problem of livestock production in sub-Saharan African countries including, jeopardizing the lives of 55 million people. The problem of infection in domestic animals as well as human being is greatly affect social, economic and agricultural development of communities within tsetse infested areas which roughly constitutes more than a third of African between 14°N and 29°S of the continent [6].

The most important trypanosomes affecting cattle in Ethiopia are Trypanosoma congolense, Trypanosomavivax and Trypanosomabrucei [8, 9]. Trypanosomosis is continuous as major constraint due to the challenge of vector control activities and drug resistance development in the country. However, trypanosomes program is currently limited in the southern rift valley of Ethiopia [4, 9]. Even though the disease is endemic in the country especially in Eastern

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Wollega zone, there is no well documented information about bovine trypanosomosis and associated risk factors. But, baseline data collection and regular investigation on the prevalence of the parasites and its vector is essential to know the burden of the disease at different geographic locations and to enable the measurement of the impact of any control options that will be introduced later for determination of trypanosome infection status. Hence, the study was designed to determine the prevalence of bovine trypanosomosis and assess potential risk factors in the selected districts of East Wollega Zones, Western Ethiopia.

**MATERIALS AND METHODS**

**Study Area:** The study was conducted from November 2013 up to April 2014 in the selected Eastern Wollega Zone, Oromia regional state of Ethiopia. The area is found at 331 km of west of Addis Ababa, the capital city of Ethiopia. The area lies between 08°N 25 56 to 08°N 5805 and 034°E 33 41 to 035°E 28 48 and has average altitude of 1150 meters above sea level. The area has temperature 33-35°C with more agricultural crops and people in rural of the country. The climatic condition alternates with long summer May to August and short rainy seasons from March to April. The winter dry seasons (November to February) with mean annual rain fall of 1200mm [10]. Agriculture is the main livelihood in the area in which cattle and sheep kept as the major livestock which are highly important for the livelihood of the local population. The rearing system of cattle in study sites depends on natural grass and crop residues that kept in traditional management system [11].

**Study Population:** The study population were constitutes indigenous zebu cattle of varies sex, age groups, body conditions scores and managed under smallholder mixed crop-livestock farming system which are kept under traditional extensive husbandry system with communal grazing and watering points [15]. The age of the animals was grouped as young and adults according to the classification used by [16] and the body condition score was categorized as poor, medium and good [14]. The study was conducted on 384 local breed cattle selected from six peasant associations (PAS) in the district and 64 study animals were sampled from each PAS. The origin, sex, age and body condition scores of the animals were the potential variables used to associate with the prevalence rate.

**Study Design:** Across-sectional study was conducted from November 2013 to April 2014 in the study areas to determine the prevalence of bovine trypanosomosis and assess associated potential risk factors in the study area. Sampling and Sample Size Determination: Simple random sampling technique was used to select the study animals for blood sample collection in the study area. The PAs (peasant associations) considered as primary unit, the herds as secondary units and individual animals as tertiary units. Cattle herd in 6 PAs were sampled during the study based on the livestock population of the district. In order to determine the desired sample size there was no previous reports of prevalence in the district. The average expected prevalence rate was assumed 50% for the area within 95% confidence intervals (CI) at 5% desired accuracy as stated [45].

\[
n = \frac{1.96^2(p)(1-p)}{d^2}
\]

where

- **n** = Sample size
- **p** = Expected prevalence
- **d** = Desired level of precision (5%)

However, the sample size was 420 to increase the representativeness of the samples to the wider population. Hence, **n = 420** cattle were sampled. Sampling was proportionally distributed based on the total cattle population in the study district and accessibility to road for peasant association (PAS).

**Study Methodology:** Blood sample were collected from ear vein of animal using microhaematocrit capillary tube and the packed cell volume, PCV was determined. Then, the tube was sealed and heparinized capillary tube containing blood was centrifuged for 5 minutes at 12,000 revolutions per minute. After the centrifugation, tubes were then placed in hematocrit reader and recorded for each sample. Then, the readings were expressed as a percentage of packed red cells to the total volume of whole blood. Animals with Packed Cell Volume (PCV < 25%) were considered to be anaemic [12]. Trypanosomes were usually found in or just above Buffy coat layer. So, capillary tube was cut using a diamond tipped pen 1 mm below the Buffy coat to include the upper most layers of the red blood cells and 3 mm above to include the plasma. The content of the capillary tube was expressed on to slide, homogenized on to a clean glass slide and covered with cover slip. The slide was
examined under 40x objective and 10x eye pieces for the movement of parasite. The Species were identified based on the characteristic the morphology of Trypanosomes [13]. This technique is the most sensitive of the parasitological tests for the detection of *T. vivax* and *T. congolense* [17].

**Data Analysis:** The collected data in the field were entered into a computer on a Microsoft Excel spreadsheet. Statistical analysis was performed using ‘Statistical Package for the Social Sciences’ (SPSS), version 20. Descriptive statistics was used to determine the prevalence of the disease and Chi-square test was used to determine any association between the disease with age, sex, body condition score, PCV value and PAs. In all the analysis, confidence level was held at 95% and P<0.05 was set for significance.

**RESULTS**

Out of total 384 cattle examined in the six-peasant association, 36 (9.38%) were positive for bovine trypanosomosis. Trypanosome infection was found in all the six examined peasant association. The highest prevalence 9(14.0%) of the disease was recorded in Fromsa while the lowest prevalence 3(4.68%) was at Garuma. In this study, the result showed that two species of trypanosome *T. congolense* 25 (69.4%) and *T. vivax* 11 (30.6%) were detected where *T. congolense* was the predominant species responsible for infection of cattle residing in the study area. Moreover, mixed infection was also found 7 (19.4%) (Table 1 and 2).

In the present study, different potential associated risk factors were assessed in the study areas. Among the assessed risk factors, body condition score were statistical significant difference ($\chi^2$=47.265, p=0.000). In addition, the highest prevalence of infection was found in animal with poor body condition (24.56%). This indicating the parasites was highly found in animal with poor body condition. However, there was no statistically significant difference between the disease and sex, age, peasant association and PCV (p > 0.05). The prevalence of trypanosome was a little bit higher in female (10.1%) than male(8.67%) animals. On the other hand, higher prevalence of Trypanosomosis was recorded in older (10.4%) than younger (6.6%) animals (Table 1 and 3).

**Table 1: The prevalence of bovine Trypanosomosis in the study area with peasant association**

<table>
<thead>
<tr>
<th>Peasant Association</th>
<th>No Animal of examined</th>
<th>+Ve result</th>
<th>Prevalence (%)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fromsa</td>
<td>64</td>
<td>9</td>
<td>14.0%</td>
<td>0.981</td>
</tr>
<tr>
<td>Gamachis</td>
<td>64</td>
<td>5</td>
<td>7.80%</td>
<td></td>
</tr>
<tr>
<td>Garuma</td>
<td>64</td>
<td>3</td>
<td>4.68%</td>
<td></td>
</tr>
<tr>
<td>Gudisa</td>
<td>64</td>
<td>6</td>
<td>9.38%</td>
<td></td>
</tr>
<tr>
<td>Ifa</td>
<td>64</td>
<td>6</td>
<td>9.38%</td>
<td></td>
</tr>
<tr>
<td>Jirata</td>
<td>64</td>
<td>7</td>
<td>10.9%</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>384</td>
<td>36</td>
<td>0.94</td>
<td></td>
</tr>
</tbody>
</table>

**Table 2: Prevalence of Trypanosome species in the study area**

<table>
<thead>
<tr>
<th>Trypanosome species</th>
<th>+Ve No of Species</th>
<th>Prevalence (%)</th>
<th>$\chi^2$-value</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>T. congolense</td>
<td>25</td>
<td>69.4</td>
<td>385</td>
<td>0.00</td>
</tr>
<tr>
<td>T. vivax</td>
<td>11</td>
<td>30.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mixed infection</td>
<td>7</td>
<td>19.4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 3: Association of prevalence Bovine trypanosomosis with risk factors**

<table>
<thead>
<tr>
<th>Risk factor</th>
<th>No infected animal</th>
<th>Prevalence (%)</th>
<th>$\chi^2$-Value</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body Condition Score</td>
<td>Good</td>
<td>2</td>
<td>1.01%</td>
<td>47.265</td>
</tr>
<tr>
<td></td>
<td>Medium</td>
<td>6</td>
<td>8.20%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Poor</td>
<td>28</td>
<td>24.5%</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>Adult</td>
<td>29</td>
<td>10.4%</td>
<td>1.323</td>
</tr>
<tr>
<td></td>
<td>Young</td>
<td>7</td>
<td>66%</td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td>Female</td>
<td>19</td>
<td>10.1%</td>
<td>0.232</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>17</td>
<td>8.67%</td>
<td></td>
</tr>
<tr>
<td>PCV</td>
<td>≤25</td>
<td>3</td>
<td>0.90%</td>
<td>207.088</td>
</tr>
<tr>
<td></td>
<td>&lt;25</td>
<td>33</td>
<td>63.5%</td>
<td></td>
</tr>
</tbody>
</table>
DISCUSSION

The overall prevalence of Bovine trypanosomosis in the study area was found to be 36 (9.38%) which is slightly lower than previously reported (10%) in around Diga district [18]. However, high prevalence was recorded in different localities of Ethiopia by NTTICC [19] and Waktole [20] and Mulaw et al. [21] who reported the prevalence of 25%, 13.4% and 28.1% in Gawo Dale district and Asosa District of BenishangulGumuz, western Ethiopia. On the other hand, the result was higher than the finding Zenebe et al. [30] who reported (4.43%) in the selected villages of Arbaminch, southern Ethiopia. Similarly, the prevalence was found to be higher than the study conducted in selected Jubi Tehenan districts of west Gojam of Amhara regional state, North western Ethiopia reported by Molalegne et al. [40] which was recorded a prevalence of 11.7%, Feyissa et al. [46] who reported of 14.2% in in selected villages of Humbo districts southern Ethiopia as well as study conducted by Shimelis et al. [28] in Benishangul Gumuz regional state, Western Ethiopia who record an overall prevalence of 28.1%, Ayana et al. [31] who found the prevalence of trypanosomiasin Amhara region Northwest Ethiopia 2.10% and Komakech [47] in Labongo Akwang sub county Kitgum district of Busitema who recorded an overall prevalence of 16.96%. This might be due to the difference in management system, vector density and lack awareness of the animal owners about the disease.

In this study, among the different species of trypanosomes detected in study period, T. Congolense 25 (69.4%) was the most prevalent trypanosome species followed by T. viviax11(30.6%)and mixed infection with T. congolenseand T. vivax, 7 (19.4%). This result was slightly lower than with the previous results of Tewelde et al. [44] at Kone (75%) and Village I (93%) settlement areas of West Ethiopia, Rowlands et al. [23] in and around Arbaminch districts (85.2%) and Leak [24] in Ghibe valley, south West Ethiopia (84%). The higher predominance of T. congolense infection in cattle may be due to the high number of serodems of T. congolenseas compared to T. vivaxand the development of better immune response to T. vivaxby the infected animal [25]. However, the finding was slightly higher than the results of other studies done in the country by Takele [26] at Mereb Abaya, South Ethiopia (66.1%), Terzu[27] in Gamo-gofa (50%) andShimelis et al. [28] in selected sites of southern region (63.4%).

In this study, Bovine trypanosomosis was higher in animals with poor body condition (24.56%) than in animals with medium body condition (8.215%) and good body condition (1.01%). There was statistically significance difference between body condition score and the disease (X²=47.265, P=0.00). This finding was in line with other findings which were reported in different parts of the country Teka et al. [29].

In this study, sex, age and peasant associations (PAs) were found to be the potential risk factors, however, there was no statistically significant difference observed (P >0.05). This result was in line with the previous finding [31 in the Dale Sadi district, KellemWollega Zone. The rate of infection was slightly higher in females (10.1%) than males (8.67%) in study area. This result was agrees with the previous report in the country [32, 33, 34]. This might be due to the fact that both sexes have equal probability of exposure to tsetse and other biting flies in grazing areas. The prevalence of the disease was compared between the age categories and higher infection rate was recorded in adult cattle (10.4%) than young cattle (6.60%). The result was related with the report of [29, 32] in Amhara region, Northwest Ethiopia.

These results also agree with that of Zenebe et al., 2014 as a higher prevalence was observed in adult animals (>3 years) and but lower in animals at 3 years of age. This could be associated to long distance travel for grazing as well as for draught in areas of high tsetse challenge. This is in agreement who stated that calves and young animals have low prevalence [35]. In addition, the young aged animals has low exposure to the vector due to suckling calves are not allowed to go out with their dams until they are weaned off [36]. Young animals are also naturally protected to some extent by maternal antibodies [37].

In this study, the prevalence of trypanosome infection was found to bedifferent among the six PAs. However, the two PAS [Ifa and Gudisa] were similar with both a prevalence of 9.38%. The finding was Disagreement with the previous reports [10], Cherenet et al. [11] reported no difference in the incidence of trypanosome infections in the origin of the animals. This could be due to the similarity in the ecosystems of the study locations that supported proliferation of both the tsetse and biting flies that feed on both sexes of cattle indiscriminately.

In the present study, the mean PCV value for the parasitemic cattle was 63.5% whilst the mean PCV value for the aparasitemic cattle was 0.90%. There was statistically significance difference between PCV value and the disease (X²=207.01, P=0.00). This result was in agreement with the reports before [39] in which the mean
PCV of parasitaemic animals became 94.87% in southern valley southern valley in southern Ethiopia and [38], 88% of all parasitaemic animals had mean PCV below 25 in Abbay basin of North west Ethiopia, [37] in which they had reported the mean PCV parasitemic and parasitaemic animal 25.65% and 18.8% respectively. Since anemia is the classical sign of the disease pathogenicity [38] the low PCV in parasitaemic animals could have contributed in reducing the mean PCV for cattle. The difference in mean PCV between parasitaemic and aparasitemic animals indicates that, trypanosmosis involves in reducing the PCV values in infected animals. The appearance of parasitologically negative animals with PCV values of less than the threshold value (25%) might be due to the inadequacy of detection method used [41] or delayed recovery of anemic situation after current situation after current treatment with trypanocidal drugs and occurrence of positive animals with PCV greater than 25% might be thought of recent infection of animals.

Hence, PCV value could be an indicator of the trypanosome infection status of cattle population under study. In contrast, it was generally accepted that the PCV value is not only affected by trypanosome, but also there are many factors like tick born disease, helminthiasis and nutritional imbalance [42]. On other hand, there parasitaemic animals were detected in those animals with good body condition despite having low PCV values [43].

CONCLUSION

The result of the current study revealed that bovine trypanosomosis was found to be the major constraints that hinder livestock productivity in study area. T. congoense and T. vivax species were responsible for the infection. Among, the potential risk factors, body condition scores and PCV value were significant. Higher prevalence of trypanosomosis infection was observed in animal with poor body condition. Even if different control measures were applied by National Tsetse and Trypanosomosis Investigation Control Center, the control and prevention is still limited due to the challenge of vector control activities and drug resistance development. Thus, proper control strategies and prevention method against the parasite and their vectors should be strengthened to minimize bovine trypanosomosis. Moreover, awareness creation of livestock owners on the control and prevention of the disease should be required.

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