A cross-sectional study was carried out to determine the prevalence of cattle trypanosomosis and assess the distribution of its vectors in Gimbo and Guraferda districts of Kaffa and Bench Maji zones, respectively, in Southern Nations, Nationalities and Peoples’ Regional State (SNNPRS), Ethiopia from November 2011 to March 2012. Simple random sampling technique was used to select 490 local zebu cattle from purposively selected three peasant associations in Gimbo and four peasant associations in Guraferda districts. Blood samples were examined for trypanosomes by the buffy coat technique (BCT) after determining the packed cell volume (PCV) and traps were employed for collection of tsetse. The overall prevalence of cattle trypanosomosis was 14.5%. The prevalence varied between the two districts, that is, Gimbo (9.2%) and Guraferda (19.6%). Trypanosoma congolense was the predominant species in the area (62%) followed by T. vivax (28.2%). Statistically significant (P<0.05) difference was observed in infection rate for the different trypanosome species, and in prevalence among animals of different body condition scores (p<0.001). However, no significant (P>0.05) difference was noted in prevalence rates among animals of the different age groups, sex and coat colors. The mean PCV per cent value of parasitaemic animals (21.31±5.070) was significantly (p<0.001) lower than that of aparasitaemic animals (27.00±5.097). Glossina pallidipes and Glossina fuscipes were captured in the study area with an overall apparent density of 3.73 flies/trap/day. In the light of these findings, integrated approaches involving both vector and trypanosome directed measures are suggested for effective management of the problem of cattle trypanosomosis in the study area.

Key words: Bench Maji, bovine, buffy coat, Kaffa, trap, trypanosomosis, tsetse fly.

INTRODUCTION

African animal trypanosomosis, also called ‘nagana’ is a parasitic disease that causes a serious economic losses in livestock from anemia, loss of condition, emaciation and death in untreated cases (OIE, 2009). It is one of the

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major impediments to livestock development and agricultural production in Ethiopia negatively influencing overall development and food self-reliance endeavors of the country. Tsetse transmitted trypanosomosis excludes more than 220,000 km² of suitable land for agriculture in the West and South West parts of the country with 14 million head of cattle, an equivalent number of small ruminants, nearly 7 million equines and 1.8 million camels are at risk of contracting trypanosomosis at any one time (MoARD, 2004).

Ethiopia is home to the largest livestock population in Africa with approximately 47.5 million cattle, 26.1 million sheep, 21.7 million goats, 7.8 million equine, 1 million camels, and 39.6 million chickens (CSA, 2009). Livestock perform multiple functions in the Ethiopian economy by providing food, input for crop production and soil fertility management, raw material for industry, cash income as well as in promoting saving, fuel, social functions, and employment. The contribution of the livestock sub-sector is estimated at 12 to 16% of the total and 30 to 35% of agricultural GDP (AAPBMDA, 1999).

Trypanosomosis is a debilitating and often fatal disease of various domestic animals and humans caused by various species of an extracellular haemo-flagellate parasite infection of genus trypanosome (Juyal et al., 2005; OIE, 2005). Trypanosomes can infect all domesticated animals and more than 30 species in the wild or zoos. In parts of Africa, cattle are the main species affected, due to the feeding preferences of tsetse flies. The host of each trypanosome species may differ, but Trypanosoma congolense, Trypanosoma vivax and Trypanosoma brucei have a wide host range among domesticated animals (OIE, 2009). T. congolense infects cattle, pigs, sheep and goats, while T. brucei commonly infects cattle, horses, dogs, cats, camels, sheep, goats and pigs (OIE, 2005). Trypanosoma evansi is commonly noted camels, buffaloes, cattle, horses, etc., and Trypanosoma equiperdum in horses (Getachew, 2005; Singh and Singla, 2012).

Most trypanosomes must develop for one to a few weeks in tsetse flies, which act as biological vectors. When an infected tsetse fly bites an animal, the parasites are transmitted in the saliva (OIE, 2005). The three main species of tsetse flies for transmission of trypanosomes are Glossina morsitans, which favors the open wood land of the savanna; Glossina palpalis, which prefers the shaded habitat immediately adjacent to rivers and lakes; and G. fuscus, which favors the high dense forest areas (Aiello and Mays, 1998). Trypanosomosis is also mechanically transmitted by tsetse and other biting flies through the transfer of blood from one animal to another. The most important mechanical vectors are flies of the genus Tabanus, but Haematopota and Stomoxys flies have also been implicated. In Africa, T. vivax has spread beyond the "tsetse fly belts" (Roeder et al., 1984).

Most cases of trypanosomosis are chronic, but acute diseases, which may be fatal within a week, can also occur (OIE, 2009). Susceptibility of cattle to trypanosomosis depends on breed, age, behavior, previous exposure, and pathogen and health status of animal. The indigenous zebus are trypano susceptible and West Africa Bos taurus breeds are tryptonotolent, that is, they can survive and be productive without treatment under trypanosomosis risk (Murray and Gray, 1984; Taylor and Authie, 2004).

Earlier study by Abebayehu and Biniam (2010) in Guraferda and Sheko districts indicated the problem of trypanosomosis to be very serious in the area. Another survey carried out by Mizan Teferi (2010) at Regional Veterinary Laboratory in Gimbo and Guraferda districts determined trypanosomosis and its vectors to be the most important livestock development constraints. This necessitates a continued follow-up and evaluation of the status of tsetse infestation and occurrence of trypanosomosis in these and surrounding villages. The objectives of this study were therefore (i) to determine the current parasitological prevalence of cattle trypanosomosis in selected districts of Kaffa and Bench Maji zones, (ii) to identify and determine the predominant trypanosome species infecting cattle in the study areas, and (iii) to assess the prevailing species and density of tsetse flies.

MATERIALS AND METHODS

Study area description

Gimbo and Guraferda districts are geographically located in the southwest part of Ethiopia in Keffa and Bench Maji zones in Southern Nations, Nationalities, and Peoples’ Regional State (SNNPRS), which are 430 and 600 km far from the national capital Addis Ababa, respectively. Climatically, the areas are characterized by long rainy season (June to October), short rainy season (February to May), and short dry season (November to January). Gimbo district (latitude: 07°27′ N; longitude: 036°16′ E) has a total land area of 87,186.05 km² with an altitudinal range of 1270 to 3500 m above sea level (m.a.s.l.). The average annual temperature is 25°C and annual rainfall ranges from 750 to 1150 mm. Guraferda district (latitude 6°49’-7°21’N and longitude 34°88’-35°43’E) has a total land coverage of 2,505.80 km² and an altitude ranging between 600 and 2500 m.a.s.l. The areas are covered by different vegetation types of savanna grass land, forest and bush lands with many wild lives. The dominant livestock populations are cattle, sheep and goats where all of them are raised under traditional extensive management system. Mixed livestock-crop farming is the dominant production system. The total livestock population of Gimbo district is estimated to be 116,680 cattle, 34,549 sheep, 22,301 goats, and 9,876 equines, while Guraferda district has 101,763 cattle, 41,353 sheep, 15,828 goats and 2,881 equines (MTRVL, 2009).
Study animals

The study animals included all ages and sex groups of local zebu cattle (*Bos indicus*) kept under traditional extensive management system together with other livestock species and fed mainly on natural pasture.

Study design

A cross-sectional survey design was conducted from November 2011 to March 2012 to determine the prevalence of cattle trypanosomosis in Gimbo and Guraferda districts, and to determine the density and species of tsetse flies in the areas.

Sample size and sampling method

Two district (Gimbo and Guraferda) and seven peasant associations (PA’s), namely: Yabekicha wellega, Gojeb, and Chomba from Gimbo district and Kometa, Gobika, Semerta, and Kuki from Guraferda district were purposively selected based on accessibility and expected challenge of trypanosomosis. Simple random sampling technique was followed to select the study animals. During sampling, peasant associations, age, sex, coat colors, and body condition score of the animals were recorded. Body condition for each cattle was estimated based on descriptions given by Nicholson and Butterworth (1986). The age of the animals was determined by dentition (De Launty and Hable, 1986). Coat color was recorded based on visualization of the main coat color such that if a second color was present, the predominant coat color was recorded.

The sample size was calculated according to the formula given by Thrustfield (2005) considering an expected prevalence of 50%, 95% confidence level and 5% desired precision.

\[
N = \left(\frac{1.96}{\exp} \times \frac{(1-\exp)}{d^2}\right)^2
\]

where \(N\) = number of sample size, \(\exp\) = expected prevalence, and \(d^2\) = absolute precision.

Therefore, based on the aforementioned formula 384 were required for the study. But to improve the degree of accuracy and account for some sample loss, a total of 490 samples were taken for the present study.

Sample collection and parasitological examination

Blood collection

Blood samples were collected from the marginal ear vein by pricking it with the tip of a sterile lancet after properly securing the animal and aseptically preparing the area around the ear vein. The samples were collected using two hematocrit capillary tubes to ¼th of the length and sealed with bee wax in one end (OIE, 2008).

Packed cell volume (PCV) determination

The blood in the microhematocrit capillary tubes was centrifuged at 12,000 rpm for 5 min using the Hawksley microhematocrit centrifuge to estimate the PCV (Murray et al., 1983). Animals with PCV less than 24% were considered anemic (OIE, 2008).

Buffy coat technique

After centrifugation and PCV determination, the capillary tubes were 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 onto a slide, covered with a cover slip and was examined under 40X objective and 10X eye piece for motile trypanosomes (Paris et al., 1982).

Thin blood smear

Positive samples in the buffy coat technique were further processed by Giemsa-stained thin blood smear prepared from the buffy coat for identification of trypanosome species based on their morphological characteristics (Murray et al., 1983).

Entomological survey

Survey for tsetse and other biting flies was conducted along Gojeb and Akobo rivers which are the main drainage system in the areas, and their tributaries from November 2011 to March 2012. Trap deployment sites were selected to represent all habitats that could be suitable habitat to tsetse fly multiplication, behavior, feeding and other related aspects. During the survey period, 29 NGU and 24 monococonical traps baited with acetone, octanol and cow urine were deployed for 48 h at approximate intervals of 100 to 200 m. The poles of the traps were greased to prevent fly predators like ants. The catches of each trap was collected after 48 h of deployment. The number and the type of traps used, coordinates and altitude of the deployment site were recorded by a global positioning system (GPS). Tsetse and other biting flies caught per trap were counted, species identified, sexed and apparent fly density (F/T/D) were calculated (Mulligan, 1970).

Data analysis

Data were coded and entered in to a Microsoft excel spreadsheets and transferred to SPSS version 15.0 for analysis. Differences in the prevalence of trypanosomosis in animals from different districts, peasant association, age, sex, color, body condition score, and trypanosome species were compared by Pearson’s chi-squared test. The mean PCV of infected and non-infected animals were compared with student t-test.

RESULT

Parasitological findings

The overall prevalence of cattle trypanosomosis in the study areas was 14.5%. The prevalence of cattle trypanosomosis in Gimbo and Guraferda districts was 9.2 and 19.6%, respectively. Statistically significant difference (P<0.05) was observed in the prevalence of trypanosomosis in cattle between the two districts. A significant difference (p<0.05) in the prevalence of trypanosomosis was noted between PA’s and ranged.
Table 1. Prevalence of trypanosome infection in cattle at seven PA’s of Gimbo and Guraferda districts.

<table>
<thead>
<tr>
<th>District</th>
<th>PA</th>
<th>Altitude</th>
<th>No. examined</th>
<th>Positive</th>
<th>Prevalence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gimbo</td>
<td>Yabekicha wellega</td>
<td>1443</td>
<td>86</td>
<td>11</td>
<td>12.8</td>
</tr>
<tr>
<td></td>
<td>Gojeb</td>
<td>1403</td>
<td>100</td>
<td>9</td>
<td>9.0</td>
</tr>
<tr>
<td></td>
<td>Chomba</td>
<td>1380</td>
<td>54</td>
<td>2</td>
<td>3.7</td>
</tr>
<tr>
<td>Guraferda</td>
<td>Kometa</td>
<td>890</td>
<td>54</td>
<td>10</td>
<td>18.5</td>
</tr>
<tr>
<td></td>
<td>Gabika</td>
<td>949</td>
<td>58</td>
<td>14</td>
<td>24.1</td>
</tr>
<tr>
<td></td>
<td>Semerta</td>
<td>1043</td>
<td>59</td>
<td>9</td>
<td>15.3</td>
</tr>
<tr>
<td></td>
<td>Kuki</td>
<td>925</td>
<td>79</td>
<td>16</td>
<td>20.3</td>
</tr>
<tr>
<td>Overall</td>
<td>-</td>
<td>-</td>
<td>490</td>
<td>71</td>
<td>14.5</td>
</tr>
</tbody>
</table>

$\chi^2 = 10.758$, P-value = 0.001 for district $\chi^2 = 14.914$, p-value = 0.021 for PA.

Table 2. Prevalence of trypanosome species identified in the study area.

<table>
<thead>
<tr>
<th>PA</th>
<th>T. congolense (%)</th>
<th>T. vivax (%)</th>
<th>T. brucei (%)</th>
<th>T. c+T.v (%)</th>
<th>T. c+T.b (%)</th>
<th>T.v+T.b (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yabekicha wellega</td>
<td>9 (81.8)</td>
<td>2 (18.2)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Gojeb</td>
<td>5 (55.6)</td>
<td>3 (33.3)</td>
<td>1 (11.1)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Chomba</td>
<td>1 (50.0)</td>
<td>1 (50.0)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Kometa</td>
<td>8 (80.0)</td>
<td>1 (10.0)</td>
<td>-</td>
<td>1 (10)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Gabika</td>
<td>8 (57.1)</td>
<td>4 (28.6)</td>
<td>1 (7.1)</td>
<td>1 (7.5)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Semerta</td>
<td>5 (55.6)</td>
<td>3 (33.3)</td>
<td>-</td>
<td>1 (11.1)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Kuki</td>
<td>8 (50)</td>
<td>6 (37.5)</td>
<td>-</td>
<td>-</td>
<td>1 (6.25)</td>
<td>1 (6.25)</td>
</tr>
<tr>
<td>Total</td>
<td>44 (62.0)</td>
<td>20 (28.2)</td>
<td>2 (2.8)</td>
<td>3 (4.2%)</td>
<td>1 (1.4%)</td>
<td>1 (1.4%)</td>
</tr>
</tbody>
</table>

$\chi^2=37.469$, P-value= 0.402; T.c+T.v: mixed infection of T. congolense and T. vivax; T.c+T.b: mixed infection of T. congolense and T. brucei; and T.v+T.b: mixed infection of T. vivax and T. brucei.

between 3.7% at Chomba and 24.1% at Gabika (Table 1). T. congolense was the most prevalent species (62.0%) followed by T. vivax (28.2%), mixed T. congolense and T. vivax infection (4.2%), T. brucei (2.8%), mixed infection of T. congolense and T. brucei (1.4%) and mixed infection of T. vivax and T. brucei (1.4%). However, the observed difference in prevalence among the various species of trypanosomes was not significant (P>0.05) (Table 2). The prevalence of trypanosomosis among the different age groups were: 10.6% in the age group 1 to 2 years, 13.5% in the 2 to 4 years, and 15.8% in those greater than 4 years of age, but the difference was not significant (P>0.05). No statistically significant difference (P>0.05) was observed in the prevalence of trypanosomosis between males and females. The prevalence of trypanosomosis in cattle with good, medium and poor body conditioned animals was 4.3, 9.9 and 26.7%, respectively and the difference was highly significant (P<0.001). There was no significant difference (P>0.05) in prevalence between animals of different coat colors (Table 3).

Hematological findings

The mean PCV values of parasitamic and aparasitamic animals during the study period were 21.3 and 27%, respectively. The difference was highly significant (P<0.001) (Table 4).

Entomological findings

During the study period, 439 flies were caught using 29 NGU and 24 monoconical traps from Yabekicha Wellega, Chomba, Semerta and Kuki peasant associations. Out of these, 396 were Glossina species, 45 Stomoxys and 2 were Tabanus flies. Out of the 396 Glossina spp., 357 were G. pallidipes and the rest (39) were G. fuscipes. The numbers of male and female Glossina species were 162 and 234, respectively. The overall apparent density of tsetse flies was 3.73 flies per trap per day (F/T/D). The apparent tsetse fly density in Gimbo and Guraferda
Table 3. Prevalence of cattle Trypanosomosis by age, sex, and body condition and coat color.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Total examined</th>
<th>No. of positive</th>
<th>Prevalence (%)</th>
<th>$\chi^2$</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age (Years)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-2</td>
<td>66</td>
<td>7</td>
<td>10.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-4</td>
<td>133</td>
<td>18</td>
<td>13.5</td>
<td>1.309</td>
<td>0.520</td>
</tr>
<tr>
<td>&gt;4</td>
<td>291</td>
<td>46</td>
<td>15.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>277</td>
<td>42</td>
<td>15.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>213</td>
<td>29</td>
<td>13.6</td>
<td>0.233</td>
<td>0.630</td>
</tr>
<tr>
<td><strong>Body condition</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poor</td>
<td>180</td>
<td>48</td>
<td>26.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medium</td>
<td>172</td>
<td>17</td>
<td>9.9</td>
<td>35.942</td>
<td>0.000</td>
</tr>
<tr>
<td>Good</td>
<td>138</td>
<td>6</td>
<td>4.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Coat color</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>79</td>
<td>8</td>
<td>10.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Red</td>
<td>280</td>
<td>37</td>
<td>13.2</td>
<td>5.065</td>
<td>0.167</td>
</tr>
<tr>
<td>Black</td>
<td>79</td>
<td>17</td>
<td>21.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brown</td>
<td>52</td>
<td>9</td>
<td>17.3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 4. Mean PCV of parasitaemic and aparasitaemic animals.

<table>
<thead>
<tr>
<th>Status</th>
<th>No. examined</th>
<th>Mean PCV (%)</th>
<th>Standard deviation</th>
<th>t-test</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parasitaemic</td>
<td>71</td>
<td>21.31</td>
<td>5.070</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aparasitaemic</td>
<td>419</td>
<td>27.00</td>
<td>5.097</td>
<td>102.758</td>
<td>0.000</td>
</tr>
<tr>
<td>Total</td>
<td>490</td>
<td>26.17</td>
<td>5.468</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5. Results of the entomological survey.

<table>
<thead>
<tr>
<th>District</th>
<th>Altitude</th>
<th>No. of traps</th>
<th>No. of days</th>
<th>G. pallidipes</th>
<th>G. fuscipes</th>
<th>Stomoxys</th>
<th>Tabanus</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>M</td>
<td>F</td>
<td>T</td>
<td>M</td>
<td>F</td>
<td>T</td>
</tr>
<tr>
<td>Gimbo</td>
<td>1276-1445</td>
<td>26</td>
<td>2</td>
<td></td>
<td>123</td>
<td>171</td>
<td>294</td>
</tr>
<tr>
<td>Guraferda</td>
<td>858-1030</td>
<td>27</td>
<td>2</td>
<td></td>
<td>22</td>
<td>41</td>
<td>63</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>53</td>
<td>4</td>
<td></td>
<td>145</td>
<td>212</td>
<td>357</td>
</tr>
</tbody>
</table>

F/T/D: Fly catch per trap per day; M: male, F: female; T: total.

districts was 6.32 and 1.24 F/T/D, respectively (Tables 5).

**DISCUSSION**

The study found that the overall prevalence of bovine trypanosomosis in Gimbo and Guraferda districts was 14.5%. This finding coincides with the result of Fasil (2004) who reported a prevalence of 15.5% in Guraferda district and Feyissa et al. (2011) who reported a prevalence of 14.2% for bovine trypanosomosis in Humbo district, Southern Ethiopia. By comparison, the
The present study revealed higher prevalence of trypanosomosis in cattle than most authors’ reports conducted in different parts of the country: Mihreteab and Mubarik (2011) 8.6% prevalence in Hawagel district, west Wellega zone; Nigatu and Abebe (2009) 10.1% prevalence in Awì zone, north western Ethiopia; and Molalegne et al. (2010) 11.7% prevalence in Jabi Tehenan district, north western Ethiopia. High prevalence of trypanosomosis in the present study can be associated with the presence of favorable environmental conditions for the existence and development of Glossina species and other biting flies. Statistically significant difference (P<0.05) was observed in the prevalence of cattle trypanosomosis among the study district where 9.2 and 19.6% prevalence rates were noted in Gimbo and Guraferda districts, respectively. The low prevalence of trypanosomosis in Gimbo district might be due to awareness of the people towards the control and treatment of the disease and the improved management of animals. High challenge of tsetse fly in the Gimbo district makes the owners self-aware and get initiated local tsetse fly control operation in addition to providing chemotherapeutic drugs to their animals by themselves. The same may not hold true in Guraferda district.

Statistically, significant difference (P<0.05) was observed in the prevalence of trypanosomosis among the study PA’s. The high prevalence of the disease especially at Gabika, Kuki, Komet, and Semerta in Guraferda district and Yabekicha wellega in Gimbo district PA’s could be due to the low altitude and the presence of suitable habitat for the vectors which results high fly challenge, respectively. Such variation in tsetse density has also been reported to be the main factor for variations in the prevalence of trypanosomosis (Leak et al., 1993).

T. congolense was the predominant species detected (62%). This result agrees with Shimelis et al. (2011) and Feyissa et al. (2011) who reported 65 and 65.7% prevalence of T. congolense compared to 35 and 20% T. vivax in Jawi district of Amhara region and Humbo district of southern Ethiopia, respectively. The study of Solomon and Fitta (2011) in Metekel and Awì zone of North West Ethiopia also showed higher result of T. congolense (77.6%) compared to 14.9% T. vivax. The higher results of T. congolense may suggest that G. pallidipes caught in the study area, which is a more efficient transmitter of T. congolense than T. vivax, is the major cyclical vector involved (Langridge, 1976). The present study also found G. pallidipes to be present at a relatively higher density. Similar results were reported by Fasil (2004) and Abebayehu and Biniam (2010) in the same study area. Mihreteab and Mubarik (2011) also noted T. congolense and T. vivax to be the most prevalent trypanosome species that infect cattle in tsetse infested and tsetse free areas of Ethiopia, respectively.

No significant difference (P>0.05) in infection rates was seen among the three age groups of animals though higher infection rate was recorded in animals of 4 years and above. Similar finding were reported by Mihreteab and Mubarik (2011) and Molalegne et al. (2010). This may be attributed to the longer distance older animal have to trek for grazing and drinking bringing them closer to higher tsetse challenge localities. Lower prevalence of trypanosomosis was observed in calves between 1 and 2 years and young animals between 2 and 3 years. This could partly be explained by the protection of maternal antibodies in calves and young animals (Fimmen et al., 1999). There was no significant difference (P>0.05) in prevalence rates among male (15.2%) and female (13.6%) animals. However, higher infection rate was recorded in male animals. According to Shimelis et al. (2011), the possible explanation for the relatively high prevalence in male animals could be associated with the fact that these animals travel long distances for draught as well as harvesting crops into areas with high tsetse challenge. The present study showed statistically significant difference (P<0.001) between animals of poor, medium and good body condition scores. Similar results were reported by Mihreteab and Mubarik (2011) and Feyissa et al. (2011). This may be the effect of the disease itself which results in progressive emaciation of infected animals (Stephen, 1986). There was no significant difference in infection rate among animals of different coat colors although higher infection rate was recorded in black and brown animals. Black and red colors have been found to be more attractive to tsetse species, with a strongest landing response on black surface (Green, 1993).

The present study found a mean PCV of 21.31 and 27.0% in parasitemic and parasitemic animal, respectively. The mean PCV of parasitemic animals was found to be significantly lower (P<0.001) than that of parasitemic animals, similar with the observations of Tewelde (2001) and Abebayehu and Biniam (2010). As anemia is the classical symptom of trypanosome pathogenicity, the low PCV in parasitemic animals could be attributed to the parasite infection. Anaemia is one of the most important indicators of trypanosomosis in cattle (Stephen, 1986).

The overall apparent density of tsetse was 3.73 F/T/D. This finding was similar with Abebayehu and Biniam (2010) who recorded a tsetse density of 2.83 F/T/D in the area. But the present finding was lower than that reported by Abebayehu and Gurarra (2010) who recorded 10.5 F/T/D in Guto Gidda district. The apparent density of tsetse was 6.32 and 1.24 F/T/D in Gimbo and Guraferda districts, respectively. The lower value of fly density in the current study might be due to the use of tsetse fly habitats for cultivation by settlers and investors in the two
districts. The season when the study was done might also have contributed for the noted lower density than previous reports of Mizan Teferi Regional Veterinary Laboratory which was done during the rainy season (MTRVL, 2009).

Two tsetse species (G. pallidipes and G. fuscipes), Stomoxys and Tabanus flies have been found in the two study districts. The numbers of female tsetse flies were higher than male tsetse flies in the study area. Phelps and Lovemore (1994) associated such higher catches of female tsetse to be attributable to their longer life span (average of 8 weeks) than males living about 4 weeks, so that more catch of females could appear.

CONCLUSION

From the findings, it is concluded that tsetse transmitted cattle trypanosomosis is a major constraint to cattle production in the study areas. The predominant species of trypanosomes in the study area were T. congolense followed by T. vivax, mixed infection of the two species and T. brucei respectively. G. pallidipes, Stomoxys and G. fuscipes were the main vectors of the pathogenic trypanosomes in the area.

RECOMMENDATIONS

Based on the aforementioned, there is an urgent need to create awareness about the disease and control methods throughout the community. There is also a great need to supply more trypanocidal drugs and integrated vector and trypanosomosis management programs. This will assist greatly to reduce the disease prevalence in the areas.

Conflict of interests

The authors did not declare any conflict of interest.

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