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Abstract

A cross sectional study was carried out to investigate the prevalence of trypanosome infection and the species of trypanosome affecting cattle in four villages of South Achefer district in Amhara regional state. Blood examination conducted on 384 randomly selected cattle showed an overall prevalence of 4.2% without significant difference ($P > 0.05$) between the villages. The species of trypanosomes encountered in the current study were *Trypanosoma vivax* and *Trypanosoma congolense* which accounted for 62.5% and 31.25% of the overall infection, respectively. Simultaneous infection with both species was detected in 6.25% of the parasitaemic animals. The prevalence of trypanosome infection did not show significant variation between cattle of different age groups and sexes ($P > 0.05$ in each case). There was a significant ($P < 0.05$) association between trypanosome infection and body condition score (BCS) of the study animals. The mean packed cell volume (PCV) of trypanosome infected animals was significantly ($P < 0.05$) lower than that of uninfected animals. Although the current study indicated low prevalence of trypanosome infection compared with previous studies, the significant impacts of trypanosomosis on cattle production and productivity should not be neglected. Entomological surveys are recommended in the future to generate a complete data on the epidemiology of the disease in the study area.

Key words: Cattle, Ethiopia, prevalence, PCV, trypanosomosis
Introduction

African animal trypanosomosis (AAT) is a vector born disease of livestock caused by haemoparasites known as trypanosomes. AAT causes serious economic losses in livestock from anemia, loss of condition and emaciation. Many untreated cases are fatal (FAO, 2002; OIE, 2009). Trypanosomosis induced annual losses in cattle production were estimated in the range of 1.0 - 1.2 billion dollars in Sub-Saharan Africa (FAO, 2002). AAT occurs where the tsetse fly vector exists in Africa, between latitude 15°N and 29°S. Trypanosomes, particularly Trypanosoma vivax can also be transmitted mechanically by biting flies, and thus, the parasites are also found in parts of Africa, parts of Central and South America where there is free or cleared of tsetse flies (OIE, 2009). Tsetse flies inhabit wide range of habitats covering over 10 million Km² representing 37% of the African continent and affecting 38 countries (FAO/WHO/OIE, 1982) including Ethiopia.

African animal trypanosomosis is one of the major impediments to livestock development and agricultural production in Ethiopia contributing negatively to the overall development in general and to food self-reliance efforts of the nation in particular. While tsetse-borne trypanosomosis is excluding some agriculturally suitable land in the West and Southwest of the country, covering approximately 180,000–200,000 Km²; 14 million head of cattle, nearly 7 million equines, 1.8 million camels, and an equivalent number of small ruminants are at the risk of contracting trypanosomosis (Langridge 1976; MoARD 2004). The most important trypanosome species affecting livestock in Ethiopia are Trypanosoma congoense, Trypanosoma vivax and Trypanosoma brucei, in cattle, sheep and goat, Trypanosoma evansi in camel and Trypanosoma equiperdum in horse (Abebe, 2005).

There are several studies addressing the problem of bovine trypanosomosis in Ethiopia (Abebe and Jobre, 1996; Cherenet et al., 2004; Dagnachew et al., 2005; Sinshaw et al., 2006; Bitew et al., 2011). However there is still paucity of information on the subject as all available data do not reflect the situation of the disease in all agro-ecological zones, seasons or regional states. Particularly the status of the disease in the current study area is not known though the area is located in tsetse infested region. The objective of this study was therefore to estimate the prevalence of bovine trypanosomosis and identify the species of trypanosome circulating in cattle in South Achefer district of West Gojjam zone, Northern Ethiopia.

Materials and Methods

Study area

The study was conducted from November 2009 to February 2010 in four villages selected from South Achefer woreda (district) of West Gojjam Zone, Amhara Regional State, North Western Ethiopia. South Achefer district is geographically located at 11°50′N latitude and 37°10′E longitude, 502 Km away from Addis Ababa, the capital of Ethiopia and covers an area of 1183.05 Km². It is characterized by high plateaus, mountains and broad valleys. The elevation of the district varies from 1500-2500 m.a.s.l. The annual mean temperature for most part of the district is 23°C and the mean annual rain fall is 1522 mm. The livestock populations found in the district include cattle, sheep, goats, horses, mules, donkeys and poultry. Among these animals cattle are the dominant species raised in the area. The cattle population in the district is estimated to be about 133,555 (RSA, 2008). Four villages namely Zibst, Wogeda, Digol and Dilangwa were selected for the purpose of this study.

Study population and management

The study population constituted indigenous zebu cattle kept under traditional management system. The farmers in the area are predominantly engaged in pastoralist production system. A total of 384 cattle were selected from the four villages as study animals and they all were above one year of age and comprised of both sexes.

Study design and sampling technique

A cross-sectional study was conducted to determine the prevalence of bovine trypanosomosis. The district was selected by convenience sampling and the villages were selected purposively based on the repeated reports of the occurrence of trypanosomosis and presence of the vectors in those particular areas. The sample size required for the
study was determined by random sampling technique (Thrusfield, 2005). The sample size was computed accordingly to be 384 and these animals were selected by systematic sampling.

Parasitological and hematological examination

Blood was collected from the ear vein puncture by using sterile lancet in to a pair of heparinized capillary tubes (75x1.2mm) which were filled to ¾ of their height and sealed at one end with crystal seal. The capillary tubes were loaded on the micro haematocrit centrifuge symmetrically and centrifuged at 12,000 rpm for 5 minutes. The PCV was determined using haematocrit reader as an indicator of anemia (Murray et al. 1983). Animals with PCV < 26% were considered to be anemic (Coles, 1986). After determination of the PCV, the buffy coat (BC) was examined by dark ground/phase contrast microscope for the detection of trypanosomes in the blood. Identification of the species of the parasite was done based on the movement of the parasite across the microscopic field (FAO, 1992). Further identification of trypanosome species was carried out through microscopic examination of Giemsa stained thin blood smears prepared from the BC for those samples that were positive on BC examination (Murray et al. 1983).

Body condition scoring (BCS)

The body condition scoring was done according to Nicholson and Butterworth (1986) from 1 to 9 scales.

Statistical Analysis

Data collected from the study animals were entered in a Microsoft Excel spread sheet and coded. All statistical analyses were performed using STATA-11 software (Stata Corp. 4905 Lakeway Drive College Station, TX 77845, USA). The point prevalence was calculated for all data as the number of infected individuals divided by the number of individual sampled×100. Chi-square test was used to evaluate the presence of association between the prevalence of trypanosome infection and some study factors such as villages, sex, age, and BCS. The degree of association between trypanosome infection and the aforementioned factors was determined by using odds ratio (OR). Independent sample t-test was used to analyze the difference in the mean PCV between trypanosome infected and non-infected study animals. In all the analyses, the confidence level was held at 95% and P < 0.05 was considered as statistically significant.

Results and Discussion

The prevalence of trypanosome infection in different villages covered by the study is given in Table 1. Of the 384 cattle examined, 16 (4.2%) animals were found infected with different trypanosome species. Trypanosome was observed in all the villages in this study. Although the prevalence of trypanosome infections was higher in Digol village, the prevalence difference between the villages was not significant (P > 0.05).

Two species of trypanosomes were identified in this study: T. vivax in Zibst, Wogeda and Digol and T. congolense in Wogeda, Digol and Dlangwa villages. Overall, T. vivax (62.5%) was the predominant species encountered. T. congolense and concurrent infection with both species was observed in 31.25% and 6.25% of the infected animals, respectively (Table 2).

Chi-square analysis of the prevalence of trypanosome infection with the sex and age of the study animals showed no significant association with either of these factors (P > 0.05 for each factor). In contrast, trypanosome infection was found to be significantly (P < 0.05) associated with BCS. It was demonstrated that prevalence was significantly higher in poorly conditioned animals (8.1%) than in medium (1.8%) and good (1.3%) conditioned animals. The odds of trypanosome infection among animals with poor BCS was 6.1 times higher than that of animals with good BCS (Table 3).

The overall mean PCV of the study animals was 22.92±2.67 (range, 17-30) and the mean PCV of trypanosome infected animals (19.85±1.86) was significantly (P < 0.05) lower than that of non infected ones (23.12±2.60) (Table 4).

The overall point prevalence of trypanosome infection recorded in cattle in the present study (4.2%) is comparable to a previous report of 4.4% in Southwest Ethiopia (Tadesse and Tsegaye, 2010).
However, it was significantly lower than what was reported by previous studies (6.1% - 14.68%) from different districts in the same regional state or other (Cherenet et al., 2004; Dagnachew et al., 2005; Sinshaw et al., 2006; Bitew et al., 2011; Mekuria and Gadissa). Besides the season of the study and the study design used, the observed difference in prevalence between the present and the previous studies could be due to variations in vector densities. Unlike the previous studies, the present study did not incorporate the determination of vector density. Due to this reason, it is possible that tsetse flies or other biting flies’ population was lower in the current study area. On the other hand the present finding is higher than the prevalence (2.66%) reported from five tsetse free villages of Tselemty district in Tigray regional state (Tadesse et al., 2011).

### Table 1: Prevalence of trypanosome infection in the villages

| Name of the village | No cattle examined | No Positive | Prevalence (%) | $\chi^2$ | $P$ |
|---------------------|--------------------|-------------|----------------|---------|-----|
| Zibst               | 96                 | 3           | 3.1            |         |     |
| Wogeda              | 96                 | 3           | 3.1            |         |     |
| Digol               | 126                | 8           | 6.4            |         |     |
| Dlangwa             | 66                 | 2           | 3              |         |     |
| Overall             | 384                | 16          | 4.2            | 2.35    | 0.504 |

### Table 2: Trypanosoms spp. identified in the villages expressed as proportion (n = 16)

| Name of the village | Trypanosoma spp., n (%) | T.vivax | T.congolense | T.vivax + T.congolense |
|---------------------|-------------------------|---------|--------------|------------------------|
| Zibst               | 3 (30)                  | -       | -            | -                      |
| Wogeda              | 2 (20)                  | 1 (20)  | -            | -                      |
| Digol               | 5 (50)                  | 2 (40)  | 1 (100)      |                        |
| Dlangwa             | -                       | 2 (40)  | -            | -                      |
| Overall             | 10 (62.5)               | 5 (31.25)| 1 (6.25)    |                        |

### Table 3: Analysis of the prevalence of trypanosome infection with age, sex and BCS of the animals

| Factor   | No cattle examined | No Positive | Prevalence (%) | OR | $P$ |
|----------|--------------------|-------------|----------------|----|-----|
| Sex      |                    |             |                |    |     |
| Male     | 170                | 4           | 2.4            | 1  |     |
| Female   | 214                | 12          | 5.6            | 2.0| 0.120 |
| Age      |                    |             |                |    |     |
| 1-2 yrs  | 83                 | 1           | 1.2            | 1  |     |
| 3-5 yrs  | 130                | 9           | 6.9            | 4.7|     |
| >5yrs    | 171                | 6           | 3.5            | 3.0| 0.107 |
| BCS      |                    |             |                |    |     |
| Poor     | 138                | 12          | 8.7            | 6.1|     |
| Medium   | 167                | 3           | 1.8            | 1.4|     |
| Good     | 79                 | 1           | 1.3            | 1  | 0.004 |

Trypanosoma vivax was the most prevalent trypanosome species encountered in the present study. This finding is in agreement with previous observations in tsetse free areas of the country (Cherenet et al., 2004; Sinshaw et al., 2006; Tadesse et al., 2011). The dominancy of T. vivax over the other species in the present and the previous studies is most likely associated with its ability to be transmitted both cyclically by tsetse flies and mechanically by biting flies. In contrast to the present finding, several studies carried out in tsetse infested areas of the country have reported T.congolense as the predominant species (Dagnachew et al., 2005; Bekele et al., 2008;
Tadesse and Tsegaye, 2010; Mekuria and Gadissa, 2011; Bitew et al., 2011). The observation of mixed infection by *T. vivax* and *T. congolense* in the present study is consistent with the reports of Abebe and Jobre (1996), Dagnachew et al. (2005), and Mekuria and Gadissa (2011).

In the present study, the prevalence of trypanosome infection was shown to be significantly (*P* < 0.05) associated with BCS. The prevalence was higher in poorly conditioned animals than in those with medium or good BCS. This finding is consistent with the observations of Tadesse and Tsegaye (2010) and Bitew et al. (2011). It has been stated that weight loss (cachexia), loss of condition and progressive emaciation are the characteristic signs of trypanosomosis (Urquhart et al. 1996; FAO 2002; OIE, 2009).

| Condition       | PCV range | Mean PCV (%) | 95% CI        | SD  | t-test | *P*-value |
|-----------------|-----------|--------------|---------------|-----|--------|-----------|
| Infected        | 17-22     | 19.85        | 18.13-21.58   | 1.86|        |           |
| Non-infected    | 18-30     | 23.12        | 22.63-23.60   | 2.60| 3.27   | 0.0014    |
| Total           | 17-30     | 22.92        | 22.44-23.41   | 2.67|        |           |

Although female animals had a higher prevalence of trypanosome infection, the difference between females and males was not significant (*P* > 0.05). The present observation accords with that of Dagnachew et al. (2005), Tadesse and Tsegaye (2010) and Mekuria and Gadissa (2011).

Similar to previous studies (Sinshaw et al., 2006; Tadesse et al., 2011; Bitew et al., 2011; Mekuria and Gadissa, 2011) no significant (*P* > 0.05) variation was observed in the prevalence of trypanosome infection between animals of different age groups. As all the animals sampled were above one year of age, this might be due to the fact that the study animals had equal chance of getting contact with the vectors while traveling long distances for grazing as well as harvesting of crops.

Assessment of the PCV of the study animals showed that trypanosome-infected cattle had significantly (*P* < 0.05) lower mean PCV than non-infected ones. This observation is in agreement with other studies of bovine trypanosomosis in the country (Cherenet et al., 2004; Dagnachew et al., 2005; Sinshaw et al., 2006; Bitew et al., 2011; Tadesse et al., 2011). Taking the PCV range 26–42% as a normal (Coles, 1986), all the trypanosome infected and 86.5% of the non-infected animals were found to be anemic. It is well established that trypanosomosis in cattle is usually chronic and anaemia is the most important clinical sign, and the most common reason to explain why animals are unable to function normally (OIE, 2009). The observation of anemia (as indicated by a lowered PCV) in the majority of non-infected cattle might be due to other factors such as malnutrition, helminthosis or other haemoparasitoses. This study was conducted in dry season where there was extreme shortage of feed for livestock in Ethiopia. Moreover, the studied animals were not screened for gastrointestinal parasites or other haemoparasites than trypanosomes during the study period.

The prevalence observed in this study is generally low compared with previous studies. However, the study design used should be seen only as a cross-sectional study covering a specific period of the infection status in the animals examined. The diagnostic ability of the buffy coat method is also another factor to be considered in drawing conclusions from this work since the diagnosis of trypanosomosis using direct parasitological techniques is feasible only in the acute state of the illness when the blood is colonized by a large number of parasites. In the chronic state of the illness, which is characterized by low parasitemia, the parasitological diagnostic technique is not being suitable (Rae and Luckins, 1984). Therefore, more sensitive tests such as PCR or serological tests are required for effective diagnosis of the infection.

**Conclusion**

Trypanosomosis is an important disease in cattle in the study area where it resulted in a significant decline in PCV and BCS of the animals. A further study using alternative techniques such as PCR or serology in combination with entomological
surveys need to be conducted in different seasons in order to generate more complete data on the epidemiology of bovine trypanosomosis and its vectors in the area.

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