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# Prevalence of Bovine Trypanosomosis and Density of Tsetse Fly in Duguna Fango District, Wolaita Zone, Southern Ethiopia

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**Abstract**

A cross-sectional study was conducted from December 2017 to April 2018 in Diguna Fango district in Wolaita zone, Southern Ethiopia, with the objectives to determine the prevalence of bovine trypanosomosis and to assess the distribution and apparent densities of vectors of the trypanosomosis. A parasitological study using buffy coat technique was employed for the determination of prevalence of trypanosomosis while monoconical traps were used for the vector studies. A total of 192 cattle randomly selected from the study population were examined for the parasitological study. The result of parasitological study revealed that the overall prevalence of trypanosomosis was found to be 7.3% in Duguna Fango district. The prevalence showed no significant difference in susceptibility between sex categories and in age groups ($P>0.05$). From the infected animals the prevalence for trypanosome species was 14.3% and 85.7% for T. vivax and T. congolense, respectively. The mean PCV values of parasitaemic and aparasitaemic animals were 19.7% and 25.7, respectively. About 20 monoconical traps in two kebele (Bilate and Anka) of Duguna Fango districts were deployed for 72 hours with odour attractants for the vector studies. There were 22 G. pallidipes and 43 tabanus had been collected from the study site with the respective density of 1.1 and 2.15 fly/trap/day. Therefore, implementing control of trypanosomosis with an integrated approach was paramount importance in areas of the study site.

**Keywords:** buffy coat, Diguna Fango, Glossina pallidipes, parasitaemic, prevalence, trypanosomosis

## 1. Introduction

Trypanosomosis is a disease caused by several species of protozoan parasites (Trypanosomes) found in the blood and other tissues of vertebrates including to livestock, wildlife and people (MOA, 1995). African animal trypanosomosis remains one of the most prevalent and biggest constraints to the development of sustainable livestock production in the continent. It is one of the most important diseases of livestock which hampers agricultural production in sub- Saharan Africa including Ethiopia. Tsetse flies occur in some 10 million square kilometer of Africa, affecting a total of 38 countries. Currently, about 37% of the 147 million cattle in countries affected by tsetse are exposed to the disease (DACA, 2006).

Trypanosomosis is a major constraint contributing to the direct and indirect economic losses to crop and livestock production (Abebe, 2005; EVA, 1994). Tsetse-transmitted trypanosomosis in human and domestic animals poses also a serious threat to the lives and livelihoods of entire communities and constitutes the greatest single constraint to livestock and crop production and to a more appropriate and responsible utilization of natural resources in Africa (Mbahin, N. *et al.*, 2013). Trypanosomosis in Africa costs livestock producers and consumer an estimated US $ 1 billion each year (kristajonson *et al*., 1999). It is a severe problem to agricultural production in widespread areas of the tsetse infested regions (Slingenbergh, 1992) that accounts over 10 million square kilometers of the tropical Africa.

In Ethiopia trypanosomosis is widespread in domestic livestock in the Western, South and South-western lowland regions and the associated river systems (i.e., Abay, Ghibe, Omo and Baro/Akobo) (TCS, 1980). Currently about 220,000 $Km^2$ areas of the above mentioned regions are infested with five species of tsetse flies namely *Glossina pallidipes, G. morsitans, G. fuscipes, G. tachinoides and G.longipennis* (NTTIC, 2004). Economically the tsetse-transmitted trypanosomes (T. congolense, T.vivax, and T. brucei) are most important in cattle in Ethiopia (Upadhayaya, 2005).

Past activities of tsetse and trypanosomosis control measures were initiated from early 1960's by French veterinary Assistance Mission followed by British Veterinary Assistance Mission up to 1976. The National Tsetse and Trypanosomosis Investigation and Control Centre (NTTICC) were established in 1971 to run activities on tsetse and trypanosomosis control (Lemecha, 1994). Since then, different tsetse control projects were underway by NTTICC and thus meaningful achievements were recorded as some areas were free of tsetse. According to Shemelis *et al*. (2011) the control strategies in trypanosomosis concentrate on vector control, parasite control, with chemotherapy and chemoprophylaxis and use of inherent trypanotolerant trait in some breed of animals.

Trypanosomosis is a major disease of cattle in Wolaita particularly in Diguna Fango district, but systemic study was not conducted so far. This disease had high influence on the productivity of the cattle by decreasing the output. Therefore, the objectives of this study were to investigate the current prevalence of trypanosomosis in Cattle and to assess the distribution and apparent densities of vectors of the trypanosomosis in the study area.

## 2. Materials and Methods

### *2.1 Study Area Description*

The study was conducted in four purposively selected villages of Duguna Fango district, Southern Ethiopia, namely: Ofa, Dendo, Bilate and Anka. Diguna Fango is one of the districts of Woliata Sodo zone located along Bilate River, 408 km away from Addis Ababa, 178 km from Hawassa and 46km from the zone's town, Woliata Sodo. The altitude Ranges from 1100 to 2355 m.a.s.l. The district covers a total area of 86,646 hectares. The area is sub divided into two ecological zones: lowland (kola) with an altitude below 1500 m.a.s.l and midland (weinadega) with an altitude range of 1500-2355 m.a.s.l. Most of the livestock population is reared in lowland (Kola) ecological zone. The rain fall pattern is bimodal, a short rainy season runs from March to May and long rainy season runs from June to September. The mean annual rainfall is 50.4mm but again this varies according to ecological zone (lower in kola and higher in weinadega). The mean annual temperature of the district is about 19°Cbeing maximum in February which is 29°C and minimum in August which is 15°C. The physical features of the district are 33% hilly, 59% plain and 8% forest land (FAO, 2021).

### *2.2 Study Population*

The study population constitutes zebu cattle of both sexes and all age groups managed under smallholder mixed crop-livestock farming system.

### *2.3 Study Design*

A cross-sectional study was conducted in four purposively selected villages of Diguna Fango district to determine the prevalence of bovine trypanosomosis, to identify the prevailing species of trypanosomes and to assess the host related risk factors of the disease. The animals (cattle) were selected randomly and restrained by farmers (voluntary assistants) for sampling.

### *2.4 Study Methodology*

Cross-sectional type of study had been taken to determine bovine trypanosomosis in the selected districts of Wolaita zone settlement area. Random sampling technique was applied to select the cattle to be examined for the determination of the prevalence of bovine trypanosomosis. The animals were categorized in to three age categories young (1-3years), adult (3-5.9 years) and old (≥6 years) according to (Del-Lahunta & Habel, 1986).

Blood samples were collected by puncture of the marginal ear vein of the cattle with sterile lancet and then the blood samples were collected in to heparinized microhaematocrit capillary tube (HCT). The $3/4^{th}$ filled tubes were sealed at one end with crystal seal and were centrifuged at 12000 rpm for about 5 minutes (Woo, 1970) using microhaematocrit centrifuge. Then the PCV were measured using PCV reader to estimate anaemia and the Buffy coat was drain onto microscope slide by cutting the capillary tube with sharp pointed diamond pencil 1mm below the Buffy coat. After which it was covered with a 22 X 22 mm cover slip on microscope slide and examined under dark field microscope (40X power objective). Thin smears were prepared for positive samples for species identification (Murray *et. al*., 1977). The trypanosome species were identified according to their motility in the Buffy coat examination.

The apparent density of tsetse fly and other biting flies in relation to altitude and vegetation types were studied at selected sites of the study areas. The apparent density was determined based on the mean catches of flies in traps

deployed and expressed as the number of fly catch/trap/day (Leak et al., 1987). The flies were caught with monoconical traps baited with acetone and cow urine. A total of 20 traps in two kebele (Bilate and Anka) of Diguna Fango district were deployed just before sunrise in the morning and in position for 72 hrs. The species of tsetse fly was identified based on morphological characteristics while other biting flies according to morphological characteristics such as size, color, wing venation and proboscis at the genus level. Sexing was done for tsetse fly just by observing the posterior end of the ventral aspect of abdomen by hand lens as a result male flies easily identified by enlarged hypophgeum (Doud & Molalegne, 2011).

*2.5 Sampling Method and Sample Size Determination*

Simple random sampling method was used for the study animals and the study design was cross-sectional. In the study area 14.2% expected prevalence was considered in sample size determination. And also the other determinants that were considered in sample size determination are 95% confidence interval and 5% desired absolute precision (Thrusfield, 2007)

Therefore, $N= \frac{(Zx)^2\text{-}Pexp(1\text{-}Pexp)}{D^2}$

N= the required sample size

Pexp= the expected prevalence rate (14.2%)

Zx= the values of the required confidence interval (1.96)

D= desired absolute precision (5%)

Hence, the sample size required as per the above formula was 187 heads of cattle. Even though the sample size is 187, this work involves 192 head of cattle to increase precision.

**3. Data Management and Analysis**

For data analysis, data entry were made on Microsoft excel spread sheet and were analyzed using SPSS software. Results were represented mainly in the form of descriptive, tabular summaries, $X^2$ test for association of risk factors was performed. The prevalence of trypanosomosis was calculated by dividing the number of positive animals for buffy coat examination to total number of animals examined.

**4. Results**

*4.1 Hematological Finding*

In this study, a PCV measurement of 25% and above was considered to be normal (Douglas & Wardrop, 2010). Cattle having PCV<25% (anemic) was 90(46.9%) whilst the cattle having PCV≥25% (non-anemic) was 102(53.1%) as indicated in Table 1. The analysis of PCV value in the animals examined for trypanosome infection showed that the mean PCV value for the parasitemic cattle was 19.7% whilst the mean PCV value for the aparasitemic cattle was 25.7%.

Table 1. The mean PCV of sampled animals on the basis of hematological finding

| Status | Frequency | Percent | Mean Pcv (%) | Pcv (%) | Number Examined | Percent |
|---|---|---|---|---|---|---|
| **Parasitemic** | 14 | 7.3 | 19.7 | PCV<25 | 90 | 46.9 |
| **Aparasitemic** | 178 | 92.7 | 25.7 | PCV≥25 | 102 | 53.1 |
| **Total** | **192** | **100** | **24.4** | | **192** | **100** |

*4.2 Parasitological Findings*

The overall prevalence of trypanosomosis was 7.3% in Diguna Fango district in the study period as shown in Table 2. Trypanosoma congolense was the most prevalent species with 85.7% followed by *T. vivax* with 14.3%. The prevalence of trypanosomes infection differed between age categories 1-3 years, 3-5.9 years ,6 and above years but not significant (P>0.05). Higher prevalence observed 25% in age group 1-3 years compared to the 3-5.9 years age category 5.9%. The prevalence of trypanosome infection was slightly higher in female (7.4%) than male (7.1%) animals but there was no statistically significant difference (p>0.05) was shown in table4.

Table 2. The prevalence of trypanosomosis based on the age of animals

| Age Categories | Frequency | Number Infected | Percent | Prevalence (%) | $X^2$ | P Value |
|---|---|---|---|---|---|---|

| | | | | | | |
|---|---|---|---|---|---|---|
| **1-3 years(young)** | 16 | 4 | 8.3 | 25 | 3.511 | 0.173 |
| **3-5.9 years(adult)** | 119 | 7 | 62 | 5.9 | | |
| **≥6 years(old)** | 57 | 3 | 29.7 | 5.3 | | |
| **Total** | **192** | **14** | **100** | **7.3** | | |

Table 3. Trypanosome species in Parasitemic animals

| Species | Number Affected | Percent | Mean PCV (%) |
|---|---|---|---|
| ***T. Congolese*** | 12 | 85.7 | 19.8 |
| ***T. vivax*** | 2 | 14.3 | 19 |
| **Total** | **14** | **100** | **19.7** |

Table 4. The prevalence of trypanosomosis based sex

| Sex | Frequency | Number Infected | Percent | Prevalence (%) | *P* Value |
|---|---|---|---|---|---|
| **Male** | 98 | 7 | 51 | 7.1 | 1.00 |
| **Female** | 94 | 7 | 49 | 7.4 | |
| **Total** | **192** | **14** | **100** | **7.3** | |

*4.3 Entomological Results*

During the period one genera of biting flies, Tabanus and one species of Glossina were encountered during the entomological survey. *G. pallidipes* were the species of Glossina was caught. The density of Glossina species and other biting flies is shown in Table 5. The overall Glossina species caught per 72 hours were 22 *G. pallidipes* and 43 tabanus fly in total of 20 traps. Fly caught per trap per day was computed from these values and so that the apparent density of glossina species was 1.1. In this study, there were 13(59%) male and 9(41%) of female *G. Pallidipes* were observed which was indicated in the table 5.

Table 5. The proportion of male and female glossina species and number of other biting flies

| Season | Species | Sex | No_ Examined | Total | Apparent Density(F/T/D) | Percent |
|---|---|---|---|---|---|---|
| Dry Season | *Pallidipes* | M | 13 | 22 | 1.1 | 59% |
| | | F | 9 | | | 41% |
| | tabanus | | | 43 | 2.2 | |

Figure 1. Showing deploy of tsetse trap in the field

**5. Discussion**

The present study indicated that trypanosomosis is still of much concern and represents a major obstacle to cattle production in Diguna Fango district of Wolaita zone, southern Ethiopia. The parasitological examination revealed a prevalence of 7.3% for bovine trypanosomosis with *T. vivax* and *T. congolense* being the pathogenic trypanosome identified during the study period. The present result is lower than the findings of Habtewold (2005) at Humbo Larena of Wolayita zone (9.3%) and Konso district (11.5%) respectively. The possible explanation to this difference could be that the Southern Valley Tsetse and Trypanosomiosis Eradication (STEP) project practice is still working in the Duguna Fango district and this might have contributed to the lower prevalence of trypanosomosis in the present study. Daud and Molalegne (2011) reported higher prevalence (24.7%) in Mao-komo special district of Benshangul Gumz regional state. This might be attributed to the differences in agroecology which favors tsetse fly.

The prevalence of trypanosomosis infection was a bit higher in female animals (7.4%) than males (7.1%), though it was not statistically significant. This is in agreement with the findings of Daud and Molalegne (2011). The possible explanation for this slight difference might be associated with physiological variation between both sexes.

Although higher infection rate was observed in animals of < 3 years of age and adult, in the present study no statistically significant ($p > 0.05$) difference was observed in both age and sex as risk factor. This result is in agreement with the previous results reported by Mussa (2002). This could be due to the fact that all animals graze and used as draft as well as harvesting of crops to the same tsetse challenged areas.

In tsetse infested area of Ethiopia, 20-30% of cattle were affected by trypanosomes and in some high tsetse challenge areas the prevalence of the disease reaches up to 50 % (Dagnachewa & Abebe, 2007). Several studies (Leak *et al.,* 1999) have indicated *T. vivax* is highly susceptible to treatment while the problems of drug resistance are higher in *T. congolense.* This is shown in the present study that the prevalence of *T. congolense* was (85.7%) higher than the prevalence of *T. vivax* (14.3%). The high proportion of *T. congolense* were detected in Duguna Fango district agreed with reported by Dagnachew and Abebe (2007) which is 58% due to *T. congolense*. This high ratio of *T. congolense* may also suggest that the major cyclical vectors or Glossina species are more efficient transmitters of *T. congolense* than *T. vivax* in east Africa (Langridge, 1976).

One of the main symptoms of the disease is anemia (Murray, 1979) consequently the present study also indicated significant difference between mean PCV values of infected and non infected cattle. Out of the observed animals, 14 of them were positive and their mean PCV value was 19.7% and 178 of them were negatives and their mean PCV was 25.7%. Other than this it can also be assumed that numerous concurrent diseases like helminthiasis, tick borne diseases and nutritional imbalance cause anemia in both trypanosome positive and negative animals.

From the total cattle populations sampled during study period, 46.9 % of cattle population have PCV<25%. Most of cattle's having PCV<25% but they react negatively for trypanosomosis infection and this may have occurred due to the inadequacy of detection method used (Murray *et al*., 1977) or delayed recovery of anemic situations after recent treatment with trypanocidal drugs or may be due to the compound effect of poor nutrition and hematophagus helminth infection such as haemonchosis and bunostomiasis (Mussa, 2002). However, PCV values can be affected by many factors other than trypanosomosis, but these factors are likely to affect both trypanosomosis negative and positive animals (Van den Bossche & Rowlands, 2001).

The present study revealed that from a total of 192 randomly selected cattle's in study area, 14(7.3%) of animals were positive. Generally, the low prevalence of the disease was found in place where low tsetse fly density is present. This result is in agreement with previous result obtained by Soud (2008) who conclude that both the apparent density and prevalence of trypanosomes are positively correlated.

The study indicates an overall apparent tsetse fly density of 1.1 flies/trap/day. This result is in disagreement with the study of Muturi *et al*. (2000) which reported about 1.4 flies/trap/day in the southern rift valley of Ethiopia. *G. pallidipes* was the only species of tsetse fly caught in the study area.

## 6. Conclusion and Recommendation

The present study indicated that trypanosomosis is an important disease limiting livestock rearing and agricultural activity in Diguna Fango district due to the presence of tsetse fly species G. pallidipes. Due to tsetse control program undertaken by theSouthern Valley Tsetse and Trypanosomiosis Eradication (STEP) project practicein Diguna Fango district, the prevalence of trypanosomosis and the tsetse density decreased significantly. The major species of trypanosomes in the study area were *T. congolense* followed by *T.* vivax. According to the host risk factors, the prevalence of bovine trypanosomosis was slightly higher in females than in males, in younger cattle than in aged.

Based on the above conclusion, the following recommendations forwarded:

- ✓ A progressive integrated control campaign in the Diguna Fango district is quite necessary to minimize

the effect of trypanosomosis and to make sustainable the observed reduction both in trypanosomosis prevalence and tsetse densities which should be encouraging to scale up the control program to other areas bordering Diguna Fango.

Appropriate disease prevention and control methods should be undertaken so as to improve livestock production and agricultural development in the area.

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**List of Abbreviations**

| | |
|---|---|
| DACA | Drug Administration and Control Agency |
| EVA | Ethiopian Veterinary Association |
| MOA | Ministry of Agriculture |
| NTTICC | National Tsetse and Trypanosomosis Investigation and Control Center |
| PCV | Packed Cell Volume |
| SNNP | South Nation Nationalities and People |
| STEP | Southern Valley Tsetse Eradication Project |
| TCS | Tsetse Control in South |