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# A cross-sectional study on the prevalence and associated risk factors of Bovine Trypanosomosis, in Bambasi Districts, BGRS, Western Ethiopia

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**Abstract:** A cross-sectional study was carried out, from November.2018 to March, 2019 to determine the prevalence and associated risk factors of bovine trypanosomosis, in Bambasi districts. Blood samples were collected from (n= 333) randomly selected cattle (*Bos indicus*). Dark phase contrast buffy coat procedures were used to determine the prevalence of trypanosome infection, while haematocrit method was used to determine the packed cell volume (PCV) values of study animals. Out of total 333 cattle sampled, 14/333 (4.20 %) were found trypanosome positive. The disease was mainly caused by *T. congolense 10/14(*71.43%) followed by *T. vivax* 3/14 (21.43%) and mixed infection by *T. congolense* and *T. vivax* accounted for only 1/14(7.14%) with statistically significant differences (P< 0.05). Mean packed cell volume (PCV) values of the infected animals were lower (21.06 % ± 0.09 SE) than non- infected animals (28.07% ±0.37) and the variation was statistically significant (P<0.05). Sex groups, body condition, and study sites were not statistically significant risk factors for the occurrence of trypanosomosis in the present study (P> 0.05); however, age categories was found to be statistically significant (p< 0.05). In conclusion, the current study showed moderate prevalence of trypanosomosis in the study area reflecting the need for strategic control measures.

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## 1. Introduction

In sub-Saharan Africa countries livestock plays a crucial role both for the national economy and the livelihood of rural community. Ethiopia takes the lead in livestock population in Africa, with an estimated number of small and large ruminant populations of 59,486,667 cattle, 30,697,942 sheep and 30,200,226 goats, 2,158,176 horses, 409, 877 mules, 8, 439, 220 donkeys and 59, 495,026 poultry (CSA, 2016/17). The economy of Ethiopia is agriculture dependent and the role of livestock as farm input including traction and manure well as hides and skins have a wide importance mainly as a source of foreign currency of the leather industry to the country. Cattle play a significant role in the socio-economic life of the people of Ethiopia (CSA, 2008).

The livelihood of more than 85% of the people of Ethiopia depends on the agricultural sector. This sector mainly possesses crop and livestock production and mixed farming. However, the full potential use of livestock production is handicapped by the presence of livestock diseases of which trypanosomosis is the leading one. Trypanosomosis is one of debilitating and killing haemo-protozoal diseases of domestic animals and humans, caused by infection with parasitic protozoa of the genus *Trypanosoma*. It is a major constraint of livestock production especially in sub Saharan Africa. The principal host species affected by trypanosomosis varies geographically, but cattle, buffalo, camels and horses are particularly sensitive (Abebe, 2005).

In addition to the products of meat and milk, cattle provide draught power for cultivation of the agricultural lands of many peasants. The consumption of these products is low for reasons of low quality and several factors exert an influence on the production and productivity of livestock mainly kept under extensive and unimproved management conditions. Diseases, Seasonal feed scarcity and poorly developed infrastructures curtail the production potential (Fimmen *et al*., 1999).

Animal diseases in general and infectious ones in particular are the major constrains to crop and livestock production in the humid and sub humid parts of the African continent. Parasitic diseases especially animal trypanosomosis is the most important factor contributing to the sub potential performance of livestock population that are at risk of contracting the

disease any time. The disease is a serious and often fatal mainly to domestic animals that occur in large areas of Africa. It is caused by species of flagellate protozoa belonging to the genus *Trypanosoma* of the family Trypanosomatidae that multiply and inhabit in the blood stream, lymphatic vessels and tissue including the cardiac muscle, and central nervous system (CNS) of host, and are transmitted by vectors which are generally haematophagus arthropods. Most cases of animal trypanosomosis (Nagana) are transmitted cyclically by tsetse flies of genus Glossina (Maudlin *et al*., 2004).

Tsetse flies are found in Africa and transmit trypanosome parasites to vertebrate hosts. Ten million $Km^2$ of Africa (equivalent to the size of USA), wholly within the tropics except for small areas on the southeast coast are infested with tsetse (OAU, 2001). There are five species of tsetse flies in Ethiopia, and among them more than three species are found in the Benishangul Gumuz region. These are Fusca group/forest loving/, Palpalis group/riverine type/ and Morsitans group/savanna fly/ (NTTICC, 2004). Trypanosomosis is transmitted cyclically by tsetse flies, mechanically by other biting flies and also other means like veneral, iatrogenic and by coitus. The three main groups of tsetse flies for transmission of trypanosomosis are *Glossina morsitans*, which favors the open land of the savanna, and *Glossina palpalis*, which prefers the shaded habitats immediately adjacent to rivers and *Glossina fusca*, which favors the high dense forest areas (Urquhart *et al*., 1996). As a result, tsetse transmitted trypanosomosis is the main constraints of cattle production and productivity in the Benishangul Gumuz region in general and Bambasi districts in particular.

### 1.1. Statement of the Problem

In Ethiopia, a substantial amount of the national resource is spent annually for control of trypanosomosis through purchase of trypanocidal drugs. An annual loss attributed to the disease exceeds US $236 million, while loses from reduced milk, meat production, animal draught power and manure are unquantifiable (FAO, 1998). Recent findings and field observations have indicated that the common trypanosomosis control tools; *i.e*., trypano curative and trypano prophylactic drugs have become ineffective in many areas due to development of drug resistance by the parasite. Moreover, toxicity of the drugs and exhibition of antigenic variation which hampers vaccine production are the limitations facing the modern veterinary medicine (FAO, 1998).

Even though Bambasi district is well known by its huge livestock population in the Benishangul Gumuz Region State, the benefit obtained from this resource is not as expected due to the presence of animal disease in general and trypanosomosis in particular and also this exerts its impact on agriculture pulling the sector back ward. As aresult, the district, the region as well as the country didn't benefit from this sector.

Therefore, the objectives of this study were:

- To determine the prevalence of bovine trypanosomosis in Bambasi district.
- To identify risk factors associated with the occurrence of bovine trypanosomosis in the district.

## 2. Materials And Methods

### 2.1. Study Area

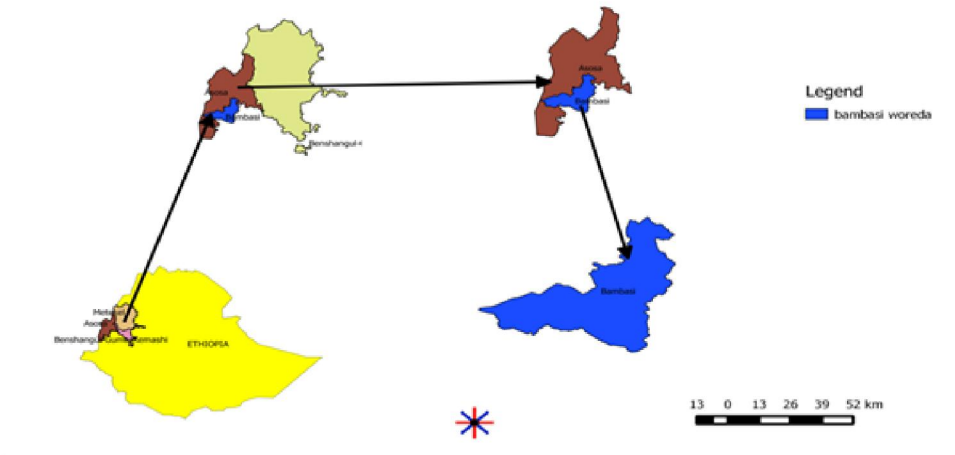


**Figure 1**: Map of Ethiopia representing the study area

***Source:*** DREMFSS, 2011

The present study was conducted in Bambasi districts from September to March, 2018. Bambasi district is located in Benshangul Gumuz Regional State Southern west of the Assosa zone and 616 km Northwest of Addis Ababa at 9.45- 9.75$^0$N and 34.35-34.88$^0$E with a minimum and maximum altitude of 1350m and 1770 m above sea level. The district is composed of 42 administrative peasant associations. The total area of the district is 2100 Km$^2$ of which the average minimum and maximum annual rainfall are 900mm and 1200mm; while the average minimum temperature is 23$^0$C and maximum temperature is 32$^0$C. The total human population of the district is 62693. Bambasi woreda has the livestock population 38964 cattle, 11,990 goats, 3,452 sheep, 1,995 equine and 38442 poultry (BWOoARD, 2017).

**2.2. Study Design and Study Animals**

A Cross sectional study was conducted from November 2018 to March 2019. The study area was selected based on the ecology and risks of tsetse to the area. they were stratified into high risk and low risk area based on tsetse ecology. The study animals were classified in different body conditions (good, medium & poor) according to Nicholson and Butterworth, (1986), age group (< 3 year and ≥ 3years) according to Maafrmd, (1998) and other factors including sex and origin were used to classify the study animals. To determine the required sample size, the most recent study conducted by Asmamaw Aki and Mengistu Godesso, (2016) who reported an overall prevalence of 9.14 % was used. Hence, the sample size were determined by using 95% level of confidence interval & 5% desired absolute precision (Thrusfield, 2005). Accordingly, the required sample sizes were calculated as follows:

$N= 1.96^2 Pexp (1-Pexp)/ d^2$

Where,

N = required sample size,

Pexp = expected prevalence

D = desired absolute precision

Therefore:

$\underline{1.96^2 x 0.0914 (1-0.0914)} / 0.05 = 128$ cattle

But to increase the precision, the sample size were increased to 333 cattle were during the study.

**2.3. Study procedure and data collection**

After the aim of the survey had been explained and permission obtained from owners; Cattles are kept under extensive traditional management system were used for sampling.

Samples were collected from 6 randomly selected villages (peasant associations) of the woreda. Blood samples were collected by ear vein puncture using a sterile lancet into a pair of heparinized capillary tubes (75x1.2mm) from each of the randomly selected animals. Each tube is sealed with crystal seal on one end (Murray, 1977).

**2.4. Sample processing and laboratory analysis**

The blood samples were centrifuge at high speed (12,000 rpm) for 5 minutes. Finally the packed cell volume (PCV) values were read by micro hematocrit reader, which can be adjusted individually for the length of the blood column in each tube, to get a value indication on the presence, absence & degree of anemia (Uilenberg, 1998).

After centrifugation, the capillary tube was cut down using diamond pointed pen 1mm below the Buffy coat to include the upper most layers of the red blood cells & 3mm above to include the plasma so that the contents was gently expressed on to a slide, mixed and covered with a cover slip ( 22 x 22mm). The preparation was examined with a 40x objective microscopes to get optimum view allowing large visual field and sufficient magnification for easy identification of trypanosomes and for their morphological features after Giemsa staining examined under 100 x objectives was used (Murray, 1991).

## 3. Results

**3.1. Trypanosome result**

Out of the total animal samples examined during the study period; 14/333 (4.20 %) were infected with trypanosomes as indicated in Table 6. The proportional prevalence of each species of trypanosome was 10 (71.43%) for *T. congolense* and 3 *(*21.43%*)* for *T. vivax*, and 1 (7.14%) for mixed infection with *T. congolense* and *T. vivax (Table 4).* The parasitological analysis during the study period indicated that trypanosome species found statistically significant (P<0.000, $X^2$=188.42) as indicated in (Table 4) below.

**Table 1:** Prevalence of infection of trypanosomes in selected kebeles

| Trypanosome species | Positive | Prevalence (%) | $X^2$ | P-value |
|---|---|---|---|---|
| *T. congolense* | 10 | 71.43 | | |
| *T. vivax* | 3 | 21.43 | 188.42 | 0.000* |
| Mixed (*T. congolense* & *T. vivax* | 1 | 7.14 | | |
| ***Total*** | **14** | **100** | | |

(* statistically significant)

### 3.2. Buffy coat result

The mean PCV values for all examined animals were 26.22 ± 0.11 SE. However, the mean PCV value for non - infected animals were 28.07 ± 0.37 SE and those of the infected animals were 21.06 ± 0.09 SE. The mean PCV values between non-infected and infected animals were found to be statistically significant (P<0.005, $X^2$ =7.87) as shown in the Table 5 below.

**Table 2:** Mean PCV comparison between parasitaemic and aparasitaemic animals

| Status | Frequency | Mean PCV | SE | $X^2$ | P- value |
|---|---|---|---|---|---|
| Infected | 68 | 21.06 | 0.09 | | |
| Non infected | 265 | 28.07 | 0.37 | 7.86 | 0.005* |
| **Total** | **333** | **26.22** | **0.11** | | |

* statistically significant

### 3.3. Associated risk factors

In the present study, animals examined were categorized in different age groups as < 3 years, ≥3 year old. Lower prevalence (1.49 %) was observed in cattle of <3 years of age and the higher (6.03 %) was seen in cattle of ≥3 years of age. The difference in the prevalence was statistically significant (p<0.05) as shown in Table 6. With regard to study sites, the highest and the lowest prevalence of trypanosomosis were recorded in Nebar-keshimando PA (10.52 %) and Keshimando number 2 PA (1.92 %), respectively.

However, there was no significant difference among the study sites (p >0.05) as indicated in (Table 6) below. The prevalence of trypanosomosis varies in both sexes; the infection in female is slightly higher (4.36 %) than male (3.85 %) and the association was not statistically significant (P>0.05) as shown Table 6. Similarly, animals were categorized in to different body conditions as good, medium and poor. The infection rate was highest (5.71 %) in cattle with poor body condition followed by cattle with medium body condition (4.25) and the lowest (2.75 %) was recorded in animals with good body.

**Table 3:** Bovine Trypanosomosis and its association with risk factors in selected kebeles

| Risk factors | No. examined | No. positive | Prevalence (%) | $\chi^2$ | p-value |
|---|---|---|---|---|---|
| ***Kebeles*** | | | | | |
| N/keshimando | 38 | 4 | 10.52 | | |
| Keshmando no2 | 52 | 1 | 1.92 | | 0.19 |
| Shobora | 97 | 2 | 2.06 | 7.42 | |
| Sonko | 75 | 2 | 2.66 | | |
| Jemasta | 27 | 2 | 7.40 | | |
| Bambasi 01 | 44 | 3 | 6.81 | | |
| **Total** | **333** | **14** | **4.20** | | |
| **Sex** | | | | | |
| Male | 104 | 4 | 3.84 | 0.041 | 0.83 |
| Female | 229 | 10 | 4.36 | | |
| **Total** | **333** | **14** | **4.2** | | |
| **Age** | | | | | |
| < 3 | 134 | 2 | 1.49 | 4.09 | 0.04* |
| ≥3 | 199 | 12 | 6.03 | | |
| **Total** | **333** | **14** | **4.2** | | |
| ***Body condition*** | | | | | |
| Good | 145 | 4 | 2.75 | | |
| Medium | 140 | 8 | 5.71 | 1.54 | 0.46 |
| Poor | 47 | 2 | 4.25 | | |
| **Total** | **333** | **14** | **4.2** | | |

(*-statistically significant)

## 4. Discussion

The present study revealed an overall, 14/333 (4.20%) prevalence of bovine trypanosomosis caused by different species of trypanosomes. Comparable research works were reported in various parts of Ethiopia by Aki (2016) in Asossa districts and Aki *et al.,* (2016) in Pawe district whose findings were 4.58 % and 5.58 % prevalences, respectively during their

research activity on prevalence of cattle trypanosomosis, associated risk factors and vector density.

In contrast, higher findings (26.30%) and (22.77%) prevalence were reported by Aki, (2017), his study on cattle trypanosomosis in Mandura and Dangur districts of the Benishngul Gumuz region, respectively and the variation in the disease distribution might be due to the difference in climatic conditions of the areas and seasonal variation and also attributed to the difference in study areas in their ecological set up such as altitude, ambient temperature, vegetation cover and vector abundance.

In this research, the majority of trypanosomosis infection was caused by *T. congolense*. The relative prevalence of trypanosome species showed 10/14 (71.43%) *T. congolense and 3/14(21.43%) T. vivax* as well as 1/14(7.14%) mixed infection with *T. congolense and T. vivax*. This result was in agreement with earlier works of (Aki *et al*., 2016) who demonstrated proportional prevalence of *T. congolense* to be 75.86% and proportional prevalence *T. vivax* to be 24.14% during his research on cattle trypanosomosis in Pawe district of the Benishangul Gumuz region, Western Ethiopia, (Kenaw *et al.,* 2015) whose finding demonstrated proportional prevalence *T. congolense* to be 85% during their research work on prevalence of cattle trypanosomosis in Asossa district of the Benishangul Gumuz region, Western Ethiopia. But, low findings was reported by Zelalem *et al*. (2015) in Asossa and Homosha districts, whose research work indicated the relative proportion of trypanosomosis species to be 18.2%, 52% and 26% for *T. vivax, T. congolense* and *T. brucei* respectively.

The current study revealed an overall mean PCV value of 26.22 % $\pm$ 0.11 SE. The PCV value of the infected animals was significantly lower (21.06% $\pm$0.09) than that of non-infected animals (28.07 % $\pm$ 0.37) ($P< 0.05$). This result was in line with earlier reports (Aki, 2017; Mulaw *et al*., 2011; Kenaw, *et al*., 2015).

In this study, animal parameters like study sites, body condition score, and sex groups, were not found to be considered as risk factor for susceptibility of animals to trypanosomosis. These findings were lining up with earlier works (Ayele *et al*., 2015; Lelisa, *et al.*, 2015; Regasa, *et al*., 2015). The fact that trypanosomosis did not depend on sex could possibly be hypothesised that both male and female animals have virtually equal chance of being in contact with flies and ultimately developing the disease.

This survey revealed the highest (10.52 %) prevalence of trypanosomosis in N/keshimando and the lowest (1.92 %) in Keshimando number 2. The variation was not found to be statistically significant ($p>0.05$). This might be attributed to the relative ecological pattern variation such as microclimate of the sites, distance between herds, animal herd density, and other factors which, in turn, influences tsetse fly and/or other biting fly population and type present in each study sites (Kenaw *et al*., 2015). Similarly, (Aki, 2017) indicated that there was significant variation in prevalence trypanosomosis among the study sites in Bullen district on the Benishangul Gumuz region.

## 5. Conclusion And Recommendations

Animal trypanosomosis is a major constraint of livestock production and productivity in Bambasi woreda. Formerly, the District lies within the tsetse belt area, the overall prevalence of cattle trypanosomosis in the present study was due to the control measures conducted in the area it become moderate. In this study, study sites, sex and body condition of the animal were not significant factors, whereas age was potential risk factor for the occurrence of trypanosomosis. Trypanosomosis was found to negatively affect the PCV values and body condition score of affected animals. Other factors such as nutritional deficiency and concurrent disease might contribute to the decrease in PCV values and body condition score of study animals. The predominant species *Trypanosoma* in the current survey was *T. congolense* followed by *T.vivax* and to a lesser extent mixed infection with *T. congolense* and *T. vivax* which was mainly transmitted cyclically by tsetse and mechanically by biting flies such as *Stomoxys, Tabanus* and *Haematopota*.

Based on the current findings, the following recommendations could be forwarded;-

- ❖ Developing and introducing control options that could minimize tsetse and other biting flies in the study area should be put in place in a holistic approach.
- ❖ Proper and strict follow up of trypanocidal drug effectiveness distribution, therapeutic strategies and alternative control measures should be implemented by concerned stake holders.
- ❖ Further study should be made on prevalence of trypanosomosis, tsetse and other biting flies investigation and other risk factors that could possibly contribute to the occurrence of trypanosomosis in the district to give the best control and prevention strategic in the study area.

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