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# Prevalence, Associated Risk Factors and Circulating Species of Bovine Trypanosomiasis in Dale Wabera District, Western Oromia, Ethiopia

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**Abstract:** Trypanosomiasis is a complex disease of protozoa caused by different species of unicellular parasites found in the blood and other tissues of vertebrates including livestock, wildlife and people. It is series constraint to agricultural production in extensive areas of the tsetse-infested Ethiopian lowlands. Therefore, this study was conducted with the objectives of assessing the prevalence of bovine Trypanosomiasis, associated risk factors and relative magnitude of the different species of trypanosomes affecting bovine in Dale Wabera District of Western Oromia. Cross-sectional study was conducted on randomly selected 384 zebu cattle from June 2020 to September 2021. Buffy-coat technique was used for diagnosing the presence of the parasite in the blood samples and thin blood smears were used for positive cases, to identify the species of the parasites. The overall prevalence of 25.52% (95% CI: 21.23-30.19) was recorded in this study. The lowest prevalence of infection observed in Foge Kombolcha 30(17.54%) 95% CI: 12.16-24.09) and the highest prevalence was recorded in Sego Adami village 44(33.33%) (95% CI: 25.37-42.06). Of the female animal examined 47(28.14%) (95% CI: 21.47-35.61) were positive for trypanosome infection while 51(23.5%) of male examined cattle were found positive. Statistically significant association was not observed between risk factors considered in this study and prevalence of the disease. *Trypanosoma congolense* were the dominant (64%) species of the parasite in this study followed by *T. vivax* (27%). This indicates abundant distribution of vectors spreading *T. congolense* and development of better immune response against *T. vivax*. Hence, strategic control of bovine Trypanosomiasis targeting vector control should be strengthened to improve livestock production and agricultural development.

**Key words:** Bovine · Circulating Species · Dale Wabera · Prevalence · Risk Factors · Trypanosomiasis

## INTRODUCTION

Trypanosomiasis is a complex disease of protozoa that is caused by different species of unicellular parasites (trypanosome) found in the blood and other tissues of vertebrates including livestock, wildlife and people [1]. Trypanosomiasis limit the extension of natural herds particularly in Africa where the presence of tsetse fly densities access to woodland and savannah areas with Good grazing potential [2]. It is series constraint to agricultural production in extensive areas of the tsetse-infested Ethiopian lowlands. Over 10 million kilometers of the tropical Africa is infected by tsetse and trypanosomiasis [3]. Trypanosomiasis can be transmitted between the hosts mainly by tsetse flies cyclically, by other biting flies mechanically and other means of transmission [4, 5]. Trypanosomes are insect- borne and their epidemiology is determined by the ecology of their insect vectors [6]. Epidemiologically, trypanosomes are distributed in the tropical Africa within the latitude of 14°N and 29°S where they are associated with their vector, Glossine (tetse fly) [7]. The tsetse flies *Glossina fusca*: the brush fly: *G. martians*: which inhabit principally savannah areas and the *G. palpalis* a riverine species effectively prevent the raising of cattle over large areas of Africa [6].

Mixed livestock and crop production characterizes the predominant farming system in the highlands. With livestock playing in a vital role in agricultural activities, the provision of animals draft power is particularly crucial [8]. Tsetse transmitted animal Trypanosomiasis still remains as one of the largest causes of livestock production losses in Ethiopia. Tsetse flies are

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estimated to infest over 220, 000 $Km^2$ fertile lands in western, southwestern and southern parts of the country. About 15-20% of the land believed to be suitable for livestock production is affected by one or two species of the tsetse flies [9]. The effect of Trypanosomiasis is not only the direct losses resulting from mortality, morbidity, infertility of the infected animals and costs of controlling the disease but also due to indirect losses which include exclusion of livestock and animal power based crop production from the huge fertile tsetse infested areas [5].

*Trypnosoma congolense, T. brucei* and *T. rhodensiense* are concentrated in western, *T. vivax* in all part but, sparse in eastern part of the country; *T. equiperdum* in the central and *T. evansi* highly concentrated in the East, northeast and southeast of Ethiopia. Consequently new areas are being invaded and settled so that communities are being continually evicted by the advancing tsetse flies. These areas include the areas the upper Didessa valley, the Northern and North Eastern edges of Lake Abaya in the rift valley, the upper reaches of the Omo Ghibe and its tributaries [2]. *Trypnosoma brucei* and *T. congolense* can infect all species of livestock, however *T. vivax* infect cattle, sheep, goats and horses, but not pigs, dogs and cats. Mixed infections with two or three species of trypanosomes are common [10].

Accurate diagnosis of trypanosome infections in livestock is required for proper appreciation of the epidemiology of the disease [2]. The diagnosis of African trypanosomiasis in domestic animals is based on the detection of the parasite by light microscope (Parasitological) or demonstration of circulating antibody (serological) in conjunction with clinical observation [11]. Stained thick blood films are use full for the detection of parasites. The wet film provides a quick and convenient means of detecting the presence of trypanosome. The thin blood films afford the best means of identifying species of trypanosomes. The dark-ground phase contrast Buffy coat technique is recommended for diagnose of the trypanosomes [12].

In Ethiopia, several researches related to trypanosomiasis have done in different areas. However, there is no sufficient data that balances its' epidemiological distribution and economic burden in Dale Wabera District. Information on the prevalence and circulating species of trypanosomes is vital to guide trypanosomiasis control intervention programs. Hence, this study was conducted with the objectives of assessing the prevalence of bovine Trypanosomiasis, associated risk factors and relative magnitude of the different species of trypanosomes affecting bovine in Dale Wabera District, Western Oromia, Ethiopia.

## MATERIALS AND METHODS

**Study Area:** This study was carried out in selected villages of Dale Wabera District which is found in Western Oromia national regional state, western Ethiopia (Fig. 1). The District is located at 593Km away from Finfinne (Addis Ababa), 75km from the zonal administration (Dembidolo) consisting of total population of 148, 198 (75, 099 men and 73, 099 women) and land area of about 53, 100.31 hectares. The study area has an altitude range of 1512 to 2200 above sea level and receives an average annual rain fall of 1200- 1800mm. The average temperature in the area is 26°C. Agro-climate classification of the district is lowland 22%, mid altitude 78% and highland 0% coverage. The farming practice in the area is mixed a crop livestock production and all class livestock except camels are found, population of cattle 125631, sheep 50223, Goats 31105, Equines 5776, poultry 147535 and bee colonies are 28753 (DWA Office, 2021-unpublished).

**Study Population:** The study was conducted on local Zebu cattle. The animals examined in this particular study were representing different sex (male and female), body condition (poor, medium and good) and age groups (young and adult) that are being reared in extensive management system in different villages of the district. The animals examined where categorized in different age groups as young (1-3) and adults greater than or equals 3 years old according to the classification used by Bitew, *et al*. [13].

**Study Design and Sampling Technique:** A cross sectional study was conducted from June 2020 to September 2021 by selecting 3 out of 24 villages found in the district purposively based on their accessibility and environmental variations. A total of 384 animals were sampled by simple random sampling technique.

**Sample Size and Sampling Method:** The sample size was determined by sample size calculation formula recommended by Thrustfield [14].

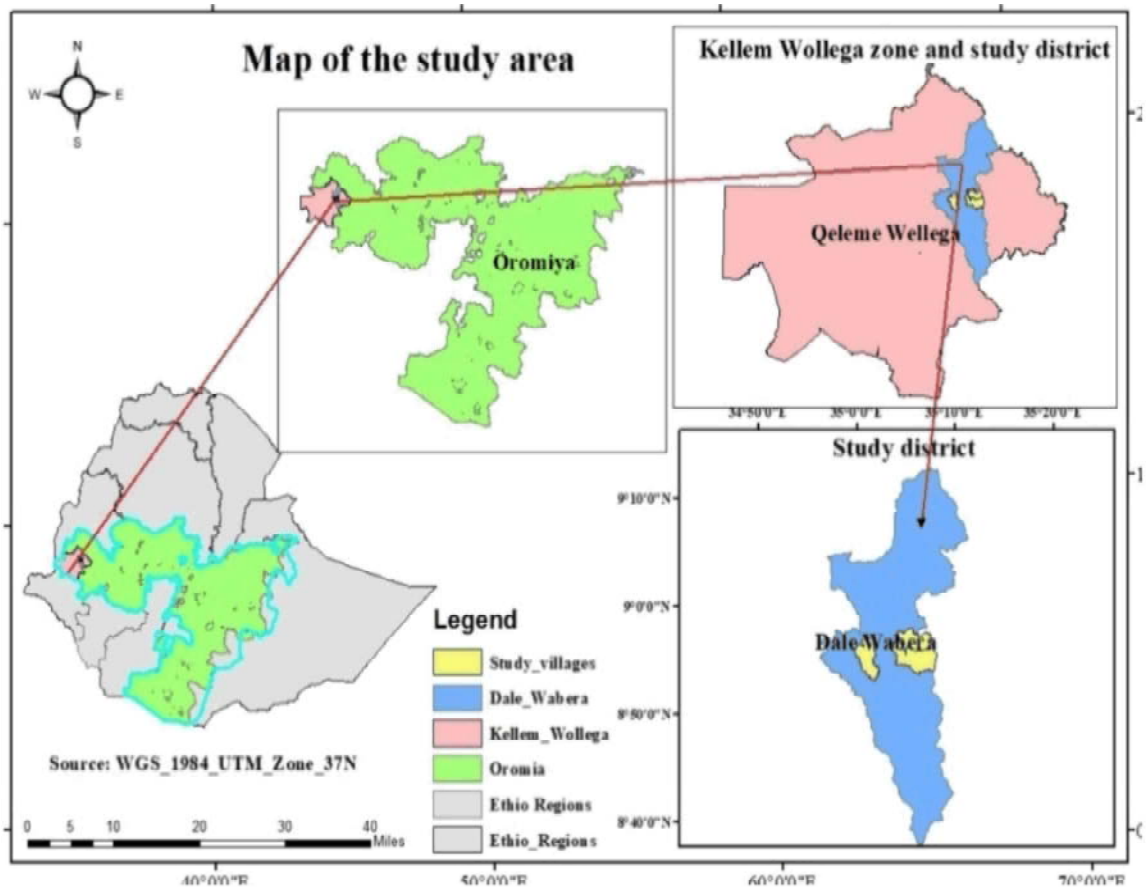


Fig. 1: Map of study area

$$N = \frac{Z^2 * p(1-p)}{d^2} \qquad \frac{1.96^2 * 0.5(1-0.5)}{(0.05)^2} = 384.$$

where, n is the sample size, p-expected prevalence, d-the desired absolute precision. Therefore, 384 animals were sampled to conduct this study.

**Sample Collection and Parasitological Examination:** Blood samples were collected after properly securing the animal aseptically from the marginal ear vein after pricking the vein with the tip of sterile lancet. The lancet was cleaned with cotton after bleeding each animal to prevent cross contamination of the samples. A Buffy-coat technique was used for diagnosing to identify the presence of trypanosomes in the samples. Thin blood smears were used for positive cases, to identify the species of the parasites by their size, location and size of kinetoplast, position of the nucleus and the attachment and length of the flagellum.

**Data Management and Analysis:** Raw data generated for this study were entered into Microsoft Excel and the prevalence of bovine trypanosomiasis in different age groups and sexes were analyzed by using SPSS version 20 software. Chi-square test was used to compare the prevalence of trypanosome infection in different variables and to determine association between variables and the disease. In all cases differences between parameters were tested at 95% CI and precision level of 5% so that p-value $\leq 0.05$ were considered as significant.

## RESULTS

The overall prevalence of trypanosomiasis was found 98(25.52%). The lowest prevalence of infection observed in Foge Kombolcha 30(17.54%) and the highest prevalence was recorded in Sego Adami 44(33.33%) in the study area. But, there was no statistically significant difference between the study villages and the disease (P-value=0.85) (Table 1).

Table 1: Prevalence of trypanosome infection in different villages of Dale Wabera District

| Village | Total animal examined | No. of positive | Prevalence % | 95% CI | p-value |
|---|---|---|---|---|---|
| Foge Kombolcha | 171 | 30 | 17.54 | 12.16-24.09 | 0.85 |
| Kara Jeno | 81 | 24 | 29.63 | 19.99-40.81 | |
| Sego Adami | 132 | 44 | 33.33 | 25.37-42.06 | |
| Total | 384 | 98 | 25.52 | 21.23-30.19 | |

CI= Confidence interval

Table 2: Sex wise prevalence of Trypanosome infection

| Sex | Total numbers of examined | Number of animals positive | Prevalence % | 95% CI | p-value |
|---|---|---|---|---|---|
| Female | 167(43.8%) | 47(28.14%) | 28.14 | 21.47-35.61 | 0.345 |
| Male | 217(56.2%) | 51(23.5%) | 23.5 | 18.03-29.72 | |
| Total | 384(100%) | 98(25.52%) | 25.52 | 21.23-30.19 | |

CI = Confidence interval

Table 3: Trypanosome infection in different age groups

| Age groups | Number of examined | Animals infected | Prevalence | 95% CI | p-value |
|---|---|---|---|---|---|
| Young | 152 | 40 | 26.32% | 19.51-34.06 | 0.772 |
| Adult | 232 | 58 | 25% | 16.56-31.09 | |
| Total | 384 | 98 | 25.52% | 21.23-30.19 | |

CI = Confidence interval

Table 4: Trypanosome infection in different body condition

| Body Condition | Total animal Examined | No. of animals infected | Prevalence (%) | 95% CI | p-value |
|---|---|---|---|---|---|
| Poor | 197 | 52 | 26.39 | 20.39-33.13 | 0.841 |
| Good | 45 | 10 | 22.22 | 11.2-37.09 | |
| Medium | 142 | 36 | 25.35 | 18.43-33.33 | |
| Total | 384 | 98 | 25.52 | 21.23-30.19 | |

CI = Confidence interval

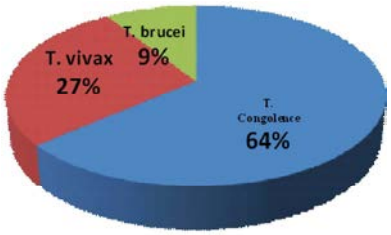


Fig. 2: Prevalence of trypanosome species in the study area

During the present survey, of the female animal examined 47 (28.14%) were positive for trypanosome infection. However, statistically there is no significant difference in the infection rate between both sexes (p-value =0.345%) (Table 2).

The trypanosome infection found in young and adult groups were 40(26.32%) and 58(25%) respectively. There is no statistically significant association between infection rate among the different age groups (p-value=0.772%) (Table 3).

Prevalence of trypanosomiasis in good body condition animal was lower when compared with poor body condition animal. But, there is no statistically significant association between body condition and the disease (p-value=0.841) (Table 4).

In this study, majorities (64%) of trypanosome species detected were *T. congolense* and the least (9%) were *T. brucei.* However, mixed infection was not detected (Fig. 2).

## DISCUSSION

In the present study carried out on 384 zebu cattle, an overall prevalence of 25.52% (95% CI: 21.23-30.19) bovine Trypanosomiasis was recorded (Table 1). Unlike this finding, relatively low prevalence were documented from multiple previous studies conducted in the country as 17.20% at Pawe, North West Ethiopia by Afework [15], 19.01% in Goro district by Abiy [16], 14.8% in Sidama zone by Bezabih *et al*. [17], 6% in Hawa Galan District of Kelem Wollega Zone by Tsegaye *et al*. [18], 4.4% in Jimma Arjo District of East Wollega Zone by Efa [19] and 10.1% in Selected Districts of South Omo Zone by Mekuria *et al*. [20].

However, the results of Tewelde [21] at kone (75%) and village 1 (93%) settlement areas of west Ethiopia, Woldeyes and Aboset [22] at Arba Minch zuriya districts (85.2%) and Rowland *et al.* [23] in Ghibe Valley, south west Ethiopia (84%) had shown higher results of Trypanosomiasis than present findings. Moreover, The present finding is relatively low which may be attributed to the frequent use of chemotherapeutic drugs, an increase in agricultural investment and reduction of tsetse population and other biting flies due to bush clearing in the area.

The prevalence of bovine Trypanosomiasis in both sexes was 28.14% (95% CI: 21.47-35.61) and 23.54% (95% CI: 18.03-29.72) in female and male animals respectively (Table 2). Although slightly higher infection was depicted in female animals, there was statistically no significant difference between both sees (p-value >0.05). This observation coincides with findings of Feyissa *et al*. [24] in southern Ethiopia and by Bezabih *et al*. [17] in Sidama zone who reported insignificant differences in susceptibility between the two sees. The possible explanation for relative increment of prevalence in female animals might be due to physiological differences [17, 25].

The prevalence study in different age groups in the area showed that the trypanosome infection rate in the age group was recorded to be 26.32% (95% CI: 19.51-34.06) and 25% (95% CI: 16.56-31.09) in the young and adult age categories respectively. However, there is no statistically significant difference among the various age groups (p-value >0.05) (Table 3). The infection rate in animals with poor body condition was slightly higher than good body condition (Table 4). This indicates that other factors such as diseases, nutritional factors as well as management system may have contributed for the poor body condition of cattle [26]. Low level of Trypanosoma infection in good body condition animals might be related to those well-nourished animals have good level of immunity and are in a better position to resist infection.

The finding of this study showed that of the total trypanosome positive animals, 64% were found to be infected with *T. congolense*, 27% were infected with *T. vivax* and the remaining 9% were infected with *T. brucei* (Fig. 2). In the current study mixed infection was not detected. The higher proportion of *T. congolense* in this study was in agreement with the previous result of tsetse infested areas of Ethiopia (58.5%) at Mereb Abaya [13]. Moreover, the results at Arba Minch Zuria districts (85.2%) by Woldeyes and Aboset [22]; in Ghibe valley, Southwest Ethiopia, (84%) by Rowland *et al.* [23] in south west Ethiopia and Tsegaye *et al*. [18] from Hawa Galan District of Kelem Wollega Zone had also shown higher results of *T. congolense*. Bezabih *et al*. [17] from Sidama zone reported high magnitude of *T. Congolense* than other species but mixed infection was detected unlike the present study. The predominance of *T. congolense* infection in cattle suggests that the major cyclical vectors or *Glossina* species are more efficient transmitters of *T. congolense* than *T. vivax* in East Africa and also due to the high number of serodems of *T. congolense* as compared to *T. vivax* and the development of better immune response against *T. vivax* by infected animals [27]. Different studies have indicated that *T. vivax* is highly susceptible to treatment while the problems of drug resistance are higher in *T. congolense*. This study revealed the presence of *T. vivax* is an indicator of the importance of mechanically transmitted trypanosome in an area where tsetse control program is under taken.

## CONCLUSION AND RECOMONDATIONS

The present finding depicted 25.52% prevalence of bovine Trypanosomiasis in the Dale Wabera district which indicates an apparently decreasing trypanosome infection rate as compared with the previously recorded results in different parts of Ethiopia. Therefore, strategic control of bovine Trypanosomiasis including vector control should be strengthened to improve livestock production and agriculture development in the study area. Attempt should be made to expand government and private veterinary service to provide the community with ant-parasitic drugs to fight against bovine trypanosomiasis in particular and other diseases in general.

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