IJMPES International Journal of
Medical Parasitology & Epidemiology Sciences

http://ijmpes.com
doi 10.34172/ijmpes.2022.04
Vol. 3, No. 1, 2022, 14-18
eISSN 2766-6492

Original Article

Prevalence of Bovine *Trypanosomosis* and Associated Risk Factors in Jima Geneti District of the Horo Guduru Wollega Zone in Ethiopia

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Abstract

Introduction: Parasitic diseases are significant causes of morbidity and mortality in humans and animals throughout the world.

Methods: A cross-sectional study was performed in Ethiopia's Jima Geneti area of the Horo Guduru Wollega Zone from December 2017 to April 2018. The prime goal of the study was to determine the prevalence of trypanosomosis in cattle and assess potential risk factors. Buffy coat and thin blood smears were employed to identify the trypanosome species. The research district and kebeles were chosen using a purposive selection strategy, while cattle were selected by a simple random sample method.

Results: In total, 25 of the 384 investigated cattle were infected with trypanosomes, leading to an overall prevalence of 6.5%. Biqiltu Qidame town had a high prevalence of 10.4%, while Adileqa Tuluchali had a low prevalence of 3.5%. The study area had the highest prevalence of *Trypanosoma congolense* (60%), followed by *Trpanosoma vivax* (28%) and *Trpanosoma brucei (12%)* The prevalence of trypanosomosis in cattle was statistically significant ($P<0.05$) with age, body condition, and packed cell volume (PCV) in the study area.

Conclusion: Bovine trypanosomosis was prevalent in the researched area that had a severe impact on livestock production. To increase the livestock's health and production in the study area, strategic disease prevention and control programs are necessary.

Keywords: Buffy coat, Cattle, Ethiopia, Thin blood smear, Trypanosomosis, Wollega

Received: December 5, 2021, **Accepted**: December 12, 2021, **ePublished**: January 1, 2022

Introduction

Agriculture is the world's most populous industry, employing 42% of the world's population and more than 50% of the population of developing countries (1). Livestock is the sub-sector of agriculture. Agriculture is the mainstay in Ethiopia similar to other developing countries. There are 55.03 million cattle, 27.35 million sheep, 28.16 million goats, 1.96 million horses, 6.95 million donkeys, 0.36 million mules, 1.1 million camels, and 51.35 million poultry in Ethiopia's livestock population (2).

Protozoan diseases such as toxoplasmosis, leishmaniasis, giardiasis, trypanosomosis, babesiosis, amoebiasis, and sarcocystosis are reported from many countries of the world (3,4). Among these, trypanosomosis is a serious disease in domestic livestock that causes a significant negative impact on food production and economic growth in many parts of the world (5), particularly in sub-Saharan Africa (6). There is a widespread trypanosomosis among the domestic livestock in Ethiopia's western, southern, and south-western lowlands, along with the connected river systems (7).

The most important species affecting cattle in Ethiopia are *Trypanosoma congolense*, *Trypanosoma vivax*, and *Trypanosoma brucei* (8). Trypanosomosis is biologically transmitted by the tsetse fly, namely, *Glossina* species (3,9). The susceptibility of cattle to trypanosomosis is based on breed, age, habitat, previous exposure, and health status (10). In the pathogenesis, a local inflammatory response is called a chancre (11). There are four major stages in the life cycle of African trypanosomes. The procyclic form, epimastigote form, and metacyclic form all develop in tsetse, while the bloodstream form is found in the mammalian host (12).

The wet blood smear, thick and thin smears, buffy coats, and packed cell volume (PCV) techniques are used for the diagnosis of trypanosomosis (13,14). Control of parasites with chemotherapeutic and chemo-

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prophylactic agents has the double effect of limiting losses caused by the infection and eliminating the transmissible trypanosome reservoir (15). To improve the welfare and security of rural communities, particularly in Ethiopia, rapid methods for assessing risk and diagnosing urgent problems are needed for the control of animal diseases. Thus, the objective of this study is to determine the prevalence of bovine trypanosomosis and its risk factors in the Jima Geneti district of Horo Guduru Wollega Zone.

Materials and Methods

Study Area

The study was conducted in the Jima Geneti district of the Horo Guduru Wollega Zone of Oromia Regional State, Ethiopia from December 2017 to April 2018. The total livestock population in the area was 351 295 heads of cattle. A mixed crop and livestock farming system is the mode of agriculture in the district (16). The district is located about 250 km West of Addis Ababa, with geographical coordinates of 09º29´N and 37º26´E. Temperatures range from 14.9˚C to 27˚C monthly. The altitude of the area ranges from 1700 to 2350 above mean sea level. The area has one long rainy season extending from March to mid-October with annual rainfall ranging from 1000 to 2400 mm (17).

Study Animals and Study Population

The animals sampled for this study were local zebu cattle (*Bos indicus*) which were kept under an extensive management system (Figure 1). The cattle of both genders and all ages found in the study district were considered as study populations All animals were grouped into three age categories, including those less than 3 years since 6 months as young, 3-5 years as an adult, and above 5 years old. The age was estimated by using dentition patterns, including teeth eruption and wear (18). In addition, the body condition was classified into three score categories of two, five, and eight representing poor, medium, and good, respectively (19).

Study Design and Sampling Technique

A cross-sectional study was conducted in December 2017 and April 2018. A purposive sampling technique was applied to select the study district and kebeles (Adileqa Tuluchali, Biqiltu Qidame town, Damu Gembo, Gudetu Geneti, and Hareto town) based on the geographical location and their accessibility, while a simple random sampling method was used to select individual animals.

Sample Size Determination

The sample size was calculated by using a 95% confidence interval, 5% desired absolute precision, and since there was no previous study conducted in the area, 50% expected prevalence of trypanosomosis via the following formula (20).

$$N = \frac{1.96^2 P\exp(1-P\exp)}{d^2}$$

where *N*, *p*, and *d* represent the required sample size, expected prevalence, and desired precision, respectively. Accordingly, the calculated sample size was 384. The number of sampled animals was not proportionately distributed but based on the abundance of study animals for each kebeles.

Blood Sample Collection and Laboratory Procedure

The parasitological diagnostic tests were used based on the study purpose (21). In brief, the blood was collected from an ear vein into heparinized capillary tubes and transferred onto glass slides to make the blood smears.

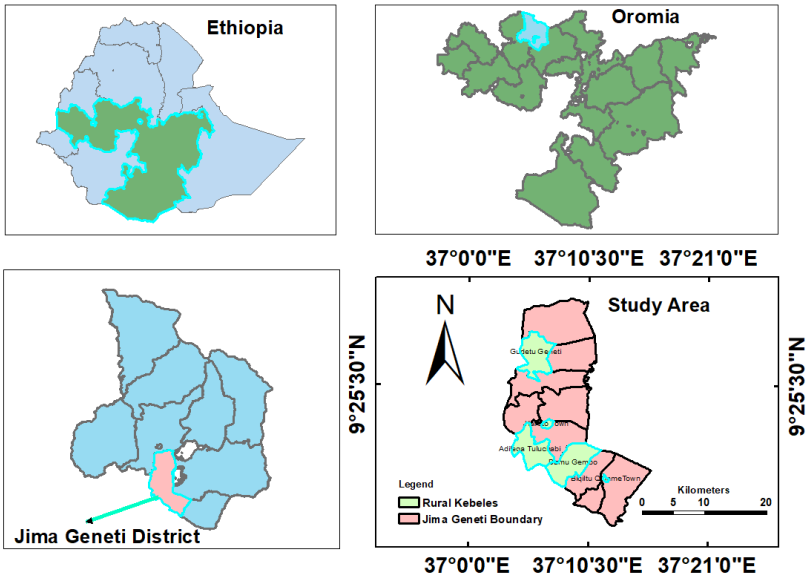

Figure 1. Study Area Map Designed Using ArcMap 10.3

Each capillary tube was filled to its last third, sealed with the crystal sealant one end, and immediately centrifuged in a microhematocrit centrifuge for 5 minutes at 10 000 rpm. The PCV was determined after centrifugation, and the anemic animals were considered to have PCV < 24%. The uppermost layers of red blood cells from each specimen were removed, and the Buffy coat was placed onto a microscope slide and examined under a phase-contrast microscope using a × 40 objective lens for the presence of trypanosomes. The thick and thin blood smears were stained with Giemsa and examined under a light microscope using a × 100 oil immersion objective lens.

Data Analysis

The data were stored in a Microsoft 2013©excel spreadsheet and analyzed using STATA (22). Pearson's Chi-square was used to evaluate the association between the prevalence of the disease with related risk factors. The confidence level was held at 95%, and the significance level was at $P < 0.05$.

Results

In the current study, the overall prevalence of trypanosomosis was recorded at 6.5%, and the highest prevalence of 10.4% was observed in the Biqiltu Qidame town (Table 1).

Trypanosoma congolense, *Trypanosoma vivax*, and *Trypanosoma brucei* were the species of *Trypanosoma* identified by Giemsa-stained thin blood smear examination among which *T. congolense* was found to be a highly prevalent *Trypanosoma* species in the study area (Figure 2).

The anemic animals, old age, and poor body condition were statistically significant ($P < 0.05$) at a higher risk of acquiring trypanosomiasis (Table 2).

Table 1. The Overall Prevalence of Bovine Trypanosomosis in the Study Areas

Kebeles	No. of Examined Animals	No. of Positive Animals	Prevalence (%)
Adileqa Tuluchali	57	2	3.5
Hareto town	111	4	3.6
Damu Gembo	42	2	4.8
Gudetu Geneti	78	7	9
Biqiltu Qidame town	96	10	10.4
Total	**384**	**25**	**6.5**

Table 2. Prevalence of Bovine Trypanosomiasis as per Different Risk Factors

Variables	Categories	No. of Examined Animals	No. of Positive Animals	Prevalence (%)	χ^2	*P* Value
Age	Young	116	2	1.7	6.76	0.03
	Adult	111	7	6.3		
	Old	157	16	10.2		
Body condition	Good	64	0	0	6.27	0.04
	Medium	129	8	6.2		
	Poor	191	17	8.9		
PCV	Non-anemic	176	0	0	22.63	0.00
	Anemic	208	25	12		
Gender	Male	166	9	5.4	0.57	0.53
	Female	218	16	7.3		

Note. PCV: Packed cell volume.

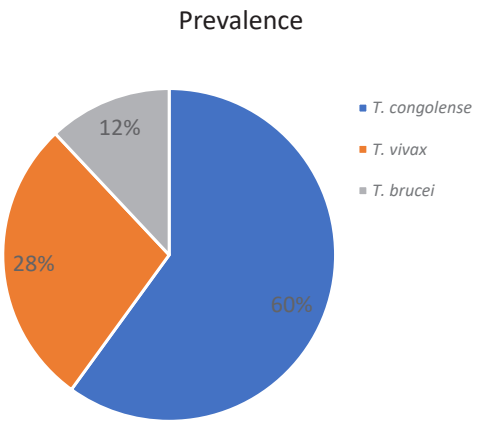

Figure 2. Prevalence of *Trypanosoma* Species

Discussion

The overall prevalence of trypanosomiasis in cattle kept under an extensive management system was 6.5% in the current study, which is in agreement with the prevalence of 5.5% in Didessa woreda, Oromiya region (23), 6.9% in Lalo Kile district of Kelem Wollega Zone (24), and 6.3% in Bako Tibe district of West Showa and Gobu Seyo districts of West Wollega Zone (25).

Moreover, almost similar prevalence of 8.5% (26) and 13.4% (27) were reported from the Sasiga and Diga districts of East Wellega and Gawo Dale districts, respectively. Compared to the present observations, the lower prevalence of 0.9%, 1.2%, and 2.1% were reported from Addisamba, Amarit, district of West Gojjam administrative zone, and Amhara region, respectively (28,29). Conversely, higher prevalence of trypanosomiasis 25.8% and 40% were reported in the Asosa district and Wolyta and Dawero zones, respectively (30,31). Those differences in the prevalence rate reported by various researchers might be due to variations in the agro-ecology, sampling season, vector infection rate, animal susceptibility, and practice of trypanocidal drug use and fly control operations which may have an impact on the epidemiological situations of the disease (32,33).

In the present study, a higher prevalence of trypanosomosis 10.4% in Biqiltu Qidame town was detected compared to 3.5% in Adileqa Tuluchali kebele. This finding is in line with 10.2% and 2.5% prevalence of trypanosomosis in Haro Gudisa and Bila town of Gudeya Bila district, western Ethiopia, respectively. This may

be due to the similarity of the addresses in the climate, altitude, and vegetation (34).

Based on the findings of this study, the majority of infections were caused by *T. congolense* (15/25, 60%), followed by *T. vivax* (7/25, 28%) and *T. brucei* (3/25, 12%). The higher infection rate with *T. congolense* in the study area is in agreement with 58.5% *T. congolense* and 32.2% *T. vivax* reported in the southwest of Ethiopia (7). Such a high prevalence of *T. congolense* may be due to the presence of a biological vector (*Glossina*), and it is mainly confirmed in the blood, while *T. vivax* and *T. brucei* could also invade the tissues (35).

In the current study, the prevalence of trypanosomosis in old (10.2%) and adult (6.3%) animals were higher than in young (1.7%) ones based on the chi-square analysis, and there was a statistically significant seroprevalence of trypanosomiasis with age ($P=0.03$). However, this finding contradicts the prevalence of 13.8% in young, 9.4% in adults, and 4% in old animals in and around Nekemte Areas, East Wollega Zone, Ethiopia (36). In this case, older animals travel long distances for feed and draught power, as well as for harvesting crops, and this could expose them to high tsetse fly challenges (37). There is also evidence that *T. congolense* infection is a chronic disease that increases with aging (38).

In the present study, the prevalence of trypanosomosis in poor body condition (8.9%) was higher than in good body condition (0%) and there was statistically significant seroprevalence of trypanosomosis with body condition ($P=0.04$). Cattle with good body conditions were aparasitaemic for bovine trypanosomosis in this study. The absence of *Trypanosoma* infection in the good body condition of animals was because well-nourished animals have a good level of immunity and are in a better position to resist infection. Moreover, there is a highly rare possibility of the re-establishment of infection in animals with good body conditions (25). This is almost similar to the prevalence of 10.7%, 2.3%, and 1.6% in poor, medium, and good body conditions, respectively, in Mao Komo special woreda, Benishalgul Gumuz (39). This might be attributed to the reduced resistance of those animals having poor body conditions or related to the progressive weight loss arising from the debilitating nature of the disease itself (40).

In this study, the prevalence of trypanosomosis was higher in anemic animals (12%) compared to non anemic animals (0%). based on the PCV results. Animals with PCV less than 24% were considered to be anemic (41). Because the development of anemia is the most reliable indicator of *Trypanosoma* infection, even though it also interferes with concurrent diseases and nutritional factors (42,43).

Conclusion

The findings of the present study indicated that bovine trypanosomosis is a prevalent parasitic disease with an overall prevalence of 6.5%, and *T. congolense*, *T. vivax*, and *T. brucei* species were identified in the Jima Geneti district. Higher prevalence and statical significance were observed in anemic, old age, and poor body conditions with trypanosomosis. Biqiltu Qidame town had the highest prevalence (10.4%) among the studied kebeles. The disease could be a constraint to livestock production in the study area. Therefore, regular screening of the disease followed by early treatment of positive animals with trypanocidal drugs is necessary. An integrated tsetse control strategy should be implemented in the area. Finally, awareness creation about the economic importance of the disease and its vectors for the stakeholders is crucial.

Acknowledgments

The authors would like to acknowledge the University of Gondar for facility support and Wollega University for the provision of laboratory facilities. We dedicate our research paper to all the scientists who did pioneer work in the field of trypanosomosis.

Author Contributions

Dinaol Tolawak: Conceptualization, methodology, investigation, data curation, formal analysis, and writing-original draft.
Kassahun Berrie: Conceptualization, methodology, supervision, writing-review, and editing.
Yagoob Garedaghi: Writing-reviewing, and editing.
Mahendra Pal: Writing, reviewing, and editing.

Data Availability Statement

The data collected and used to support this article can be offered by the first author upon request.

Conflict of Interests

The authors declare that they have no conflict of interests.

Ethical Issues

Nil.

Funding

This manuscript received no financial support.

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