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Sodo Regional Veterinary Laboratory Prevalence and Associated Risk Factors of Bovine Trypanosomiosis in Gurage Zone Abishige Wereda, Snnnpr, Ethiopia

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Abstract

Trypanosomiosis are important parasitic protozoan disease of livestock in the area and causes severe disease which results in loss of livestock and agricultural productivity with serious socio-economic consequences. A cross-sectional study was conducted from January 2021 to June 2021 in selected kebeles in Abeshege Wereda Gurage Zone with the objectives of determining the prevalence of trypanosomiosis and associated risk factors. Blood samples were collected from 623 selected cattle of the study villages and evaluated through standard parasitological methods. The overall prevalence was 15.73% (98/623). Trypanosoma congelense was the predominant species in the area (12.03%). Among species of trypanosomiosis, T. conglence and T. vivax were identified in 75(12.03%) and 23(3.69%) in examined samples respectively. Mixed infection by two species was noted in 1(0.16%) of the samples. Meanwhile from considered epidemiological factors body condition and PCV-value were showed statistically significance difference (P<0.05) with the overall prevalence of trypanosoma infections in cattle. On the other hand, trypanosoma infection among age, kebele and sex showed no statistically significant difference (P>0.05). In conclusion, bovine trypanosomosis is economically important disease that affects the health as well as productivity of cattle in Abeshege Wereda. Hence, appropriate disease prevention and control methods should be undertaken to improve livestock production and agricultural development in the area.

Keywords: Associated risk factor; Bovine; Prevalence; Trypanosomiosis; PCV

Introduction

Background

Trypanosomosis is a parasitic disease caused by unicellular protozoan parasites of the genus trypanosoma and family trpanosomatidae. They multiply in blood stream, lymphatic vessels and tissue, including cardiac muscle and the central nervous system. Trypanosomosis is transmitted by tsetse flies (Glossina spp) are believed to be the most important infectious disease holding back development of livestock production in Africa (Itard [1]). African animal trypanosomosis (AAT), also called Nagana is the most important disease constraint to livestock and mixed crop-livestock farming in tropical Africa (Courtin et al. [2]). The distribution of the disease is parallels the distribution of tsetse flies and comprises of an area approximately 10 million Km^2 (O"Gorman et al. [3]) in 37 subSaharan African countries (Sachs [4]). Nagana puts 55 million cattle at risk and leads to the death of three million animals every year, inflicting a direct annual loss of US$ 1.0-1.2 billion in cattle production (Chitanga et al. [5]; Cecchi et al. [6]). Trypanosomosis is a haemoprotozoan disease of animals and humans caused by several species of parasites of the genus Trypanosoma (CFSPH [7]). The most common pathogenic trypanosome species affecting cattle in Africa are T. congolense, T. vivax and to a lesser extent, T. b. brucei (Simukoko et al. [8]; O"Gorman et al.[9]). In areas where more than one trypanosome species is present, mixed infections in domestic animals are often encountered (Takeet et al.[10]; Moti et al.[11]). Trypanosomosis is a vector-borne disease known to be transmitted cyclically by tsetse flies (Krafsur [12]; WHO [13]) and mechanically by a number of biting flies of genus diptera such as Tabanus, Hematopota, Chrysops and Stomoxys (Desquesnes et al.[14]; Kone et al.[15]). The main tsetse-transmitted trypanosomes include T. congolense, T. vivax, T. b. brucei and T. simiae (Namangala [16]). Mechanical transmission of T. congolense has been shown under experimental conditions and can therefore not be excluded from contributing to its spread in Africa (Desquesnes et al., 2009[14]). In addition, T. equiperdum is transmitted sexually (Hagos [17] and Namangala [18]). Moreover latrogenic transmission could also occur when using the same needle or surgical instrument on more than one animal, at sufficiently short intervals, that the blood on the needle or instrument does not dry (Desquesnes and Dia [19]). Ethiopia is believed to have the largest livestock population in Africa. An estimate indicates that the country is a home for about: 59.50 million cattle, 30.70 million sheep, 30.02 million goats, 11.01 million equines, 1.21 million camels and 56.53 million chickens (CSA [20]). However, Ethiopia is one of the countries suffering from trypanosomosis with approximately 220,000

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Km^2 of arable land is infested with five species of tsetse flies: namely Glossina pallidipes, G. m. submorsitans, G. fuscipes, G. tachinoides and G. longipennis (NTTICC [21]). According to Leta et al. [22], the prevalence of bovine trypanosomosis in Ethiopia range from 1.38 to 17.15 %. The most important trypanosome species affecting livestock in Ethiopia are T. congolense, T. vivax and T. brucei in cattle, sheep and goats, T. evansi in camels and T. equiperdum in horses (Getachew [23]; Hagos [17]). In Ethiopia, the direct loss (mortality) due to trypanosomosis is estimated to amount 1.5 to 2 billion Birr per year (FAO [24]).

Statement of problem

In Gurage zone as a genearal and Abshege Wereda particular, trypanosomosis is one of the most important livestock diseases, which poses a serious threat to the lives and livelihood of entire communities and constitutes the greatest disease constraint to livestock production. To overcome the problem and to assess the epidemiology of trypanosomiosis, many researches are conducted previously in Gurage zone and surroundings by many researchers. They found the causative factors of trypanosomiosis. So to know the current status of bovine trypanosomiosis in the area, the current study needed to conduct and to address epidemiology of trypanosomiosis.

Objectives

General objectives

A general objective of this study was to determine the overall prevalence of trypanosomiosis and its associated risk factors in cattle in study area.

Specific objectives

- To estimate the prevalence of trypanosomiosis in study area
- To investigate associated risk factors that predisposes the occurrences of trypanosomiosis
- To identify species of trypanosoma from infected animals

Research questions

Trypanosomiosis raises several questions due to its etiological causes and associated risk factors. In this study trypanosomiosis has the following questions that should be solved accordingly after the relevant research conducted.

- What is the overall prevalence of trypanosomiosis in the cattle in the study area?
- What are the major risk factors associated with the disease in the study area?
- What are the major species of trypanosomiosis that causes infection in cattle in the study area?

Significance of study/benefit and beneficiary/

Bovine trypanosomiosis exerts a great negative impact on the socio economic aspect especially for those of farmers' and private organizations whose income rely on ruminant production. So at the end, this research will identify the cause of the trypanosomiosis and associated risk factors. Subsequently the study will benefit farmers and small ruminant private organization by obtaining information pertinent to trypanosoma infection. The finding might also help to the researchers and as a baseline data for further researches activities. The study will generate data for policy makers, governmental and non-governmental organization to undertake and develop different prevention and control strategies.

Scope of study/delimitation/

The current study will play a great role in estimating the prevalence of bovine trypanosomiosis, identification of species and its associated risk factors in the study area. Generally, this research needs a wider agro-ecology, a seasonal variation, a large study population, species and breeds diversification to identify exact root cause and associated factors to the societies and the government as a whole. But some of this aim will not achieve due to many reason. Some of them are financial shortage, a non-suitable agro-ecology for transportation and short study period.

Materials and Methods

Description of study area

The present study was conducted in Gurage zone Abeshege Wereda, in southwestern part of Ethiopia and 200 km away from the capital Addis Ababa (Figure 1). These areas are collectively located between $37^0.52'.431''$ and $37^0.74'.235''$ East and between $7^0.96'.385''$ and $8^0.53'.347''$ North with altitude range from 1107-1923 meters above sea level (m.a.s.l.). The climate alternates with long summer rain fall (June-

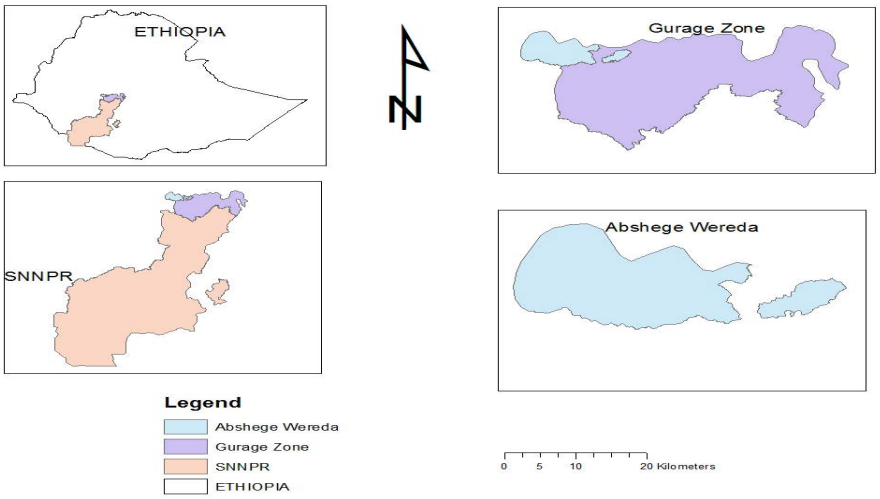

Figure 1: Map displaying study area.

September) and a winter dry season (October-May). The area receives a mean annual rainfall of 900 mm and the mean monthly maximum temperature ranging between 29.8^{0}C and 44.0^{0}C. The study sites are composed of cultivated land, grazing land, forest shrub, bush and wood land, water bodies and rural and urban settlement areas. These areas have the same altitude, same tsetse challenge and are adjacent to Ghibe River. The livestock population includes cattle, sheep, goats and equines which are an integral part of the livelihood. Mixed crop-livestock farming is the main source of livelihoods where Maize, Teff and hot-pepper are the main cash crops. The whole Gurage zone lie south west of the capital and are generally within the tsetse belt with relatively medium to high fly challenge.

Study population

The study animals were local breed of cattle which selected from study area that managed in extensive management system and consisting of different age, sex and body condition and will be selected from 4 purposely selected rural kebeles. During sampling, age, sex, and body conditions of the animals will be recorded. According to Gatenby [25] (1991) and Steele [26] the body condition scoring of animal classified as poor, medium and good and the age of animals will estimated through dentition and categorized as young (< or = to one years) and adult (> than one years).

Study design

Cross-sectional study design was carried out from January 2021 to June 2021 to estimate the prevalence and associated risk factors of bovine trypanosomiosis.

Sampling technique

Sampling techniques was used in this study are purposive sampling and simple random sampling technique. In purposive sampling technique, Wereda and study kebeles namely Ghibe, Borer, Hudad Arat, and Tawula Gefersa are selected based on transport access and animal population numbers. In simple random sampling technique animals will sample from selected kebeles.

Sample size determination

For estimation of the disease prevalence, the sample size was determine by assuming the expected prevalence to be 50%, the statistical confidence level 95%, while the desired precision taken is 5%. According to Thrusts field (2018) formula the sample size calculated as the following.

$$n = \frac{Z^2 Pexp.(1-Pexp)}{d^2}$$

Where: n = required sample size; Pexp = expected prevalence; d = desired absolute precision (5%). According to the above formula, the calculated sample size was 384. To increase precision and also to be representative, sample size was approximately inflated 2 times. Therefore, the total sample size required for this study was 623. Due to difference in cattle population in 4 selected kebeles, the sample size allocated proportionally based on number of cattle population.

Parasitological data collection

Packed cell volume (PVC) determination

After well straining of animal in the field, blood will collected from an ear vein into heparineized micro-haematocrit capillary tubes. Each capillary tube will filled to its last third and sealed with crystal seal at one end and centrifuge immediately in a micro heamatocrite centrifuge for five minute at 1500rpm. After centrifugation, the capillary tubes are placed in a haematocrit reader. The length of the packed red blood cells column is expressed as a percentage of the total volume of blood. Then the packed cell volume (PCV) will determined. Animal with PCV less than or equal to 24% are considered to be anemic (Radostitis et al. [27]).

Buffy coat technique

In Buffy Coat technique, blood will collected from an ear vein using heparinized micro-haematocrit capillary tube and the tube will sealed. A heparinized capillary tube containing blood will centrifuged for 5 minutes at 12, 000 rpm. After centrifugation, tryponosomes are usually found in or just above the buffy coat layer. The capillary tube will cut using a diamond tipped pen 1mm below the buffy coat to include the upper most layers of the red blood cells and 3mm above to include the plasma. The content of the capillary tube will expressed onto a slide and covered with cover slip. The slide will examined under x40 objective and x10 eye piece for movement of parasite. Trypanosome species are identified according to their morphological descriptions as well as movement in wet film preparations provided by OIE (OIE [28]).

Thin blood smear

A small drop of blood from a micro haematocrit capillary tube will applied to a clean slide and spread by using another clean slide at an angle of 45°. The smear was dried by moving it in the air and fixed for 2 minutes in methyl alcohol. The thin smear will flood with Giemsa stain (1:10 solution) for 30 minutes. Excess stain will drain and washed by using distilled water. Then it will allow drying and examined under the microscope (x100) oil immersion objective lens (OIE [28]).

Data management and analysis

The well-organized data and result of parasitological examination will be entered and managed in MS Excel work sheet and analyzed by using STATA version 14.2. The prevalence will summarized by using descriptive statistics and association of bovine trypanosomiosis prevalence with different potential risk factors such as age, sex, and body condition score will analyzed by chi-square. A p value of 5% is used as cut off for statistical significance at 95% confidence interval.

Result

Overall prevalence

In the present study, total of 623 cattle which belongs to different age groups, sexes and body conditions that were managed under extensive management system were examined for the presence or absence of trypanosome in their blood by using the buff coat method. Out of 623 examined cattle, 98 were positive for trypanosomosis and the overall prevalence was 15.73% (98/623) (Tables 1 and 2).

Identified trypanosomosis species

The major species of trypanososme were morphologically identified by using thin blood smear in the study area were trypanososma congelence, trypanosome vivax and also mixed infection (trypanosome vivax and trypanosome brucei) were also observed (Table 3).

Discussion

In the current study the overall prevalence of trypanosomiosis was 15.73%. Overall prevalence in the present study was in agreement with the results of Feyisa et al. 29], Degneh et al. [30] and Gemtessa

Table 1: Prevalence of trypanosomiosis.

Risk factors	No of examined	No positive	Prevalence
Kebele			
Ghibe	149	22	14.77%
Borer	217	38	17.59%
Hudad Arat	155	29	18.71%
Tawula Gefersa	103	9	8.74%
Age			
Young	159	21	13.21%
Adult	464	77	16.59%
BSC			
Good	455	56	12.31%
Medium	59	6	10.17%
Poor	109	36	33.03%
Sex			
Female	153	24	15.69%
Male	469	74	15.78%
PCV			
<24	333	78	23.42%
≥24	290	20	6.90%
Total	623	98	15.73%

Table 2: Prevalence of trypanosomiosis and associated risk factors.

Risk factors	No of examined	No positive	Prevalence	X^2 –square	P-value
Kebele					
Ghibe	149	22	14.77%		
Borer	217	38	17.59%	5.5069	0.138
Hudad Arat	155	29	18.71%		
Xawula Gefersa	103	9	8.74%		
Age					
Young	159	21	13.21%	1.0250	0.311
Adult	464	7	16.59%		
Body condition					
Good	455	56	12.31%		
Medium	59	6	10.17%	29.9991	0.001
Poor	109	36	33.03%		
Sex					
Female	153	24	15.69%	0.0007	0.978
Male	469	74	15.78%		
PCV					
<24	333	78	23.42%	31.9394	0.001
≥24	290	20	6.90%		
Total	623	98	15.73%		

and Dera [31] which found an overall prevalence of 14.2% in Humbo distrct, 14.1% in Gidami distrct, 15.57% in Eastern Wollega, and 12.28% in Dale Wabera distrct respectively. On the other hand, this finding was significantly lower than the reports of Zekarias and Zeryehun [32], Belete [33], Abera et al. [34] and Amare [35] who reported 27.5%, 26.3%, 21.33%, and 21.0% prevalence of bovine trypanosomosis respectively at Wozeka, Nyangatom woreda, Konta special distrct, and Omo river basin of South Western Ethiopia. The reason for this difference may be associated with the decrease in the degree of tsetse infestation due to control measure taken. Additionally, this may be due to the continuous control effort being under taken which gradually decreasing the prevalence of the disease. Widespread use of trypanocidal drugs in the area might have also contributed to the low prevalence. In addition season of the study might have

Table 3:Prevalence of identified species of trypanosomosis.

Species	No. of examined	No. of infected	Prevalence	X^2-square	P-value
T. c	623	75	12.03%	456.7746	0.001
T. v	623	23	3.69%	127.9375	0.001
T. v. and T. b.	623	1	0.16%	5.3658	0.021
Total	623	98	15.73%		
T. c = trypanosome congelence, T. v =trypanosome vivax, T. b= trypanosome brucei					

Table 4: Mean PCV of Parasitaemic and Aparasitaemic in Abshege Wereda.

Status	No. of examined	Mean PCV (%)	Standard deviation	[95% Conf. Interval]
Parasitaemic	98	19.45547	0.1710516	19.11918 19.79176
Aparasitaemic	525	27.12734	0.1795519	26.77382 27.48086

contributed to the finding of low prevalence. It is also possible that the continuous human settlement might have led to destruction of bush lands and forest with resultant destruction of the normal ecology of tsetse flies and there by decrease the vector density and hence infection level. Regarding with kebeles, the infection rate of trypanosomosis was higher in Hudad Arat kebele (18.71%) followed by Borer kebele (17.59%), Ghibe kebele (14.77%) and Xawula Gefersa (8.74%) and there was no significant difference in trypanosomosis infection rate among kebeles ($p>0.05$). This result is in conformity with findings obtained by Getnet [36] at Soddo Zuria district, Feyisa et al. [29] in Humbo district, and Abera et al [34] in Konta special district. The possible reason for the difference among kebeles could be attributed to higher tsetse challenge in Hudad Arat, Borer, Ghibe and Xawula Gefersa kebele due to availability of dense bush land which serves as suitable pocket area for tsetse reproduction. In the present study, age was considered to be one of the risk factors for trypanosome infection. Accordingly, slightly higher infection rate (16.59%) was observed in adult animals (>3yrs) than young animals (≤3yrs) (13.21%) in the study area. This result is in conformity with findings of Feyisa et al [29], Yigzaw et al. [37], and Ayana et al. [38]. There was no statistically significant difference among different age groups ($P>0.05$). The possible reason for this is natural protection mounted by maternal antibodies which are abundant in young animals and depleted in the older counterparts (Fimmen et al. [39]). In the cases of body condition, the prevalence of trypanosomiosis infection was higher (33.03%) in animals of poor body condition than those of medium (10.17%) and good (12.31%). In this study there was statistically significant difference among body condition ($P<0.05$). This finding agrees with previous reports (Molalegne et al. [40]; Feyissa et al. [41]), who found the highest prevalence of trypanosomosis in poor body conditioned animals. This might be attributed to reduced resistance of those animals having poor body condition or related to the progressive weight loss arising from debilitating nature of the disease itself. The prevalence of trypanosomes infection 15.78% in male and 15.69% female showed in significant variation that sex did not justify a relationship with occurrence of infection. This finding coincide with the result of Getachew [42], Tefera (1994) [43], Adane [44]and Wellide et al. [45] who obtained no significant difference in susceptibility between male and female in response to the infection with T. vivax and T. congolense. This is due to the fact that cattle are driven to pasture and watering regardless of sex and allowed in the same ecology having comparable degree to acquire infection. A similar result was reported by who demonstrated about 18.45% for male and 13.8% for female in sexes in late rainy season in Abay (Blue Nile) river basin and 12.8% for male and 11.32% for female in dry season without significant

variation. The current study also tried to indicate the difference between mea n PCV values of infected and non-infected bovine in the study area. Mean PCV of infected and non-infected animals were significantly different ($p<0.05$), where infected groups had low mean PCV value. The current finding is in agreement with many different research reports. The mean PCV, Table 4 value of parasitemic animals is found to be significantly lower than that of aparasitemic animals and this result is similar to the results obtained by Haile [46], Acha [47] and SRVL [48]. Taking the PCV value 24-46% as normal for zebu cattle 58.6% of aparasitemic animals have registered PCV value less<24%. This suggests that even though anemia is characteristics of trypanosomosis, other factors can also cause reduced PCV. So while diagnosing trpanosomiasis on the basis of PCV one should take various anemia casing agents in to consideration. Anemia can occur because of other causes such as nutritional deficiency, worm infestation and other hemoparasites (Radostitis et al. [27]). It was shown the development of anemia is most reliable indicator of the progress of the trypanosome infection (ILRAD [49]; Getachewu [23]. In animal absence of other diseases causing anemia, however, low PCV value of an individual animal is a good indicator of the presence of a trypanosome infection (Radostitis et al.[27]).In this study with regard to species of parasites, it was observed that *trypanosome congelense* was the predominant species in the area followed that *trypanosome vivax*. This finding agrees with the report of Dagnachew et al. [50-59]; in several studies conducted in sub-Saharan Africa, T. *congolense* has been found to be the most prevalent trypanosome species in cattle. This difference might be due to difference sampling method and sampling techniques, seasonal variation and infection rate of animal. The high ratio of *T. congolense* may be ascribed to the more efficient transmission of this species by tsetse flies than T. *vivax* in tsetse infested areas. Indicated that *T. vivax* was highly susceptible to treatment while the problems of drug resistance were higher in *T. congolense*.

Conclusion and Recommendations

The results of current study revealed that trypanosomosis is one of the constraints to animal production at the study area. Bovine trypanosomosis is one of the major impediments to livestock development and agricultural production in study area contributing negatively to the overall development in general and to food security in particular. The most prevalent species in the study area was T. congolense followed by T. vivax and and also mixed infection of T. vavix and T. brucei was also observed. Cattle with poor body conditioned were highly infected by trypanosomiosis than medium and good body conditioned cattle. The PCV values <24 was indicated that cattle those were anaemic and infected by trypanosomiosis. Based on the above conclusion, the following recommendations are forwarded:

- Proper and strict following of trypanocidal drug utilization
- Awareness creation should be given to the farmers about risks of drug resistance
- Attempt should be made to expand government and private veterinary services to serve the community properly
- Suitable community-based tsetse and trypanosomosis control program should be designed and implemented
- Further studies on the epidemiological aspects and development of drug resistance in pathogenic trypanosomes are required.

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List of Abbreviation

AAT African Animal Trypanosomiosis

% Percentage

BCS Body condition score

CSA Central Statistical Agency

DIC Disseminated Intravascular Coagulation

FAO Food and Agricultural Organization

Km2 Kilometre square

m.a.s.l Meter above sea level

Mm Millimeter

NTTICC National Tsetse- Trypanosomosis Investigation and Control

RBC Red Blood Cells

SNNPR South Nation Nationalities and People Region

0C degree Celsius

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