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Prevalence of Bovine Trypanosomosis in Gudeya Bila District, East Wollega Zone of Oromia Regional State, Western Ethiopia

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Abstract: A cross sectional study was conducted in Gudeya Bila district, East Wollega zone, Oromia Regional State of Ethiopia to determine the prevalence and associated risk factors of bovine trypanosomosis using parasitological techniques from November 2015 to May, 2016. Blood samples were collected randomly from selected cattle of both sex and different age groups and examined with parasitological techniques (i.e. thin smear). Out of the total 384 examined animals, 25 (6.5%) cattle were infected with trypanosomosis. Most of the infections were due to *Trypanosoma congolense* (60%) followed by *Trypanosoma vivax* (36%) and, the rest was T. b. brucei (4%). The overall prevalence of bovine trypanosomosis during the study period was 6.5%. Among peasant associations, Haro Gudisa had high prevalence rate (10.18%), whereas, low prevalence rate (2.47%) was recorded in Bila town. The prevalence of the disease between the sexes was 6.02% for males and 6.88% for females. Prevalence rate was slightly higher in adult (6.86%) than in young animals (5.13%). No statistically significant associations (P>0.05) were observed between the disease and potential risk factors like PAs, age and sex. Poor body condition animals (10.34%) were highly affected compared to medium (1.17%) and good (0%) body condition. This study showed a significant association (p=0.021) between trypanosomosis infection and body condition of animals. In conclusion, this study confirmed that trypanosomes were prevalent and poses a serious threat to animals, especially, to cattle production in the study area. Therefore, proper strategies ought to be designed and implemented to minimize the effect of this disease on livestock production and productivity.

Key words: Bovine · Gudeya Bila · Prevalence · Trypanosomes · Trypanosomosis

INTRODUCTION

Ethiopia possesses the largest livestock population in Africa. The country ranked 8th in the world averaging 23 million between 1995 and 2000, 46 million in 2003 and 44 million in 2004 [1]. Now a day, it is a home for an estimated 54 million head of cattle, 25.5 million of sheep and 24 million of goats [2].

Despite large livestock population, Ethiopia fails to optimally utilize this resource due to different constrains facing the livestock subsector. Shortage of nutrition, reproductive insufficiency, management constraints and animal disease are the major constrains [3]. One of the diseases hampering the livestock subsector is bovine trypanosomosis [4].

Trypanosomosis is the main haemoparasitic disease in domestic animals and is caused by the protozoan parasite *Trypanosoma*. The parasite is transmitted biologically by the tsetse fly (*Glossina* species) and infects animals over an area known as the 'tsetse belt', which extends approximately 10 million km^2 across 37 countries in Africa, from the Sahara Desert in the North to South Africa in the south [5].

In Ethiopia, Trypanosomosis is wide spread 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). About 220,000 Km^2 of these regions are infested with five species of tsetse flies namely *Glossina pallidipes*, *G. morsitans, G. fuscipes, G. tachinoides and*

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G. longipennis [6, 7]. Economically the tsetse transmitted trypanosomes (*T. congolense, T. vivax* and *T. brucei*) are most important in cattle with 14 million heads at risk in Ethiopia [8]. The various *Glossina* species and trypanosomosis via invading about 220, 000 km^2 of fertile land in south and south-western parts of the country also constrained the livestock production [9].

Some trypanosome species such as *Trypanosoma vivax* can be transmitted by biting flies mechanically and can establish itself even outside the tsetse belt, placing an estimated 160 million cattle and 260 million sheep and goats at risk [10]. The clinical signs of the disease depend up on the species and strain of trypanosome, the vector and resistance of the affected breed animal. Trypanosomosis can be diagnosed based on either detection of the parasite by the light microscope (parasitological) or demonstration of the circulating antibody (serological) in conjunction with clinical observation [11]. The stained thin blood smears afford the best means of identifying species of trypanosomes [12].

Trypanosomosis in livestock causes great losses in terms of mortality, abortion, reduced fertility, milk and meat production and ability to work as traction animals [13]. In addition to these, the disease is also responsible for an annual loss of millions of dollars in livestock production as a result of the cost related to treatment, prevention and vector control efforts [14].

In Ethiopia, the disease is more prevalent in the southern and western regions where the primary vector exists. Recently, however, new areas are being invaded and settled communities are being evicted continually by the advancing infections. Several attempts have been made to control trypanosomosis in the country, with chemotherapy and chemoprophylaxis. However, bovine trypanosomosis is tremendously affecting the productivity and health of livestock in different areas. Gudeya Bila district is one of the areas in which trypanosomosis causes problem in livestock production. As a result, the people suffer from low level of draught power and productivity that compromise the socio-economic and nutritional status of inhabitants. However, no previous work has been carried out to determine the condition of the disease in the district. Knowing the current status and clearly understand epidemiology of typanosomosis and its vectors are crucial to integrate all efforts towards combating the disease and reducing economic losses. Therefore, the objectives of the study were: To determine the prevalence of bovine trypanosomosis and its associated risk factors for the prevalence of trypanosomosis and to know the types of trypanosome that highly causing economic losses in Gudeya Bila district.

MATERIALS AND METHODS

Study Area: The study was conducted in Gudeya Bila district of East Wollega zone, western Ethiopia from November 2015 to March 2016. It is located at the distance of 270 Kms from Addis Ababa to west. The district is bordered by Jima Genati district of Horo Guduru Wollega in east, Bako Tibe district of West Shoa in South-east, Gobu Sayo and Sibu Sire districts of East Wollega in west and Abe Dongoro district of Horo Guduru Wollega in north. There are 13 peasant associations and 2 town administrations (Bila and Jare). The area has two seasons: rainfall from June to September and a dry season from October to May, with a mean annual rainfall of 1100 mm-1950 mm. The altitude ranges from 1100 m – 2400 m. The daily average minimum and maximum temperatures are 18.5 °C and 27.5 °C, respectively [15].

According to the woreda's Office of Agriculture and Rural Development, the animal population of the study area in 2014 was 124,567 cattle, 85,743 sheep, 106,212 goats, 63,685 horses, 2482 donkeys and 1632 mules. The climate of the district is under the factors of suitable temperature and humidity for the tsetse survival and for biting flies since they are near Gibe River and its tributary which provides adequate humidity and ambient temperature. The topography of the district is highly mountainous and covered with different types of vegetations. The district is known by its production of crops such as maize, teff, beans and some kinds of fruit and vegetables [16].

Study Animals: The animals used in this study were local zebu cattle (*Bos indicus*), which were brought to clinic due to different cases. They were usually kept under an extensive husbandry system. Animals were allowed to graze freely during the day and housed in poorly constructed barns at night. The age of animals was determined by dentition and categorised into two age groups (adult and young) according to [17], based on dental table by [18]. Address of the animal was recorded by asking the owner and body condition was also taken in consideration by grouping the animals into three (poor, medium and good) [19]. Based on the description of body condition score [20].

Study Design: Cross sectional survey was conducted on 384 randomly selected animals to determine the prevalence of bovine trypanosomosis. From any animal that was come to clinic, some were examined being representative of all cattle population of the district.

Sample Size Determination: A random sampling technique was used to recruit an animal for the study. The sample size was determined based on the formula given by [21]. Because there was no information about the prevalence of the disease in the area, 50% was taken as the expected prevalence and to calculate the sample size, 5% absolute precision and 95% confidence interval was also used. The formula used to calculate sample size was:

$$n = \frac{(1.96)^2 . Pexp\ (1- Pexp)}{d^2}$$

Where: n = required sample size
Pexp = expected prevalence = 50%
d = desired absolute precision = 5%

Hence, the sample size required as per the above formula was 384 heads of cattle.

Study Methodology

Parasitological Examination: The blood samples were collected from the ear vein of randomly selected cattle to determine the prevalence of trypanosomosis after recording the age, address, sexes and body condition of animals. Blood sample collection was performed by piercing the marginal ear vein with a sterile lancet and blood was drawn by a haematocrit capillary tube. Small drop of blood from capillary tube was applied to clean slide and was spread by using another clean slide at an angle of 45^0 for thin smear preparation. The smear was air dried and was fixed for 2 minutes in methyl alcohol. The thin smear was flooded with Geimsa stain for 30 minutes. Excess stain was drained and washed by using distilled water. Then, it was allowed to dry by standing up right on the rack and examined under the microscope by (100x) oil immersion objective lens [22].

Data Analysis: The collected data during the study period was entered into Microsoft Excel 2007 program and was decoded. Association between risk factors and prevalence of trypanosomosis was determined by Chi square test (Fisher exact test) using SPSS software version 20. Values were considered significant at $p<0.05$.

RESULTS

Prevalence of Trypanosomosis: Out of a total of 384 cattle examined, 25 were positive for trypanosomosis, hence the overall prevalence rate of the study area was 6.5%. The species of trypanosomes identified were *T. congolense* (60%), *T. vivax* (36%) followed by *T. b. brucei* (4%). The associations of the disease with address, age, sexes and body conditions were assessed. Accordingly, the prevalence rate among addresses was compared and found to be high in Haro Gudisa (10.18%) followed by Jaweja (6.42%) and Tibe (5.81%). Haro Gudisa is found around the source of Ghibe River and covered with different types of vegetables. However, there was no statistical significant between the prevalence and addresses ($p> 0.05$).

Table 3: Prevalence of bovine trypanosomosis with respect to PAs

			Trypanosomes *spp*				
Pas	No of examined	No of positive	*T. c*	*T. v*	*T. b b.*	Prevalence (%)	x^2 (P value)
Bila town	81	2	1(50%)	1(50%)	0	2.64	14.786(0.097)
Haro Gudisa	108	11	8(72.7%)	2(18.2%)	1(9.1%)	10.18	
Jaweja	109	7	3(42.86%)	4(57.1%)	0	6.42	
Tibe	86	5	2(40%)	3(60%)	0	5.81	
Total	384	25	14	10	1		

Note: *T. c = Trypanosoma congolense, T. v= Trypanosoma vivax and T. b b= Trypanosoma brucei brucei*

Females were compared with males to understand the prevalence rate of the disease based on sex and found to be infected slightly higher than males. But the difference had no significance, because no association between sex and prevalence of trypanosomosis was observed ($p=0.097$).

Table 4: Prevalence of bovine trypanosomosis with respect to sex

Sex	No of examined	No of positive	Prevalence (%)	X^2	P value	CI (Lower-Upper)
Female	218	15	6.88	1.200	0.753	0.923 - 0.968
Male	166	10	6.02			
Total	384	25	6.5			

The present finding revealed that the prevalence was higher in older or adult animals than younger. Although many reports from other places described that age is a risk factor for transmission of the disease, this study showed insignificant association ($p > 0.005$).

Table 5: The prevalence of bovine trypanosomosis with respect to age groups

Age	No of examined	No of positive	Prevalence (%)	X^2	P value	95%CI(Lower Upper)
Adult	306	21	6.86	2.943	0.400	0.388- 0. 487
Young	78	4	5.13			
Total	384		25	6.50		

Body condition of the animals under study was taken in consideration to determine if there was association between body condition of the animals and prevalence rate of the disease. The present study showed that there was association between body condition and prevalence of the disease ($p<0.05$). Animals with poor body condition were highly infected with the disease than animals with medium body condition. No parasite was detected in blood of animals with good body condition.

Table 6: Prevalence of bovine trypanosomosis with respect to body condition score.

Body condition	No of examined	No of positive	Prevalence (%)	X^2	P value	95%CI (Lower-Upper)
Poor	232	24	10.34	14.909	0.021	0.003- 0.028
Medium	59	1	1.7			
Good	93	-	-			
Total	384	25	25			

DISCUSSION

In the present study the prevalence of bovine trypanosomosis exposure was investigated in Gudeya Bila district of East Wollega zone, Western Ethiopia. The overall prevalence rate of the present investigation in the study area was 6.5% which was virtually similar with the result of [23] in Bako Tibe, West Shoa and Gobu Seyo, East Wollega which was 6.25%, [12] in Lalo Kile district, Kelem Wollega zone, western Ethiopia (6.86%) and [24] in Chena district, Southwest Ethiopia (6.9%).

Other studies on the disease were made in different areas. When it was compared with results from different areas by different researchers, the present study was lower than that of the result reported by [25] in which 8.55% prevalence rate was reported from Diga and Sasiga districts of East Wollega zone and [26], reported a prevalence rate of 15.57% from Guto Wayu and Sibu Sire districts of East Wollega zone. And also [27, 28], worked at Humbo Laren, Wolaita zone and Konso district and reported prevalence rate of 9.3% and 11.5%, respectively. The prevalence of bovine trypanosomosis in Hawagelan district of Kelem Wollega zone of western Ethiopia to be 8.6% [29] and also a report from three districts of East Gojjam zone bordering the Blue Nile River in Ethiopia revealed a prevalence rate of 8.2% [30]. The difference might be due to agro-economical condition of the area and a season at which the activity of biting flies is high to play a major role in the disease transmission.

This finding was also higher than the results of [31] at Amhara region, Northwest Ethiopia (2.1%) and [32], Dale Sadi district, Western Oromia (5.84%). Report from Didessa district of Illu Aba Bora zone described the prevalence rate to be 4.86% [33]. The result of [34] from Arbaminch was lower than the present study (4.43%). This might be due to the lack of recent study and application of effective controlling methods in the study.

The finding of this study revealed that the majority of the infection was due to T. *congolense* (60%) followed by T. *vivax* (36%). The higher infection rate with T. *congolense* in the study area is in agreement with the trypanosome species prevalence data from other tsetse infected region of Ethiopia. An infection rate of 58.5% for T. *congolense* and 32.2% for T. *vivax* was reported in South-west of Ethiopia [7]. From northern Ethiopia, an infection rate of 54.3% for T *congolense* and 45.7% for T.*vivax* was reported. Such a high ratio of T. *congolense* may be caused by the presence of a biological vector (Glossina), whereas T. *vivax* is more readily transmitted mechanically by biting flies than tsetse flies and T. *congolense* is mainly confirmed in the blood, while T. *vivax* and T. *brucei* also invade the tissues [33].

The prevalence of the disease between the addresses was compared and found to be slightly higher in Haro Gudisa (10.18%) followed by Jaweja (6.42%). However, there was no significant association between prevalence rate and addresses. This might be due to the similarity of the addresses in climate, altitude and vegetations since they are located around each other. All of them are virtually exposed to the infestation of tsetse flies.

The associations of the disease with sex, age and body condition were assessed. Accordingly, there was no significant difference in the prevalence of trypanosomosis in male animals compared with female animals (p=0.753). This result was in close agreement with what was reported previously by [35, 31]. No statistically significant difference in the prevalence rates in sex as [36, 37]. And this might be due to the fact that both sexes have virtually similar exposure to biting flies in grazing areas.

There were previous reports showing higher prevalence in adult animals as compared to young animals which is believed to be due to high preference of tsetse for adult animals and less exposure of young animals to tsetse challenge as they are usually kept at homestead [38, 39]. But the present finding revealed that the prevalence in adult animals was slightly higher than in younger animals. There was no significant association between age and prevalence rate. This might be due to most of the animals that were considered as young during sampling were between 2 and 3 years. They were not suckling and were allowed to graze with older cattle. Both adult and young animals were field grazers and they had equal exposure to biting flies in grazing lands. This was in line with previous reports by [26, 40].

Significant association was observed between body condition score and infection rate. According to the present result, the prevalence rate of the disease is significantly higher in animals with poor body condition. This finding is consistent with the observations of [13, 17]. However it would be difficult to conclude either poor body condition predispose to trypanosome infection or trypanosome infection cause loss of body condition based on such cross-sectional study done by [41, 42].

CONCLUSION

The study results revealed that bovine trypanosomosis in four PAs of Gudeya Bila district indicated that an overall 6.5% prevalence of the disease. In this study, T. *congolense* (60%), T. *vivax* (36%) and T.b. brucei (4%) are trypanosomes species identified. Higher prevalence of trypanosomosis infection was observed in animals with poor body condition with a significant association between them. No significant association of prevalence rate in relation with other risk factors (sex, age and villages) was observed. From this study it is possible to conclude that trypanosomosis is an important disease and a potential threat affecting the health and productivity of animals in the study area.

Therefore based on the above conclusion, the following recommendations were forwarded:

- Strategic control of bovine trypanosomosis including vector control should be strengthened to improve livestock production and agricultural development in the area.
- Attempt should be made to expand government and private veterinary services to serve the community in the study areas.
- Laboratory facility and skilled veterinary professionals should be fulfilled in the clinic to avoid tentative diagnosis which is a challenge for drug resistance.
- Further surveys and studies should be conducted and appropriate, feasible control of trypanosomosis must be done.
- Educating the public in the affected areas of trypanosome to participate in control strategies.

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