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Full Length Research Paper

Prevalence and host related risk factors of bovine trypanosomosis in Hawagelan district, West Wellega zone, Western Ethiopia

Mihreteab Bekele[1]* and Mubarik Nasir[2]

[1]School of Veterinary Medicine, College of Agriculture and Veterinary Medicine, Jimma University, P. O. Box 307, Jimma, Ethiopia.
[2]Qebena District Agricultural Office, Gurage Zone, Southern Nations, Nationalities and Peoples' Regional State, Ethiopia.

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A survey was conducted in Hawagelan district, West Wellega zone, western Ethiopia from November 2009 to March 2010 to determine the prevalence of bovine trypanosomosis and the prevailing species of trypanosomes as well as to assess host related risk factors. Blood samples collected from 384 randomly selected cattle were subjected to parasitological and haematological analysis. The overall prevalence was found to be 8.6%. *Trypanosoma congolense* was the predominant species in the area (72.7%). The prevalence among the species of trypanosomes showed statistically significant difference (P<0.05). However, it was not statistically significant between sex and the different age groups (P> 0.05). The mean packed cell volume (PCV) value of the infected animals was lower (20.8%±3.2) compared to non-infected animals (24.9%±3.8). There was statistically significant difference (P<0.05) in the PCV values of infected and non-infected animals. Moreover, animals with different body condition exhibited statistically significant variation (P<0.05) in the prevalence of trypanosomosis. Finally, this work showed that trypanosomosis is an important disease affecting the health and productivity of cattle in the district. Hence, due attention should be given to this sector so as to improve livestock production and agricultural development in the area.

Key words: Hawagelan, cattle, survey, trypanosomosis.

INTRODUCTION

Trypanosomosis is a serious parasitic disease caused by different species of unicellular parasites (trypanosomes) found in the blood and other tissues of vertebrates including livestock, wildlife and people (Tesfaye, 2002; Uilenberg, 1998). The disease in domestic livestock causes a significant negative impact in food production and economic growth in many parts of the world, particularly in Sub-Saharan Africa (Taylor, 1998). Trypanosomosis which takes the form of an acute or chronic status is normally characterized by fever, anaemia and loss of productivity. Among domestic animals, cattle are most susceptible to *Trypanosoma congolense*, *Trypanosoma vivax* and *Trypanosoma brucei* infections (Blood and Radostits, 2007). The effects of trypanosomosis is not only due to the direct losses resulting form mortality, morbidity, infertility of the infected animals and costs of treatment or controlling the disease but also due to indirect losses, which include exclusion of livestock and animal power from the huge fertile tsetse infected areas (Awoke, 2000). Accordingly, trypanosomosis is ranked among the top ten global cattle diseases impacting on the poor (Perry et al., 2002). In Africa, animal trypanosomosis and its vectors occur in vast areas of Sub-Saharan Africa with devastating impact on livestock productivity (PATTEC, 2001). In Ethiopia, about 220,000 km^2 in the South West and North West part of the country following the greater river basins of Abay, Omo, Ghibe and Baro and having a high potential for agricultural development are infested with five species of tsetse files namely, *Glossina pallidipes, Glossina*

*Corresponding author. E-mail: Mihreteab124@yahoo.com or mihreteab.bekele@ju.edu.et. Tel: +251 047 111 0102, +251 911 316089. Fax: +251 047 111 09 34.

morsitans, Glossina fuscipes, Glossina tachinoides and Glossina longipennis (Langridge, 1976).

According to Getachew et al. (2004), trypanosomosis is prevalent in two main regions of Ethiopia that is, the North West and the South West regions. Six species of trypanosomes are recorded in Ethiopia and the most important trypanosomes, in terms of economic loss in domestic livestock are the tsetse transmitted species: *T. congolense, T. vivax* and *T. brucei*. For the closely related *T. brucei* subspecies, *T. b. rhodensiense, which* causes human sleeping sickness, cattle can be a reservoir host. The other trypanosome species of economic importance are *Trypanosoma evansi* of camels and *Trypanosoma equiperdum* of horses (Getachew, 2005). According to NTTICC (2004), tsetse transmitted animal trypanosomosis still remains as one of the largest causes of livestock production losses in Ethiopia. About 10 to 15% of the land believed to be suitable for livestock production is affected by one or two species of the tsetse flies (NTTICC, 2002). While tsetse-borne trypanosomosis is excluding agriculturally suitable land of the country; 14 million head of cattle are at the risk of contracting trypanosomosis at any one time (Langridge, 1976; Moard, 2004). A number of studies have been so far undertaken in different parts of Ethiopia to determine the magnitude of this economically important disease (Cherinet et al., 2006; Adane and Gezahegne, 2007; Miruk et al., 2008; Nigatu and Abebe, 2009; Abebayehu and Biniam, 2010; Abebayehu et al., 2011). Nevertheless, very few and limited studies were carried out hitherto to assess the prevalence of this disease in Hagawelan District.

Therefore, the objectives of the study were to determine the prevalence of bovine trypanosomosis, to identify the prevailing species of trypanosomes and to assess host related risk factors in Hagawelan District, West Wellega zone, Oromia Regional State of Ethiopia.

MATERIALS AND METHODS

Study area

The study was carried out in Oromia National Regional State, West Wellega zone, in Hawagelan District which is located at 515 km away form Addis Ababa towards the west part of Ethiopia. The study area has an altitude of 1200 to 2200 m above sea level; temperature range from 15.5 to 32.5°C with the annual average being 24°C. The area receives an average annual rainfall of 700 to 1100 mm. The district covers an area of 79,849 km^2 hectares and it is bordered by Dalewabera at east, Sayo at west, Yamalogiwalel at north and Illubabor at south. The livestock populations in the district include cattle, sheep, goat, horses, donkey and poultry. Among these animals, cattle are the predominant species raised in the area. The cattle population in West Wellega zone is estimated to be about 859,614 (CSA, 2008).

Study design

A cross-sectional study was conducted in Hawagelan district, West Wellega zone, Western Ethiopia in dry season from November 2009 to March 2010 to determine the prevalence of bovine trypanosomosis, to identify the prevailing species of trypanosomes and to assess host related risk factors.

Study population

Out of 32 villages in the district, 8 namely: Mede Telila, Boke, Chiro, Mesela, Ifabas, Odamoti, Village 17 and 18 were purposively selected based on accessibility and the number of cattle population. The animals were maintained under traditional management system. The main feed of cattle in the study area was natural pasture. During the dry season cattle were fed on crop residues.

Sample size determination and sampling method

The sample size was calculated according to the formula given by Thrusfield (2005) with 50% expected prevalence (considering that no previous study has been done in the area), 95% confidence level and 5% precision. Simple random sampling technique was followed to select individual animals. During sampling, age, sex and body condition of the animals were recorded. Body condition for each cattle was estimated based on Nicholson and Butterworth (1986) ranging from score 1 (emaciated) to 5 (obese).

Study methods and procedures

Parasite survey

Packed cell volume (PCV) determination: Blood samples were obtained by puncturing the marginal ear vein with a lancet and collected directly into a pair of heparinised capillary tubes. The tubes were then sealed at one end with crystal seal. PCV was measured in a micro-haematocrit centrifuge (Hawksley and Sons, UK). The capillary tubes were placed in microhaematocrit centrifuge with sealed end outer most. Then the tube was loaded symmetrically to ensure good balance. After screwing the rotary cover and closing the centrifuge lid, the specimens were allowed to centrifuge at 12,000 rpm for 5 min. After centrifugation, the capillary tubes were 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. Animals with PCV less than 24% were considered to be anaemic (OIE, 2008).

Buffy coat technique

Heparinised microhaematocrit capillary tubes, containing blood samples were centrifuged for 5 min at 12,000 rpm. After the centrifugation, trypanosomes were usually found in or just above the buffy coat layer. The capillary tube was cut using a diamond tipped pen 1 mm below the buffy coat to include the upper most layers of the red blood cells and 3 mm above to include the plasma. The content of the capillary tube was expressed onto a glass slide, and covered with cover slip. The slide was examined under x40 objective and x10 eye piece for movement of parasite (Paris et al., 1982). Trypanosome species were identified according to their morphological descriptions as well as movement in wet film preparations provided by OIE (2008).

Thin blood smear

A small drop of blood from a micro haematocrit capillary tube was 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

Table 1. Prevalence of bovine trypanosomosis in the study area.

Villages	No ofanimals examined	No ofpositives	Prevalence (%)	95% confidenceinterval	
Mede Telila	96	13	13.5	6.7	20.4
Boke	48	3	6.3	-0.6	13.1
Chiro	24	1	4.2	-3.8	12.2
Mesela	36	2	5.6	-1.93	13.1
Ifabas	48	3	6.3	-0.6	13.1
Odamoti	36	2	5.6	-1.93	13.1
Village 17	36	3	8.3	-0.7	17.4
Village 18	60	6	10	2.41	17.6
Total	384	33	8.6	5.8	11.4

$\chi^2 = 5.262^a$, P = 0.628 and df = 7.

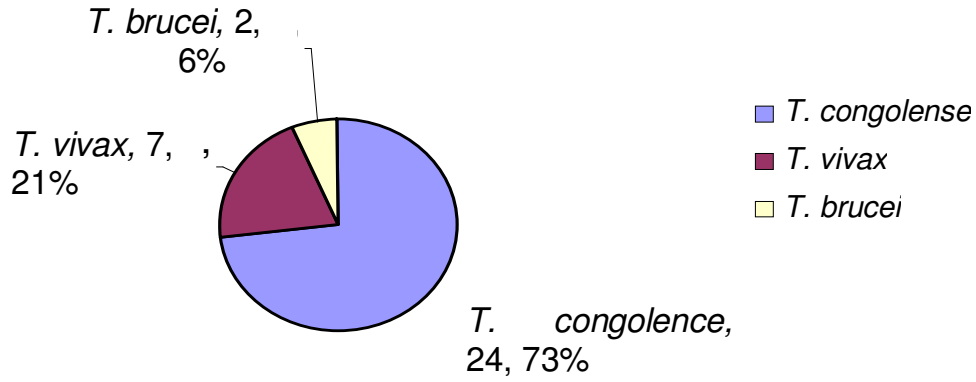

Figure 1. Distrubution of the species of trypanosomes among the infected animals.

fixed for 2 min in methyl alcohol. The thin smear was flooded with Giemsa stain (1:10 solution) for 30 min. Excess stain was drained and washed by using distilled water. Then it was allowed to dry by standing up right on the rock and examined under the microscope (x100) oil immersion objective lens (OIE, 2008).

Data analysis

Collected raw data and results of parasitological and haematological examination were entered in to a Microsoft excel spread sheets program and then was transferred to SPSS version 16 for analysis. The prevalence of trypanosome infection was calculated as the number of positive animals as examined by Giemsa stain of thin blood film and buffy coat method divided by the total number of animals examined at the particular time. Pearson's chi-square ($\chi 2$) was used to evaluate the association of different variables with the prevalence of trypanosome infection. P-value less than 0.05 (at 5% level of significance) were considered significant in all analysis.

RESULTS

Parasitological findings

Out of 384 cattle examined, 33 (8.6%) were positive for trypanosomosis. According to the sampled villages of the district, the highest prevalence was observed in Medetelila and the lowest in Chiro (Table 1); however, the differences were not statistically significant (P>0.05).

Distribution of trypanosome species

T. congolense, T. vivax and *T. brucei* were the prevailing species of trypanosomes in the study area. Of the 33 infected cattle, 24 (72.7%; 95% CI, 57.5 to 87.9%) harboured *T. congolense,* 7 (21.2%; 95% CI, 7.26 to 35.2%) *T. vivax* and 2 (6.1%; 95% CI, -2.08 to 14.2%) *T. brucei*. Accordingly, *T. congolense* was the most prevalent followed by *T. vivax* and *T. brucei* (Figure 1) and the observed difference in the prevalence among the various species of trypanosomes was statistically significant (P<0.05).

Haematological findings

The mean PCV value of the infected animals was lower (20.8%±3.2) as compared to the mean PCV value of non-infected animals (24.9%±3.8) and statistically significant difference was observed between the PCV value of

Table 2. Prevalence of bovine trypanosomosis based on host related risk factors.

Host related risk factors	No examined	No of positives	Prevalence (%)	95% confidence interval		χ^2(p-value)	df
Sex							
Male	303	27	8.9	5.7	12.1		
Female	81	6	7.4	1.7	13.1	0.184[a](0.668)	1
Total	384	33	8.6	5.8	11.4		
Age, years							
< 2	11	0	0	-	-		
2-5	144	9	6.2	2.3	10.2	3.08[a](0.215)	2
> 5	229	24	10.5	6.5	14.5		
Total	384	33	8.6	5.8	11.4		
Body condition							
Good	133	2	1.5	-0.57	3.57		
Medium	141	14	9.9	5.0	14.9	15.423[a](0.000)	2
Poor	110	17	15.5	8.7	22.2		
Total	384	33	8.6	5.8	11.4		

χ^2 = 3.480E2[a], P = 0.000 and df = 3.

infected and non-infected animals (P<0.05).

Prevalence of trypanosomosis according to age, sex and body condition

The prevalence of trypanosomosis was higher in males as compared to female animals (Table 2). However, the difference was not statistically significant (P> 0.05). The highest prevalence was observed in the adult animals greater than 5 years old (Table 2) and the variation in prevalence between the different age group was not statistically significant (P> 0.05).

Prevalence of trypanosomosis based on body condition

There was a statistically significant variation in the prevalence of trypanosomosis (P<0.05) among those animals with different body condition (Table 2).

DISCUSSION

The overall prevalence in the study area was 8.6% (95% CI, 5.8 to 11.4%) indicating that trypanosomes are still of much concern and represent a major obstacle to livestock production. Nevertheless, this result was lower as compared to a range of studies conducted previously in Ethiopia; for example, Abebe and Jobre (1996) at tsetse infested areas of Ethiopia (17.67%); Afework (1998) at Pawi, North West Ethiopia (17.20%); Wondesen (1986) in Bunno (18%); Shimelis et al. (2005) in Dembecha and Tabitehenan (12%); Abiy (2002) in Goro District (19.01%) and Yohanes (1997) in Metekel District (17.20%). Obviously, there is a higher prevalence of the disease in wet season and lower in dry season (Thomas, 1999) probably reflecting the seasonal population dynamics of biting flies. The lower prevalence of in this study might therefore be partly attributed to the fact that it was conducted during the dry season. *T. congolense* was the predominate species (72.7%; 95% CI, 57.5 to 87.9%) in the study areas as compared to other species of trypanosomes. This is in agreement with the previous results of Abebe and Jobre (1996) for tsetse infested areas of Ethiopia (58.5%); NTTICC (2003) Frat Adanhegn peasant association (62.5%); Muturi (1999) at Mereb Abaya, South Ethiopia (66.1%) and Terzu (2004) in selected sites of Southern region (63.4%). Moreover, the results of Tewelde (2004) at Kone (75%) and village I (93%) settlement areas of west Ethiopia, Woldeyes and Aboset (1997) at Arbaminch Zuria districts (85.2%) and Rowland et al. (1993) in Ghibe valley, south west Ethiopia (84%) had also shown higher results of *T. congolense*. These suggest that the major cyclical vectors or Glossina species are more efficiently transmitters of *T. congolense* than *T. vivax* in east Africa (Langridge, 1976).

According to Getachew (2005), *T. congolense* and *T. vivax* are the most prevalent trypanosomes that infect cattle in tsetse infested and tsetse free areas of the Ethiopia respectively. Even though higher infection rate (8.9%; 95% CI, 5.7 to 12.1%) was registered for males as compare to the females (7.4%; 95% CI, 1.7 to 13.1%), the difference was not statistically significant (P>0.05). This result is in agreement with the previous researches reported by Adane and Gezahegne (2007) and

Abebayehu et al. (2011). This might be due to the fact that both sexes have virtually similar exposure to flies in grazing areas. There was higher prevalence of the disease in older animals >5 years as compared to those in younger 2 to 5 years old. No infection was observed in the eleven examined animals less than two years old (Table 2). This might be owing to very small sample size of this age category. In addition, Rowlands et al. (1995) in Ghibe valley indicated that suckling calves are not allowed to go out with their dams until they are weaned off. Young animals are also naturally protected to some extent by maternal antibodies (Fimmen et al., 1999). This could result in low prevalence of trypanosome that was observed in calves. Nevertheless, the observed difference observed in the prevalence of trypanosomosis among the age group was not statistically significant ($P>0.05$). The trypanosome infection in those animals with poor body condition were significantly higher ($P<0.05$) than those in good body condition. This was in agreement with (Abiy, 2002). On one hand, the disease itself results in progressive emaciation of the infected animals; nevertheless, on the other hand non–infected animals under good body condition are with good immune status that can respond to any foreign protein better than those non–infected cattle with poor body condition which can be immune compromised due to other diseases or malnutrition, since malnutrition and concurrent infections depress the immune responsiveness in some cases (Collins, 1994). The mean PCV value of parasitemic animals is found to be significantly lower (20.8%±3.2) than that of aparasitemic (24.9%±3.8) animals which is similar to the results obtained by Haile (1996), SVRL (2006) and Cherinet et al. (2006).

Taking the PCV value 24 to 46% as normal for zebu cattle (Blood and Radostits, 2007), 70% of the parasitemic and 40% aparasitemic animals have registered PCV values less than 24%. This suggest that even though anaemia is characteristic of trypanosomosis, other factors can also cause reduced PCV yet some trypanosome infected animals can also keep their PCV within the normal range for a certain period of time. So, while diagnosing trypanosomosis on the basis of PCV, one should take various anaemia causing agents into consideration.

CONCLUSION AND RECOMMENDATION

Our study revealed that *T. congolense, T. vivax* and *T. brucei* were the prevailing species of trypanosomes in the study area. In relation to the host risk factors, the prevalence of bovine trypanosomosis was highest in those animals with poor body condition. Finally, bovine trypanosomosis is an important disease and a potential threat affecting the health and productivity of cattle in the district. Hence, the necessary attention should be given to this disease so as to improve livestock production and agricultural development in the area.

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