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PREVALENCE OF BOVINE TRYPANOSOMIASIS AND ITS VECTOR DENSITY IN SHEKA ZONE, ANDERACHA WOREDA

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ABSTRACT: A cross sectional study was conducted in Andracha woreda Sheka Zone of South western Ethiopia to determine the prevalence and associated risk factors of bovine trypanosomiasis using parasitological and entomological study. It was conducted from November, 2015 to April, 2016. Blood samples from randomly selected 383 cattle of both sex and different age groups were collected and examined with hematological and parasitological techniques. Out of the total examined cattle, 8(2.1%) were infected with trypanosomes. The highest infections were due to *Trypanosoma conglense* (1.3%) followed by mixed infection (0.52%) and *Trypanosoma brucei* (0.26%). The disease was more prevalent (2.3%) in females than in male cattle (0.2%). There were no statistically significant difference among / between age and sex groups (P>0.05). The mean PCV (%) values during the study period were 23.38 ± 1.51 in parasitaemic and 30.02 ± 0.14 in aparasitaemic animals, which was found statistically significant (P<0.05). *Glossina pallidipes* were the only fly species caught during the study period and the entomological monitoring showed that the apparent density (expressed as flies per trap per day, i.e. f/t/d) of *Glossina Pallidipes* in the study area were 0.83, 0.89, 1.11 and 0.44 at Yokchichi, Gemadro, Beshifa and Shebena, respectively; with the overall apparent density of 0.82. Since it is endemic diseases, strategic control of bovine trypanosomiasis including vector control should be strengthened to improve livestock production in this area.

Keywords: Trypanosoma, prevalence, Glossina, PCV, Anderacha woreda, Sheka, Ethiopia

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INTRODUCTION

Trypanosomiasis is a complex disease caused by unicellular parasites found in the blood and other tissues of vertebrates including livestock, wildlife and people. African animal trypanosomosis (AAT) is found mainly in those regions of Africa where its biological vector (tsetse fly) exists (CFSPH, 2009). Although the occurrence and impact of trypanosomosis depends on tsetse challenge, host distribution, livestock breeds, farming practices and control practices. African animal trypanosomosis causes serious economic losses in livestock through mortality and morbidity of affected animals, reduced productivity, treatment and prevention costs, abandoning arable land etc. (FAO, 2002).

Moreover, the presence of animal trypanosomosis is a major constraint to the introduction of highly productive exotic dairy animals and draught oxen to lowland settlement and resettlement areas for the utilization of large land resources. Since more than 90 percent of crop production in Ethiopia is dependent on animal draught power mainly on ploughing oxen, many large fields lie fallow due to a lack of these animals in trypanosomosis infested area, which worsens the food supply and living conditions in affected areas (Mulaw et al., 2011).

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The risk of infection in humans as well as in domestic animals has greatly affected social, economic and agricultural development of communities within tsetse infested areas which roughly constitutes more than a third (10 million Km square of Africa between 14°N and 29°S) of the continent. The 31 species of tsetse flies that invade one-third of Africa through the Trypanosomes they transmit to humans and animals overshadow and darken the public health and agriculture sector in 38 African countries via exposing 160 million cattle to the risk of anemia, emaciation and death .Tsetse flies in Ethiopia are confined to southwestern and northwestern regions between longitude 33^0 and 38^0 E and latitude 5^0 and 12^0 N, covering an area of 220000 Km^2 (Dagnachew et al., 2011).

Bovine trypanosomiasis continued to be the major constraints of livestock production in Sub-Saharan Africa, jeopardizing the lives of 55 million people. The most important trypanosome species affecting cattle in Ethiopia are *Trypanosoma congolense, Trypanosoma vivax*, and *Trypanosoma brucei* (Alemayehu et al., 2012). Negative consequence of trypanosomosis on cattle health and production is influenced by Trypanosome species, Trypanosome strain, and age of the infected animal, breed and nutritional status (Tasew et al., 2012). The disease leads to loss of productivity in animals and, without treatment, is frequently fatal. Large areas of land are today left with relatively few cattle because of the presence of the tsetse fly, and the estimated losses in agricultural output and productivity are very significant (FAO, 2002).

The influence of tsetse on African agriculture through the transmission of trypanosomiasis continues to be a major constraint to the development of national economies and their achievement of self-sufficiency in basic food production. The general distribution of tsetse flies is determined principally by climate and influenced by altitude, vegetation, and presence of suitable host animals. Tsetse flies in Ethiopia are confined to southern and western regions between longitude 33^0 and 38^0 East and latitude 5^0 and 12^0 North which amounts to about 200,000 Km^2. Tsetse infested areas lied in the low lands and also in the river valleys of Blue Nile, Baro Akobo, Didessa, Ghibe and Omo. Out of the nine regions of Ethiopia five (Amhara, Beninshangul Gumuz, Gambella, Oromia and Southern Nation Nationalities and peoples) are infested with more than one species of tsetse flies (Keno, 2005). Although several studies have been carried out so far in different part of the study (Mulaw et al., 2011; Alemayehu et al., 2012; Gebreyohannes and Legesse, 2014; Teka et al., 2012; Lelisa et al., 2015; Takile et al., 2014; Adale and Yasin, 2013) there is still paucity of information in the current study area the study was conducted in the study area. This study was conducted with the following objectives: to assesses the prevalence of bovine Trypanosomosis in the study area and to evaluate the apparent density of bovine Trypanosomosis vectors in the study area.

MATERIAL AND METHOD

Study area

The study was conducted at Sheka zone, Anderacha woreda. Anderacha is one of the woredas in the Southern Nations, Nationalities, and Peoples' Region of Ethiopia. Part of the Sheka Zone, Anderacha is bordered on the south by Yeki, on the southwest by the Gambela Region, on the northwest by the Oromia Region, on the north by Masha, and on the east by the Keffa Zone. Based on the 2007 Census conducted by the CSA, this woreda has a total population of 23,985, of whom 12,048 are men and 11,937 women. The agricultural activity is mixed farming majorly depends on coffee production (CSA, 2009).

Study population and Study animals

The study animals were local breed cattle (231 males and 160 females) kept under small holder extensive management system in the study area. For ease of analysis and based on their reproductive biology, the sampled animals were categorized into young (1 - 3 years), and adult (>3 years). Body condition scores were estimated as per the recommendations of Nicholson and Butterworth (1986) for evaluating the body condition of zebu cattle. The body condition of animals was recorded by classifying animals in to three groups as good, medium, and poor based on the appearance of ribs and dorsal spines.

Study design

A cross sectional study was conducted at Sheka zone, Anderacha woreda of four randomly selected kebeles to determine the prevalence of trypanosoma infection in cattle and its vector density.

Sample size and sampling method

Systematic random sampling technique was used to select the study subjects from the population in the study area. The sample size was determined based on previously conducted research by Alemayehu et al. (2012) at Chena woreda of 6.9% expected prevalence and absolute desired precision of 5% at 95% confidence level. The desired sample size was calculated using the standard formula described by Thrusfield (2005) and found 99 cattle. However, a total of 383 samples were taken to increase precision.

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Study methodology

Parasitological survey: For parasitological examination a total of 383 blood sample were collected from ear vein of each cattle using microhaematocrit/ capillary tube. During blood collection the necessary bio-data of each animal was recorded. The microhaematocrit / capillary tubes were filled with blood to 2/3 of their length and centrifuged for 3 min at 1500 rpm and examined for trypanosomes by cutting the capillary tube slightly below the Buffy coat to include erythrocytes. The content of the Buffy coat was poured on a slide and covered with cover slip and examined using a microscope. Species identification was done by morphological examination of trypanosomes on Giemsa stained thin blood smears prepared from the positive animals and examined under a microscope using the oil immersion objective (Murray et al., 1988).

Hematological survey: Blood samples for packed cell volume (PCV) were also collected from the selected cattle using heparinized capillary tubes. The packed cell volume (PCV) was measured after centrifugation of the tubes for 5min at 12,000 rpm in microhaematocrit centrifuge and the results were observed using microhaematocrit reader following the standard procedure described by (Murray et al., 1988).

Entomological survey: For the entomological study, tsetse flies were collected by 24 NGU traps deployed in different positions of the study areas of different kebele. Six traps each were deployed at Yokchichi, Gemadro, Beshifa and Shebena kebeles. Traps were deployed in the riverside at approximately 100 m apart for 3 consecutive days. In all the traps Acetone was used as a bait to attract the flies. Fly catch per trap per day (f/t/d) was determined to calculate the fly density and distribution (Leak et al., 1987). Species of the caught flies were identified as described by Uilenberg (1998) and Pollock (1982). Sexing was also done for the flies just by observing the posterior end of the ventral aspect of abdomen by hand lens as a result male flies easily identified by enlarged hypophgeum (Bright et al., 1992).

Data management and analysis

Data collected were entered into Microsoft Excel spread sheet and descriptive statistics was applied to calculate the prevalence of trypanosomiasis using STATA, 2013; window version 13.1. The Percentages (%) were used to measure prevalence and chi-square ($\chi 2$) to measure significance of association among variables considered in this study. In all analysis, confidence level was held at 95% and $P < 0.05$ was set for significance.

RESULT

Parasitological Findings

From the total of 383 cattle examined with a Buffy coat technique, 8 were Positive for trypanosomes giving an overall prevalence of 2.1%. The prevalence of bovine trypanosomiasis was different among the kebeles, the highest being in Beshifa (4.2%) and the lowest in Shebena (0%), however there was no statistically significant difference ($p>0.05$). *Trypanosoma congolense*, and *Trypanosoma brucei* were the Trypanosoma species identified by Giemsa stained thin blood smear examination. Among the total of 8 cases of trypanosome infections detected 5(62.5%) of the infections were due to *T. Congolense*, 1(12.5%) were due to *T. brucei* and mixed 2(25%) (Table 1). Sex wise prevalence of trypanosome infection was slightly higher for female (2.3%) than for male (2%) cattle. However, statistically significant difference ($P>0.05$) was not observed between sexes (Table 2). With respect to body condition score, prevalence was 11.62%, 1% and 0.86% for poor, medium and good body condition score, respectively; which showed statistically significant variation ($P<0.05$) between them. The prevalence of trypanosomosis from 126 young cattle was 1(0.8%) and from 257 adult cattle was 7(2.72%) with no a statistical significant difference ($P>0.05$) among age groups ($p=0.215$).

Hematological finding

The mean PCV (%) values during the study period were 23.38 ± 1.51 in parasitaemic and 30.02 ± 0.14 in aparasitaemic animals. Statistical analysis made to compare mean PCV value of parasitaemic and aparasitaemic animals revealed parasitaemic animals had lower mean PCV than aparasitaemic animals, moreover there was a statistically significant difference ($p= 0.000$) between the two variables. Cattle having PCV value ≤24 was 8(2.1%) and PCV>24 was 375(97.9%).

Entomological finding

A total of 59 flies were caught in all kebeles. The flies belong to Glossina species and all of them were *Glossina pallidipes*. The overall apparent fly density was 0.82 f/t/d (Table 4). Glossina pallidipes were caught during

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the study period and the entomological monitoring showed that the apparent density of Glossina Pallidipes in the study area were 0.83f/t/d, 0.89f/t/d,1.11f/t/d and 0.44f/t/d at Yokchichi, Gemadro, Beshifa and Shebena respectively with the overall apparent density of 0.82 F/TD.

Table 1 - Species of Trypanosomes and its prevalence in different kebele

Kebele	No. of animals examined	No. (%) positive for *T. congolense*	No. (%) positive for *T. brucei*	Mixed	Overall positive (%)
Yokchichi	96	1(1.04%)	1(1.04%)	0(0%)	2(2.1)
Gemadro	96	1(1.05%)	0(0%)	1(1.04%)	2(2.1)
Beshifa	95	3(3.12%)	0(0%)	1(1.05%)	4(4.2)
Shebena	96	0(0%)	0(0%)	0(0%)	0 (0)
Total	383	5(62.5%)	1(12.5%)	2(25%)	8(2.1)

Table 2 - Prevalence of Trypanosomosis and its associated risk factors

Variable	Categories	No. of animals examined	No. (%) Positive	Prevalence	P value
Sex	Female	174	4 (2.3)	4.139	0.793
	Male	209	4(2)		
Age	Young	126	1(0.8)	1.540	0.215
	Adult	257	7(2.7)		
BSC	Poor	43	5(11.6)	21.552	0.000*
	Medium	224	2(1)		
	Good	116	1(0.86)		
PCV	Anemic	8	7(87.5)	291.449	0.000*
	Non-anemic	375	1(0.26)		

*P < 0.05; = significant

Table 3 - Mean PCV of the examined cattle over aparasitaemic and parasitaemic animals

Over	Mean	Std. Err	(95 % Confidence. Interval)	
Aparasitaemic	30.02	0.138	29.75	30.29
Parasitaemic	23.37	1.511	20.40	26.35

*P =0.05; significant

Table 4 - Distribution, Sex identification and apparent density of G. pallidipes flies trapped from the study area in Anderacha wereda

Study site (kebele)	No of trap deployed	Tsetse fly caught on 3rd day			
		Male	Female	Total	F/T/D
Yokchichi	6	8	7	15	0.83
Gemadro	6	7	9	16	0.89
Beshifa	6	11	9	20	1.11
Shebena	6	3	5	8	0.44
Total	24	29	30	59	0.82

DISCUSSION

The overall prevalence of trypanosomiasis recorded in the present study was 2.1%. This result is lower than study conduct by Alemayehu et al. (2012), Gebreyohannes and Legesse (2014) and Teka et al. (2012) at Chena wereda, in Weliso wereda and selected villages of Arbaminich, respectively. The lower prevalence observed in the current study could be due to previous control method implemented in the study areas for the last years by prophylactic, chemotherapy and insecticide methods. From the 8 trypanosoma infected cattle encountered, 5(62.5%) was positive for *T.conglense,* 1(12.5%) for *T.brucei* and 2(25%) were positive for mixed infection. This

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result approaches to study conducted by Lelisa et al. (2014) in Hawa–Gelan district. The presence of relatively higher infection by *T. congolense* probably suggests that transmission of trypanosomes in the study area is more of biological than mechanical.

Although the prevalence of Trypanosomosis was relatively higher in female cattle than males there was no significant difference between sexes groups (P > 0.05). This finding is consistence with Lelisa et al. (2015), Takile et al. (2014), Adale and Yasin (2013) and Mulaw et al. (2011) who did similar investigation at Mandura District Northwest Ethiopia, Guto Gida District of East Wollega Zone, Wolaita Zone Kindo Koish District and Assosa, respectively. The result did not agree with study done by Teka et al. (2012), in selected villages of Arbaminch and Gemeda (2015) in and around Nekemte Areas, East Wollega Zone. The high prevalence in females may be related to their milk production and pregnancy makes them stressed and result in susceptible to the infection.

The prevalence of trypanosomosis from 126 young cattle was 1(0.8%) and from 257 adult cattle it was 7(2.72%); with no statistical significant difference (P>0.05) among age groups (P=0.215). This result agrees with study conducted by Alemayehu et al. (2012) in Chena Wereda, and Bishaw et al. (2012) at Wembera district of West Gojam. This result is different from study conducted by Dagnachew and Shibeshi (2011) anger valley of East Wollega Zone and Teka et al. (2012), at selected areas of Arbaminich. This may be due to the fact that most of the young animals in the study area were confined to house and they don't have access to grazing lands where the vectors usually prevail. However, the observed difference in the prevalence of trypanosomosis between the age groups could be associated partly to the non-proportional sampling and sample size. The disease was found with the highest prevalence in poor body condition (11.62%) followed by in medium (1%) and good body condition (0.86%). This finding was consistent with the study conducted by Habte et al. (2015) at Darimu District, Ilu Aba Bora Zone, Western Ethiopia, Lelisa et al. (2014) in three selected settlement areas of Hawa-Gelan district, western Ethiopia, Feyisa et al. (2015) in Didesa District of Oromia Regional state and Gebreyohannes and Legesse (2014) at Wolliso Wereda. It may be related with the disease itself causes progressive emaciation of the infected animals. In the other scenario, animals with good body condition have well developed immune status that can respond to any infection than those non–infected cattle with poor body condition

The mean PCV (%) values during the study period were 23.38 ± 1.51 in parasitaemic and 30.024 ± 0.14 in aparasitaemic animals. This result agrees with study conducted by Feyisa et al. (2015) at Didesa District of Oromia Regional State and Dagnachew and Shibeshi (2011) at anger valley of East Wollega Zone. The interplay of several factors acting either individually or synergistically contributes to the development of haemolytic anaemia in human and animal trypanosomosis. Most common among these factors are erythrocyte injury caused by lashing action of trypanosome flagella, undulating pyrexia, platelet aggregation, toxins and metabolites from trypanosomes, lipid peroxidation and malnutrition. Meanwhile, idiopathic serum and tumor necrosis factors are responsible for dyserythropoieses (Mbaya et al., 2012). Comparable overall apparent density of flies (1.4) has been recently reported by Shiferaw et al. (2016). The lower overall apparent fly density may be attributed to the season of the year during which the traps were deployed. However, recording these much apparent densities of Glossina Pallidipes during the dry season of the year can potentially pose huge influence on the disease transmission.

CONCLUSION AND RECOMMENDATION

The present study showed a relatively low prevalence of trypanosomiasis 2.1% and apparent density of tsetse flies 0.82 f/t/d in Anderacha wereda. However, this is an evidence not to be neglected that tsetse and trypanosomosis has yet continued to pose a considerable threat to cattle of the study area warranting an integrated parasite and vector control to safeguard cattle production and productivity. In this study *T. conglense* (62. 5%), *T. brucei* (12.5%) and mixed infection (25%) are trypanosome species identified and on entomological survey, only one species of tsetse fly identified was *G. pallidipes.* Higher prevalence of trypanosomosis infection was observed in animals with poor body condition and low PCV animals. From the total risk factors PCV and body condition are found significant. Based on the above conclusion, the following recommendation are forwarded

- Strategic control of bovine trypanosomosis including vector control should be strengthened to improve livestock production.
- Further surveys and studies should be conducted and appropriate, feasible control of trypanosomosis must be done.

Author's contribution

B Yigzaw performed the data collection, laboratory works and write up of the manuscript. T Asmare analyzed the data and S Derso revised the manuscript for important intellectual contents. All authors read and approved the final manuscript.

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Conflict of interests

The authors have declared that no competing interests exist.

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