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Study on prevalence of bovine trypanosomosis and its risk factors in Zala Woreda, SNNPRS, Southern Ethiopia

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Abstract

A cross sectional study was carried out from November 2016 to April 2017 in zala woreda of Gammo Gofa Zone, southern Ethiopia to determine the prevalence of bovine trypanosomosis and identify the prevailing species of trypanosome as well as to identify associated risks. During sampling sex, age and body condition of the animals were recorded as risk factors for the occurrence of the disease. The Buffy coat technique was employed for the detection of trypanosome and to measure packed cell volume (PCV) values. Thin blood smear with Giemsa staining was made from positive samples for species identification of the parasite. Out of the total 384 (229 female and 155 male) animals randomly selected and examined, 10 were found infected with trypanosomes with an overall prevalence of 2.6%. Among which, 6(61.1%) was found to be infected by *T. congolense* while 4(38.9%) were infected by *T.vivax*. Regarding to age of animals, the highest prevalence was detected in adult (> 2 years) (3%) while the lowest was in calves (≤ 2 years) (1.2%), the difference was not statistically significant (> 0.05). There was not significantly higher ($p > 0.05$) in males (4.5%) than females (1.3%).The prevalence trypanosomosis on the basis of body condition was 7.1% poor, 3.6% medium and 0.6% good. There was not statistical significant difference of infection rate between the body conditions of the animals. The mean packed cell volume values in parasiteamic animals was 20.60% while aparasiteamic animals 24.49% with not statistical significant difference. Generally, this study revealed that trypanosomosis is still a core problem for livestock production in the study area. Therefore, more attention should be given to control both the disease and tsetse flies.

Keywords: *Bovine; Prevalence; Risk Factor; Trypanosome; Trypanosomosis; Zala*

1. Introduction

Ethiopia is capable with the largest number of livestock population estimated more than 43.1 million cattle, 48 million small ruminants, 15 million camels, 7 million equines and 52 million chickens (CSA, 2010), which is the first in Africa and animal production plays a major role in economic development of the nation. In the country, Cattle are important source of income for rural communities and are one of the nation's major sources of foreign currency from export. However, this great potential is not properly exploited. This is because of endemic disease burdens, traditional management system, inferior genetic makeup coupled with malnutrition and absence of well-developed market infrastructure (Dereje *et al*., 2014).

Southern Nation Nationality and people Regional state has a total area of 438,370 hectare, which accounts for about 10 percent of the country. The main occupation of rural population is mixing farming practice where by crop and livestock are

managed hand- in hand together. Cattle directly provide food such as meat milk, food products such as hide. Indirectly they contribute over 30 percent to agricultural production by supplying essential input such as manure for replenishing soil fertility and restoring nutrient, and animal traction and power for ploughing and trashing; increasing the productivity of small holdings. Nevertheless many factors affect the maximum benefit to be obtained cattle. Livestock disease is among the major factors that affect production and productivity, and trypan osomosis is the most important disease that influences livestock productivity in the region (CSA, 2010).

Trypanosomosis is among the well known constraints to livestock production in Africa as it causes a serious and often fatal disease of livestock mainly in rural poor community and rightfully considered as a root cause of poverty in the content (Vreysen, 2006). It is the most serious disease of cattle which causes great socio economic losses in Africa. Its socio economic impact is reflected on direct losses due to mortality, morbidity, and reduction in milk and meat production, abortion and stillbirth. Additionally, reduction of livestock from tsetse infested grazing areas and reduced crop productions due to insufficient animal drought power are under indirect losses (Radostitis *et al*., 2007).It is a serious constraint to agricultural production in extensive areas of tsetse infested Ethiopia law lands. As a result of the trypanosomosi threat, a large proportion of the livestock population is found in the highlands that are assumed to be tsetse free (Mihret and Gezahagne, 2007).

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* (Bekele and Nasir, 2011). *T.vivax* also found in areas outside of the tsetse belt, which it can possibly transmitted by mechanical vectors of biting flies (Mulalem and Getachew, 1997). The reported prevalence varies from locality to locality depending on agro climatic conditions, seasons, and as part of activities which were intended to control the impact of the disease. The prevalence of T.congolence, T.vivax and T.brucei was 58.5%, 31.2%, and 3.5%, respectively in southern Ethiopia (Abebe and Jobre, 1996).However, T.congolense (36.36%) was the dominant trypanosome species followed by T.vivax (18.18%) and T.brucei (9.09%) in southwestern Ethiopia (Tadesse and Tsegaye, 2010).

It is believed that five Glossina species (Glossina (G) morsitans, G.pallidipes, G.fuscipes, G.tachinoides, and G.longipennis in Ethiopia with the first four lists being the most widespread having significant economic importance (Abebe, 2005).Tsetse species identified from Omo and Rift valley belts of SNNPR were G. m.submorsitans, G.fuscipes, G.pallidipes and G.longipennis (SRVL, 2000). The upper Omo and Gibe areas known to be especially infested by G.pallidipes, G.m.morsitans and G.fuscipes; but the Rift valley areas especially Lake Abay infested by G.pallidipes, G.tachinodes and G.longipennis (Bergenie, 2006).

In Ethiopia trypanosomosis is one of the important diseases which contribute to the direct and indirect economic losses on livestock production at least 6 million of the 31 million cattle of the country are exposed to the disease .Therefore, the economic loss which follows decreased productivity and death of livestock is enormous. Apart from this direct economic loss, a vast area of arable land cannot be utilized for agricultural purposes due to fear of trypanosmosis (Zeleke, 2011).

Although trypanosmosis is considered as a major constraint to livestock productivity in Ethiopia in general and in SNNPRS area specially, regular studies have not yet been carried out on the epidemiological dynamics and socio economic impact of bovine trypanosomosis in this study area. Information on t he prevalence and identifying the different species of trypanosome and vectors are important to device appropriate control measures (Terzu, 2006). Therefore, the objectives of this study were to determine the prevalence of bovine trypanosomosis and its associated risk factors in zala woreda, south Gammo Gofa zone and to identify different species of trypanosomes involved in the study area.

2. Materials and Methods

2.1. Study area

A study was conducted in three peasant association of Zala woreda, namely Mela Kaysha, Gayle Tsosa and Wagesho kebelles. This woreda is located in South West Gammo Gofa zone of SNNPRS at 650Km from Addis Ababa. The district is covered by different vegetation (the vegetation is dominantly occupied by

wood- grass land (WGL) and has an altitude 1171m, 1312m and 1142m above sea level Mela Kaysha, Gayle Tsosa and Wagesho respectively. The woreda receives an annual rainfall of 800 and 1000 minimum and maximum respectively. Agro-climatically, the area has kola climatic condition**.** Agriculture is the main livelihood in the area in which cattle and goat kept as the major livestock which are highly important for the livelihood of the local population. The rearing system of cattle in study sites depends on natural grass and crop residues that kept in traditional management system.

2.2. Study Population

The study animals were local breed cattle (155 males and 229 females) managed under smallholder mixed crop-livestock farming system, the animals are kept under traditional extensive husbandry system.

2.3. Study Design

A crosssectional study was conducted from November, 2016 to April, 2017 to determine the prevalence of bovine trypanosomosis. The study a nimals were selected by using simple random samplin g method based on their age, sex and body condition i nto account. Conventional age categories were made a s young (≤2 years), and adult (>2years) (Bayisa *et al*., 2015). Body condition scores were determined as 1, 2, 3, 4 and 5 based on criteria adopted by (Matthew Man, 1993). And later on classified as poor (BSC 1 to 2), medium (BSC 3) and good (BSC 4 to 5) based on the appearance of short ribs, dorsal spines and tail head.

2.4. Sample size determination

Since there was no similar work done in the study area previously, expected prevalence was taken as 50% and the confidence interval have chosen as 95%. By substituting these values in the formula, the sample size was 384. Thus, the sample size is calculated according to Thrusfield (2005) as follows:

$$N = \frac{1.96^2(Pexp)\,(1-Pexp)}{d^2}$$

Therefore, $$N = \frac{1.96^2(0.5)\,(1-0.5)}{0.5^2}$$

$$N = 384$$

Where, N=required sample size, Pexp =expected prevalence, d=desired level of precision (usually 0.05). Thus, by using the given formula the sample size will be estimated to be 384.

2.5. Study Method and procedures

Blood sample were collected from Mela Kaysha, Gayle Tsosa and Wagesho during study period for parasitological study. It was obtained by puncturing ear vein with a lancet and collected directly into a pair of hepranized capillary tubes. A pair of capillary tubes was filled with blood from animals to ¾th of their height centrifuge symmetrically. Then, the tube was sealed and heparinzed capillary tube containing blood was centrifuged for 5 minutes at 12,000 revolutions per minute. After the centrifugation, tubes were then placed in hematocrit reader and packed cell volume (PCV) was determined. Then, the readings were expressed as a percentage of packed red cells to the total volume of whole blood. Animals with Packed Cell Volume (PCV < 25%) were considered to be anaemic (Morag, 2002).

After centrifugation, trypanosomes were usually found in or just above Buffycoat layer. So, 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 upper most layer of (RBC). The content of the capillary tube was expressed on to slide, homogenized on to a clean glass slide and covered with cover slip. The slide was examined under 40x objective and 10x eye pieces for the movement of parasite. From positive samples thin smears were made, fixed with methanol for 5 minutes and stained with Giemsa solution for 30 minutes to identify the morphology of Trypanosomes (Dereje *et al*,. 2014).

2.6. Data Analysis

The data was first entered and managed in to Microsoft excel spread sheet and analyzed with descriptive statistics of statistical package for social sciences (SPSS) software version 20.0 for windows. The prevalence of trypanosomosis was expr esses as percentage with 95% confidence interval by dividing the total number of animals positive to trypanosomosis to the total number of animal examined. The trypanosomosis with variable: peasant association, sex, age, body condition and PCV of infected and non infected animals were compared by chi-square test. P-value less than 0.05 (at 5% level of significance) were considered significant in all analysis.

3. Results

3.1. Parasitological Findings

From a total of 384 sampled animals, 10 were found to be positive for trypanosome infection using Buffy coat technique with an overall prevalence of 2.6%. *T.congolence* 6(60%) was the most prevalent species followed by *T.vivax* 4(40%). The prevalence of trypanosomosis in cattle within three peasant associations (PAs) during study period were 1.8%, 2.8% and 4.2% at Mela Kaysha, Gayle Tsosa and Wagesho, respectively as shown in table 1. Despite the occurrence of highest prevalence in Wagesho (4.2%) and the lowest in Mela Kaysha (1.8%), the difference was not statistically significant (p>0.05).

Table 1: The prevalence of trypanpsome and trypanosomosis in different PAs of Zala woreda

PAs	No. of cattle examined	Prevalence (%)	Trypanosome species	
			T.congolence	*T.vivax*
Mela Kaysha	167	1.8%	2(66.7%)	1(33.3%)
Gayle Tsosa	145	2.8%	2(50%)	2(50%)
Wagsho	72	4.2%	2(66.7%)	1(33.3%)
Total	384	2.6%	6(61.1%)	4(38.9%)

$X^2 = 1.44$ P = 0.837

While collecting the samples, animals were categorized in to less than or equal to two years (≤ 2 years) and greater than two years (> 2 years). With the regard to the prevalence 1.2% and 3% were in age less than or equal to two years (≤ 2 years) and greater than two years (>2 years), respectively. As the age increases, the prevalence rate was also increased. But none of these differences were statistically significant (p>0 .05). A comparison of trypanosome infection between males and females were made. Based on this factor, the overall prevalence of bovine trypanosomosis in males and females were 4.5% an d 1.3%, respectively. The prevalence of male was higher than females. However there was no statistically significant difference (p>0.05) observed between two sex groups. Out of 384 cattle sampled, 7.14%, 3.6% and 0.6% prevalence of bovine trypanosomosis was recorded in poor, medium and good body conditions of the animals respectively. But none of these differences were statistically significant in the prevalence of trypanosomosis among animals with different body conditions.

Table 2: Prevalence of trypanosomes based on host related risk factors (Age, Sex and Body condition score

Host related risk factors		No examined	No of positive	Prevalence (%)	X^2	p-value
Age	≤ 2 year	83	1	1.2%		0.546
	> 2 years	301	9	3%	1.211	
	Total	384	10	2.6%		
Sex	Male	155	7	4.5%	3.815	0.148
	Female	229	3	1.3%		
	Total	384	10	2.6%		
BCS	Poor	42	3	7.1%	7.492	0.112
	Medium	168	6	3.6%		
	Good	174	1	0.6%		
	Total	384	10	2.6%		

3.2. Hematological Findings

The overall mean PCV value of cattle tested was 24.38%. The mean PCV value of parasiteamic and aparasiteamic cattle was found to be 20.60% and 24.49%, respectively (table 3).Moreover the total prevalence of trypanosomosis in PCV less than 25% and greater than or equal to 25% are 4.2% and 1% respectively (table4). However, there was no statistical significant difference ($p>0.05$) observed between parasiteamic and aparasiteamic group.

Table 3: comparison of mean PCV between parasiteamic and aparisteamic cattle

Disease Condition	No. of animal examined	Mean PCV
Parasiteamic	10	20.60%
Aparasitemic	374	24.49%
Total	384	24.38%

$X^2 = 5.033$ p – value = 0.284

Out of 384 tested cattle, 189 (49.2%) had PCV value lees than 25(<25%) and 195(50.8%) were greater than 25 (25%). From parasitaemic cattle 80% and 20% had PCV less than 25% and greater than 25%, respectively.

Table 4: prevalence of trypanosomosis between aneamic and non aneamic

PCV	Number of animal examined	Number of parasiteamic	prevalence
<25	189	8(80%)	4.2%
≥25	195	2(20%)	1%
Total	**384**	**10**	**2.6%**

4. Discussion

From a total of 384 randomly selected cattle's, the overall prevalence of bovine trypanosomosis in the study area was found to be 10 (2.6%) of animals were positive of which 3(1.8%), 4(2.8%) and 3(4.2%) in Mela Kaysha, Ga yle Tsosa and Wagesho was recorded respectively**.** This result concord with the report prevalence of 4.43% from neighboring districts of south Gammo Gofa zone Arbaminch in Fura and Eligo (Wondewosen *et al.*, 2012) and Wonchi Woreda, South West Shoa Zone, Central Ethiopia with the report prevalence of 2.1%(Dula *et al*,. 2014). However, high prevalence was recorded in different localities of Ethiopia by (NTTICC, 2004), (Waktole, 2008) and (Mulaw *et al*,. 2011) who reported the prevalence of 25%, 13.4% and 28.1% in Gawo Dale district and Asosa District of Benishangul Gumuz, western Ethiopia. The lower prevalence of trypanosomosis registered in the present study area compared to these places may be, in these districts tsetse control (suppression of flies population by the use of insecticide impregnated targets and i nsecticide treated livestock) has been carried out by the southern tsetse and trypanosomosis control project for many years which significantly reduced the prevalence.

In this study, *T.congolense* was the predominant sp ecies (61.1%) causing bovine trypanosomosis in the area followed by *T. vivax* (38.9%). 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 sex distribution more numbers (4.5%) of males are affected than female(1.3%) animals, the highest infection rate in males as compared to females may be attributed to stress factors related to work where male animals are used for drought purpose and they have to walk long distances in areas where there is a high risk of tsetse challenge (Zecharias And Zerihun, 2012).There were no statistically significant variation (P>0.05) was observed in the prevalence of the disease between the two sex, the absences of statistically significant variation between male and female animals in the prevalence of the disease might be due to both sex had equal chance to exposed to the vectors. This result is in agreement with previous reports in the country (Adane and Gezahegne, 2007); (Abebayehu *et al*., 2011) and this might be due to the fact that both sexes have virtually similar exposure to biting flies in grazing areas

There was higher prevalence of the disease in older animals >2 years as compared to those in younger ≤ 2 years old. One infection was observed in the 83 examined animals less than or equal to two years old, the prevalence in old cattle was almost twice greater than the younger ones. This could be associated to the fact that older animals travel long distance for feed and to serve for draught power as well as for harvesting crops and this may pose them to high tsetse fly challenge. In addition, young animals are also naturally protected to some extent by maternal antibodies (Fimmen *et al*., 1999), this could result in low prevalence of trypanosome in the younger animals. This result is in agreement with previous reports in the country (Sinshaw, 2004; Mihreteab and Mubarik, 2011). On the other hand disagreement with (Dula *et al*., 2014) he stated that, presence of significant difference between age groups of the animals. But, the practical difference observed in the prevalence of trypanosomosis among the age group was not statistically significant (P>0.05).

The body condition is also an important indication for trypanpsome infection, the occurrence of infection was highest in poor body c ondition (7.1%) followed by in medium (3.6%) and good body condition (0.6%). There was no a statist ically significant variation in the prevalence of tryp anosomosis (P>0.05) among cattle with different body conditions with poor body condition animals being the most susceptible. Thus, the majority of the infected animals manifest poor body conditions; this may be because of the chronic characteristic of trypanosomosis causing progressive emaciation. Also, it can be because of the fact that well-conditioned animals have better immune status than poor ones having the capability of responding to any foreign protein. The finding agrees with the reports of earlier studies in Ethiopia (Bayisa *et al*., 2015).

Aneamia was considered to be an important clinical sign and/or indicator of trypanosomosis (Rodostitis *et al* ., 2007) and the reduced the performance of the animals. Concerning the PCV determination (even though other disease contribute to the low PCV values), most of the parasitemic animals were found to be anemic compared with aparasitemic. During the study period, cattle with PCV<25% were considered anemic (Dereje *et al*., 2014) which is said to be the principal sign of trypanosomosis in livestock. In the present study, the highest proportion (80%) o f parasitaemic cattle has PCV<25. This result is in agreement, even if relatively higher than the previo us results reported by (Wondewosen *et al*., 2012) at Arbaminch (in Fura and eligo), south Ethiopia (76.47%).

In the present study, the mean PCV value for the parasitemic cattle was 20.60% at the same time as the mean PCV value for the aparasitemic cattle was 24.49%; however, trypanosomosis infection and mean PCV values obtained in this study of parasitemic and aparsitemic cattle were in harmony with the report of (Rowlands *et al*., 1993) in Ghibe valley at South Western Ethiopia, in which was stated that the average PCV of parastiologically negative animals was considerably higher than the average PCV of parasitological positive animals

From the total cattle populations sampled during st udy period, 189(49.2%) of cattle populations have PCV<25%. Almost 80% cattle's having PCV<25% but they react negatively for trypanosomosis infection and this may have occurred due to the insufficiency of detection method used or delayed recovery of anemic situations after recent treatment with trypanocidal drugs or may be due to the compound effect of poor nutrition and hematophagus helminth infection such as haemonchosis and bunostomiasis (Afework, 1998). However, PCV values can be affected by many factors other than trypanosomosis, but these factors are likely to affect both trypanosomosis negative and positive animals (Van den Bossche and

Rowlands, 2001).Since the present study it can be thus be concluded that trypanosomosis is an important disease and a potential threat in affectin g the healthy and productivity cattle in the economi cally important southern Ethiopia.

5. Conclusion and Recommendations

In general, bovine trypanosomosis is economically important disease of live stock that affect the health as well as productivity of cattle. The prevalence of the disease varies from site to site. The current study indicated, overall low prevalence of trypanosomosis in the study area but, *T. congolense* was the most prevalent species while *T. vivax* was less abundant in the study area. The observed association between reduction in PCV and reduced body condition with infection showed the impact of the disease on productivity of infected animals in the area. Based on the above conclusion the following recommendations are forwarded: appropriate disease prevention and control method should be undertaken so as to improve livestock production and agricultural development in the area; further study on the trypanosomosis in the area should be conducted; feasible diagnosis and systematic treatment of affected animals should be made to recover the health and productivity of livestock and awareness creation to community about the impact of trypanosomiasis on livestock production and productivity; thereby the use of traps as vector control strategy should be given.

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