BRJ BASIC RESEARCH JOURNALS

Basic Research Journal of Agricultural Science and Review ISSN 2315-6880 Vol. 8(3) pp. 029-037 August 2020
Available online http//www.basicresearchjournals.org

Full Length Research Paper

Effect of gibe – III Dam construction along Omo River Basin on prevalence of bovine trypanosomosis in selected localities of Loma District, Dawuro zone, Southern Region

Semayat Oyda*[1], Shimelis Argaw [1], Getinet Ayalew [1], Mebrat Alemayehu [1], Teferi Mandado[2],

[1]Wolaita Sodo University, Dawuro – Tarcha Campus, Department of Animal and Range Science, P.O.Box 01, Tarcha, Ethiopia
[2]Dawuro zone, Livestock and Fishery Resource Development Department

*Corresponding author's e-mail: semayatoy79@gmail.com, drsemayat@gmail.com, Tel: +251-910-049-011

Accepted 25 August 2020

ABSTRACT

A cross – sectional study was conducted between 2018 and 2019 in Dawuro Zone Loma district, Southern Nations, Nationalities and Peoples Regional State (SNNPRS) to assess the effect of dam construction on prevalence of bovine trypanosomosis and identify dominant species of trypanosomes in the area. The study methodology was based on questionnaire survey, parasitological study and entomological survey. Entomological survey revealed that *Glossina pallidipes* was the most prevalent tsetse fly species along with *Glossina fuscipes* tsetse fly. The apparent fly density (ADT) (0.517fly/trap/day) was significantly higher ($p<0.05$) in the area. At species level, the ADTs for *G. pallidipes* and *G. fuscipes were* 0.45fly/trap/day and 0.067fly/trap/day respectively. In the parasitological survey, a total of 302 cattle were examined, 52 of them were positive giving an overall trypanosomosis prevalence of 17.2%. Prevalence with *T. congolense, T. vivax* and *mixed* infection was 10.9%, 4.9% and 1.3% respectively. Higher infection rate was observed in older animals (<7 years) 10.9% (95% CI=0.19-0.28) and lower in young animals (<3 years) 1.3% (95% CI=0.26-0.36). The mean PCV values (%) of parasitaemic and aparasitaemic animals during the study period were 34.62±6.66 and 77.20± 2.66 respectively. The regression analysis of cattle average PCV from cattle prevalence indicated that cattle average PCV decreased with increasing prevalence of trypanosome infections with a negative regression coefficient values for the study areas. Therefore, trypanosomosis is the most important problem for agricultural activity and animal production in the area and the situation is challenging as the control and prevention of trypanosomosis is difficult due to limited veterinary service providers and the expansion of veterinary drug black markets in the area.

Keywords: *Cattle, Trypanosomosis, pallidipes, Dawuro, livestock, benefits, Glossina, population*

INTRODUCTION

According to recent estimates, Ethiopia has 56.71 million cattle, 29.33 million sheep, 29.11 million goats, 1.16 million camels and 56.87 million poultry (CSA, 2015). The huge amount of livestock population of cattle are utilized as they provide traction power (a vital contribution to the overall farm labor requirements), provide milk, meat, cash income, manure and serve as a capital asset against risk and in general livestock are complementary to crop in

highlands (Tekle, 2012) and livestock are a “Living bank” or “Living account” for rural and urban poor farmer, or livestock owners. They serve as a financial reserve for period of economic distress such as crop failure as well as primary cash income. Among livestock, cattle are the primary resource for people and government of Ethiopia (Ayele *et al.,* 2012).

Benefits from enormous livestock resource comprises of diseases, age-old traditional management system, inferior genetic make-up coupled with under nutrition and complicated by malnutrition and absence of well-developed market infrastructure (MoA, 1997) and productivity in Ethiopia is low and due to poor nutrition, reproduction insufficiency, management constraints and prevailing animal disease (Ayele *et al.,* 2012; ILRI, 1999; Bekele *et al.,* 2010).

Trypanosomosis is a disease complex caused by several species of blood and tissue dwelling protozoan parasites of the genus *Trypanosoma* (Mulatu *et al.,* 2016; Singla *et al*., 2004. The disease is distributed over approximately 10 million km^2 of Sub Saharan Africa between latitudes 14°N and 29°S which directly coincide with distributions of tsetse flies (Radostits *et al.,* 2007). In Ethiopia, the most important tsetse born trypanosomes inflicting economic losses in domestic livestock are *T. congolense, T. vivax, and T. brucei* (Keno, 2005). The distribution of tsetse flies is determined principally by climate and influenced by altitude, vegetation and presence of suitable hosts (Leak, 1999). Five species of tsetse flies, *G. m. submorsitans, G. pallidipes, G. tachinoides, G. f. fuscipes* and *G. longipennis* have been recorded in Ethiopia. Tsetse infested areas lie in lowlands and in the valleys of Abay (Blue Nile), Baro, Akobo, Didessa, Ghibe and Omo Rivers. The infestation is confined to the southern and western regions of Ethiopia between 33°-38°E and 5°-12° N which amounts to about 200,000 km^2 (Haile *et al.,* 2017).

The most important *Trypanosoma* species affecting livestock are *Trypanosoma congolense, Trypanosoma vivax, Trypanosoma brucei,* in cattle, sheep and goat, *Trypanosoma evansi* in camel and *Trypanosoma equiperdum* in horse (Abebe, 2005; Haile *et al.,* 2017). The species of trypanosome known to exist in Ethiopia, which are pathogenic to cattle are, *T. congolense*, *T. vivax* and *T. brucei* (Ayele *et al.,* 2012; Abebe and Jobre, 1996; Abebe, 2005).

In Ethiopia, Trypanosomosis is widespread in domestic livestock in the Western, South and South-western lowland regions and the associated river systems (MoA, 1995; Abebe and Jobre, 1996; Abebe, 2005). Currently about 220,000 Km^2 areas of the above mentioned regions are infested with five species of tsetse flies namely *Glossina pallidipes*, *G .morsitans, G. fuscipes, G. tachinoides and G. longipennis* (Tekle, 2012; NTTIC, 2004).

Trypanosomiasis can be transmitted through cyclical or mechanical transmissions. In cyclical transmission there is always development and replication of parasite in intermediate hosts (tsetse flies) species like *Glossina m. submorsitans*, *G. pallidipes, Glossina fuscipes fuscipes and Glossina tachinoides*. These species of tsetse flies are distributed along the lowlands of western, southern and southwestern part of Ethiopia (Wondewosen *et al.,* 2012). The disease is also transmitted mechanically by biting flies of the genus *Tabanus*, *Haematopota*, *Chrysops* and *Stomoxys* (Bezabih, et al., 2017; Oluwafemi et al., 2007).

Study area has very huge number of livestock population but the production and productivities are low when compared to huge number. Bovine trypanosomosis is one of known constraints to this production (Aki and Godeso, 2016; Shimelis *et al*, 2011). Since the study area is hot and agro – ecological lowland, the tsetse flies distribution and trypanosomosis is prominently and cause economic loss to farmers. The objective is to assess the effect of dam construction along Omo river basin on the prevalence of bovine trypanosomosis and to identify the dominant trypanosome species in selected localities of Loma district, Dawuro Zone.

MATERIALS AND METHODS

Sites

The study was conducted in selected localities of Loma district, in Dawuro Zone. The total land area of the district is about 125051 hectares and total population of human beings in the district in this year (2016) is 137,641, of them, about 69,646 females and the remains 67,995 males. Altitudes (elevation) of the district ranges between 700 – 2600 meter above sea level (masl) and mean annual rain fall is about 900 – 1500 mm and temperature of the area also ranges from 12 – 28 °C (on average 20 °C). Geographically, the area is located at around 37°32’ E longitudes and 7°19’ N latitude, the top map of the area shows that as it was mentioned above. The district is defined in agro – ecologically (climatic) characteristic as Dega (highland, 12%) 15006.12 Ha, Woina Dega (midland, 28%) 35014.28 Ha and Kola (Lowland, 60%) 75030.60 Ha from total land area cover (125, 027 hectare). The total livestock population of district includes: cattle (344,828), equine (6,328), sheep and goat (167,831), poultry (126,363) (LDFEDO, LDLFRO, LDFNRDO, 2016/17).

Local breeds of cattle with different age groups, body conditions and coat colors as well as both sex groups that are kept under traditional extensive husbandry system with communal herding were taken as study population. Different age groups of cattle were categorized to examine blood sample. Age groups categories was as less than (young), between 4 to 6 years (medium) and ages above

7 years (adult) (Eyob *et al.,* 2017).

Study animals

The study was conducted on 302 indigenous zebu cattle of sexes, age groups and body condition animals. The animals in the area mainly depend upon communal grazing lands and crop residues as feed sources. The watering points of animals in Zima Waruma, Afuki Woyro, Yello Worbati and Subo Tullema was from the dam water mostly which is infested with tsetse- flies.

Study design

Cross – sectional study design was employed to determine the current prevalence of bovine *trypanosomosis* and to estimate tsetse density in area long Omo river basin. A local zebu cattle (*Bos indicus*), which are usually kept under an extensive husbandry system, grazing the communally owned pasture land throughout the year was randomly sampled.

Sampling methods and sample size

Simple random sampling technique was used to select sampling localities (Pas) from total which have contact with the dam. There are about ten (10) (peasant association) localities from Loma district which have direct contact with dam construction. Using simple random sampling, four (4) localities were selected.

Sample size of the study was determined according to the formula stated by Thrusfiled, (2005). A total of 302 cattle were selected among cattle in selected localities by systematic random sampling method. During sampling, the age, sex, body conditions and coat colors of study animals were considered. The sample size was calculated by using Thrusfield, (2005) formula and previously obtained prevalence (26.82%) by Teklebirhan *et al.,* (2016) was used and 302 cattle were included in the study.

$$N = \frac{1.96^2\ exp\ (1 - pexp)}{d^2}$$

- Where, N is the required sample size,
- P_{exp} is the expected prevalence and *d* is the desired absolute precision.
- Expected prevalence (26.82%) obtained by Teklebirhan *et al.,* 2016 and in the overall study, a 5% absolute precision at 95% confidence level is considered.

Data collected was recorded properly in a format already prepared for this purpose and handled carefully and analyzed systematically. Statistical software for the analysis of data was STATA 12 - for windows version. Prevalence of bovine trypanosomosis was expressed as the number of parasitaemic animals through Buffy coat microscopic study to the total animals examined (%) and hematological findings was also expressed as percentage of the red blood cells to the total blood content (%) and the analysis was employed to detect odds of disease occurrence.

Data management and analysis

This section describes the statistical methods used for data analysis. The data for this study consisted of nominal, ordinal, and scale data (continuous and categorical). Data was analyzed using STATA version 13.0 For data analysis, both descriptive and inferential statistics Cross tabulations, Chi-square test, T-test, binary logistic regression were applied. The total prevalence rate was calculated by dividing the number of positives by the total number of animals examined in the area. Chi-square test was employed using STATA software version 13.0 to determine prevalence on sex, age and body condition scores. Two sample T-tests were utilized to compare the Mean PCV values between parasitemic (anemic) and aparasitemic (non-anemic) animals. Differences between parameters were tested for significance at probability levels of 0.05(5%).at 95%level of significance and P-values of than 0.05. Flies per trap per day (F/T/D) analysis were used to calculate an apparent tsetse and biting flies densities.

RESULTS

Questionnaire survey

History of farmer's settlement

A total of 60 household heads were interviewed from four localities, of which 81.7% were males. The interviewees were selected purposively. About 68.33% of the respondent said the prominent bovine disease in the area is trypanosomosis. 71.67% of the farmers were suspecting the disease as trypanosomosis if animal got diseased while about 8.33% of farmers were suspecting the case as pneumonia.71.76% of respondent revealed that dam construction didn't show much difficulty in bovine trypanosomosis. As 61.67% interviewee stated more susceptible age groups of animals was aged bovine animals and animal in poor management (nutrition) status. According to the color of animals, 46.67% interviewees revealed that color of bovine with black were animals at risk of contracting diseases including trypanosomosis.

Table 1. Different fly catches in four localities

Sites	Flies types			
	Tsetse fly	***Musca domestica***	**Bees**	**Others**
Zima	12	3	1	0
Yello	14	3	4	1
Subo	0	10	1	2
Afuki	5	5	6	1
	31	21	12	4

Table 2. prevalence distribution

No.	Sites	Fly types				
		Tsetse fly		**Housefly**	**Bees**	**Others**
		Pallidipes	Fuscipes			
1	Zima	10 (32.3%)	2 (6.5%)	3 (14.3%)	1 (8.3%)	0
2	Yello	14 (45.2%)	0	3 (14.3%)	4 (33.3%)	1 (25%)
3	Subo	0	0	10 (47.6%)	1 (8.33%)	2 (50%)
4	Afuki	3 (9.8%)	2 (6.5%)	5 (23.8%)	6 (50%)	1 (25%%
	Total	27 (87.1%)	4 (12%)			

Socio – economic status

100% of the respondent livelihoods were dependent on mixed crop - livestock production systems. The average number of cattle per household was 25 cattle/household and the cultivating land per household was about 0.75 hectar on average.

Livestock management

Livestock also used for milk, meat, source of income and transportation. Four selected study areas are lowlands and livestock species composition were cattle (81%), small ruminants (17%) goats and sheep (shoats) (1.1%) and 0.9% equine in area. The average number of cattle size in herd was 200 and herd was made of different cattle from several owners 5 – 10 (average 5). Each herd was kept together for grazing and watering as “wudia” in local language and “menga” in Amharic (National language) in day time as well as at night in the barn (“Beret”). Milking was carried out at home because milking cows and calves (below a year) kept at home.

The grazing and watering points are nearby which is Omo river on which the dam was constructed. The questions about transmission of trypanosomosis was responded as follows; 95% of the respondents indicated that the transmitter and cause of the disease is the biting flies locally called “hargia udunxiya” its equivalent are *tsetse fly*. The seasonal occurrence of trypanosomosis was indicated by respondents (98%) after the *long rainy season* “Badhesa” and after short rainy season “*Ofinta*” locally.

Entomological survey result

A total of 20 NGU traps were deployed at an interval of 100m, and overall 68 flies were caught in 72 hours. Among those, 31 were tsetse species *G. pallidipes* (27) and *G.fuscipes* (4), and 37 were other species of flies. The number of flies per trap and per day was 1.55 and 10.33 respectively. An overall apparent density of tsetse fly caught was 0.517 F/T/D with highest density of *G. pallidipes* (0.45) and lowest density of *G.fuscipes* (0.067F/T/D). An apparent density of tsetse flies in each locality to trap was recorded as 1.35, 0.2 per each day but locality level ADT from higher to lowest is 0.45, 0.39, 0.16 and 0 Zima, Yello, Afuki and Subo. With regard to species highest density was record by *pallidipes* and their apparent density caught was order from highest to lowest 0.23 F/T/D, 0.17 F/T/D, 0.15 F/T/D and 0 F/T/D at Yello Worbati, Zima, Afuki Woiro and Subo Tulema respectively.

The apparent fly density was found to be 0.517 fly/trap/day, 0.37 fly/trap/day and 0.12fly/trap/day for tsetse, muscids and bees in the study area for three days respectively. At species level, 0.45 fly/trap/day, 0.067 fly/trap/day for two types of tsetse flies *pallidipes* and *fuscipes* respectively. Table 1 and 2.

Parasitological survey

Trypanosome prevalence

A cross-sectional study was carried out during the study period in four selected localities. A total of 302 animals

Table 3. the prevalence of trypanosomosis in four selected localities of district

Sites/localities	No. of sample	No. of positive	Prevalence (%)	X^2	P – value
Zima Waruma	65	16	24.6	0.1061	0.000
Yello Worbati	85	14	16.5		
Subo Tulema	80	12	15		
Afuki Woyro	72	10	13.9		
Total	302	52	17.2		

Table 4. Univariable logistic regression analysis of the prevalence of trypanosomosis and associated risk factors

Risk factors	Level of risk factors	No examined	No. positive	X^2	p-values
Sex	Males	224	42 (13.91%)	0.2204	0.2350
	Females	78	10 (3.31%)		
Age	≤ 3	84	4 (1.32%)	0.8507	0.009
	4-6	100	15 (4.97%)		
	≥7	118	33 (10.93%)		
Coat Color	Black	124	39 (12.91%)	0.000	0.000
	Red	53	7 (2.32%)		
	White	125	6 (1.99%)		
Body condition	Poor	109	45 (14.9%)	0.0201	0.000
	Medium	141	6 (1.99%)		
	Good	52	1 (0.33%)		
Village	Zima Waruma	65	16 (5.29%)	0.1061	0.000
	Yello Worbati	85	14 (4.64%)		
	Subo Tulema	80	12 (3.97%)		
	Afuki Woyro	72	10 (3.31%)		
Total		302			

(cattle) were examined in four selected localities. The prevalence of *trypanosomosis* was determined by using different variables. As the result of this particular study, the overall infection rates in the four sites were found to be 17.2%. The highest infection rate (24.6%) was recorded in Zima Waruma followed by Yello Worbati (16.5%), Subo Tulema (15%) and Afuki Woyro (13.9%). There was statistically significant difference among the four *localities* (p = 0.1061) (Table 4).

The prevalence of *trypanosomosis* at species level was 10.9%, 4.9% and 1.3% respectively as *T. congolense, T. vivax and mixed infection* as shown in Table 4. The prevalence rate of trypanosome infection between sex category (Tables 3) was 13.9% for males and 3.3% for females in the areas and there doesn't exist any statistical difference (p>0.05) observed in the sex groups but there was highly significantly difference (p<0.05) between age categories in the area (Tables 4). Higher infection rates observed in older animals (<7 years) 10.9% (95% CI=0.19-0.28) and lower in young animals (below 3) 1.3% (95% CI=0.26-0.36). The occurrence was about 0.5 times (Odd ratio) higher in older cattle than young. The body coat of the animal was highly risk for occurrence of trypanosomosis. The prevalence recorded was higher in coat color of black (12.91%) and next (2.32%) red colored animals followed by 1.99% white. The body condition score was also very important factor. The occurrence disease in poor body conditioned animals were about 17.6x (odd ratio) higher than other medium and good. The prevalence of disease in poor body conditioned animals were 14.9% and others 1.99% and 0.33% respectively in medium and good with 95% CI (0.31 – 0.42, 0.43 – 0.57, 0.13 – 0.22).

The relatively higher infection rates were observed in male animals 13.91% but the difference was not significant (p>0.05) (table 4). There was significant difference (p<0.05) between the age groups of animals as the prevalence in adult animals (>7 year) was 110.93% (95% CI= 0.86 – 1.9) and in calves (<3year) 1.32% (95% CI=0.12 – 0.37) (p>0.05) (Table 4). The predominant trypanosome species in the study area was *T. congolense 6*3.5% while *T. vivax* was 28.8% and the remaining infections were due to mixed (*T. congolense* and *T. vivax*) 7.7% (Table 5). (((Table 2,4,5 and 6)))

Haematological findings

The mean PCV (%) value of parasitaemic and aparasitaemic animals was 34.62±6.66 and 77.20±2.66 with (95% CI=0.2124 – 0.4799) (CI, 0.7195 – 0.8244) respectively. There was significant difference found between the parasitaemic animals and aparasitaemic.

Table 5. Different trypanosome species in the study sites

localities	No. of positive	Species			X^2	P – value
		T.Congolenses	*T. vivax*	*Mixed*		
Zima Waruma	16	10 (62.5%)	4 (25%)	2 (12.5%)	0.1061	0.1090
Yello Worbati	14	7 (50%)	5 (35.7%)	2 (14.3%)		
Subo Tulema	12	9 (75%)	3 (25%)	0 (0)		
Afuki Woyro	10	7 (70%)	3 (30%)	0		
Total	52	33 (63.5%)	15 (28.8%)	4 (7.7%)		

Table 6. Mean PCV of apparently healthy and cattle infected with *Trypanosoma* species

Status of animal	No. of sample	PCV<25%	PCV≥ 25%	Mean ± SD	(95% CI)	P – value
Parasitemic	52	34 (11.26	18 (6)	34.62±6.66	(0.2124 – 0.4799	0.00
Aparasitemc	250	57 (18.9%)	193 (64%)	77.2±2.659	(0.7196 – 0.8244	
Total	302	91 (30.13%)	211 (69.8%)			

Prevalence of trypanosomiasis with associated risk factors

In the current study, the association of prevalence with the various risk factors was computed. Accordingly, the prevalence of *trypanosomosis* was significantly difference in age category ($p<0.05$) as it was higher in adults cattle above 7 years old than other age groups. The cattle with black coat color were highly at risk for occurrence of disease.

DISCUSSION

Questionnaire survey

The disease *trypanosomosis*, locally called as 'Golfuwa in local language /Gendi" in Amharic was reported to be the most important livestock constraint limiting the overall agricultural activity and livestock productivity by 68.33% of the interviewed people. This finding was in agreement with results reported by (Shimelis, 2004; Tewelde, 2001; Afewerk, 1998) in the western and northwestern parts of Ethiopia where tsetse-transmitted trypanosomosis is the primary problem for livestock productivity and agricultural development.

The occurrence of *trypanosomosis* is throughout the year but major infections are observed after rainy season and after short rainy season. The results of Tewelde (2001), Nagaro and Mwenndia (2000) and Afewerk (1998) reported consistent results; however their results indicated the occurrence of trypanosomosis was in all seasons. Absence of tsetse control activity generally makes the farmers prone and dependable on the use of chemotherapy where there was minimum veterinary service.

Similar results were also reported by Tewelde (2001) and Afewerk (1998), 57% and 43% of the drugs applied by the farmers themselves and other uncertified people. In the same report 48% and 40% of the treatment were given below the recommended dose while 20% and 40% did not have any idea.

Above 60% of the treatment was given for clinical cases and 40% for nonclinical cases.

Entomological survey

G. pallidipes and *G. fuscipes were* the only species of tsetse fly found in the Omo river basin areas of Western Ethiopia Dawuro zone with overall apparent density of 0.517fly/trap/day. Other flies like bees and muscids also caught along with tsetse fly. The result of tsetse fly survey agrees well with the general knowledge on the ecology of tsetse species found in other area for the *G. pallidipes* and *fuscipes* group. The geographical distribution of *G. pallidipes and fuscipes* is concentrated in the lowland area as climatic conditions are more favorable. Earlier works by done (Krug, 1971; Ford *et a*l., 1976; Lanridge, 1976; Shimelis, 2004) had established the tsetse geographical limit at 1600 m.a.s.l. and later Tikubet and Gemechu (1984) the upper limit reaches to 1700 m.a.s.l. and NTTICC (1996) reported the limit to be 2000 m.a.s.l. while in the present survey the maximum limit was 1100 m.a.s.l. The apparent density of *G. pallidipes* were 2.4 and 0.6 in the wet and dry season and for *G. fuscipes* 0.1 and 0.06 respectively reported by (Misangi, 1999) in southern rift valley of Ethiopia and the mean fly catches of *G. pallidipes* was 1.42 and *G. fuscipes* was 0.29 at Ghibe valley by Leak *et al*., (1993). *G. tachinoides* and *G. m. submorsitans* were detected by Langridge (1976) in the Abbay valley areas and Beles river valleys is also incriminated with these species of *tsetse fly*. Most of the tsetse were caught in the lowland areas so that the apparent density decreases as altitude increases ($p<0.05$). This findings support earlier works by Langridge (1976), Tikubet and Gemechu (1984) and Leak *et al*. (1999) indicated that

climate, which is largely influenced by altitude has an impact on tsetse population. The present study showed apparent fly density was found to be 0.517 fly/trap/day, 0.37fly/trap/day and 0.12fly/trap/day for tsetse, muscids and bees in the study area for three days respectively. At species level, 0.45 fly/trap/day, 0.067 fly/trap/day for two types of tsetse flies *pallidipes* and *fuscipes* respectively.

Parasitological survey

The highest prevalence of bovine trypanosomosis was found in the low altitude (below 1100 m.a.s.l) areas along the river valleys of Omo river as compared to the mid altitude areas. The seasonal occurrence of the disease is also consistent with the general knowledge of the vectors of trypanosomosis and hence it was higher during the late rainy season. The most prevalent trypanosome species in *tsetse*-infested areas of Ethiopia are *T. congolense* and *T. vivax*. It is true for present study agrees with Rowlands *et al*. (1993) reported a prevalence rate of 37% for *T. congolense* in southwest Ethiopia. Abebe and Jobre (1996) reported an infection rate of 58.5% for *T. congolense*, 31.2% for *T. vivax* and 3.5% for *T. brucei* in southwest Ethiopia. Different workers (Afewerk, 1998; Tewelde, 2001; Muturi, 1999) reported a prevalence rate of 17.2%, 21% and 17.5% in Metekel district, in Upper Didessa Valley and Southern Rift Valley areas of tsetse infested regions respectively and the dominant species was *T. congolense*, (Teklebirhan et al., 2016; Migbaru et al., 2017).

The predominance of *T. congolense* infection in cattle may be due to the high number of serodemes of *T. congolense* as compared to *T. vivax* and the development of better immune response to *T. vivax* infected animals (Leak *et al*., 1999; MacLennan, 1980, Shimelis, 2004, Migbaru *et al.,* 2017; Teklebirhan, 2016). Higher infection rates were observed in male animals in the present study but the difference was not significant. Similar results reported by different workers (Afewerk, 1998; Muturi, 1999; Tewelde, 2001). Other findings indicated that lactation stress results into higher prevalence than non-lactating cows (Rowlands *et al*., 1995). The possible suggestion to the present findings would be that male animals are more exposed to draught purposes travel long distances for draught in areas where the tsetse challenge is high and as a result the risk of trypanosomosis also high.

Age was found to be a risk factor in the present study finding and higher infection rates were observed in adult animals which are 0.5times higher in adult than young. This could be associated to the fact that animals travel long distance for feed and draught as well as for harvesting crops to tsetse high challenge areas. Rowlands *et a*l. (1995) in Gibe valley indicated that suckling calves did not go out with their dams but graze at homesteads until weaned off. Young animals are also naturally protected to some extent by maternal antibodies (Fimmen *et al*., 1982) which may result in low prevalence in calves. *T. congolense* infection was chronic diseases that increase infection rates with age. *T. congolense* infection is usually higher in adult animals than young (McDermott and Coelman, 2003).

Statistically significant variation ($P<0.05$) was observed between coat color of animals with respective prevalence of 2.32%, 1.99%, 12.91% in red, white and black colored animals. Similar finding was reported at Konta special district and Mareka district of Dawuro zone as there was significant difference in prevalence among different coat colored animals with the highest prevalence in black hair-coat animals (33.39% and 25.6% respectively) (Eyob *et al.,* 2017; Ataro *et al.,* 2015).

Trypanosome infection and mean PCV obtained between parasitaemic and aparasitaemic animals had significant difference ($p<0.05$). It was in agreement to the work done in Gibe, southwest Ethiopia indicated PCV less than 25% required treatment, and for animals treatment was given with positive cases. Rowlands *et al*. (2001) in Gibe observed in an increase in PCV value, the proportion of positivity decreases and hence mean PCV was a good indicator for the health status of herds in an endemic area. The lower mean PCV value in parasitaemic animals than the aparasitaemic animals is reported by several authors (Shimelis, 2004; Leak et al., 1987; Afewerk, 1998; Muturi, 1999; Tewelde, 2001).

The development of anaemia is one of the most typical signs of trypanosomosis caused by *T. congolense* in susceptible cattle breeds (Murray and Dexter, 1988). The level of anaemia or the PCV usually gives a reliable indication of the disease status and productive performance of an infected animal (Trail *et al*., 1991; Shimelis, 2004). Bovine trypanosomosis control aims at reducing the prevalence of infection with a concomitant increase in the herd average PCV (Bauer *et al*., 2001). The resultant low PCV values in infected animals may not only be trypanosomosis as a sole factor, however the difference in mean PCV between parasitaemic and aparasitaemic animals indicating that trypanosomosis involves in reducing the PCV values in infected animals Conner (1994) indicated anaemia associated trypanosomosis causes weakness, lethargy and lack of stamina which ultimately reduce efficiency of working animals. The consequence of anaemia is one of the most typical signs trypanosome caused by *T. congolense* in susceptible cattle breeds (Murray and Dexter, 1988; Abebe, 1991).

CONCLUSIONS AND RECOMMENDATIONS

The result of the present work revealed that trypanosomosis is the most important problem for

agricultural activity and animal production in the Dawuro zone Loma district of Southern Ethiopia (Zima Waruma, yello Worbati, Subo Tulema and Afuki Woiro). Only two species of tsetse *G. Pallidipes and fuscipes*, were the main vector of pathogenic trypanosome in the savanna areas of Africa. *Glossina pallidipes and fuscipes* advanced as high altitude as above 1100 m.a.s.l. posing a risk to areas considered tsetse free by earlier studies. The overall prevalence of bovine trypanosomosis was found to be 17.2% in the area ($p<0.05$). The prevalence was higher in male cattle as compared to female in sex ($p<0.05$). The mean PCV values of parasitaemic and aparasitaemic animals had significant difference ($p<0.05$). Thus the research work gave vital information for the epidemiological picture of trypanosomosis and its vector and occurrence of drug resistance.

Therefore, the following recommendations are forwarded:

1. Designing and implementation of integrated (vector control and chemotherapy) control strategies of *trypanosomosis*.
2. Awareness creation about the disease and access to CAHW service should be accessible to local community to keep health status of farmer's animal.
3. Further studies on the tsetse challenge, the economic impact of trypanosomosis and drug resistance have essential roles for the overall control.

REFERENCES

Abebe G (1991). The integrity of the hypothalamic-pituitary-adrenal axis in Boran (*Bos indicus*) cattle infected with *Trypanosoma congolense*. Brunel University, UK, PhD Thesis.

Abebe G (2005). Trypanosomosis in Ethiopia. Review Article. The Biological Society of Ethiopia, Ethiop., J. bio. Soci., 4(1): 75-121.

Abebe G, Jobre Y (1996). Trypanosomosis: A threat to cattle production in Ethiopia. The Revue de Medicine Veterinaries, 147: 897-902.

Afewerk Y (1998). Field investigation on the appearance of drug resistant population of trypanosomes in Metekel district, northwest Ethiopia. Addis Ababa University and Freiuniverstat Berlin, Faculty of Vetrinary Medicine, Ethiopia, MSc Thesis.

Aki A (2016). Study on the Prevalence of Trypanosomes Affecting Bovine in Tsetse Infested Asossa District of Benishangul Gumuz Regional State, Western Ethiopia, World Rural Observations 2016;8(3), http://www.sciencepub.net/rural

Aki A, Godeso M (2016). Across sectional Study on Bovine Trypanosomosis and Apparent Vector density in Bambasi District of Benishangul Gumuz Regional State, Western Ethiopia: prevalence and Vector density. Researcher 2016;8(7):32-39], ISSN 1553-9865 (print); ISSN 2163-8950 (online), http://www.sciencepub.net/researcher, doi:10.7537/marsrsj080716.05.

Ataro A, Berhanu S, Andualem T (2015). A study on prevalence of bovine trypanosomosis in selected areas of Konta Special Woreda, Southern Ethiopia. *Afr. J. Agric. Res. 11(6):500-506.*

Ayele T, Ephrem D, Elias K, Tamiru B, Gizaw D, Mebrahtu G, Mebrat E (2012). Prevalence of Bovine Trypanosomosis and its Vector Density in Daramallo District, South Western Ethiopia, J. Vet. Adv., 2012, 2(6):266-272, ISSN: 2251-7685.

Bauer B (2001). Improved strategies for sustainable trypanosomosis management within the context of primary animal health care. In: Proceeding of the International Scientific Council for Trypanosomosis Research and Control (ISCTRC), Mombassa, Kenya. No.120: 123-130.

Bekele J, Asmare K, Abebe G, Ayelet G, Esayas G (2010). Evaluation of Deltamethrin applications in the control of tsetse and trypanosomosis in the southern rift valley areas of Ethiopia.,Veterinary Parasitology, 168:177-184.

Bezabih M, Shabula Z, Byene N (2017). Prevalence of bovine trypanosomiasis in Dara District Sidama Zone, Southern Ethiopia, Journal of Parasitology and Vector Biology, Vol. 9(9), pp. 132- 136, DOI: 10.5897/JPVB2015.0226, http://www.academicjournals.org/JPVB.

Budd LT (1999). DFID-funded tsetse and trypanosome research and development since 1990, Volume 2, Economic Analysis. DIFID Animal Health Program.

Conner RJ (1994). Improving draught animal management with strategic chemotherapeutic control of trypanosomosis. In: improving animal traction technology. Workshop of the animal traction network for Eastern and Southern Africa, Lusaka, Zambia, 18-23 Jan 1992.

CSA (Central Statistical Agency), (2015). Agricultural Sample Survey 2014/15, Volume II. Report on livestock and livestock characteristics (private peasant holdings). Central Statistical Agency: Addis Ababa, Ethiopia.

EVA (1994). Ethiopia Veterinary Association Proceeding of the 8th conference, Addis Ababa.

Eyob E, Bangu B, Berhanu B (2017). The prevalence of bovine trypanosomosis and associated risk factors in Mareka Woreda of Dawuro Zone, Southern Ethiopia*, journal of parasitology and vector Biology, Vol. 9(5), pp. 39-46, DOI: 10.5897/JPVB2016.0265, http://www.academicjournals.org/JPVB*

FAO (2005). The influence of trypanosomosis on African animal production. Anim. Zootechnol. pp. 1-2.

Fimmen, H.O. Mehlitz, D., Horchner, F., Korb, E. (1992): Colstral antibodies and Trypanosoma congolense infection in calves.Trypanotolerance research and application.GTZ, No.116, Germany.pp173-187.

Ford J, Makin MJ, Grimble RJ (1976. Trypanosomosis Control Program for Ethiopia. Ministry of Overseas Development of Great Britain. Pp.1-30.

Haile G, Nigussie L, Mekonnen N, Furgassa W (2017). Prevalence of Bovine Trypanomosis and Vector Density in Four Selected Settlements of Dangur Area, North Western Ethiopia, Acta Parasitologica Globalis 8 (1): 01-08, ISSN 2079-2018, IDOSI Publications, DOI: 10.5829/idosi.apg.2017.01.08.

Ilemobade A (2009). Tsetse and trypanosomosis in Africa: The challenges, the opportunities, Onderstepoort. J. Vet. Res., 76: 35-40.

ILRI (1999). Making the livestock revolution work for poor, annual report ILRI. Nairobi: Kenya. Pp. 1-32.

Keno M (2005). The current situation of tsetse and trypanosomiasis in Ethiopia., Ministry of Agriculture and Rural development, Veterinary service department, in proceedings of the 28th meeting of International Scientific Council for Trypanosomiasis Research and Control (ISCTRC), Addis Ababa, Ethiopia.

Kristjanson PM, Swallow BM, Rowlands GJ, Krusska RL, Leeuw D (1999). Measuring the Cost of African animal Trypanosomosis, the Potential Benefit of Control and Returns to Research, Agr., Sys.,59:79-98.

Krug W (1971). A survey of trypanosomosis with particular emphasis to livestock, in the south western province of Ethiopia. Bull.Epizoot.Dis.Afr.19, 243-255.

Langridge WP (1976). Tsetse and Trypanosomosis Survey of Ethiopia. Ministry of Overseas Department UK. Pp.1-40.

Leak SGA (1999). Tsetse Biology and Ecology: Their Role in the Epidemiology and Control of Trypanosomosis, Tydskr S Afr vet Ver 70: 172-176.

Leak SGA, Mulatu, W (1993). Advance of Glossina morsitans submorsitans and G. pallidipes along the Gibe river system in southwest Ethiopia. Acta Trop. 55, 91-95.

Leak SGA, Woume KA, Colardeue C, Duffera W, Feron A (1987). Determination of tsetse challenge and its relationship withtrypanosomosis prevalence. In: livestock production in tsetse infested areas of Africa. ATLN, p. 43-52.

Loma district Farm and Natural Resource development Office

(LDFNRDO, (2017). The Profile and information Loma district structure in 2009 reports.
Loma district Finance and Economy development Office (LDFEDO, (2017). The Profile and information Loma district structure in 2009.
Loma district Livestock and Fishery Resource Development Office (LDFNRDO, (2017). The Profile and information Loma district structure in 2009, Annual Report, pp: 7-9.
MacLennan KJR (1980). Tsetse transmitted trypanosomosis in relation to the rural economy, Wld.Anim.Rev. 36: 2-22.
McDermott JJ, Woitag T, Sidibe I, Bauer B, Boucader D, Ouedrago D, Kamuanga M, Peregrine AS, Eisler MC, Zessin KH, Mehlitz JD, Clausen PH (2003). Field studies on drug- resistant animal trypanosomes in Kenedogou province, Burkina Faso. Acta Trop. 86, 93-103.
Migbaru KB, Zerihun SH, Natenael TB (2017). Prevalence of bovine trypanosomiasis in Dara District Sidama Zone, Southern Ethiopia, J. para. Vect. Bio, Vol. 9(9), pp. 132-136, DOI: 10.5897/JPVB2015.0226 http://www.academicjournals.org/JPVB
MoA (Ministry of Agricultural), (1995). Ethiopian ruminant livestock development strategy, Addis Ababa, Ethiopia, Ministry of Agricultural, p.112-113.
MoA (Ministry of Agricultural), 1997). Livestock development policies in Eastern and Southern Africa., Proceedings of a seminar organized by CTA, OAU/IBAR and the Ministry of Agriculture and Cooperatives, Swaziland, 28 July-1 August.,pp.216.
Mulatu E, Lelisa K, Damene D (2016). Prevalence of Bovine Trypanosomosis and Apparent Density of Tsetse Flies in Eastern Part of Dangur District, North Western Ethiopia, J Vet Sci Technol 2016, 7:4, http://dx.doi.org/10.4172/2157-7579.1000347
Murray M, Dexter (1988). Trypanotolerance, its criteria and genetic and environmental influence. In: Proceeding of a meeting on livestock production in tsetse affected areas of Africa, ILCA/ILRAD, Nairobi, Kenya.
Muturi KS (1999). Epidemiology of bovine trypanosomsis in selected sites of the Southern Rift valley of Ethiopia. FVM, AAU, Ethiopia, MSc Thesis.
Nagaro PM, Mwendia CMT (2000). Tsetse and trypanosomosis: An epidemiological survey in Osupuko and Mara division of Narok district. International Scientific Council for Trypanosomiasis Research and Control. 25th Meeting, Mombassa (Kenya), 25 Sep-1 Oct 1999.
NTTICC (1996). Annual Report. Ministry of Agriculture, National Tsetse and Trypanosomosis Investigation and Control Center (NTTICC). Bedelle, Illubabor, Ethiopia. Pp.29.
NTTICC (2004). National Tsetse and Trypanosomosis Investigation and Control Center, Annual Report on Tsetse and Trypanosomosis Survey, Bedele, Ethiopia.
Oluwafemi RA, Ilemobade AA, Laseinde EAO (2007). The Impact of African animal trypanosomosis and tsetse on the livelihood and Well being of cattle and their owners in the BICOT study area of Nigeria. Sci. Res. Essays 2:380-383.
PATTEC (2001). Pan Africa Tsetse and Trypanosomosis Eradication Campaign (PATTEC): Plan of action, June, 2001.
Radostits OM, Gay C, Constable PD (2007). Veterinary Medicine: A text book of diseases of cattle, horses, sheep, pigs and goats: 10th edn. Elsevier, London., pp: 1531-1540.
Rowlands GJ, Leak SGA, Peregrine AS, Nagda SM, Mulatu W, d'Ieteren GDM (2001). The incidence of new and the prevalence of recurrent trypanosome infection in cattle in southwest Ethiopia exposed to a high challenge with drug-resistant parasite. Acta Trop. 79, 149-163.
Rowlands GJ, Mulatu W, Authie E, Leak SGA, Peregrine AS (1993): Epidemiology of bovine trypanosomosis in the Ghibe valley, southwest Ethiopia. Acta Trop. 53, 135-150.
Rowlands GJ, Mulatu W, Nagda SM, Dolan RB, d'Ieteren GDM (1995). Genetic variation in packed red cell volume and frequency of parasitaemia in East African Zebu cattle exposed to drug resistant trypanosomes. Livestock Production Science. 43, 75-84.
Shimelis D (2004). Epidemiology of Bovine Trypanosomosis in the Abbay Basinareas of Northwest Ethiopia, Addis Ababa University, Faculty of Veterinary MedicineDebre zeit, Ethiopia, PhD Thesis
Shimelis M, Addis M, Fromsa A (2011). Study on the Prevalence of Major Trypanosomes Affecting Bovine in Tsetse Infested Asosa District of Benishangul Gumuz Regional State, Western Ethiopia. Global Veterinaria 7 (4): 330-336, 2011.
Singla LD, Aulakh GS, Juyal PD, Singh J (2004). Bovine trypanosomosis in Punjab, India, Proceeding of The 11th International Conference of the Association of Institutions for Tropical Veterinary Medicine and 16th Veterinary Association Malaysia Congress, 23-27 August 2004, PetalingJaya, Malaysia,
Slingenbergh J (1992). Tsetse Control and Agricultural Development in Ethiopia.Wld Anim.Rev. (FAO) 70-71, 30-36.
STATA, version - 12: Statistical software, Release 14, Stata Corporation 4905, Lakeway drive, Collage station Texas 77845, USA.
Tekle Y (2012). Prevalence of Bovine Trypanosomosis in Tsetse Controlled and Uncontrolled Areas of Eastern Wollega, Ethiopia, Priory Lodge Education Limited publish.
Teklebirhan T, Kifleyohannes TS, Tonamo A (2013). Prevalence and Control Approaches Used in Tsetse and Trypanosomosis of Bovine at Loma Woreda, Dawuro Zone, Southern Ethiopia, European Journal of Biological Sciences 8 (1): 01-07, 2016, DOI: 10.5829/idosi.ejbs.2016.8.01.1111 ,ISSN 2079-2085.
Tewelde T (2001). Study on the occurrence of drug resistant trypanosomes in cattle in the farming in tsetse control areas (FITCA) project in western Ethiopia. Addis Ababa University, Faculty of Veterinary Medicine, Ethiopia, MSc Thesis.
Thrusfield M (2005). Veterinary Epidemiology third edition, Blackwell science, UK, pp: 626.
Tikubet G, Gemechu T (1984): Altitudinal distribution of tsetse flies in the Fincha valley (western part of Ethiopia). Insect. Sci. Application. 5, 389-395.
Trail JCM, d'Ieteren GDM., Maile JC, Yangari G (1991). Genetic aspects of control of anaemia development in trypanotolerant N'Dama cattle. Acta Trop. 48, 285-291.
Upadhyaya A (2005). Text of preventive Veterinary Medicine 1sted, International book distributing co, (publishing Division), Army printing press,33 Nuhru Road, saddart contt, Lucknow-226002.
Wondewosen T, Dechasa T, Anteneh W (2012). Prevalence study of bovine trypanosomosis and tsetse density in selected villages of Arbaminch, Ethiopia, J. Vet. Med. Anim. Health 4(3):36-41.