



**ADDIS ABABA UNIVERSITY COLLEGE OF NATURAL AND
COMPUTATIONAL SCIENCE DEPARTMENT OF ZOOLOGICAL
SCIENCES**

**DISTRIBUTION OF TSETSE FLY AND THE PREVALENCE OF BOVINE
TRYPANOSOMASIS, IN HAWA GALAN DISTRICT WESTERN
OROMIA, ETHIOPIA**

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Approval Page

This is to certify that the thesis prepared by Temesgen Alemayehu entitled, ‘**Distribution of Tsetse Fly and the Prevalence of Bovine Trypanosomiasis; in Hawa Galan district Western Oromia, Ethiopia**’ in partial fulfillment of the requirements for the degree of Masters of Science in Biology compiles with the regulation of the university and meets the accepted standards with respect to original and quality.

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List of acronyms

F/T/D.....Flies per trap per day

HGWLDFRO.....Hawa Galan woreda Livestock Development and Fish Recourse office

HGWANROHawa Galan woreda Agricultural and Natural resource office

HGWRLALUP.....Hawa Gelan Woreda Rural Land Administrative and Land use Plan office

M.A.S.L.....Meters Above Sea Level

NTTICC.....National Tsetse fly and Trypanosomiasis and Investigation and Control
Center

PAs.....Peasant Associations

PCV.....Packed Cell Volume

Abstract

Livestock farming is a major part of African agricultural sector and plays an important role in food and economic security through provision of a variety of products and services including hides, skins, milk, meat, drought power, manure fiber and energy and capital accumulation. Trypanosomiasis is distributed in natural herds particularly in Africa where tsetse flies are present. Ethiopia is one of the countries which are affected by trypanosomiasis. A cross sectional study was conducted in Hawa Gelan district of Kellel Wollega Zone, Oromia Regnal State western Ethiopia from September 2017 to July 2018 to study the distribution of tsetse flies and prevalence of Bovine trypanosomiasis. Simple random sampling was used to select 384 cattle from five peasant association for collection of blood sample and 50 traps (10/site) were deployed in this peasant association. Buff coat technique was used to determine prevalence of bovine trypanosomiasis in the study area. The blood sample was examined and it was found that 24 (6.25%) were parasite positive. The prevalence was significant in age group, sex and peasant association. The most common trypanosoma species identified, *Trypanosoma congolense*, was 16 (66.66%) higher than that of the prevalence of *Trypanosoma vivax* 7 (29.16%) and *Trypanosoma brucei* 1 (4.16%). Adult animals were relatively more prone to high infection rate 6.94% than young animals 4.54% and higher prevalence of trypanosomiasis infection was observed in animals with poor body condition and low packed cell volume (PCV) value animals. Out of 24 trypanosomiasis positive animals 75% had PCV < 24%, i.e., they were both infected and anemic. This clearly shows that, PCV value can be affected by trypanosomiasis. The mean PCV value of the present finding of parastemic (20.75) and was significantly lower than aparastemic animals (26.62). The trap was deployed before sun for 48 hours. 259 flies were caught during survey, acetone octanol and cow urine were used as attractants. Out of these flies 78 (35.13%) were the *Glossina* species and the rest 181 (69.86%) were biting flies. The major *Glossina* species identified were 65.3% (51/78) *Glossina tachinoides* and 34.6% (27/78) *Glossina morrisoni* sub *morrisoni*. The apparent densities of different flies during the study period 0.8fly/trap/day for tsetse species and 2.6 flies/trap/day. Finally, to minimize the disease vector tsetse implementing control method with integrated approach is essential for sustainable benefit from cattle.

Key words: bovine, infection prevalence, trypanosomiasis, tsetse flies

1. Introduction

Livestock farming is a major part of African agricultural sector which plays an important role in food and economic security through provision of a variety of products and services including hides, skins, milk meat, drought power, manure fiber and energy and capital accumulation. In addition to its significant contribution to agricultural Gross Domestic Product (GDP) and to food security in many countries livestock is an intrinsic part of people's identity and way of life and also have various social and cultural functions that vary among different cultures, socio-economy, agro-ecology and location in tropical and sub-tropical Africa (Kosgey, 2004). Ethiopia's ruminant livestock population is the largest in Africa and 10th in the world (ILCA, 1991)

Tsetse transmitted trypanosomiasis affect 38 sub-Sahara countries immense economic and social impact. It is complex disease of protozoa caused by deferent species of parasite found in the blood and other tissue of vertebrate including livestock, wild life and people (Tesfaye, 2002).

Trypanosomiasis limits the extension of natural herds particularly in Africa to wood land and savannah areas with good grazing potential (Getachew, 2005, Abebe and Yilma, 1996). Ethiopia has a huge diverse livestock population that plays an important role in the economy and livelihoods of farmers and pastoralist (Jobire *et al.*, 2010).

The country's livestock heads is estimated to be over 150 million. Of these, approximately 53.4 million are cattle, 48.28 million are small ruminants, 8.58 million are equine, 1 million are camel and 49.3 are poultry (CSA, 2011). Despite the large animal population; production and productivity is very low in Ethiopia and even below the average for most countries in eastern and sub-Saharan African countries. This is due to poor nutrition, reproductive insufficiency, management constraint and prevailing animal disease (Jobire *et al* 2010). One of the major factors that affect productivity of livestock in Ethiopia is trypanosmiasis disease which is transmitted by tsetse fly. It is one of the major disease impediments to the livestock development and agricultural production which negatively affect the overall development of the agriculture in general and to the food self-reliance of the nation in particular. Currently, six species of trypanosomes are recorded in Ethiopia and the most important trypanosome in terms of

economic loss in domestic livestock are tsetse fly transmitted species; *Trypanosoma Conglese*, *Trypanosoma vivax* and *Trypanosoma brucie*.

Tsetse flies are distributed mainly in Southwest and Northwest region between longitude 33⁰ E and 38⁰E and latitude 5⁰ and 12⁰ N and cover an area of 220000km² in Ethiopia. The *Glossina* species (*Glossina moristans*, *Glossina tachinoide*, *Glossina fuscipes*, *Glossina pallidipes* and *Glossina longipennis*) have been recorded from Ethiopia and except *Glossina longipennis* all of them are wide spread with significant economic importance (Getachew, 2005) these (NTTICC, 2004) according to tsetse transmitted to animals.

Trypanosomes are among the main causes of livestock production loss in Ethiopia. About 15-20% of the land believed to be suitable for livestock production is affected by one of two species of tsetse flies (NTTICC, 2002). The effects of trypanosomes is not only the direct losses resulting from mortality, morbidity, infertility, of animals and cost of controlling the disease but also due to direct losses which include the exclusion of stock and animal power based crop production from fertile tsetse infect areas (Awoke, 2000).

1.1 Statement of the problem

Hawa Gelan district is one of which trypanosomiasis cause problem in livestock production. As the result, the people suffering from low level of draught power and productivity that comprise the socio-economic and nutritional status of inhabitants. Almost all economy of the society depends on agriculture which relies on farming crops and livestock. However, most of its productivity is affected by different factor such as cattle disease. Bovine is common disease in Hawa Gelan district.

1.2 Objectives of the study

1.2.1 General objective

To investigate tsetse fly distribution and prevalence of bovine trypanosomiasis in Hawa Gelan district.

1.2.2 Specific objectives

- To determine the species and relative magnitude of vectors of Trypanosomes in Hawa Gelan district of Kellem Wollega Zone.
- To assess the prevalence of bovine trypanosomiasis in Hawa Gelan district.
- To assess the species and relative magnitude of the different species of Trypanosomes of bovine in the district.
- To determine PCV values in parasitaemic and aparastaemic animal.
- To assess the prevalence of bovine Trypanosomes between sex and age.

1.3. Significance of the study

According to national tsetse and trypanosomiasis investigation and control center tsetse fly transmitted trypanosomiasis still remain as one of the largest cause of livestock production losses in Ethiopia.

Trypanosomiasis characterization are in fever, anemia, immune depression, hear failure, Edema and wasting. Methods used to reduce trypanosomiasis and its effects are use of drugs for curative and preventive and use of trypanotolerant cattle (Fikru, 2006). Economic impacts developed are direct losses (loss of production, mortality and abortion), cost of control (cost of drugs, transportation cost to field and operators' salaries) and indirect losses (loss of potential production). Now a day, limitation of food is global problem in developing country such as Ethiopia. Bovine trypanomiasis is one of the greatest factors that affect productivity.

This study is important to investigate the impact of the bovine trypanomiasis which hinders the development of natural herds particularly in Africa. The presence of tsetse fly is dense in wood land and savannah areas with good grazing potential in Ethiopia and elsewhere. Knowledge of the current status, clear understands of epidemiology of trypanosomiasis and its vectors are crucial to integrate all efforts to word combating the disease and reduce economic loss.

2. Literature Review

2.1 Classification of tsetse flies

Tsetse flies are classified under one genus *Glossina* of the family Glossinidae, Order Diptera. There are 31 species and subspecies identified in the genus at present. The classification of tsetse flies is based largely on morphological difference in structure of the genitalia (Fikru, 2006).

2.2 Status of Tsetse Flies in Ethiopia

Approximately 220,000km² agriculturally suitable land in the South, west and Southwest Ethiopia is infested by tsetse flies (1/3 of the country). Five species of *Glossina* (*Glossina morsitans* sub *morsitans*, *Glossina tachinoisdes*, *Glsina Longipennis*) have been recorded from Ethiopia and except *Glossina longipennis* all of them are wide spread and significant economic importance (Getachew, 2000) these are *Glossina morsitans* sub *morsitans*, *Glossina tachinodes* which have a West to East distribution across Africa South of Sahara Desert and *Glossina pallidipes* and *Glossina fuscipes* which often occur to gather in East Africa although the former extended from to South whereas the later has essentially central Africa (Getachew, 2005)

Table 1. Tsetse infected region and river basins of Ethiopia (Source: Getachew, 2005)

Region	Major river basin	Species of <i>Glossina</i>
Amhara	Abay/ Blue Nile	<i>Glossina submorsitans</i> , <i>Glossina tachinoisde</i>
Benishangul Gumuz	Abay blue Nile	<i>Glossina submorsitans</i> , <i>Glossina tachinoisde</i>
Gambela	Baro/Akobo	<i>Glossina submorsitans</i> , <i>Glossina tachinoisde</i> , <i>Glossina pallidipes</i> and <i>Glossina fuscipes</i>
Oromia	Abay /Didesa	<i>Glossina sub morsitans</i> , <i>Glossina tachinoisdes</i> ,
	Upper Gibe,Baro/ Akobo	<i>Glossina pallidipes</i> and <i>Glossina fuscipes</i>
SNNPR	Omo Gibe rift valley	<i>Glossina pallidipes</i> and <i>Glossina fuscipes</i>

2.3 Trypanomiasis

Trypanomiasis is a disease caused by trypanosomes (protozoa parasite), is a great economic and medical important in Africa. African trypanosomiasis is confined to countries south of the Sahara. The area affected is an enormous block of the Africa land mass extending from approximately 14° N to south Angola at 29° S. An estimated 10 million km² (extending to 38 countries), or nearly a quarter of the area of the Africa continent, largely denied to cattle, other domestic animals as well as man because of Trypanosomiasis. While eradication of trypanosomiasis remains an unrealistic goal for most of Africa, considerable effort has been invested in the control of this disease by the use of trypanocidal drugs, vector management and exploitation of genetic resistance exhibited by indigenous breeds. Even though the use of trypanocidal drugs is well established and represents the most adopted approach to control trypanosomes, there is a scope for increased use. Reports show increasing cases of trypanosome resistance to current drugs, both in individual cases and regionally, especially in East and West Africa. There appears to be little hope for developing new trypanocidal drugs to benefit small holder farmers in the short term. Given the actual or potential problem of drug resistance in many areas, drug usage clearly cannot be relied upon continuously as the sole method of trypanosome control (Fikru, 2006).

2.4 Classification of Trypanosomes

Study on of the morphology of parasite and types of disease trypanosomes revealed that there were at least two distinct species of trypanosomes (*Trypanosoma brucei gambiense* and *Trypanosoma br. hodesiense*) parasiting man (sleeping sickness) and three other species of the trypanosomes; *Trypanosoma b. brucei*, *Trypanosoma vivax* and *Trypanosoma congolense* Parasiting cattle (causentozoan or gandi) (Fikru, 2006).

The modern classification of trypanosomes is rearranged in to two major sections. The salivarian which are pathogenic to man and livestock and stercorarian. The section of the trypanosomes of the animal contains about eight genera and numerous species on the basis of the mode of development and method of transmission by insect vector and the developmental stage and

morphology in the invertebrate host. Stercorarian trypanosomes develop to epimastigotes in the mid gut of the insect vectors and complete their development to the metacyclic infective stage in the mid gut (posterior station).

2.5 Trypanosomiasis in Africa

Trypanosomiasis, a disease caused by trypanosomes (protozoan parasite), is of great economic and medical importance in Africa. African trypanosomiasis is confined to countries south of the Sahara. The area affected is an enormous block of the African land mass extending from approximately 14° N to southern Angola at 29° S, with continuous and pocket areas of infestation. An estimated 10 million km² (extending to 38 countries), or nearly a quarter of the area of the Africa continent, is largely denied to cattle, other domestic animals as well as man because of trypanosomiasis (Fikru, 2006).

Human African Trypanosomiasis is exclusively transmitted by the tsetse flies (*Glossina* species) while animal trypanosomiasis, which is transmitted mainly by tsetse flies could also be transmitted by other biting flies, such as Tabanids (Fikru, 2006).

Trypanosomiasis in domestic animals and malaria in humans have caused significant periodic movements of human settlement in Ethiopia from the 1960s up to the present day. These movements themselves are also likely to have influenced tsetse fly distribution. For example, *Glossina morsitans sub morsitans* extend its range in south west Ethiopia (Leak and Woudyalew, 1993). Possibly by moving in to areas where suitable habitat has been created by bush encroachment in to previously cultivated land. Alternatively, climatic changes, resulting in warmer climate, may have enabled tsetse flies to occupy land at higher altitudes than was previously possible.

Trypanosomiasis results in severe losses in productivity of domestic livestock due to poor growth, weight loss, low milk yield, reduced capacity for work, infertility and abortion. It also impairs the development of animal agriculture in zones which constitute 41 % of the land, but which carry only 26% of the ruminant population. The annual loss in meat production alone was estimated at US 5 billion dollar in 1984. The number of cattle at risk of contracting tsetse fly-transmitted has been estimated 46 million, in an area of about 8.7 million km². In Africa 80% of

the traction power is non-mechanized. A six fold increase in agriculture output as a result of the availability of a draught ox a family unit has been calculated (Fikru, 2006).

2.6 Trypanosomiasis in Ethiopia

In Ethiopia, an estimated area of 150,000-200,000 km² in the Western, Southern, Southwest low land areas, and the major river basins are reported to be infected by different tsetse fly species. It is estimated that some 10 to 14 million heads of cattle in Ethiopia are exposed to the risk of trypanosomiasis. It is not only the loss in meat and milk production of animals recovering from the disease but the great damage caused by this disease in that has hundred thousands of hector of land unfit for settlement and cultivation in addition some drugs applied to treat the diseased animals developed resistance and they are costly. The estimated maximum benefit per square kilometer of tsetse infested area over a 20 year period is 10,000 USD. Consequently, the total maximum benefits from dealing with bovine trypanosomiasis in Ethiopia could be as much as 1 billion USD over a 20 year period (Tadel, 1991).

2.7 Etiology

Trypanosomiasis is a complex disease caused by unicellular parasite found in the blood and tissue of vertebrates including cattle and man (Tesfaye, 2002). The diseases are caused by flagellate protozoa called trypanosomes which are transmitted by number of deferent arthropod vectors mainly by biting flies. Most important trypanosomes species affecting livestock in Ethiopia are *Trypanosoma congolense*, *Trypanosoma vivax* and *Trypanosoma b.brucie* parasiting in cattle, sheep goats, *Trypanosoma evansi* in camel and *Trypanosome eqiperdium* in horse (Getachew, 2005).

2.8 Morphology and Motility

Once the basic featured processed by all trypanosomes all appreciated, the diagnostic differences can be recognized and species identified (Uilberg, 1998). Trypanosomes move actively and progress by movement of undulating membrane and the flagellum where present (Uileberg, 1998). They elongated spindle shape protozoa ranging from 8-39 micrometers. They characteristically leaf life in shape. They have single flagellum and this attached to the organism by undulating membrane (Soulsby, 1982). All possess flagella which are rise at posterior end of

the body and basal body at the foot of flagella pocked .The flagellum run to the anterior end of the body and is attached along the length to pellicle to form undulating membrane. Motility of each of parasite can be identified in fresh unfixed blood *Trypanosome brucie* move rapidly within small area of microscope and *Trypanosome congolense* move sluggishly often apparently attached the red blood cell and *Trypanosome vivax* rapidly across the microscope field (Urquhart *et al.*, 1995).

In giemsa stained blood smear the sub genera are distinguished by their size, location, size of kintoplast, position of nucleus and the attachment and length of flagellum (losos, 1986).

2.9 Life cycle

The life cycles of Trypanosomes are complex. Tsetse flies ingest trypanosomes in the blood or lymph while feeding on infected host. The trypanosomes undergo cycle of independent and multiplication in the digestive tract of the fly until the infective metacyclic trypanosomes or metacyclic trypanosomes are produced (Uilenberg, 1998). There they undergo a transformation losing their typical trypanosomes, or trypomastigote and metacyclic trypanosomes, which infective forms of the host (Urquhart *et al.*, 1996). After further multiplication, epimastigote transform in to small typical trypomastigotes for with a glycoprotein surface coat. The entire process takes at least 2-3 week and metacyclic trypomastigote are inoculated into new host when tsetse fly feeds, with trypanosome *Trypanosoma vivax* similar process of cyclic development takes place (Taylor *et al.*, 2007).

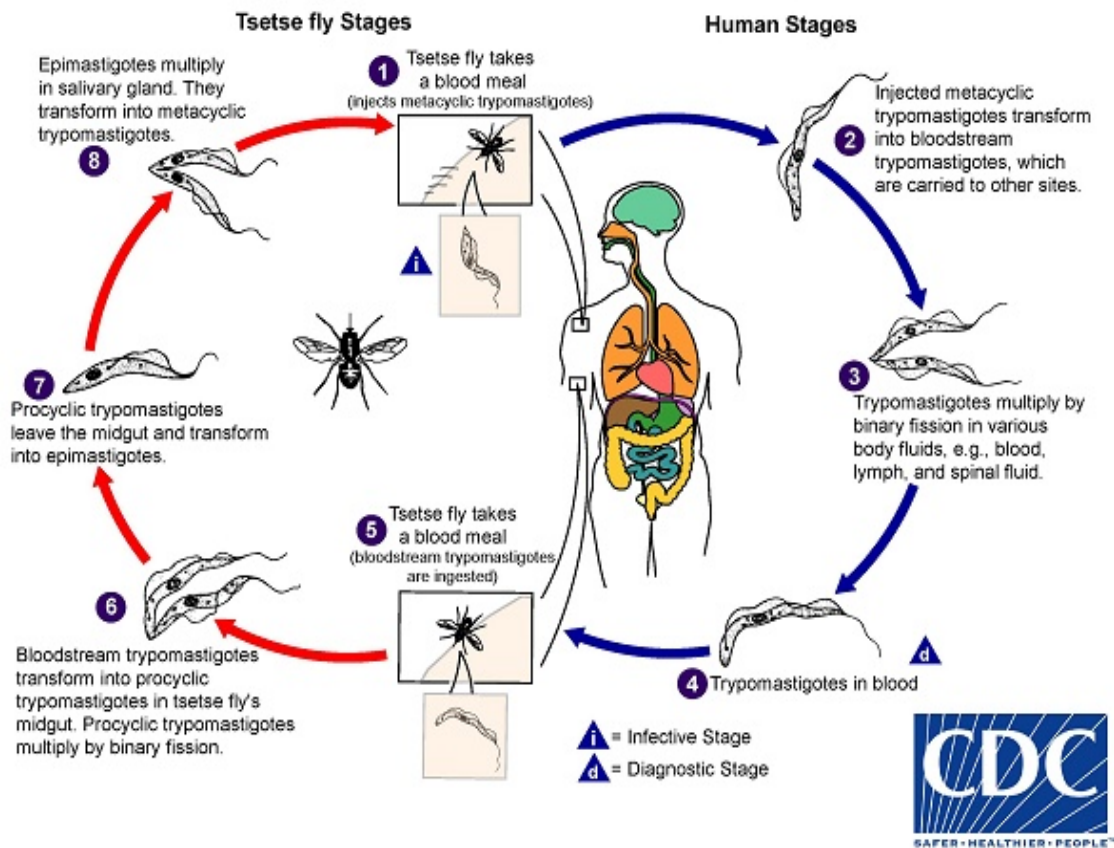


Figure 1. Generalized life cycle of a fly- transmitted Trypanosoma

2.10 Epidemiology of trypanosomes

The epidemiology of trypanosomiasis depends on the distribution of the vector, the virulence of the parasite and the response of the host. Of the three groups of *Glossina* (savanna type, riverine type and forest type) the savannah and riverine are the most important vectors since they inhabit area suitable for grassing and watering.

2.11 Distribution

Tsetse flies in Ethiopia are confined to the Southern and western region between longitude 33⁰ E and 38⁰E and latitude 5⁰ N and 12⁰. They infest areas which together amount to 220000km².

Tsetse infested areas lie in the low lands and also in the river valley of Abay (Blue Nile), Baro, Akobo Didesa, Gibe and Omo (Abebe *et al.*, 2005).

2.12 Transmission

Trypanosomes are the complex disease which is transmitted mainly by tsetse flies or cyclically, by other biting flies or mechanically and by another means of transmission (Uilenberg, 1998 and Awoke, 2000). Trypanosomes in section salivaria are transmitted to mammalian host by the bites of flies during feeding after a full development in different bodies of tsetse according to the species of trypanosomes. The feeding habit of tsetse on a wide of wild animals in Africa leaves the latter as a nucleus of source of infection for domestic animals in cyclically transmitted trypanosomes (ILRAD, 1981). Mechanically transmission is particularly important in relation to *Trypanosoma vivax* and *Trypanosoma evansi* particularly on the fringe of tsetse areas (Hoare, 1970). It can occur in the presence of biting flies of the genus *Tabanu*, *Hematopta*, *Chrysopsa* and *Stomoxys* (Getachew, 2005).

2.13 Clinical Sign

Anemia, generalized enlargement of the superficial lymph nodes, lethargy and progressive loss of body condition are the major signs of the tyranosomiasis. Infected animals can easily be exhausted and lag behind the herd. Trypano resistant breeds can be recovered if the nutrition condition is good and the infection severity is low (Brown *et al.*, 1990).

2.14 Pathogens and Pathology

The pathogeneses and pathology of the disease caused by African trypanosomes differ according to the species causing the infection (Robert, 1979). Infected tsetse inoculating metacycle trypanosomes in the skin of the animal were, trypanosomes grow for an few days localized swelling (chancre). They enter the lymph nodes, the blood stream, where they divided rapidly by binary fission (Anwar, 1993). Generally, pathogenesis of trypanosomes may be considered under: localized swelling (chancre) lymph adenopathy, anemia and tissue damage (Getachew, 2005).

2.15 Diagnosis

Trypanosomiasis can be diagnosed based on either detection of the parasite by the light microscope (parasitological) or demonstration of the circulating antibody (serological) in conjugation with clinical observation. The stained thin blood smears afford the best means of identifying species of trypanosomes. Trypanosomes move actively and progress by movements of the undulating membrane and the flagellum when present. They are elongated spindle shaped protozoa ranging from 8 – 39 micrometer. The flagellum runs to the anterior end of the body and is attached along its length to the pellicle to form an undulating membrane. Motility of each species of the parasite can be identified in fresh unfixed blood films (Uilenberg, 1998). The morphology and the motility of species of trypanosomes are summarized in the following table.

Table 2. Summary of morphology and motility of trypanosoma species (Source; Urquhart *et al.*, 1995)

No	Species	Morphology	Motility in fresh blood	Undulating membrane
1	<i>T. brucei</i>	Pleomorphic	Movement rapidly	Pronounced
2	<i>T. congolense</i>	Monomorphic	Movement sluggishly	Poorly developed
3	<i>T. vivax</i>	Monomorphic	Movement rapidly	Poorly developed

2.16 Treatment, Control and Prevention

Diminazeneaceturate and homidium salts are drugs that are used in the treatment of trypanosomiasis. The control strategies in trypanosomiasis concentrate on vector control, parasite control with chemotherapy and chemoprophylaxis and use of inherent trypanotolerant trait in some breeds of animals (Getachew, 2005).

3. Materials and Methods

3.1 Study area and population

The study was conducted from September 2017 to July 2018 in Hawa Gelan district. Hawa Gelan is located at Oromia region of Kellema Wollega Zone. The district is located about 624km from West of Addis Ababa. The district is bounded by Sadi Chanqa in Northeast, Sayo district in West, Illuababora at the southern and Southwestern and Yamalgi Walal at the northern direction. The human population of the district is 129486 of which 65662 are males and 63854 are females. The district receives annual rain fall ranging from the minimum of 900 mm to the maximum of 2200 mm, while the maximum and the minimum temperature is 24⁰c and 18⁰c respectively. The livestock population of the district was estimated to be about 229966. From these 75927 cattle's, 35741 sheep, 21450 goat, 1087 horses, 7500 donkeys, 1366 mules and 86895 poultry; make the total population of live stocks of Hawa Gelan districts (HGWLD FRO). The farming system of the area was mixed farming where 87% of the population engaging in agriculture. Crops and livestock scale are important source of income for all Wealth group (CSA, 2017). The study population was undertaken on both sex and age group of local breed of bovine species. The administrative center of the district is Geba Robi, which is 28 km far from the zonal capital, Dembi Dollo.

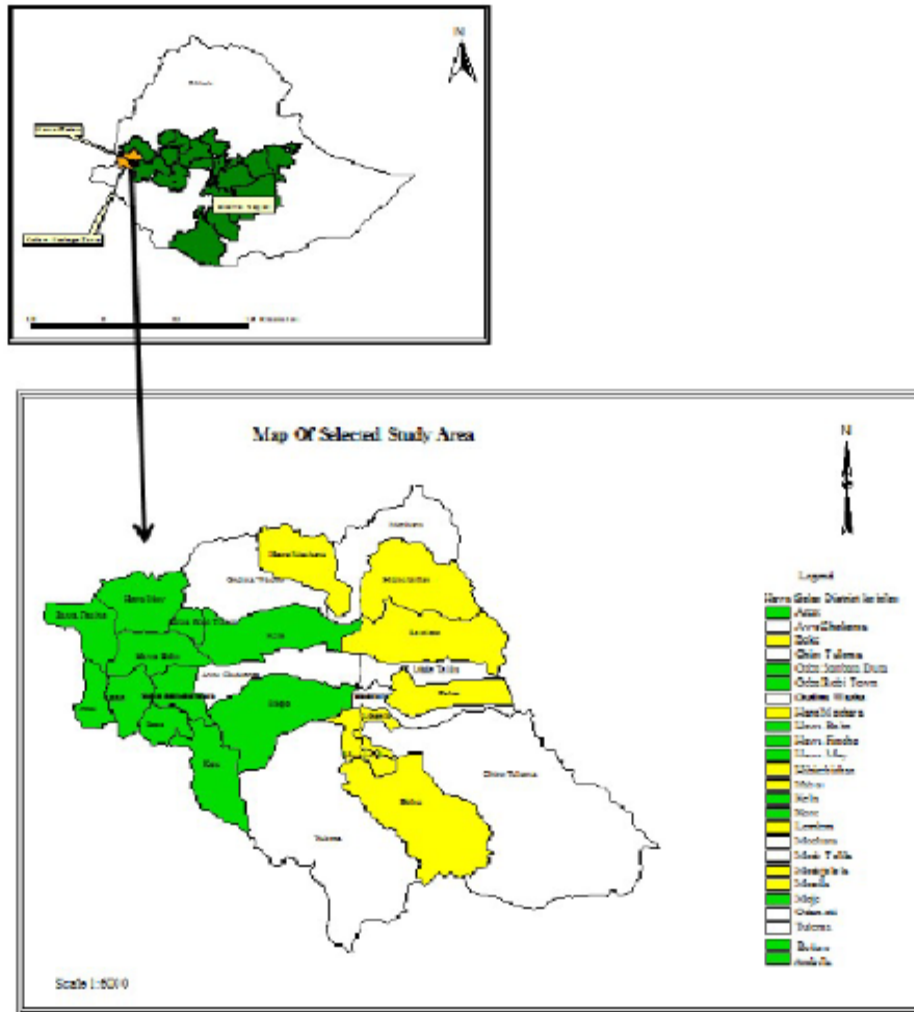


Figure 2. Map of the study area

3.2 Land Use

According to the reports from the districts' land administrative office, the district covers a total area of 51011 hectares. Out of these 24937 hectares are agricultural land, 16509.5 hectare lands with permanent plants, 248 hectares are settlement (construction) lands, 2239 hectares are grazing lands, 1465.5 hectares are rocky lands, 1792 hectares wet land and 3920 hectares are covered by fragmented forest (HGWRLALUPO).

3.3 Topography, Soil and Drainage

The topography of the district is rise with elevation varying between 1200-2200 m.a.s.l. (HGWANRO, 2016). Its lowest and highest point lies in specific area of Tuluma and Fincho, respectively. Soil of the study area is classified as fertile, red, clay, etc. traditionally. No further studies were carried out on the soil to categorize scientifically. The study area is surrounded by different rivers like Keto, Hindina, Birbir, Daliyu, Tibe, Chibbi, Chokorsa, Horor, Kombolcha, Cabal, Galo, Lagareti and Yankina were the major rivers of the district.

The study area is divided based on traditional agroecology such as badadare (woyina- Dega) and gemoji (kolla) agro ecological zone with an elevation of 1500-2300 and 500-1500m a.s.l respectively (HGWANRO, 2014). The dominant agro-ecology of the district is the hot to warm moist low lands which covers about 56.25 % of the total area of the district. The wayinadega agro-ecology of the district accounts for 43.75% of the total area of the district. The district receives annual rain fall ranging from the minimum of 900 mm to the maximum of 2200 mm. The major rainy seasons of the district are spring (September-November), summer (June-August) and autumn (April-May) (HGWANRO, 2016).

3.4 Sample size determination

In these study area there were 12819 heads of cattle's. The simple random sampling technique was applied to collect blood from ear vein. The sample size were determined based on 95% confidence interval, 5% desire absolute precision and 50% prevalence according to the formula indicated by Thrufield (2005).

Therefore, $N = \frac{(z_x)^2 p_{exp}(1-p_{exp})}{D^2}$

$$D^2$$

N= the required sample size

P_{exp}=the expected prevalence rate (50%)

Z_x=in the values of the required confidence interval (1.96) of 95% CI

D=desired absolute precision (5%)

$$N=1.96*1.96*(1-0.5)0.5/0.05^2= 384$$

Hence; - the sample size required as per the above formula is 384 heads of cattle

For sample size calculation, 95% CI and 5% desired absolute precision, and expected prevalence of the disease (P=50%) would be used. I have no data base preferences. Thus, the calculated sample sizes for blood examination were considered 384 to determine the prevalence of trypanosomiasis in the area. Proportional sampling for age and sex would be considered.

3.5 Study design

A cross-sectional study type with simple random sampling was conducted to determine the prevalence of bovine trypanosomiasis at this area using blood. Initially, from 32 peasant association (PAs) found in the district 5 peasant association (Boke, I.bas, H.mechera, Hibrabiran and lemlem) would be selected purposively due to area can be considered as tsetse burden site of the study area (HGWLDFRO). A total of 384 animals were sampled the number of animal sampled from each peasant association was selected based on simple random sampling. Epidemiological risk factors such as sex, age body score condition and origin of animal were assessed for the presence of association with the prevalence of Trypanosomiasis. The distribution and apparent density of tsetse flies are though deployed 50 monoconical pyramid trap made from local materials bite by acetone, octanole and three week cow urine were placed site of near grassing and watering area of cattle (Dransfield, 1990)

3.6 Sample collection

Blood sample were collected securing after properly the animal and aseptically preparing around the vein. In the present study a blood sample obtained from marginal ear vein after pricking the vein with the tip of sterile lancet. The lancet was cleaned with cotton after bleeding each animal top to prevent cross contamination of the sample. During sample collection; age, sex, PAs, altitude and body condition of each animal were recorded. The age of the animals was grouped as young (< 3 years) and adults (>3 years) (Bitew *et al.*, 2011). On subjective basis body condition of examined animals were evaluated during sample collection. They were classified as

poor, medium and good relative to the average body condition of local animals (zebu) (Nicholson *et al.*, 1986).

3.7 Parasitological and Hematological examination

Buffy coat or dark ground technique

Buffy coat is used for diagnosis of low parasitemia, to identify the trypanosome species and quantification. Blood was collected by heparinized micro hematocrit capillary tube up to $\frac{3}{4}$ of its volume from each animal and one end of the tube was sealed with crystal sealant. The tube was placed in the micro hematocrit centrifuge insuring that the sealant is at outer end (Radostits, 2007). The blood in the centrifuge at 12000 rpm for 5 minutes as centrifugation process gets an end the tube were taken from the hematocrit centrifuge and tubes are then placed in haematocrit and read expressed as percentage of packed cells to the total volume of whole blood. Animals with PCV <24% were considered to be anemic (Van den Bossche *et al.*, 2001) and then capillary tube were cut using demand pencil 1mm below the Buffy coat including the top layer of the red blood cell (Murray *et al.*, 1977). The content of capillary tube was expressed on the slide, homogenized on to clean slide and cover with cover slip. Then, the slides are examined under microscope of 40x objective lens and 10 x eye piece lenses for the movement of the parasites in Mechara animal health center Kelem Wolega Zone (Paris *et al.*, 1982).

3.8 Entomological survey

During the study period 50 monoconical pyramid trap were developed from local materials blue black colour and white mesh baited with three week old cow urine, acetone and octanol in separate bottles to attract tsetse flies was placed along livestock grazing areas watering point and near the Hindina, Keto, Galo, Lagareti, Boni and Birbir river were site of cattle feeding and watering. To prevent the ascent of ants up on the poles towards the collecting cage, the underneath of each pole was smeared with grease. To access the apparent of different tsetse fly species and other biting flies, entomological samples were collected and studied in selected sites of the study areas with deployment of traps of (10traps/sites) before sun rise in the morning for 48 hours at 100m interval were set along a transect sampling techniques were employed. During trapping, three Chemicals, acetone and octanol was dispensed from open vials though an

approximately 'o' sized hole and three week cow urine was stationed (Dransfield *et al.*, 1900). The different fly catches in each trap were counted and the species of tsetse fly were identified based on the characteristic morphology (leak *et al.*, 1993) and for other biting flies according to their morphological characteristics such as size color, wing venation structures and proboscis at the genus level (Walle and Shearer, 1997). Sexing was done just by observing the posterior ends of the ventral aspect of the abdomen by hand lens male fly were identified by enlarged hypopygium in the posterior ventral part of the abdomen. Tsetse fly apparent density mean catch in traps deployed was expressed as the number of tsetse catch/trap/day (Leak 1993).



Figure 3. Monoconical pyramid trap model to caught adult tsetse.

3.9 Data management and Analysis

The data collected from individuals animals, age, sex, body condition, parasitological examination, and sample from each trap were inserted to micro soft excel spread sheets. Microsoft excel were used to compare the prevalence of trypanosome infection with different variable, PA, age sex, body condition to compare the mean PCV of infected animals with that of non-infected animals. Mean catch of trap/day calculated by scientific calculator for entomological survey.

4. Results and Discussion

4.1 Results

4.1.1 Parasitological Finding

Prevalence of bovine trypanosomiasis in relative to peasant association

Out of 384 randomly selected cattle head in Hawa Gelan district 24 of them were found infected with different species of trypanosomiasis. The prevalence of the disease varying from 3.94% (in Lemlem) to 7.79% (in Boke) and the overall prevalence was calculated to be 6.25% (n=24) for bovine trypanosomiasis in the study area. The high prevalence 7.79% and 7.59% was observed in Boke and Ifa bas villages remarkable in the study area.

Table 3. Prevalence of bovine trypanosomiasis with in Hawa Gelan district

	Kebele	No.of examine cattles	No of positive cattles	Prevalence (%)
1	Boke	77	6	6(7.79%)
2	I.bas	79	6	6(7.59%)
3	Haro mechara	78	4	4(5.12%)
4	Hibirabiran	74	5	5(6.75%)
5	Lemlem	76	3	3(3.94%)
	Total	360	24	24(6.25%)

Prevalence of bovine trypanosomiasis in relation to age

The animals examined were categorized in to two age groups young and adult (less than 3 year young) and greater than three year adult). The trypanosome infection prevalence was found to be 5/110(4.54%) the young and 19/274(6.93%) in adult.

Table 4. Prevalence of bovine trypanosomiasis with age in Hawa Gelan district

Age	No.of examine cattles	No.of positive cattles	Prevalence rate (%)
Young	110	5	5(4.54%)
Adult	274	19	19(6.93%)
Total	360	24	24(6.25%)

The prevalence bovine trypanosomiasis with species of parasite in Hawa Gelan District

During this study *trypanosome congolense*, *trypanosome vivax* and *trypanosome brucie* were detected. Among 384 cattle examined 24 animals were infected with trypanosome parasite of which 16 (66.66%) cattle were found to be *trypanosome Congolese*, 7 (29.16%) by *trypanosome vivax* and 1 (4.16%) by *trypanosome brucie*.

Table 5. Prevalence of bovine trypanosome species in Hawa Gelan district with species of parasite identified

Species of parasite	No.of positive cattles	Prevalence rate (%)
T.conglence	16	16(66.66%)
T.vivax	7	7(29.16%)
T.brucei	1	1(4.16%)
Total	24	100

Prevalence of bovine trypanosome in both male and female animals in Hawa Gelan district

During the present survey, from a total of 384 cattle examined, 182 were female and 202 of them were male animals. Of the female animals examined, 3.84% (n=7) were positive for trypanosome infection while 8.41% (n=17) of the male animals were found infected as summarized in table in table 6 bellow. The trypanosome infection in male animals was slightly higher than in female animals.

Table 6. Prevalence of bovine trypanosome in both male and female animals

Sex	No. of examined animal	No. of animals with parasite	Prevalence rate (%)
Male	202	17	17(8.41%)
Female	182	7	7(3.84%)
Total	360	24	24(6.25%)

Prevalence in relation to body condition score

Prevalence of bovine trypanosomiasis among body condition was studied in the area. From the total of 384 cattle randomly selected and examined animals in five PAs 125 of them were poor body condition (32.55%) from which 16 animals were positives of trypanosomes (12.8%), while 159 of them were medium body condition 41.4% in 7 animals were positive of trypanosomes (4.4%) and 93 of them were good body condition (24.21%) in which (1.07%) were positives of trypanosomes and the higher rates was recorded in animals with poor body condition.

Table 7. Body condition scoring and prevalence rate of trypanomiasis in HawaGlan district

Body condition	No. of examined animals	No. of animals with parasite	Prevalence rate (%)
Good	93	1	1(1.07%)
Medium	166	7	7(4.2%)
Poor	125	16	16(12.8%)
Total	384	24	24(6.25%)

Packed Cell Volume (PCV)

PCV for all study animals was analyzed to estimate the degree of anemia. From the total of 384 animals: 41.14% had PCV value less than 24% and from 360 trypanosomiasis negative animals 6.51% had less than 24% PCV value from trypanosome positive 24 animals 75% had PCV value less than 24%. Furthermore, 58.85% of the cattle have had a PCV value normal range (24-46%). The mean PCV value of the present finding of parastemic (20.75) and was significantly lower than aparastemic animals (26.62).

In case of hematological finding the factor may be related to the debilitating nature of the disease (Radostis et al., 2007) in the absence of other disease causing animal, a low PCV value of individual animals is a good indicator of trypanosome infection (Ababe, 2005, Marcotty et al., 2008) during the study period cattle with PCV < 24% were considered anemic while PCV > 25 were nonanemic (Van den Bossche et al., 2001) with is said to be the principal sign on trypanosomiasis in livestock (Gardiner, 1989). From this study anemic animals were more affected than non-anemic animals because anemic animal had low defense mechanism.

Table 8. Prevalence of bovine trypanosomiasis in anemic and non-anemic animals in Hawa Gelan district

No	Measurement	No. of examined cattles	No. of parasitic cattles	No. of aparasitic cattles	Prevalence rate (%)
1	≤24 (Anemic)	158	18	140	18(11.39%)
2	>24(nonanemic)	226	6	320	6(2.65%)
3	Total	384	24	360	24(6.25%)

4.1.2 Entomological survey

Glossina species of tsetse flies and other biting flies were caught during the study period. Out of flies caught 259 these, 78(35.1%) were *Glossina species* and the left 181 were biting flies. The

apparent fly density found to be 0.8flies/trap/day for tsetse flies and 2.55 f/t/d. The compositions of *Glossina* species identified in the present study were 34.6% (27/78) *G.morsitans sub moristans* and 65.3% (51/78) *Glossinatachinoides*.

Table 9. Apparent density of *Glossina* species and other biting flies collected in different 5 peasant association of Hawa Gelan district.

0	Kebele	No.of trap	Tsetse flies		Biting flies	Total fly	F/D/T
			<i>Glossina tachinoides.</i>	<i>G.morsitan sub moristans</i>			
1	Boke	10	15	8	28	51	2.55
2	I.bas	10	11	4	51	68	3.4
3	H/ machara	10	6	4	42	54	2.7
4	H/ birabran	10	9	4	29	38	1.9
5	Lemlem	10	10	7	31	48	2.4
	Total	50	51	27	181	259	2.6

Among the five PAs I.bas showed the highest fly trap per day (F/T/D) 3.4 which followed by Haro Mechara had 2.7 F/T/D. When we compare the number of *Glossina* species the highest *G.m. sub moristans* were caught in Boke with the lowest being in Haro Mechara and Ifa Bas peasant association and also the highest caught of *G. tachinoide* were caught in Boke and the lowest being in Haro Mechara as summarized in Table 9.



Figure 4. Counting and identification of the tsetse species

4.2 Discussion

Typanosomiasis is major constraint to the utilization large land resources and also affect the livestock, cattle in particular as major role in agriculture economy of Ethiopia. The introduction of draught oxen was severely constrained by the spread presence of trypanosomiasis (Getache, 2005).

In the present study on 384 local zebu cattle, an overall of 6.25 % (n=24) bovine trypanosomiasis prevalence rate. This was some similar to previous work documented as 6.86% Lalo Kile district, Kelem Wollega Zone, Western Ethiopia (Efrem *et al.*, 2013).

The result in the present study was lower than that of the result recorded (Tefase, 2012) in which 8.5% prevalence rate was recorded in Diga and Sasiga district of Eastern wollega zone (Yibrah, 2012) reported the prevalence rate of 15.57% from GutoWayu and Sibu Sire district of Eastern Wolega zone.

This study results in also lower than the reported 12.41% in Metekel and Awizones of North West Ethiopia (Solomon and Fitta, 2010) and 20.40% in Wolayta Dawero Zones southern Ethiopia (Miruk, 2008).

The prevalence of bovine trypanosomiasis in the same area to be 8.6 % (Mihreteab and Mubarik, 2011) and also range of prevalence, were also documented from multiple previous studies conducted in the country as 12.5% at Meda Jalal western Ethiopia (NTTICC, 2007), 19.01% in Goro district Southwest Ethiopia (Abiy, 2002). The present finding of relatively low prevalence may be attributed to the frequent use of chemotherapeutic drugs an increase in an agricultural investment and tsetse challenge in the area. The relative high prevalence of trypanosmosis in the above area could be due to high tsetse distribution and animal contact parasite and vector control program practical in the area were lower practice and frequent use of trypanocidal drug as well as the increased of tsetse challenge because of high density of vector in those area. The lower prevalence in the current study might be due to the low sensitivity of the parasitological diagnostic methods, the uncontrolled use of trypanocidal drugs, application of relatively well designed method of tsetse control and treatment, expansion of cultivation in the area which in

directly affects flies distribution and awareness of the people towards the control and treatment of the disease.

In this study, the prevalence of bovine trypanosomiasis between peasant associations was not significant, even though it is higher than in Boke (7.79%) this may be the result of uncontrolled animal movements between PAs and due to marsh areas which favorable for tsetse flies .

In this study, animals with age ≥ 3 years (old) were relatively more prone to high infection rate 6.94% than animals with age < 3 years (young) 4.54%. This can be associated to the fact that adult animals travel long distance for grazing and drought as well as harvest crops in tsetse challenging areas (Rowlan *et. al.*, 1995) sucking calves does not go out with their dams but stay at home until they are weaned off. Besides, young animals are also naturally to some extents maternal antibodies (Fimmen, 1992).

There was also evidence that *Trypanosoma congolense* infection was chronic disease that increase rate with age, (MC Dermott *et al.*, 1999. According to (Torr *et al*, 2000) tsetse flies are attracted significantly more by odor of large animals. The present wok reveled that *Trypanosoma congolese* was the predominant species and found to be a major cause of cattle trypanosomiasis in the study area followed by *Trypanosome vivax* and trypanosoma bruei. This result agrees with previous research of (Shimels *et.al.* 2011). The result in this study area showed that from the total of trypanosome positive animals; 66.6% affected by *Trypanosoma congolese* 29.16%*Trypanosoma vivax* and 4.16%*Trypanosoma brucei*. These result related with the reported proportion of 63.2% *Trypanosoma congolense*, 13.6% *Trypanosoma vivax*, 11.6% *Trypanosoma brucei* infection in cattle from the Mao-Komo special district (Ali and Bitew, 2011). The current result was relatively also relatively similar with the previous study by conducted in Bedele wereda which was reported to be: 71% *Trypanosoma Congolese* 20% *Trypanosoma vivax* and 9% *Trypanosoma brucei* (NTTICC, 2004). The proportion of *Trypanosoma congolense* detected in this study is not agree with the report of Abebe (2007) which is 58% due to *trypanosome congolense*. This predomiance of *Trypanosoma congolese* infection in cattle may be due to the development of better immune response to other trypanosome species *by* infected animals (Sinshaw *et al.*, 2006). Such high proportion of *Trypanosoma congolense* may cause by the presence of a biological vector (Glossina), whereas

Trypanosoma vivax is more readily transmitted mechanically by biting flies than tsetse flies (Landgridge, 1976). The lower infection rate of domestic animals by *Trypanosoma brucei* than by other trypanosome species may be due to the seasonal absence of parasite in circulation (Losos, 1978). Other studies by Rowlands, (1995) and Leek *et al* (1999) have indicated that *Trypanosomiasis* is highly susceptible to treatment while the problems of drug resistance are higher in *Trypanosoma congolense*.

During the study period, the prevalence of bovine trypanosomiasis was assessed between sexes of animals and among 24 trypanosome positive animals; out of the total male animals sampled in the study area (202), only 17(8.46%) of them were positive to parasite trypanosome species and similarly; out of 182 female animals sampled, only 7 animals were positive for the parasite (3.41%), i.e. relatively higher infection rates in male than female animals. This was not in agreement with the work of (Daya and Abebe 2008), Tesfaye *et al.*, 2012) report similar result where they observed no significant difference in trypanosome infection between male and females (Teka *et al.*, 2012) and (Quadeer *et al.*, 2008) in separate studies added that no statistically difference in the prevalence of bovine trypanosome between sex group.

This may be attributed to stress factors related to working male animals which are commonly used for draught power in Ethiopia and they walk long distance even in area with high risk of tsetse challenges.

In the present study, the occurrence of disease in three different body conditions (poor, good medium) animals shows the highest prevalence in poor body condition (12.8%) followed by in medium (4.2%) and good body condition (1.07%).

This finding is consistent with observations of Tadesse and Tsegaye, (2010) and Bitewet *al.*, (2011). There was significant difference in the prevalence of trypanosomiasis between animals with good and poor body condition. This is in agreement with (Mussa, 2002) and (Molalegne *et al.*, 2010). This may be related to the debilitating nature of the disease (Redostits *et al.*, 2007).

The disease itself results in progressive emaciation of the infected animal nevertheless non infected animal under good body condition have well developed immune status that can respond for any foreign protein better than those non infected cattle with anemic 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 (OIE, 2009). Out of 125 total animals sampled poor body condition 87.2% of them were react negatively from trypanosomiasis. This indicates that other factors such as disease, nutritional factors as well as management system may have contributed for the poor body conditions of cattle (Smith, 2009). The absence of trypanosome infection in the poor body condition animals may be due to malnutrition, internal parasites and other body loss disease (OIE, 2009). According to (Vanden Bossche *et al.*, 2001, Rowlan *et al.*, 1995) cattle with $PCV \leq 24\%$ are considered anemic and anemia is principal sign of trypanosomiasis in livestock (Gardiner, 1989). From the total of 384 cattle sampled during this study 158 (41.14%) of them had a $PCV \leq 24\%$. In another side despite 140/158 (88.8%) of the total animals sampled had a $PCV \leq 24\%$ they react negatively from trypanosomiasis infection. This may have occurred due to less sensitivity and specificity of the test used (Murray, 1977) or delayed recovery of anemic situations after recent treatment with trypanocidal drugs or may be due to combine effect of poor nutrition and hematophagous helminth infection such as haemonchiasis and bunostomiasis (Afework, 1998). This suggest that anemia is a characteristic of the trypanosomiasis, other factor can also contribute to the reduce PCV values. In the present study, out of 24 trypanosomiasis positive animals 75% had $PCV \leq 24\%$, i.e., they were both infected and anemic. The mean PCV value of the present finding of parastemic (20.75) and was significantly lower than aparastemic animals (26.62). This clearly shows that, PCV value can be affected by trypanosomiasis. This study also revealed that almost 6 (2.65%) the cattle had a PCV value normal (24-46%) while they were react with trypanosomiasis positive infection. This is also agree with the previous reported result that cattle having PCV value of normal range were showed to be infected with trypanosome parasite (Teka *et.al.*, 2012) .

Out of 259 flies were caught during the study period, 78/259(30.13%) were the *Glossina* species and the rest 181(69.87%) were biting flies. The major *Glossina* species identified were 65.4% (51/78) *Glossina tachinoides* and 27/78(34.6%) *Glossina morsitana sub morsitans*. This was agree with the finding of (Leak, 1999) who concluded the distribution and abundance of some species of tsetse flies such as *Glossina sub morsitans* and *Glossina tachinoides* to be closely associated with the number and habitat of certain wild animals and also described that the highest density of certain tsetse fly species are reported from areas with very high density of wild animals and low human population area. The entomological survey indicated that the apparent

densities of different flies during the study period 0.8 fly/trap/day for *Glossina* species and 2.6 flies/trap/day. The finding was relatively lower for both *Glossina* species and biting flies with the finding of NTTICC (2007), at Burelluababora zone of western Ethiopia which was reported to be 7.23 flies/trap/day and 3.13 for tsetse. This result was not agreement with the previous (Tilahun *et al.*, (2012) in which reported that fly density between 16 to 22.4 flies/trap/day in Tana Beles and Fentahun *et al.*, (2012) who reported 11.9 f/t/d for tsetse. The relative lower level of tsetse population in present study may be due to the use of insecticide impregnated targets and insecticide-treated livestock under the area by NTTICC and the expansion of settlements and farm land in the area expressed of deforestation limit the tsetse and other flies habitat. It is also may be related to the level of dryness, which resulted in the migration of game animals from the study area.

5. Conclusion and Recommendations

5.1 Conclusion

This study indicated that the prevalence of bovine trypanosomiasis in five peasant Kebeles of Hawa Gelan district was 6.25%. *Trypanosome brucie* constitutes 4.16%, *Trypanosome vivax* 29.16% and *Trypanosome congolense* 66.6%. Relatively higher infection rates in male than female animals and adult animals were relatively more prone to high infection rate 6.94% than animals young 4.54%. Higher prevalence of trypanosomiasis infection was observed in animals with poor body condition and low PCV animals. The mean PCV value of the present finding of parastemic (20.75) and was significantly lower than a parastemic animals (26.62).

There are two types of *Glossina* species in this study area; *Glossina tachinoides* and *Glossina morsitans sub moristans*. The apparent density of different flies during the study period was 2.55flies/trap/day.

It conclude that trypanosomiasis is the most wide spread and prevalent protozoan disease affecting the health, productivity and capacity for work of animals.

5.2 Recommendations

- ✓ Strategic control of bovine trypanosomiasis including vector control should be strengthened to improve livestock production and agricultural development in the area.
- ✓ Proper planning should be made to expand government and private veterinary services to serve the community in the study areas.
- ✓ Educating the public in the tsetse belt or affected areas of trypanosome to participate it in control strategies.
- ✓ Line communication must be established between livestock owner and veterinary service.
- ✓ Further surveys and studies should be conducted and appropriate, feasible control of trypanosomiasis must be done.

References

- Abebe G. and Jobre Y., (1996). Trypanosomiasis threat to cattle production to Ethiopia. *Revue de Medicine Vs Revue de Medecin Veterinaire*. 147:897-902.
- Abebe G. (2005). Trypanosomiasis in Ethiopia. *Journal of biological science*, 4:75-121
- Abiy M. (2002). Prevalence of Bovine Trypanosomiasis in Goro woreda, Southwest Ethiopia. DVM Thesis Abstract, DebreZeit. pp: 344.
- Afewerk Y. (1998). Field investigation on the appearance of drug resistant population of trypanosomes in Metekel District, North-West Ethiopia, MSc thesis, Addis Ababa University and Freie Universt at Berlin, Faculty of Veterinary Medicine, Ethiopia
- Ali D. and Bitew M. (2011). Epidemiological study of bovine trypanosomiasis in Mao-Komo special district, Benishangul Gumuz, Regional State Western Ethiopia. *Global Veterinaria*, 6: 402-408.
- Allsopp R. (1997). Implementation of odor-bait techniques for the control of tsetse flies in eastern and southern Africa. 24th Meeting of the International Scientific Council for Trypanosomiasis Research and Control (ISCTRC).
- Anwar N. (1993). Protected and unprotected area of the upper Diddesa Valley. *DBishoftu*. pp. 344
- Awoke K. (2000). study of Trypanosomosis and its vectors in Humbo and mereb wereds *Ethiopian veterinary journal*, 4(1), p.61.
- Bekele G., Yilma J., Asmare K, Ayelet and Esayas G. (2010). Evaluation Deltamethrin applications in the control of tsetse and trypanosomiasis in Southern rift valley areas of Ethiopia. *Vet. Parasitol.* 168: 177-184.
- Bitew M., Amedie Y., Abebe A. and Tolosa. T (2011). Prevalence of bovine Trypanosomiasis in selected areas of Jabi Tehenan district, West Gojam of Amhara regional state, northwestern Ethiopia. *Afri.J.Agricul.Res.*, 6:140-144.

- Brondwn C.G.D., Hunter A. G and Lucking A. G (1990). Disease caused by protozoa, in Handbook on Animal disease in the tropics (eds: Swell and Brockles), 4th edition, Baillier Tindeall, London. 4:200-207.
- cDermott JJ, Coleman PG (1999). Modeling; Research into trypanosomiasis epidemiology- the essential contributions of theory, model, diagnostics and field studies.
- CSA (2011) (Central Statistical Authority). Livestock Population of Ethiopia Central Statistical Authority (CSA), Addis Ababa, Ethiopia.2011.
- CSA (17) (Central Statistical Authority). Livestock Population of Ethiopia Central Statistical Authority (CSA), Addis Ababa, Ethiopia.2017.
- Daya T. and Abebe G. (2008). Seasonal Dynamics of Tsetse and Trypanosomiasis in selected sites of Southern Nation, Nationalities and Peoples regional State, Ethiopia.Ethiop. Vet J., 12(2): 77-92.
- Drans field, Bright well R., Kyork C. and Williams B. (1990). Control of tsetse fly populations using traps at Nuruman south west Kenya.Bull Ent. Res., 80: 265-276.
- Tadele K. (1991). Efficacy of two insecticides deposited on target world population of Glossing M submoristants .DVM thesis, Addis Ababa university, F.V.M. debre Zeit Ethiopian
- Efrem D. Bashatu F., Bacha B., Addisalem H.and Misgana D. (2013). Prevalence of Bovine Trypanosomiasis in Lalo Kile District Kelem Wollega Zone, Oromia Regional State, Western Ethiopia Wollega University, School of Veterinary Medicine, P.O.Box:395, Nekemte, Ethiopia.Acta Parasitologica Globalism. 4(2):34-40.
- Fentahun T., Tekeba M., and Chanie M. (2012). Prevalence of Bovine Trypanosomiasis and Distribution of Vectors in Hawa Gelan District, Oromiand Region, .Ethiopia. Global Veterinaria, 9:297-302.
- Fikru D. (2006). Acomparative Studyon the Ecology of tsetse flies (Diptera:Glossinidae) in the Wabe and Walga River Systems.Addis Ababa, Ethiopia.

- Fimmen H.O., Mehlitz D., Horchiner F. and Korb E (1992). Colostral antibodies and Trypanosoma congolense infection in calves. Trypanotolerance research application. GTZ, No. 116, Germany, pp: 173-187.
- Gardiner P.R. (1989). Recent studies of the biology of Trypanosoma vivax. Advances in Parasitology 28:229-316.
- Getachew A. (2005). Trypanosomiasis in Ethiopia, Addis Ababa University, faculty of veterinary medicine, DebraZeit, Ethiopia, J.B.O.L. sci-121
- HGWANRO (2014). Hawa Gelan Woreda Agricultural and Natural Resource Office, 2016
- HGWLDFRO (2016). Hawa Gelan Woreda Rural Land Administrative and Land Use Planning Office, 2016.
- Hoare C.A., (1970). The mammalian trypanosomes of Africa. In: The African Trypanosomiasis, pp. 23, (Mulligan, H. W. ed.). George Allen and Unwin, Lond
- ILCA, (1991). A Hand book of African Livestock statistics. Working document no.5, International Livestock Center for Africa, Addis Ababa, Ethiopia.
- ILRAD (1991). Part of the International Laboratory for Research on Animal Disease. Nairobi, Kenya, pp: 21-30.
- Kosgey LS. (2004). Breeding Objective and Breeding Strategies for Small Ruminants in the Tropics. Ph.D. Thesis. Wageningen University, the Netherlands, 272pp
- Langridge W.P. (1976). Tsetse and trypanosomiasis survey of Ethiopia Ministry of overseas department, UK, pp: 1-40.
- Leak S.G.A. and Woudyalew Mulatu (1993). Advances of G.m. submorsitans and G. pallidipes along the Ghibe-riversystem in southwest Ethiopia. Acta Tropica 55:91-95.
- Leak S.G.A. Mulatu W., Authie E., Peregrinc A.S., Rowland G. J. and J.C.M. Trail (1993). Tsetse challenge and its relationship to trypanosomiasis prevalence in cattle. Acta trop., 53: 121-134.

- Leak S.G.A (1999). Tsetse Biology and ecology their role in the epidemiology and control of Trypanosomes CABI publishing in association with ILRI p. 152-210
- Losos G.J. and Chovinard A. (1978). Pathogenecity of trypanosomiasis proceedings of a work shop hold at Nairobi Kenya.
- Marcotty T., Simukoko H., Berkvens D., Vercruyss J., Praet N. and Van den Dossch P. (1999). Evaluating the use of packed cell volume as an indicator of trypanosomal infections in cattle in eastern Zambia. *Prevent. Vet. Med.*, 87: 288-300.
- McDowell, R.E. (1977). Ruminant products: more meat than milk. Winrock International Livestock and Training Centre, Marilton, Arkansas.
- Mihretrab B. and Mubarik N. (2011): Prevalence and host related risk of bivariate trypanosomiasis in Hawa Galan district western Ethiopia. *African Journ. Of Agri. Research*, 6(22):5055-5060.
- Miruk A. (2008). Prevalence of bovine trypanosomiasis and trypanocidal drug sensitivity studies on *Trypanosoma congolense* in Wolyta and Dawero zones of southern. Ethiopia. *Vet. Parasitol.* 2008; 152:141-147.
- Molalegne B., Yeshitla A. and Asmamaw A. (2010). Prevalence of bovine trypanosomiasis in selected Areas of Jabi Tehenan Distirct, West Gojam of Amahra Regional state, Northwestern Ethiopia. *Global Veterinaria*, 5(5): 243-247.
- Murray M., Murray P.K., and McIntyre W.I. (1977). An improved parasitological techniques for the diagnosis of African trypanosomiasis. *Trans.R.Soc.Trop. Med. Hyg.* 71:325-326.
- Murray M. (1988). Trypanotolerance, its criteria and, genetic and environmental *influences*. *Proceedings of a meeting held in Nairobi, Kenya from the 23rd-27th November 1987* organized by the International Livestock Center for Africa and the International Laboratory for Research on Animal Diseases. ILCA/ILRAD. pp: 133-151.
- Mussa A. (2002). Prevalence of Bovin Trypanosomiasis in Goro wereda, Southwest Ethiopia. DVM Thesis FVM, A.A.U., DebreZeit.

- Nicholsom M.J. and Butter worth, M.H. (1986). A guide to body condition scoring of zebu cattle. International Livestock Center for Africa, Addis Ababa, pp: 45-48.
- NTTICC (2002). National Tsetse and Trypanosomiasis Investigation and Control Center: Annual Report, Bedelle, Ethiopia, 2002.
- NTTLCC (2004) National Tsetse and Trypanosomiasis Investigation and Control Center: Annual Report, Bedelle, Ethiopia, 2004.
- NTTICC (2007). National Tsetse and Trypanosomiasis Investigation and Control Center: (Annual Report, Bedelle, Ethiopia, 2007.
- OIE (2009). Manual of standards for diagnostic tests and vaccines for terrestrial animals, 6th ed. Paris.pp: 813-2008.
- Paris J., Murray, M. and Mcodimba, F (1982). A comparative evaluation of the parasitological technique currently available for the diagnosis of African trypanosomiasis in cattle, *ActaTrop.*, 39-307.1-11.
- Quadeer, Danbirini S., Usman M., Akogum O., Gundiri M. and Bobbo A. (2008): Prevalence of bovine trypanosomiasis in Bassa local government area, Plateau State, Nigeria, *Nigeria Journal of Parasitology*,29:136-139.
- Radostits O.M., Gay G.C., Hinchiff K.W. and Constable P.O. (2007). *Veterinary Medicine: A textbook of the disease of cattle, sheep, goat, pigs and horses*, 10 edition London: Saunders Elsevier,.pp: 1530-1533.
- Roberts M.J. (1979). Observations on the function of the charioted and on egg hatching in *Glossinaspp* (Diptera:Glossinidae). *Bulletin of Entomological Research* 62:371-374.
- Rowlands G., Mulatu W., Authie E., Leak S and Peregrine A. (1995). Epidemiology of bovine Trypanosomiasis in the Ghibe valley, South West Ethiopia, *ActaTropica*. 53: 135-150.
- Sinishaw A., Abebe G., and Yoni W. (2006). Biting flies and trypanosome vivax biting flies and trypanosome vivax Tana, Ethiopia. *Veterinary parasitology*142:35-26.

- Shimelis M., Mekonnen A. and Abebe F. (2011). Study on the Prevalence of Major Trypanosomes Study on the Prevalence of Major Trypanosomes Benishangul Gumuz Regional State, Western Ethiopia College of Agriculture and Veterinary Medicine, JimmaUniversity. *Global Veterinaria*.7 (4):330-336.
- Smith B. (2009). Trypanosomiasis.In:Large Animal Internal Medicine.4thedn, pp1160.
- Solomon M. and Fitta G. (2010). Survey on Bovine Trypanosomiasis and its vector in Metekal and Awi Zones of Northwest Ethiopia. *ActaTropica* 117: 146-151
- Souls by E.J.L (1982). Helminthe, Arthropods and protozoa of domesticated animals 7thed Great Birtain, sounders sounders company: U.S.A.p. 4-16
- Tadese A. and Tsegaye B. (2010). Bovine trypanosomiasis and its vector in two district of Bench Maji Zone South West Ethiopia, *Tropical Animal Health and Production*, 42:1757-1662Q
- Tafese W. (2012). Prevalence of bovine trypanosomiasis and its vectors in two districts of East Wollega Zone, Ethiopia.Faculty of Veterinary Medicine, Universityof Gondar.
- Taylor, Coop AL. and Wall L. (2007). *Vet. Parasitology*
- Teka W., Terefe D. and Wendimu A. (2012).Prevalence study of bovine trypanosomiasis and tsetse density in selected villages of Arbaminch. *Ethiopia Journal of Veterinary Medicine and Animal Health*, 4: 36-41.
- Tesfaye M. (2002). Report of trypanosome infection route in *Glossina M/submortitents* and *Glossina tachihodes* in didessaa valley from July 2 –September 26/2002 .bedelle.
- Tilahun A.D. Yilkal A. and.Yacob H. (2012). Bovine trypanosomiasis in three districts of Southwest Oroia, Ethiopia, *Ethiop. Vet. J.*, 16(1): 23-39.
- Thrusfield M. (2005). *VeterinaryEpidemiology*.3rd ed.UK, BlackwellscienceLtd,pp:233-250.
- Torr S.J. and Mangwiro T.N.C. (2000). Interaction between cattle and biting flies: effects on the feeding rate of tsetse. *Medical and Veterinary entomology*, 14: 400-409.66.

- Uilenberg G. (1998). A field guides for diagnosis treatment and prevention of African animal trypanosomosis, W.P.FAD, Rome P.43-35.
- Urquhart GM, Armour J, Duncan JL, Dunn AM, Jennings FW (1995). *Veterinary Parasitology*. The University of Glasgow, Elbs.pp.203-212.
- Urquhart G.M., A.M. and Jennings, F, W. (1996): *Veterinary Parasitology* 2nd Edition. Black well science ltd., London UK. PP212-119.
- Van den Bossche, P. and Rowlands G.J (2001). The relationship between the parasitological prevalence of trypanosome infections in cattle and helped average packed cell volume. *Acta Trop.*, 78: 168-170.
- Walle R. and Sharer D. (1997). *Veterinary entomology, arthropod ectoparasite of veterinary importance*. London: Chapman and hall, pp: 141-193.
- Yibrah T. (2012). Prevalence Of Bovine Trypanosomiasis in Tsetse Controlled and Uncontrolled Areas Of Eastern Wollega, Southern Agricultural Research Institute, Hawassa, Ethiopia P. O. Box. 1445.

7. Annex 1

7.1 Sample Collecting formats on prevalence of Bovine Trypanosomiasis.

Date _____

Table. Sample Collecting formats on prevalence of Bovine Trypanosomosis and Association in Hawa Galen district.

Kebele _____

Site _____

No	Peasant association	Owner name	Animal	Age	Sex	Body condition	PCV	Result

7.2 Annex 2. Sample collecting form on the distribution and apparent density of flies

Date _____

Sample collecting form on the distribution and apparent density of flies in Hawa Gelan district.

Kebele _____

Site _____

No	Peasant association	Trap cod	Glossinssp		Biting flies	Total flies	F/D/T
			G.m.sub moristance	G.tachinoid			

7.3 Annex 3



7.3 Monoconical phyramid trap model (A), Samples of tsetse, Vegetation of the study area(C)

7.4. Annex 4



7.4. Traps collected from the site (A), Counting sample of tsetse flies (B), Microscope (C), Centerfuge (D)