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The Prevalence Of Caprine Trypanosomosis In The Abrahamo Woreda

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Abstract: A cross-sectional study was conducted in Abrahamo Districts of Benishangul Gumuz Regional State, Western Ethiopia from **September 2024 to February, 2025** to determine Caprine trypanosomosis prevalence, prevailing trypanosomes species, and associated risk factors. Blood samples collected from (n= 384) randomly sampled caprine. Dark phase contrast buffy coat procedures were used for determining prevalence. Whereas, haematocrit method was used for packed cell volume (PCV) values determination. Out of total 384 samples, 77/384 (20.05%) were found trypanosome positive. *Based on Predominant trypanosome species among recorded were Trypanosome congolense* 76.25%, *Trypanosome vivax* 12.5%, *Trypanosome brucei* 7.5% and mixed infection 3.75%. There were statistically significant differences concerning existing trypanosome species (P< 0.05). Mean packed cell volume (PCV) value of the parasitic animals was lower (19.06%) than a parasitic animals (26.01%) and the variation was statistically significant (P< 0.05). Sex groups, study sites, and age categories (P> 0.05) were demonstrated non-significant risk factors, however; body conditions, pcv status and trypanosome species were found significant(p<0.05). In conclusion, the current study showed high trypanosomosis prevalence in the area reflecting the need for strategic control measures.

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Key words: Abrahamo; caprine; Trypanosomosis; prevalence; Risk factors

1. INTRODUCTION

Africa hosts 205 and 174 million Sheep and Goats representing approximately 17% and 31% of the world total small ruminant population, respectively (Yibeltal, M., 2005). The population of small ruminants in sub-Saharan Africa is estimated to be 274 million (Oyeyemi, M., 2002, Yibeltal, M., 2005). The small ruminant population in Ethiopia is 24 million sheep and 18 million goats. Small ruminants mostly owned by smallholder farmers for whom this resource is critical for nutrition and income generation. Low cost of production requirement of little land and higher prolificacy made them attractive asset for development. They are well adapted to hot and dry conditions and provide golden opportunity to alternatively exploit potential of lowland areas (Oyeyemi, M., 2002, Yibeltal, M., 2005).

In spite of the presence of large number of small ruminant population, Ethiopia fails to optimally utilize this resource as the sector is suffering from lower productivity. Among many factors which limit the economic return from small ruminant production diseases stands in the front line (Firew, T., 1999). One of such diseases that hamper small ruminant productivity is trypanosomosis. In Ethiopia, 6.12 million small ruminants are at risk of contracting trypanosomosis (MOA, 2015).

A small ruminant, especially goats has been reported to be resistant to trypanosomosis (Getachew, A., 2005). However, several studies conducted on the prevalence of small ruminant trypanosomosis in Ethiopia, Kenya and Nigeria revealed that small ruminants acquire infection resulting in economic losses (Getachew, A., 2005). Despite their use as a living bank for small holder rural farmers in the southwestern Ethiopia enough works had not been performed which estimates the problem of small ruminant trypanosomosis.

Small ruminants form an important part of the livestock industry in the sub-saharan Africa. They serve as valuable supplement to cattle in term of animal protein supply for the teaming population including the provision of manure for field crops. It has also been estimated that over 90% of sheep and goats in the sub-saharan Africa are found in East and West Africa (Getachew A.,2005). The roles of small ruminants in the epidemiology of the disease in nature is still not known, but it has been shown that goats and sheep could act as reservoir for the spread of animal and human trypanosomosis (Yanan *et al*., 2005; Dede *et al*., 2005).

Tsetse transmitted animal *Trypanosomiasis* is one of the major constraints to socio-economic development in Africa. Tsetse flies infest approximately 10 million km^2 of the continent affecting 38 countries. It is considered

that 7 million km^2 of this area would otherwise be suitable for livestock and or mixed agricultural development. About 30% of the 147 million cattle in countries affected by tsetse are exposed to the disease. The situation with regard to sheep, goats, pigs, horses, donkeys and camels is probably similar but is less well documented. Data available at present indicate that the overall situation is deteriorating. Since the 1950's the areas of savanna tsetse infestation have continued to increase. As a result there is increasing pressure on tsetse-free pasturages (Getachew A., 2005).

Trypanosomiasis is a devastating disease of livestock caused by protozoal parasites of the genus *trypanosoma* that inhabits blood and other tissues of vertebrates including animals, wildlife and human (Adam *et al.,* 2003; Gupta *et al*., 2009; Bal *et al*., 2014). It is a vector borne disease that is transmitted biologically by tsetse flies and mechanically by other biting flies (FAO, 2002; OIE, 2009). It is a major constraint contributing to direct and indirect economic losses to crop and livestock production (Abebe, 2005) and has a significant negative impact on economic growth in many parts of the world (Taylor *et al*., 2007; Sharma *et al*., 2013), particularly in sub-Saharan Africa (Cecchi *et al*., 2008). The most important trypanosome species affecting livestock in Ethiopia are *Trypanosoma congolense, Trypanosoma vivax*, and *Trypanosoma brucei* in cattle, sheep and goats, *Trypanosoma evansi* in camels and *Trypanosoma equiperdium* in horses (Abebe G, 2005).

The Diagnosis of trypanosome infection is based on clinical signs; but the clinical signs of the African Animal trypanosomosis are indicative but are not sufficiently pathognomonic. Therefore, standard methods have been developed and applied practically to diagnose the disease in animals. The methods include: direct microscopic examination of blood, either by the wet film method; but it is insensitive (Getachew, 2005). Stained thin and thick smear techniques permit detailed morphological studies and identification of different *Trypanosoma* species by light microscopy. Sensitivity can be improved through parasitological buffy coat techniques of concentration of the parasites by centrifugation and blood inoculating into susceptible laboratory animals (Getachew, 2005).

Benishangul Gumuz is one of the five regions of Ethiopia infested with more than one species of tsetse flies (Keno, 2005). Five species of Glossina (*G. morsitans submorsitans, G. Pallidipes, G. tachnoides, G. f. fuscipes and G. longipennis*) have been registered in the region (Keno, 2005; ARAHDL, 2016/17). The tsetse flies (vectors), *G. fusca*; the bush fly, *G. morsitans*, which inhibit principally savannah area and *G. palpalis*; a riverine species, effectively prevent the rearing of the cattle over the large area of the region (NTTICC, 2004). And nearly 31,000 km2 or 62% of the Benishangul Gumuz region's total land area is believed to be infested with tsetse fly (NTTICC, 2004). Even though Caprine Trypanosomosis is considered an important livestock disease in Benishangul Gumuz Region, little is known of the prevalence of Trypanosome infections in *Goats* in the Abrahamo District. Therefore, the objective of this study were to determine the prevalence of trypanosomosis in goats in Abrahamo District , identify the Trypanosomes species and to asses the associated risk factors.

2. Methodology

2.1 Study area

Abrahamo Woreda is one of the Assosa zone Woreda in Benishangul-Gumuz Regional State which is located in the North-west part of the capital city of the region. The district is located between 8030'' and 40°27" N and 34°21" and 39°1" E. Woreda has 180 altitudinal differences between the highest and the lowest places. The lowest point is 1461 meters a.s.l while the highest peak is 1641 meters above sea level (a.s.l). It has two major physiographic divisions. The first one is the warm temperate agro-climatic zone (1500-1900m), which comprises low plateaus of the Woreda and covers about the 98.49% of city land surface. The second is lowlands (less than 1500m) constitute about 1.51% of the total land area of the city. The temperature ranges from 20° C - 35° C (highest) to 12° C - 20° C (lowest). February to May is the hottest months while November to December is the cold months). The total amount of rain fall recorded at District during the last nine months of (2020) is 1,119 mm (BGRSMSC, 2020).

The rainy season starts from April/May up to October/November with an average annual rainfall that ranges from 800 mm to 2000 mm. The rainy season starts in March and extends to November with the highest concentration in June, July, and August. The livelihood of the society largely depends on mixed livestock and crop production. Majority the people of Woreda are merchants; about 17 percent are agrarian especially in animal rearing such as cattle, sheep, goats, donkeys, mules, and poultry and the rest participate small and medium scale industries(CSA & BoFed, 2007 & 2012). Extensive livestock husbandry, feeding and outdoor housing system was found, Back yard chicken Management system is practiced, where local breeds are allowed to scavenge, what nature provides them. In the woreda, animal movement was due to agriculture and trade purpose. Animal in the area was used for meat, milk, ploughing, traction power, and income generation. Socioeconomy of the people in the area was mainly depending on mixed farming (CSA, 2015 and Abrahamo woreda agriculture office, 2021).

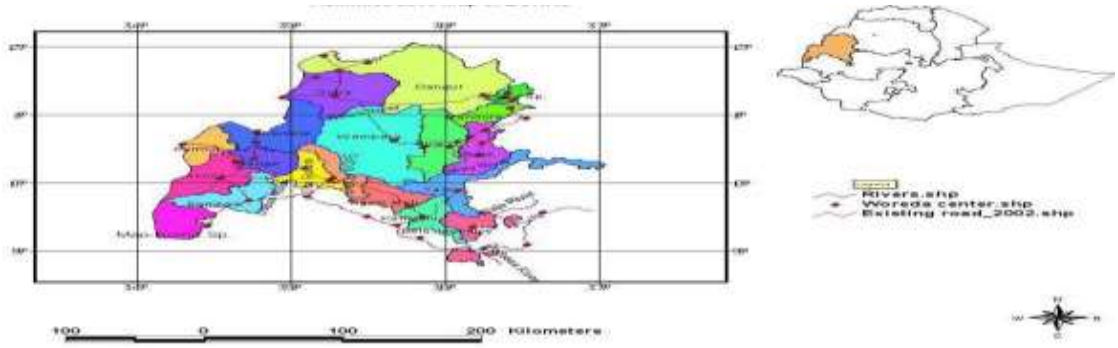

Figure: 1. Administrative maps of BGRS, 2015

2.2 Study Design

A cross-sectional study design was conducted from September 2024 to Feburary 2025 to determine the prevalence of Caprine Trypanosome infections and associated risk factors in Abrahamo Districts based on parasitological and hematological examination.

2.3 Study population

Animal sampled was local breeds of caprine, which are usually managed under an extensive husbandry system, grazing the communally owned pasture land throughout the year and was randomly sampled. They grazed together during the day time and returned to their individual owner's farmstead each evening. The body condition of each of the study caprine was scored as good, medium and poor Nicholson MJ, and Butterworth MH (1986). Concurrently, their age was be categorized in years (< 2, 2-5, >5) based on De-Lahunta A, and Habel RE (1986).

2.3 Techniques and Sample Size Determination

Animals was selected using simple random sampling methods. Kebeles was selected purposive as convenient based on woreda agriculture office data. For sample size determination, since there was no record of previous prevalence in the study area, the sample size was calculated according to Thrusfield (2007) formula. Accordingly, 50 % expected prevalence of trypanosomosis, with 5% absolute precision at 95% confidence interval. The formula was given by

$$n = \frac{1.96^2 * P_{exp}(1-P_{exp})}{d^2}$$

Where n = sample size required; P_{exp} =expected prevalence; d = desired absolute precision

So, total sample size will be 384 cattle was randomly sampled.

$n = (1.96^2 * 0.05) * (1-0.05)/0.0025 =$ **384 samples** were collected in the Abrahamo distirict.

2.5 Laboratory methods

*2.5.1 Packed cell volume (PCV) determination and Buffy coat technique*384 Blood samples was obtained by puncturing the marginal ear vein with a lancet and collected randomly from cattle of the settlement into capillary tube after piercing the marginal ear vein by using a lancet. One end of the capillary tube was sealed and centrifuged at 12,000 rpm for 5 minutes to separate the blood cells and to concentrate trypanosomes using centrifugal forces as buffy coat. Then PCV was measured using haematocrit reader (Hermmle Labortechnik, type Z, Germany).

The heparinized microhaematocrit capillary tubes containing blood samples was cut using a diamond tipped pen 1 mm below the buffy coat to include the upper most layers of the red blood cells and 3 mm above to include the plasma and expressed on microscopic slide, mixed and covered with 22x 22mm cover slip.The content of the capillary tube pour onto a glass slide, and covered with cover slip. Then the slide was examined under 40x objective of a microscope using dark ground buffy coat technique to detect the presence of the parasite (Murray *et al*., 1977; Paris, 1982). Buffy coat positive samples was stained by Giemsa's in thin blood smears, fixed with methanol for 5 minute and examined under oil immersion using 100x objectives to identify the species of trypanosomes. The length of the packed red blood cells column is expressed as a percentage of the total volume of blood. Trypanosome species was identified according to their morphological descriptions as well as movement in wet film preparations (OIE, 2008) and Animals with PCV less than 24% were considered to be anemic (OIE, 2008).

2.5.2 Diagnostic Techniques

Diagnosis of Trypanosomosis in tsetse, humans or domestic livestock is a basic requirement for epidemiological studies as well as for planning and implementing chemotherapy and for monitoring vector control operations. Accurate diagnosis of trypanosome infection in livestock is required for a proper appreciation of the epidemiology of the disease in any geographical locality. Besides clinical diagnosis, parasitological, serological and molecular methods with varying degrees of sensitivity and specificity are available for the diagnosis of trypanosomosis (Dagnechew, S., 2004).

Thick blood smears

- Place drop of blood on slide
- Spread it to a size of about 2 cm in diameter
- Air dry quickly
- Immerse the smear in distilled water 5-10 min
- Fix with methanol alcohol of 75 % for three minutes
- Stain with Giemsa diluted in distilled water 1:10 for 30 min
- Examine under the microscope

Thin blood smear

- Put drop of blood on slide
- Spread the blood on the slide using a cover slip or another slide at an angle of 45 degree
- Dry with air
- Fix with methanol for three minutes
- Stain with Giemsa
- Wash with phosphate buffer at PH 6.8-7.2
- Allow to dry
- Examine under the microscope 1x100 magnification

Dark ground /phase contrast BCT *(Murray method)*

- Collect blood in heparinised capillary tube
- Seal one end with crystaseal
- Place in microhaematocrit centrifuge
- Allow to spin 12,000 rpm for 5 min
- Cut the capillary tube with diamond pencil 1 mm below the buffy coat to include RBC
- Extrude on slide & cover with cover slip
- Examine in dark ground phase-contrast microscope with x40 objective

2.6 Animal Coat Color Classification

A visual color classification was performed which involves stating for each animal the main coat color. Animals that have black and grey coat color was categorized to black. Animals that have dark brown, light brown and fawn coat color was classified in to brown. Animals that have pale, white and other light colored coat was classified in to light color category. If a second color present the predominant coat color was selected.

3. DATA ANALYSIS

The collected parasitological and hematological data was entered into a Microsoft excel spread sheets program and then was transferred to Intercool STATA version 10.0 for analysis. The prevalence of trypanosome infection was calculated as the number of positive animals as examined by buffy coat method divided by the total number of animals examined at the particular time. Data collected on PCV values was analyzed by ANOVA to compare the mean PCV values of infected animals against that of uninfected animals. Pearson's chi-square ($\chi 2$) was used to evaluate the association of different variables with the prevalence of trypanosome infection. In all of the statistical analysis, a confidence level of 95% is used and P-value of less than 0.05 (at 5% level of significance) was considered as statistically significant.

4. Ethical Considerations

This protocol was presented for initial and continuing review and approval by JUCAVM institutional ethical review board. Any changes to the protocol or consent form were approved by all ethics committees. Since the study involves domestic animals subject, the ethical approval for the study were obtained from Ethical Research Board (ERB) of the JUCAVM for domestic animal.

5. RESULT

5.1 Parasitological result

Out of the total animals examined (n=384), 77/384(20.05%) were found to be infected with trypanosomes (Table-1). The prevalence of trypanosome species was 76.25 % for *T. congolense*, 12.5 % for *T. vivax, 7.5 % for T.brucei and 3.75 %* was found to be mixed infection and the infection rate was found to be statistically significant (P<0.000) among trypanosome species . the highest infection was reorded in megell 38 (22.91%) while the lowest infection was registered in megelle 37 (16.66%) (Table 1 and 2).

Table 1 : Origin based Prevalence of bovine trypanosomosis in Abrahamo District

No.	Study sites	No. of examined	No. positive	(%) positive	CHI2	P-value
1	abrahamo	96	20	20.83	0.30	0.95
2	Megelle 32	96	19	19.79		
3	Megelle 38	96	22	22.91		
4	Megelle 37	96	16	16.66		
	Total	384	77	20.05		

Table 2. Species based prevalence of bovine trypanasomosis in Abrahamo district

Trypanosomes	No. positive	Positive (%)	X^2	P- value
T. congolense	61	76.25	283.02	0.000
T. vivax	10	12.5		
T. brucei	6	7.5		
Mixed	3	3.75		
Total	80	100		

X^{2}- chi square

4.2 Hematological result

The mean PCV value for all examined animals was 24.05. However, the mean PCV value for non infected and infected animals was 26.01 and 19.06 respectively. The mean PCV values of cattle were significantly ($p < 0.000$) influenced by trypanosome infection as 19.06 % and 26.01 % PCV values in trypanosome positive and negative animals were registered, respectively (Table 3).

Table 3: Mean PCV comparison of parasitaemic and aparasitaemic animals

Status	Frequency	Mean PCV (%)	SE	X^2	p-value
Infected	167	19.06	3.82	103.52	0.000
Non-infected	217	26.01	3.22		
Total	384	24.05	3.52		

PCV: packed cell volume**;** SE: standard Error

5.3 Trypanosomosis associated Risk factors

The highest prevalence (21.33%) of trypanosomosis was recorded in animals >5 years old whilst the lowest prevalence (0 %) was recorded in animals age less than 2 years of old and the association was not found statistically significant among the age groups (Table 7). Slightly, higher prevalence was registered in female animals (20.79 %) than in male animals (19.23 %), which was not found to be statistically significant ($p> 0.05$) (Table 7). The highest prevalence of trypanosomosis (43.39%) was found in animals with poor body condition while the lowest (15.2 %) and (17.98%) was recorded in animals with good and medium body conditions respectively, and the difference was significant ($p<0.000$). The effect of age, sex, and body condition on prevalence of trypanosomosis is summarized in Table 4.

Table 4: Bovine Trypanosomosis and its association with risk factors in Abrahamo kebeles
(*statistically significant)

Risk factors	No. examined	No. positive	Prevalence (%)	χ^2	p-value
Sex					
Male	182	35	19.23	0.14	0.70
Female	202	42	20.79		
Total	**384**	**77**	**20.05**		
Age					
< 2	2	0	0		
2-5	43	6	13.95	1.66	0.43
>5	339	71	20.94		
Total	**384**	77	20.05		
Body condition					
Good	191	29	15.18		
Medium	139	25	17.98	21.46	0.000*
Poor	53	23	43.39		
Total	**384**	**77**	**20.05**		

6. DISCUSSION

20.05 % of Caprine Trypanosomosis prevalence were reported in the study area. This finding was high as compared to the earlier findings of Samson L. and Frehiwot M. 2010 in upper Didessa valley, Ethiopia, who reported 4.5% sheep trypanosome prevalence and 3.7% of goat trypanosome prevalence and Gael Darren M *et al*.,(2020) in mongo country in south Gabon, central Africa, indicated that 13.6% of small ruminant trypanosomosis prevalence. Similarly, 2.11% of small ruminant trypanosomosis (2.76% sheep trypanosome and 1.7% goat trypanosome) prevalence was reported by Abebayehu T *et a*l.,(2010) in Guta Gidda district, East wellega zone, western Ethiopia.

On the otherhand, the present finding was inconsistent with the study conducted by (Aki A *et al*., 2015) who reported 8.96% bovine trypanosomosis prevalence in Kameshi District, Benishagul Gumuz region, western Ethiopia. In contrast, 22.38 % bovine trypanosomosis prevalence was reported by Bayisa *et al*. (2015) in Asossa district, which was high as compared to the current study. Similarly, 26.30% cattle trypanosomosis prevalence was reported by Aki A *et al*. (2017) in Mandura district which were higher than the present findings.

This research showed that the infection was predominantly caused by *T. congolense (76.25*%), *T.vivax* (12.5%), and *T. brucei* (7.5%) and mixed infection (3.75%). This result is in line with the reported proportions of *T.congolense* (75.5 %) followed by *T.vivax* (14.28%) from Metekel and Awi zones (Mekuria *et al.,* 2011). This result was also in consistent with prior reports of (Mulaw *et al.*,2011) who studied on prevalence of major trypanosomes affecting cattle in Assosa district of Benishangul Gumuz Regional State, western Ethiopia and who found proportional prevalence of *T. congolense to be* 66.7% ; (Abraham *et al*., 2012) conducted their study on prevalence of bovine trypanosomosis in selected sites of Arba Minch district, Southern Ethiopia whose result showed proportional prevalence of *T. congolense* to be 61.4%; (Biyazen *et al*., 2014) reported proportional prevalence of *T. congolense to be* 63.64% during their work on trypanosomosis and anemia in cattle population of Dale Wabera district of Kellem Wollega Zone, western Ethiopia.

The high proportional infection rate of *T. congolense* in cattle might be attributable to the high number of serodems of *T. congolense* relative to other species of trypanosomes. It could also be due to the possible development of better immune response to *T. vivax* by the infected animals as demonstrated by (Leak *et al*., 1993). Further, it might be attributed to the efficient transmission of *T. congolense* by cyclical vectors than *T. vivax* in tsetse-infested areas. Previous reports indicated that *T. congolense* and *T. vivax* are the most prevalent trypanosomes that infect cattle in tsetse infested and tsetse free areas of Ethiopia respectively (Leak *et al*., 1999). Different studies (Leak *et al*., 1993; Rowland *et al*., 1995) have indicated that *T. vivax* is highly susceptible to treatment while the problems of drug resistance are higher in *T. congolense.*

The effect of different risk factors such as sex, age categories, study sites, PCV status, trypanosome species, and body conditions on prevalence of caprine trypanosomosis was studied and, statistically significant associations were observed in, PCV status, body conditions and trypanosomes species ($p<0.05$) while sex groups, age categories and study sites were not found to be statistically significant ($P >0.05$). This result is in agreement with previous reports of (Lelisa *et al*, 2015 and Bayisa *et al,* 2015). The overall mean PCV value for examined animals was 24.05. The

mean PCV value of infected animals was significantly lower (19.06) than that of non - infected animals (26.01). This result is in alignment with previous works of (Ali *et al*., 2011; Mulaw, 2011).

7. CONCLUSION AND RECOMMENDATIONS

The high prevalence of Caprine trypanosmosis (20.05%) were remains a major problem that hinders livestock production and productivity in the district. The most widely distributed and dominant species of trypanosomes in the study sites are *T. congolense (76.25%) followed by T.vivax (12.5%), and* to some extent *T. brucei (7.5 %)* which was mainly transmitted by *G. morsitans sub morsitans* and other biting flies. Parameters of study animals such as sex, sites, and age were not found to be a risk factor for trypanosomosis whereas body conditions and trypanosome species were risk factors. This study showed that trypanosome infection and other factors such as (nutritional, seasonal, concurrent disease) was found to negatively affect the PCV values of animals.

Based on the present findings, the following recommendations are forwarded:-

- Particular attentions towards the identified trypanosome species so as to control the impact of the disease on caprine,
- Development of control options that could minimize the Tsetse fly and biting flies in the study area should be introduced in a wholistic approach.
- Proper and strict follow up of trypanocidal drug distribution, therapeutic strategies and alternative control measures should be implemented by concerned stake holders.
- Attention should be given to identified risk factors
- The farmer in the area should be trained how to control the vector of the disease and provided with materials
- Delthamethrin 1% pour on techniques, Target and Traps are important control options in the area so as reduce the trypanosomosis risk in the area.

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