

Distribution and Density of Tsetse Fly as Vector for Bovine Trypanosomosis In Omobeyam District Jima Zone Oromia Region Ethiopia

Abstract

The study was conducted from January 2019 to April 2019 in Omobeyam districts of Oromia Regional State, Ethiopia. It was designed to avail information on Distribution, Species and apparent densities of Tsetse fly and prevalence of bovine trypanosomosis. During the study period survey was conducted to know the distribution, density and to identify the species of Tsetse flies found in the area by deploying traps. A total of forty eight (48) traps of four type's i.e. mono pyramidal mono conical, bi conical and INGU were deployed. The traps were deployed in two villages i.e. Meti segada and Gafarsa gudina; and hence one thousand two hundred and eighty three (1283) flies were caught. Of all 1283 flies caught, 401 were male while 882 were female. The fly species caught were *Glossina pallidipes* (356)(27.75%) *Glossina morsitans* (543)(42.32%) and *Glossina fuscipes* (384)(29.63%). The overall apparent density of tsetse flies was 13.36 fly/trap/day. A parasitological study using buffy coat technique was employed for the determination of prevalence of trypanosomosis. A total of 388 cattle randomly selected from the study population were examined for the parasitological study. The result of parasitological study revealed that from the total 388 cattle diagnosed 27 were found positive for Trypanosomosis infection and hence overall prevalence of trypanosomosis was found to be 6.96%, 95% CI=14.10-19.08 indicating trypanosomosis is a serious problem in the area. Trypanosome species were identified during the study period: *T. vivax* (33.33%), *T. congolense* (48.15%) the rest were mixed infection (18.52%). Highest trypanosome prevalence (18.67%) was seen in animals with poor condition than that of those with medium (16.76%) and good (14.20%) body condition for the concerned blood parasite but no significant difference was observed ($P>0.05$). tsetse fly and Trypanosomosis pose great threat to cattle residing in study areas. Thus, appropriate intervention measures need to be taken.

Keywords: Tsetse fly; Trypanosomosis; Omobeyam FTD Prevalence

Introduction

Tsetse fly is a blood sucking insect genus *Glossina* with about 31 different species. The fly is found in three different ecological conditions i.e. along river basins (riverine group), in the Savanna grassland (*Morsitans* group) and

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in dense forest (*Fusca* group) [10]. Among the 31 species of tsetse flies five species are found in Ethiopia; these are *Glossina m. submorsitans*, *Glossina pallidipes*, *Glossina tachinodes*, *G. f. fuscipes* and *Glossina longipennis*. Tsetse flies in Ethiopia are confined to southern and western regions between longitude 33° and 38° East and latitude 5° and 12° North which amounts to about 200,000 Km². Tsetse infested areas lied in the low lands and also in the river valleys of Blue Nile, Baro Akobo, Didessa, Ghibe and Omo. Out of the nine regions of Ethiopia five (Amhara, Beninshangul Gumuz, Gambella, Oromia and Southern Nation Nationalities and peoples) are infested with more than one species of tsetse fly [13]. Tsetse fly is the vector for the parasite trypanosome, which causes Animal trypanosomosis. Trypanosomosis is an endemic disease to east Africa including Ethiopia [1]. Bovine trypanosomosis is one of the diseases that are caused by flagellated protozoan parasites belong to the genus Trypanosome [2]. Trypanosomosis limits the extension of natural herds in Africa where the presence of tsetse fly density access to woody land and savannah areas with good grazing potential. It is a serious constraint to agricultural production in extensive areas of the tsetse infested regions [3], which accounts over 10 million square kilometers of the tropical Africa. The reduced capacity for work animals is also a very important factor where 80% of the traction power in African agriculture is provided by animals. In general, there is a great threat of trypanosomosis which impedes the economic development of Africa. Out of six species of trypanosomes recorded in Ethiopia, three are the most important trypanosomes in terms of economic loss in domestic livestock and are tsetse transmitted species. These include Trypanosome congolense, *T. vivax* and *T. brucei*. Tsetse transmitted animal trypanosomosis still remains as one of the major causes of livestock mortality and production losses in western, southwestern and northwestern lowlands of Ethiopia [1],

although trypanosomosis can also be transmitted by other blood sucking insects. Currently, trypanosomosis is found to be one of the factors hampering livestock production and productivity in most parts of western and south western Ethiopia. An understanding of the prevalence of the disease and magnitude of the vector population is crucial for designing appropriate control strategies. Therefore, the aim of this research was to identify the distribution and species of Tsetse fly estimate the relative infection rate of trypanosomosis in cattle in Omobeyam district, Southwestern Ethiopia.

Materials and Methods

Study area

The study was conducted from January to April 2019 in two peasant associations of Omobeyam district located in Oromia regional state. The district is situated at 435 Kilometers South West of Addis Ababa. The mean annual rain fall of the district ranges from 950-2200 mm. The annual temperature ranges from 17-30°C. The district has altitude ranging from 900-3000 meters above sea level. Three climatic conditions i.e. highland/dega (35%), midland/wayenadega (30%) and desert/kola (35%). The animal population of the Omobeyam district is estimated to be 233,365 cattle, 192,331 sheep, 106,220 goats, and 97,595 equines population. The area is well known by its diversified wildlife such as buffaloes, lions, leopards, baboons, Bush pigs, warthog, bush buck, kudu, hippopotamus, crocodiles, etc. which might be claimed to serve as sources of food for tsetse fly and as reservoir for trypanosomes.

Entomological Study

A total of 48 baited four different types of i.e. mono-pyramidal, mono conical, bi conical and INGU traps were deployed along suitable tsetse habitats to assess the apparent densities, distributions and species of tsetse flies and other haematophagous flies involving in transmission of trypanosomes. All traps were baited with acetone, Octenol (1-3-Octane) and cow urine filled in separated bottles and labeled and deployed at an interval of 100 meters [20]. After 48 hours of trap deployment time the cages were collected and captured flies were identified and sexed according to morphological characteristics and counted. The tsetse flies were identified to species level and the other biting flies to the genus level. Tsetse flies were identified from other biting flies by their unique morphological features of their proboscis, pulps, arista and hatchet cells of their wings [5]. The species of Tsetse fly were differentiated by morphological differences of male and female genitalia as well as ecological differences [10].

Parasitological Study

Study Population, Sampling Design and Sample Size Determination

The cattle in the study area are local breeds that are kept under

traditional extensive husbandry systems with communal herding. A cross-sectional study was conducted in two purposively selected villages of Omobeyam district, Oromia Regional State, southwest Ethiopia. Then simple random sampling technique was followed to select individual study animals. The number of animals required for the study was determined using the formula given by [6] for simple random sampling. The size of sample was determined using 95% level of confidence, 50% expected prevalence and 0.05 desired absolute precision. A total of 388 cattle were diagnosed to determine Trypanosomosis prevalence. The sex, body condition and origin of cattle peasant associations were explanatory variables used to associate with the prevalence. Body condition for each cattle was estimated based on [7].

Study Methodology

Survey of trypanosomes: Blood samples were collected in to heparinized micro hematocrit tubes (Deltalab S.L, Barcelona, Spain) after piercing the ear vein using lancet. Then one end of the capillary tube was sealed with sealant (Hawksley Ltd, Lancing, UK) and centrifuged at 12,000 revolutions per minute (rpm) for five minutes to separate the blood cells and to concentrate trypanosomes using centrifugal force as buffy coat. Then Packed Cell Volume (PCV) was determined using hematocrit reader and recorded. The capillary tubes were then broken just below buffy coat and expressed on microscopic slide, mixed and covered with a 22×22 mm cover slip. Then it was examined under x40 objective of microscope using dark ground Buffy coat technique to detect the presence of motile trypanosomes and for positive samples Geimsa stain of thin blood smears were made, fixed with methanol for 5 minutes, and examined under oil immersion using x100 objective to identify the species of trypanosomes [9].

Data Management and Analysis

The distribution, species and density of Tsetse flies caught were identified by counting and grouping them accordingly in the two peasant associations. The density of fly population is calculated by dividing the number of flies caught by the number traps deployed and number of days of deployment, and expressed as fly/trap/day (FTD). The data collected was entered in to Microsoft Excel Data base system. The entered data were analyzed using Spss version 20 statistical software program. The association between FTD and associated risk factors by logistic regression. The parasitological data collected was also entered in to Microsoft Excel Data base system. The entered data were analyzed using Spss version 20 statistical software program. The prevalence of trypanosomosis was calculated by dividing the proportion of cattle infected with one and/or more trypanosome species by the total number of cattle examined multiplied by 100. The association between the prevalence of trypanosome infection and associated risk factors were assessed by logistic regression, whereas the student's t-test was used to assess the difference in mean PCV between trypanosome positive and negative animals. A statistically significant association between variables was said to exist if the calculated $P < 0.05$ at 95% confidence level.

Results

Entomological Findings

The tsetse flies found during the study period were *Glossina m. submorsitans*, *G. pallidipes*, *G. fuscipes fuscipes* and other biting flies particularly genus *Stomoxys*, *Haematopota* and *Tabanus*. A total 3161 blood sucking flies were caught during the study period of which 1283 (40.58%) were tsetse fly, 140 (4.43%) were *Stomoxys*, 110 (3.48%) were *Haematopota*, 8 (0.25%) were *Culex* and 1620 (51.25%) were *Tabanids*. The overall fly species caught was 32.92 fly/trap/day. The apparent densities of *Glossina*, *Tabanus*, *Haematopota* and *Stomoxys* were 13.36, 16.87, 1.45 and 1.14 flies/trap/day respectively. The apparent densities of *Glossina* species was 14.19 and 12.54 fly/trap/day in Gafarsa gudina and Meti sagada PAs, respectively. The sex category indicated male and female tsetse fly account for 31.25% and 69.75% of total caught *Glossina* species, respectively.

Prasitological Findings

From the total examined cattle (n=388), 27 (6.95%) were found to be infected with trypanosomes. Out of the total 190 cattle examined, 10(5.26%) cattle were positive for trypanosomosis in Meti Sagada PA, while 17 (8.5%) were infected with trypanosomes out of the 198 examined cattle in Gafarsa Gudina PA ($\chi^2=3.9$; $P=0.00$). Infection rate was 7.84% and 5.97% in male and female respectively. Higher prevalence of trypanosomosis was recorded in anemic cattle ($PCV \leq 24\%$) than those with PCV values within the normal range (25_48%) (Table 3). The proportion of trypanosome infection with species level indicated 13 (48.148%) were found to be infected by *T.congolense*, 9 (33.33%) were found to be infected by *T.vivax*; 5(18.51%) were mixed infections ($\chi^2=20$; $P=0.22$). The prevalence in male and female animals was 7.84% and 5.97%, respectively ($\chi^2=3.89$; $P=.000$). Higher prevalence was recorded in adult animals as compared to the young ones. Higher prevalence of trypanosomosis was recorded in animals with a poor body condition (14.7%) than in those in medium (4.7%) and good body condition (3.5%). The overall mean PCV values of examined cattle was 25.37, The mean PCV of parasitaemic and aparasitaemic animals was 20.25 and 25.4 respectively.

PA	FTD	χ^2	P-value
GafarsaGudina	14.19	6	0.199
MetiSagada	12.54		

Table 2: FTD of respective PA

Variables	No of negvalues	no of posivalues	Total	χ^2	p-value
PA					
GafarsaGudina	181(91.4%)	17(8.6%)	198(51%)	3.9	.000
MetiSagada	180(94.7%)	10(5.3%)	190(49%)		
	361(93.04%)	27(6.96%)	388(100%)		
Sex					
Male	188(92.15%)	16(7.84%)	204(52.57%)	3.89	.000
Female	173(94.02%)	11(5.97%)	184(47.42%)		
	361(93.04%)	27(6.96%)	388(100%)		
Bcs					
Good	112(96.5%)	4(3.5%)	116(29.89%)	12	.213
Medium	162(95.3%)	8(4.7%)	170(43.81%)		
Poor	87(85.3%)	15(14.7%)	102(26.28%)		
			388(100%)		
PCV					
≤ 24	131(85%)	23(15%)	154(39.7%)	12	.213
> 24	230(98.3%)	4(1.7%)	234(60.3%)		
	361(93.04%)	27(6.96%)	388(100%)		
Species					
<i>T.congolense</i>		13(48.148%)			
<i>T.vivax</i>		9(33.33%)			
Mixed		5(18.51%)			
Total		27(100%)			

Table 3: Prevalence of Bovine trypanosomosis with associated risk factors in Omobeyam District

Discussion

In this study, the entomological findings revealed that three species of *Glossina* (*Glossina m. submorsitans*, *G. pallidipes*, and *G. fuscipes fuscipes*) out of five reported in Ethiopia and other biting flies of genera *Stomoxys*, *Haematopota* and *Tabanids* occur in Omobeyam district, Oromia Regional State, South west Ethiopia. These three tsetse specie also were reported by Lelisa et al, 2018 in Southwestern Ethiopia. Among the species of Tsetse flies found in the area, *Glossina Morsitans* was the most abundant (42.32%), followed by *Glossina fuscipes* (29.93%) while *Glossina Pallidipes* was the least (27.74%). The apparent densities of *Glossina* species was 14.19 and 12.54 fly/trap/day in Gafarsa Gudina and Meti Sagada PAs respectively. This result is fairly in agreement with Damena et al 2016, who reported 14.43 FTD in Chewaka District, south western part of the country. But this finding was higher compared to Getachew et al and Dagnachew et al who reported 4.08 and 4.5 FTD respectively. This might be due to presence of favorable environmental conditions like altitude,

PA	Trap Site	No of trap deployed	Tsetse fly species and count												FTD
			<i>Glossinapallidipes</i>			<i>Glossinamorsitans</i>			<i>Glossinafuscipes</i>			Total			
			M	F	Total	M	F	Total	M	F	Total	M	F	Total	
GafarsaGudina	Along omo river	24	41	104	145	64	183	247	105	184	289	210	471	681	14.19
MetiSagada	Along omo river	24	88	123	211	82	214	296	21	74	95	191	411	602	12.54
	Total	48	129	227	356	146	397	543	126	258	384	401	882	1283	13.36

Table1: Omobeyam District Tsetse Fly distribution

moisture, forests and animal contact Murray et al., (1983). The sex category indicated male and female tsetse fly account for 31.25% and 69.75% of total caught *Glossina* species, respectively. The higher number of female than males might be related with the longer lifespan of female than male tsetse flies [10].

Prevalence of trypanosomosis in Omobeyam areas, located along Omo River basin during the study period was found to be 6.97%. This result is fairly similar with earlier reports of Mohammed and Lelisa et al who reported 5.47% in Guba District and 5.43% in Mandura District, north western Ethiopia respectively. The prevalence of trypanosomosis in Gafarsa Gudina and Meti sagada PAs was 8.6% and 5.3%, respectively. Which was statistically significant difference ($p < 0.05$) between these two districts. This may be related with difference in density of Tsetse flies between the two PAs. The present result revealed that the trypanosome species encountered in the area were *T. vivax* and *T. congolense*. The study showed that *T. Congolense* was the predominant (48.14%) species in the area followed by *T. vivax* (33.33%) while mixed infection was 18.51%. Similar reports were made previously by [11] where *T. congolense* is prevalent species. The prevalence of trypanosomosis in male and female animals was 7.84% and 5.97%, respectively. The difference in prevalence between the sex groups was statistically significant ($p < 0.05$), this could be due to the wide distance between the residential and farming area, which is along the river side where by the flies are abundant and hence increasing the risk of fly bite for the Ox, while Cows graze relatively less fly contact area. The other reason could be higher production of CO_2 by Ox than cows which is attractant to the vectors [13], Although the difference is not significant ($p > 0.05$), higher prevalence of trypanosomosis was higher in animals in a poor body condition (14.7%) than in those in medium (4.7%) and good body condition (3.50%) indicating weight loss is one of the symptoms of trypanosomosis. The mean PCV value of parasitaemic animals was 20.25% and aparasitaemic animals was 25.49%. Measuring the mean PCV value is one of the indicator of a herd infected with trypanosomosis and hence the anemic status of sampled animals showed reduced PCV values. Such result was also reported by Lelisa et al., Kassaye and Tsegaye. Thus, the development of anemia is the most reliable indication of the progress of the trypanosome infection. There are also parasitologically negative animals within the PCV values of less than the threshold value ($\leq 24\%$). This may be due to in adequacy of detection method (Buffy coat technique) or delayed recovery of anemic situation after current treatment with trypanocidal drugs. Other blood parasites infection like babesiosis and theileriosis and malnutrition can also lead to the development of anemia; Whilst, the occurrences of parasitologically positive cattle with PCV greater than 25% might be thought of recent infections of animals with trypanosomes. Thus, tsetse control methods should be widely expanded to reach all infested areas in sustainable manner besides drug therapy to reduce the devastating effect of trypanosomosis.

Conclusion

The area is highly Tsetse flies and other biting flies which are vector for the Animal trypanosomosis a disease with a devastating effect with livestock productivity and health, and hence wide and continues vector and trypanosomosis control should be taken at national level.

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