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Prevalence of bovine trypanosomosis and its associated risk factors in Bambasi woreda, Western Ethiopia

Abstract

A cross-sectional study was conducted in Bambasi woreda from November 2014 to May 2015 to determine the prevalence rate of trypanosomosis and its associated risks. Blood samples were collected from a total of 400 randomly selected cattle. The samples were examined by using Buffy coat technique and hematological procedures. The overall prevalence rate of trypanosomosis was 21.5%(n=85). The species specific trypanosomosis prevalence rate was; *Trypanosome congolense* 51.76%(n=44), *Trypanosome vivax* 28.23%(n=24), *Trypanosome brucei* 11.76%(n=10) and mixed 8.23%(n=7). There was statistically significant difference between trypanosome species (P<0.05). During the study period the prevalence of bovine trypanosomosis was assessed between sexes and age groups of animals. However, the prevalence of trypanosomosis with regard to study areas and body conditions were significantly different. The Mean packed cell volume (PCV) value of infected animals was lower (21.6%±3.20) than uninfected animals (24.32%±2.22). The only tsetse fly which was caught during the study period was *Glossina morsitans sub morsitans* and its mean apparent density was 4.95fly/trap/day. But mechanical vectors of trypanosomosis such as tabanus (1.83f/t/d), stomoxys (1.29 f/t/d) and haematopota (0.41f/t/d) were also found. The overall result of this research shows that the disease is severely affecting the agricultural productivity of the area so attention should be given to control trypanosomosis and its vectors.

Keywords: risk factor, bovine, PCV, trypanosomosis

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Abbreviations: %, percent; EIAR, ethiopian institute of agricultural research; F/T/D, fly per trap per density; *G. f. fuscipes, Glossina fuscipes fuscipes*; *G. longipennis, Glossina longipennis*; *G. morsitans sub morsitans, Glossina morsitans sub morsitans*; *G. pallidipes, Glossina pallidipes*; *G. tachnoids*, *Glossina tachnoids*; KM, kilo meter; KM^2, square kilo meter; MM, mille meter; NTTICC, national tsetse and trypanosomosis investigation and control center; Pas, peasant associations; PCV, packed cell volume; P-value, predictive value; Rpm, revolution per minute; SE, standard error; SPSS, statistical package for social science; *T. congolense, Trypanosome congolense*; *T. Vivax, Trypanosome vivax*; *T.Brucei, Trypanosome brucei*; US$, united states dollar; χ^2, pearson chi square

Introduction

Diseases of livestock reduce agricultural output by up to 30% in developing countries.[1] African animal trypanosomosis or Nagana represents a serious problem in most of Africa, specifically in sub-Saharan Africa.[2] Nagana is a disease caused by *Trypanosoma vivax, T. Congolense* and *T. Brucei* species. The outcome of disease occurrence depends on the interplay of the host, the parasite and environmental factors. Animal trypanosomosis is a wasting disease of cattle as indicated by its name "Nagana" which is a Zulu word that means "powerless/useless".[3] The economic loss which follows decreased productivity and death of livestock is enormous. Livestock production in Sub-Saharan Africa suffers from high prevalence of trypanosomosis with estimated annual losses due to direct and indirect consequences of the disease nearby billions of dollars.[4]

Animal trypanosomosis known as Ghendi in Ethiopia is also one of the main constraint to livestock production and preventing full use of land to feed the rapidly increasing human population. This disease is found throughout Ethiopia with the exception of the highlands and transmitted by cyclical or mechanical means. Most of the infection is transmitted mechanically by biting flies such as *Tabanids* and *Stomoxy's*. Cyclically, *Glossina* (tsetse flies) transmitted trypanosomosis holds 180,000-200,000km^2 agriculturally fertile land of west and south west part of the country.[5,6] Five species of Glossina namely *G. Morsitans sub morsitans, G. Pallidipes, G. f. Fuscipes, G. Tachnoids* and *G. Longipennis* are widely found in Ethiopia.[7,8] The cyclically transmitted trypanosome species affecting cattle, sheep and goats are *Trypanosome congolense*, *T. Vivax* and *T. Brucei*.[9] In bovine cyclically-transmitted trypanosomosis is very important.[10]

Bambasi woreda is located in Benishangul Gumuz Regional State of Ethiopia, which is most severely trypanosome affected area. In this region, almost all domestic animals in and adjacent are at risk of acquiring the disease at any time. Recent population movements including resettlement, as well as climate change is favoring the expansion of the tsetse habitat and brought domestic animals particularly cattle, in direct contact with the fly thereby exposing a significant number of animal populations to trypanosomosis infection. Therefore the objective of this research was to determine the Prevalence, Vector Density and Associated Risks of Bovine Trypanosomosis in Bambasi woreda, Benishangul Gumuz Regional State, Western Ethiopia.

Materials and methods

Study area

This study was conducted in selected kebelles of Bambasi woreda. Bambasi woreda is located in Benishangul Gumz Regional State of Ethiopia at 614km far from the capital city Addis Ababa and it is found between latitude 9^0-10^0N and longitude 034^0-035^0 E.[11] Native grasses and bamboo forests are dominantly available vegetation. Under the effect of socio-economic activities, the vegetation is increasingly dominated by shrubs and herbs. Crop production by using animal traction is the main activities of the people followed by animal husbandry such as cattle and small ruminants. The production system of cattle in the region is characterized by an extensive management system.

Study design and sampling method

A cross sectional study design was used to determine the prevalence of bovine trypanosomosis from November 2014 to May 2015. Blood samples from both sexes were collected by using simple random sampling technique. During sampling kebelles (PAs), age, and body condition score of animals were also recorded. Body condition score was grouped in to poor, medium and good conditioned animals based on the appearance of ribs and dorsal spines applied for Zebu cattle.[12] The study district and peasant association was purposively selected. The animals were sampled at watering, grazing points and veterinary clinics. Desired sampling size was calculated using 50% expected prevalence according to the formula given by Thrusfield MV[13] But to improve the degree of precision a total of 400 samples were taken.

Hematology and parasitological study

Blood samples were collected aseptically from ear veins using heparin zed micro-haematocrit capillary tube and sealed on one end by crystal seal. The samples were properly labeled and submitted to Assosa Regional Veterinary Diagnostic laboratory for further examination. The capillary tube was spun in a haematocrit centrifuge for 5min at 1200rpm and read by micro-hematocrit reader for determination of PCV.[14] The centrifuged capillary tubes were cut with diamond pointed pen 1mm below and 3mm above. The Buffy coat were poured onto a slide, mixed and covered with cover slip (22mmx22mm). The samples were examined by using a 10x magnification in combination with 40x objective microscope for identification of motile trypanosomes.[15]

Entomological survey

A total of 73 monoconical traps were deployed for trapping the vector during the study period. These traps were constructed from locally made blue and black cloth with white mesh on the top. The traps were odor baited by acetone and cow urine; the distance between traps, altitude and type of vegetation were considered. Collection of flies was held after 48hours of deployment and the flies which were captured in the collecting cage were categorized by species.

Data analysis

The collected data were analyzed by using SPSS version 20 software. Descriptive statistics was used to determine the prevalence of trypanosomosis in cattle and Chi-square test (χ^2) was used to assess associated risk factors. In all analyses, the confidence interval level was 95% and P value less than 0.05 was considered as significance.

Results and discussion

Prevalence of trypanosomosis

A total of 400 cattle blood sample were examined to determine the presence of trypanosomosis by Buffy coat technique and thin blood smear. Trypanosomosis were detected in 85 cattle with an overall prevalence of 21.25%. The result indicated that a given cattle were infected with three *Trypanosome species* and most of the infection were caused by *T. Congolense* 51.76%(n=44/400), followed by *T. Vivax* 28.23%(n=24/400), *T. Brucei* 11.76%(n=10/400) and mixed infection 8.23%(n=7/400). The species-specific prevalence of trypanosome showed that statistically significant difference.

Prevalence of trypanosomosis varied among age groups (Table 2) and the highest prevalence was observed in cattle aged 2<x<7years (21.6%), Where X- represent age in terms of years. The prevalence of trypanosomes infection varied between age categories but not significantly (P>0.05). The prevalence of trypanosomosis was higher in male (23.5%) than female cattle (19.6%) (Table 3) but there was no statistically significant difference (p>0.05). The incidence of bovine trypanosomosis on the basis of body condition score was graded as good, medium, poor, and were found to be 9.25%, 17.9 %, and 41.2% respectively (Table 4). And the rate shows significant (P<0.05). So, the body condition was inversely related to infection rate. The prevalence of trypanosome species in cattle within kebelles (PAs) in the study areas showed that Musa and Mender 45 as the highest and lowest trypanosome infection rate recorded areas respectively (Table 5). And the rate showed that significant (P<0.05).

The research showed that the mean PCV value for examined animals was 23.75±3.97 SE. But the mean PCV value for negative and positive animals was 24.32±2.22 SE and 21.6±3.20 SE respectively. Significant difference (P<0.05) was observed (Table 6). The overall prevalence of anemia was 54%(n=216). The incidence of anemia was higher in trypanosome positive animals (77.64%) than negative animals (47.62). Among the anemic animals 16.5%(n=66) was trypanosome positive but 37.5%(n=150) of animals had anemia without trypanosome infection. However, 4.75%(n=19) of animals having normal PCV value were also found trypanosome positive (Table 7).

Entomological findings

From a total of 1239 captured flies during the study period 58.35%(n=723) were tsetse flies belonging to the genus glossina, 21.54%(n=267) tabanid, 15.25%(n=189) Stomoxys and 4.84%(n=60) haematopota. The apparent density of *G.Mor. sub. morsitans* was 4.95 F/T/D (fly/trap/day). The highest and lowest fly density were recorded in Musta and Mender 45 (334 (11.13 F/T/D) and 196 (6.53 F/T/D)) respectively (Table 8).

The current study conducted for a period of six month in Bambasi woreda revealed that trypanosomosis is the most prevalent disease causing considerable direct and indirect economic losses in the study area. The overall prevalence of bovine trypanosomosis was 21.25% which was higher when compared with previous reports in different parts of the country, such as 1.3% in Arbaminch by Girma et al.[16] 6.9% in Chena district by Alemayehu et al.[17] 6.3% in Kindo Koish District by Adale & Yasine[18] and 8.57% in western oromia by Tasew & Dugma.[19] This might be due to difference in using controlling methods of trypanosomosis, climate and ecological conditions such as

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altitude, rainfall, and temperature and livestock management system. But the research was agreed with NTTICC[20] with prevalence of 22% in Gari settlement area.

The research showed that out of 85 positive cattle for trypanosomosis, *T. Congolense* was found to be the causative agent in 51.8%(n=44), *T. Vivax* 28.23%(n=24), *T. Brucei* 11.76%(n=10) and mixed infection accounted for 8.23%(n=7). The predominate species causing bovine trypanosomosis was *T. Congolense* and this finding agreed with previous report from south-western Ethiopia by Abebe & Jobre,[9] Duguma et al.[21] Zecharias & Zeryehun,[22] Teka et al.[23] This might be because the research area is suitable for the multiplication of biological vector (tsetse flies). Vector born trypanosome species are disseminated in most parts of Western and South Western parts of Ethiopia Abebe,[7] Mulaw et al.[24] Meanwhile, the current finding disagrees with Nabulime et al.[25] in Mulanda, eastern Uganda. This difference may be caused by the variation in agro ecology, vegetation and environment of research areas.

Table 1 Prevalence of trypanosomosis in terms of species level

Trypanosome Species	No Examined	No of positives	Prevalence%	X^2(P-value)
T. congolense	400	44	51.76	182.75(0.0001)
T. vivax	400	24	28.23	
T. brucei	400	10	11.76	
Mixed Infection	400	7	8.23	

T. Congolense, Trypanosome congolense; *T. Vivax, Trypanosome vivax*; *T. Brucei, Trypanosome brucei*

Table 2 Trypanosomosis in different age category

Age groups	No examined	No of positives	Prevalence%	X^2(P-value)
x< 2	72	15	20.8	0.110(0.946)
2 <x< 7	282	61	21.6	
x > 7	46	9	19.56	
Total	400	85	21.25	

Table 3 Sex wise Prevalence of bovine Trypanosomosis

Sex	No examined	No of positives	Prevalence%	X^2(P-value)
Male	166	39	23.5	0.85(0.35)
Female	234	46	19.6	
Total	400	85	21.25	

Table 4 Prevalence of bovine trypanosomosis based on body condition

Body condition	No examined	No of positives	Prevalence%	X^2 (P-value)
Good	108	10	9.25	32.75(0.000)
Medium	195	35	17.94	
Poor	94	40	41.2	
Total	400	85	21.25	

Table 5 Prevalence of bovine trypanosomosis based on kebelles (PAs)

Kebelles(PAs)	No examined	No of positives	Prevalence%	X^2(P-value)
Musta	54	20	37.03	11.101(0.049)
Keshimando	53	11	20.75	
Mender 49	70	11	15.7	
Mender 45	90	14	15.55	
Bambasi	64	14	21.87	
Dabuse	69	15	21.7	
Total	400	85	21.25	

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Table 6 Mean PCV value of trapanosomosis positive and negative animals

Status	Frequency	Mean PCV (%)	SE	Overall PCV	X^2(p-value)
Positive	85	21.6	3.2	1836	
Negative	315	24.32	2.22	7662	25.37(0.000)
Total	400	23.75	3.97	9498	

Table 7 Status of anemia in trypanosomosis positive and negative animals

Trypanosome status	Anemia	Frequency	Percent (%)	Percent share per strata
Positive	Anemic	66	16.5	77.64
	Non-anemic	19	4.75	22.35
Negative	Anemic	150	37.5	47.62
	Non-anemic	165	41.25	52.38

Table 8 Tsetse and biting fly density

Kebelles (PAs)	Tsetse fly		Biting fly					
	G. M. sub moristance		Tabanid		Stomoxys		Hematopota	
	Total no	F/t/d	Total no	F/t/d	Total no	F/t/d	Total no	F/t/d
Musta	81	4.05	39	1.95	31	1.55	12	0.6
Keshimando	63	3.5	32	1.77	19	1.05	9	0.5
Mender 49	103	5.15	28	1.4	15	0.75	11	0.55
Mender 45	111	3.7	48	1.6	23	0.76	14	0.46
Bambasi	150	5.35	53	1.89	55	1.96	8	0.28
Dabuse	215	7.16	67	2.23	46	1.53	6	0.2
Total	723(58.35%)	4.95	267(21.54%)	0.079	189(15.25%)	0.056	60(4.84%)	0.0178

F/t/d Fly Per Trap per Day

G. M. sub moristance Glossina moristance sub moristance

The prevalence of bovine trypanosomosis was assessed between age group of animals and there was no significance difference with in age groups (Table 2). Similarly, the prevalence of trypanosomosis in male was slightly higher than female but the difference was not statistically significant (Table 3). This may be due to both sexes and age groups are equally susceptible to the disease. This finding agreed with Adale & Yasine[18] in Wolaita Zone Kindo Koish District of Ethiopia and Bedada et al.[26] in Addisamba and Amarit District of West Gojjam Zone.

The occurrence of disease in three different body condition (poor, medium and good) animals shows the highest prevalence in poor body condition (41.2%) followed by in medium (17.9 %) and good body condition (9.25%). The finding showed that infection rates in poor body condition animals were significantly higher than that of medium and good body condition animals (Table 4). This is due to poor body condition animals are susceptible to the infectious disease. The reason behind is may be due to reduced performance of the animals created by lack of essential nutrients and poor management by the animal owner. In contrast, trypanosomosis is a chronic disease as stated by Urquhart et al.[27] the observed emaciation and weight loss might be caused by the disease itself. This result agreed with previously reported findings by Girma et al.[16] Teka et al.[23] Fayisa et al.[28] and Bitew et al.[29]

The prevalence of bovine trypanosomosis between kebelles (PAs) was significantly different (Table 5). High prevalence of trypanosomosis was recorded in Mutsa kebelle than other kebelles. This might be due to controlled animal movements between PA's, presence of favorable environment, moisture and vegetation for replication of vectors.

The mean PCV value for all examined animals was 23.75±3.97 SE. However, the mean PCV value of trypanosome positive animals was significantly lower (21.6±3.20 SE) than that of negative animals (24.32±2.22 SE) (Table 6). This finding is aligned with previous works by Ali & Bitew[30] and Rowlands et al.[31] The overall incidence of anaemia was 54% in the research area and the presence of anemia was higher in trypanosome positive animals (77.64%) than negative animals (47.62%) (Table 7). This is due to the contribution of trypanosomosis for causing anemia in infected animals. This finding agreed with previous reports by Tewelde[32] in western Ethiopia and Desta[33] in upper Dedesa valley of Ethiopia. Among the anemic animals 37.5% of them were negative to trypanosome infection. This is because the observed anemia can be caused by other means such as blood sucking gastrointestinal parasites and malnutrition.[34] However, 4.75% of the cattle with normal PCV value were also found infected by trypanosome and this result is in line with Garoma[35] report from East Wollega Zone. This might happen due to the ability of trypanosome positive animal to maintain their PCV value and technical errors of diagnosis methods used.[36]

Monoconical traps were deployed for trapping both biological and mechanical vectors. Among the total trapped tsetse flies only *Glossina morsitans sub morsitans* (58.35%) with 4.95 f/t/d mean apparent density were found (Table 8). This finding is lower than Dagnachew et al.[37] in Abay (Blue Nile) basin but higher than that of Desta[33] in upper Didessa valley western Ethiopia. This difference might be due to variation of agro ecology and vegetation. However, different types of biting flies (mechanical vectors) were also identified among these tabanus (21.51%), stomoxys (15.25%) and hematopota (4.84%) with apparent densities of 0.079f/t/d, 0.056f/t/d, and 0.0178f/t/d respectively. Fayisa et al.[28] in Didesa district and Efrem et al.[38] in Gimbi district also reported the presence of biting flies. This result showed that the effect of biting flies for transmission of trypanosomosis in the study area.

Conclusion

Generally the research confirms that trypanosomosis is a major threat in the research area. The research showed that bovine trypanosomosis is mainly caused by *T. Congolense*. Neither sex nor age groups have seen significance difference but kebelles (PAs) and body conditions showed significance difference in the research area. The mean PCV value of trypanosome positive animals was significantly lower than negative animals indicating the effect of trypanosomosis in lowering the PCV value. The only tsetse fly caught was *G. Moristans sub morsitans* but mechanical transmitters of the disease such as stomoxys, tabanus and haematopota were found during entomological survey. Therefore awareness creation and appropriate control methods of trypanosomosis on its vectors and against the parasites should be designed and implemented.

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Conflict of interest

Author declares that there is no conflict of interest.

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