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Prevalence of Bovine Trypanosomosis in Tsetse Controlled and Uncontrolled Areas of Eastern Wollega, Ethiopia

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ABSTRACT

A cross-sectional study was conducted in tsetse controlled and uncontrolled areas of East Wollega zone at Anger-River Basin settlements to assess the current status of bovine trypanosomosis and evaluate the maintenance of control achievements. Selected 5 PA's located in Gutowayu and Sibusire districts were studied as controlled and uncontrolled sites. Blood sample collection was carried out from the ear vein of cattle selected at random and Buffy coat examination was used as a diagnostic technique. Overall, 66(15.57 %) out of 424 cattle examined were found to be infected with different species of trypanosomes (68.18% (45/66) T. congolense & 31.82% (21/66) of T. vivax). The infection rates in uncontrolled and controlled areas were 22.77% &7.5% respectively. These results have shown a statistically significant difference ($P<0.05$) that higher infections were detected in those PA's located in uncontrolled area. The highest prevalence was recorded in uncontrolled site of Meti, PA (30%) followed by 16.42%. And the lowest one was 4.63% from controlled site of Lugo. The mean PCV values of parasitaemic and aparasitaemic animals were 24.31% ±5.65 SD and 25.97% ± 4.56SD, respectively with a statistical significant difference ($P<0.05$). The prevalence of infection in adult (>3yrs) cattle was 19.03% and 10.53% for young (1-3yrs) and the statistical analysis showed that these results differed significantly ($X2=5.1154$; $P<0.05$). Calves and young animals less exposed since they are either tethered or kept close to the homestead where tsetse habitat has been destroyed so the trypanosomes challenge is higher in older animals may be due to tsetse feeding preference for old animals and they are usually driven for grazing and watering. There was no variation with regards to sex in infection rates. In general prevalence of trypanosomosis was higher in cattle in uncontrolled area as there is continued tsetse challenge compared to those in controlled area where level of tsetse population is maintained at low level due to previous control interventions. However, detection of low level of parasitaemia in controlled sites still show some degree of persistent presence of tsetse or movement of cattle into uncontrolled area in search of pasture and water. Therefore, initiation of tsetse control operation in those PA's in the uncontrolled areas seems and maintaining the achieved results of previous controlled sites is essential.

Key words: Bokogima, Buffy coat, Gadisa Oda, Horo Aleltu, Lugo, Meti, T. Congolese, T. Vivax.

INTRODUCTION

Ethiopia has enormous livestock resource with a total contribution of 15% to gross domestic product (GDP) and 33% to agricultural output. Current estimates of livestock population show that there are 41.5 million heads of cattle, 41 million sheep and goats, 5.8 million equines, 1 million camels, and over 52 million poultry (DACA, 2006). The huge livestock resource particularly cattle are utilized as they provide traction power (a vital contribution to the overall

Farm labour requirements), provide milk, meat, cash income, manure and serve as a capital asset Against risk and in general livestock are complementary to crop in the highlands (MoA, 1997). Despite the importance of livestock to the largest sector of the population and to the economy at Large, the sub-sector has remained untapped. The little benefit from the enormous livestock Resource of the country is attributed to a multitude of problems. This comprises of diseases, Age-old traditional management system, inferior genetic make-up coupled with under nutrition and And complicated by malnutrition and the absence of well-developed market infrastructure (MoA, 1997).

Trypanosomosis, a devastating disease caused by protozoan parasites of the genus Trypanosoma That found in the blood and other tissues of vertebrates including livestock, wildlife, and people (Uilenberg, 1998; Hoare, 1972; Hall, 1985; Adam et.al., 1971) and transmitted by tsetse flies (Glossina species) (Dollan, 1998) is a major constraint which is contributing to the direct and indirect economic losses to crop and livestock production (Abebe, 2005; PATTEC, 2001; EVA, 1994). Trypanosomosis in Africa costs livestock producers and consumer an estimated US $ 1 billion each year (kristajonson et. al., 1999). It is a severe problem to agricultural production in widespread areas of the tsetse infested regions (Slingenbergh, 1992) that accounts over 10 million square kilometres of the tropical Africa (Budd, 1999). In Ethiopia, Trypanosomosis is widespread in domestic livestock in the Western, South and South-western lowland regions and the associated river systems (i.e. Abay, Ghibe Omo and Baro/Akobo) (TCS, 1980; MoA, 1995; Abebe and Jobre, 1996; Abebe, 2005; Langridge, 1976). Currently about 220,000 Km2 areas of the above mentioned regions are infested with five species of tsetse flies namely Glossina pallidipes, G.morsitans, G.fuscipes, G.tachinoides and G.longipennis (NTTIC, 2004).

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Recent findings indicate that the potential area of tsetse infestation is estimated to be ranging from 135,000- 220,000 square kilometres based on maximum dispersals up to 2000 meters above sea level (Slingenbergh, 1992). Economically the tsetse-transmitted trypanosomes (Trypanosoma congolense, T. Vivax, and T. brucei) are most important in cattle with 14 million heads at risk in Ethiopia (Abebe, 2005; Fraser, 1986; upadhayaya, 2005).

Past activities of tsetse and trypanosomosis control measures were initiated from the early 1960s by French veterinary Assistance Mission followed by British Veterinary Assistance Mission up to 1976. The National Tsetse and Trypanosomosis Investigation and Control Centre (NTTICC) was established in 1971 to run activities on tsetse and trypanosomosis control (Lemecha, 1994).

Since then different tsetse control projects have been underway by NTTICC and thus meaningful Achievements were recorded as some areas were freed of tsetse. These tsetse control activities Against, mainly, Glossina morsitans submorsitans were undertaken in an area of over 4500km2 of Didessa Valley as part of the Eastern Africa egional Program. However, strict attention should be paid in preventing the occurrence of renovation of such freed sites and consolidate the sustainability of the achieved results. This necessitates a continued follow-up and evaluation of the current status of tsetse infestation and occurrence of trypanosomosis in such controlled sites and their surrounding villages. Therefore, the objective of this study was conducted on the current operation sites of NTTICC to investigate the status of bovine trypanosomosis in selected sites of tsetse controlled and uncontrolled areas to compare and assess how far the achieved results of control were sustained.

MATERIALS AND METHODS

Description of the Study Area

Location

The study was conducted in different areas in East Wollega Zone settlement areas. The settlement areas in which the study was conducted were Gutowayu and Sibusira woredas which are tsetse controlled and uncontrolled respectively. These areas are parts of the major tsetse and trypanosomosis belt. Both are found in the Anger River Basin and its tributaries and they are about 339kms distance from Addis Ababa. These settlements and PA's are located within the former mechanized state farm (Wollega state farm) within the same basin except Boko Jima settlement area of Sibu sire woreda which is outside of these state farms but on the periphery under the Escarpment in the valley of big river called Aleltu which is a big tributary of Anger River.

Vegetation

The initiation of the state farm activity which changed the ecology by bush clearing and Cultivation of a vast area as a result left the treeless landscape with crops, offices and campus. This Valley (Anger and Aleltu) had a richer vegetation and wild fauna, which only a few have been left. But after the change of the government and termination of state farm in 1996, revival of Vegetation, which created favorable conditions for the survival of tsetse (Mulligan, 1970; OIE, 2005; FAO, 1980; Warness, 1997), took place and most of these areas undergoing another ecological change before the settlement and tsetse control (MoA, 1984).

Much open savannah grassland, bushes, big tress which left from the clearing program along the Rivers, a tributary of Anger River. The largest and least sorghum and maize cultivated lands coffee, and various bush vegetation is available.

Climate

According to the information obtained from the development agent of the settlements, staff member and NTTICC working on the tsetse control program in that Woreda, the minimum and maximum temperature is 13.40c and 32.50c respectively, and the average one 29.95OC and the minimum and maximum rainfall is 17.50 mm and 400.8 mm respectively and the average one 160.70mm.Generally the weather is kola and has an altitude ranging from 1314 to 2000masl. The The area has two distinct seasons: the dry season extending from December to May; and the wet A season which extends from June to September. The livelihood of the major section of the Population in the area depends on crop- livestock mixed farming.

Wild life

In both woredas game animals/ wild animals are rarely encountered and hence tsetse flies are believed to be depending, for their blood meal, on domestic animals. But the most dominant ones include bush buck, bush pig, warthog, crocodile, Buffalos and hippopotamus.

Tsetse Distribution

Among the 5 species of tsetse (Richard et.al., 1977; Radostits et.al., 2006; Urquart et.al., 1987) Found in Ethiopia (in the administrative regions of southern Western Ethiopia), only two were found in these woredas (G. m. Submorsitans and G. tachinoides) but now only one species present (G. tachinoides) left (NTTICC, 1998) and dominant species of Glossina (leak, 1999).

Furthermore, there was a chance to carry out a preliminary survey for tsetse flies in 3 PA's of the controlled area, where only Glossina tachnoides (372) were caught with traps deployed along the river during this study period. The other savannah species was usually caught before the control

intervention in the Aleltu & Loko River areas but now eliminated not only because of the control intervention however the habitat for that fly is completely used for cultivation. The highest F.T.D (9.5) was recorded at Gadisa Oda especially on Loko River and the least FTD (1.4) was at BokoJima settlement on Lega Jagna which is Aleltu tributary. The investigator didn't carry out fly trapping in sites found beyond the settlements area where the habitat seems to be favourable to tsetse flies even including G. morsitans.

Human Activity and Livestock Density In both areas land is used for crop production (particularity for sorghum, maize and also oily seeds) and the availability of oxen for ploughing is an essential factor. And the predominant livestock in both areas (PA'S) is cattle though there is a risk of bovine trypanosomosis in areas especially in the uncontrolled part. According to information (socio-economic data) obtained from these Development agents livestock population and human settlers of these sites shows that: in Lugo 3,040 cattle, 1565 shoats, 395 equines, and 4881 human settlers in 823 Family head (2024 Female& 2034 Male); in Gadisaoda 2905 cattle, 2478 shoats, 1204 equines, 5261 human in 916 Family head (2478 Male, 1867 Female) in Bekojima 712 cattle, 2037 shoat, 393 equines ,6055 human in 807 Family head (2514 Female and 2738 Male) and in Meti 3674 cattle, 596 shoats 415, equine & 5770 human population in 760 Family head (3436 Female and 2574Male).

Animals Examined

In this study, a total of 424 cattle from 5 settlements (PA'S) were sampled and examined for the presence of trypanosomosis. The study animals were cattle kept under extensive Management system. The sampling includes all cattle.

Sample size and sampling method

Simple random sampling method used was for the study animals and the study design was crosssectional.

In the study area 50% expected prevalence was considered in sample size determination. And also the other determinants considered in sample size determination are 95% confidence interval and 5% desired absolute precision.

Therefore, N= (Zx) 2-Pexp (1-Pexp) (Thrusfield, 1995)

D2

N= the required sample size

Pexp= the expected prevalence rate (50%)

Zx= the values of the required confidence interval (1.96)

D= desired absolute precision (5%)

Hence, the sample size required as per the above formula was 384 heads of cattle. However, a total

of 424 (200 cattle from the controlled area and 224 from uncontrolled areas) were sampled.

Data Collection

Relevant data of the study animals was recorded along with blood specimen collections. The individual animal details such as the identity of the animal, age, sex, source of the animal from where was come either from controlled or uncontrolled area.

Haematological Examination

Crosses sectional type of study was used to determined and compare bovine trypanosomosis in the controlled and uncontrolled districts of Eastern Wollega zones settlement areas, Anger River Basin. A random sampling technique was applied to select the cattle to be examined for the determination of the prevalence of bovine trypanosomosis (Thrusfield, 2007). The animals were categorized in to three age categories calf (up to1), young (1-3years) and adult (>3 years). The animals (cattle) were selected randomly and restrained by farmers for sampling. Blood samples were collected by puncture of the marginal ear vein of the cattle with sterile lancet and then the blood samples were collected in to heparinzed microhaematocrit capillary tube (HCT). The 3/4th filled tubes were sealed at one end with crystal seal and centrifuged at 12000 rpm for about 5 minutes (Woo, 1970) using microhaematocrit centrifuge. Then the PCV was measured using PCV reader to estimate anaemia and the Buffy coat was drained onto microscope slide by cutting the capillary tube with sharp pointed diamond pencil 1mm below the butty coat. After which it was covered with a 22 X 22 mm cover slip on microscope slide and examined under dark field microscope (40X power objective). Thin smears were prepared for positive samples for species identification (Murray et. al., 1977; Paris et. al, 1982). The trypanosome species were identified according to their motility in the Buffy coat examination.

Data Analysis

The data obtained from both study areas was properly recorded, organized and stored in Microsoft excel sheet program, and the analysis was carried out by using of Microsoft excel spreadsheet for data summarization and statistical software program called STATA 8.0 version used for different ways of analysis and showing the significance of results. The overall prevalence was calculated by using dividing the number of BCT positive animals by the total numbers of the animals tested. The packed cell volume pattern between negative and positive animals, the prevalence rates the disease between uncontrolled and controlled area, sex and age of the animals were compared.

RESULTS

Of all examined cattle a total of 66 were found positive for different species of trypanosomes showing an overall prevalence of 15.57% (95% CI: 12.10- 19.03) where 45 were for T. congolense and 21 were T. vivax (Table 1).

Table 1: Comparison of Trypanosome prevalence in both controlled and uncontrolled areas

Area	Total sampled	Parasitaemia			Prevalence (%)
		Positive	T. vivax	T. congolense	
Controlled	200	15	4(26.67%)	11(73.33%)	7.5
Uncontrolled	224	51	17(33.33%)	34 (66.67%)	22.77
Total	424	66	21(31.82%)	45(68.18%)	15.57

Table 2: Infections (Parasitaemia), mean PCV and prevalence in uncontrolled areas

Woreda	PA's	Total sampled	Parasitaemia			Mean PCV values		Prevalence (%)
			Total	Tc	Tv	Parasitaemic	Non-parasitaemic	
Gutowayu	Horo Aleltu	124	21	13	8	25.29	27.22	16.94%
	Meti	100	30	21	9	24.63	27.01	30%
	Total	224	51	34	17	24.96	27.12	22.77%

Key: Tc = Trypanosoma congolense; Tv= Trypanosoma vivax

Table 3: Infections (Parasitaemia), mean PCV and prevalence in controlled area

Woreda	PA's	Total sampled	Parasitaemia			Mean PCV values		Prevalence (%)
			Total	Tc	Tv	Parasitaemic	Non-parasitaemic	
Sibusira	Boko Jima	44	5	4	1	22	25.31	11.36
Gutowayu	Horo Aleltu	108	5	4	1	26.2	24.98	4.63
	Meti	48	30	21	9	18.8	24.28	10.42
	Total	200	15	11	4	22.33	24.86	7.5

Key: Tc= Trypanosoma congolense; Tv= Trypanosoma vivax

The prevalence rate of trypanosomosis in the controlled area was 7.5% and 22.77% in uncontrolled one (Table 1). Statistical Analysis of these results indicated a highly significant difference between the two study areas (X2 = 18.74; P< 0.01). Likewise, the highest prevalence (30%) was recorded in Meti (uncontrolled PA) and lowest prevalence (4.63) in Lugo (controlled PA). Here the Analysis also indicated that there was a highly significant variation between individual PA's of the two intervention category (X2 =27.42; P<0.01).The trypanosome species encountered were T. congolense and T. Vivax (NTTICC, 2002) of which T. congolense accounted for 68.18% while T. vivax accounted for 31.82% (Table 3). Therefore, the result indicates the predominance of T. congolense over T. vivax in both study areas (controlled and uncontrolled area). The effect of sex on the occurrence of infection of trypanosomes was also analysed.

Accordingly, the rates were found to be 16.73% and 13.79% in males and females respectively.

Nevertheless, no difference of significance was detected (X2 =0.8529; P>=0.05) (Table 4).

Table 4: Trypanosomosis infection rate according to sex

Sex	Examined	Infected	Prevalence (%)
Female	143	19	13.29
Male	281	47	16.73
Total	424	66	15.57

Attempts were also made to assess the effect of age category on the occurrence of infection in due course. Consequently, adult cattle (>3 years of age) were more infected (19.03 %) than young (1-3 years) (10.53%). The statistical analysis result showed that there was a significant difference in trypanosome infection rate between young and adult ($X2 = 5.1154$; $P<0.05$) (Table5).

Table 5: Trypanosomosis infection according to age

Sex	Examined	Infected	Prevalence (%)
Calves	22	3	
Young (2-3)	152	16	10.53 (16/15)
Adult (>3)	281	47	19.03 (47/247)

Finally, comparison of mean PCV values of parasitaemic and aparasitaemic animals were treated using paired t-test and that the results revealed significant difference ($P< 0.05$) (Table 6).

Table 6: PCV values of Parasitaemic and non-parasitaemic cattle

Status	No examined	Mean PCV	Std. Dev (SD)	(95% CI)
Negative	358	25.97	4.563	25.50, 26.45
Positive	66	24.31	5.652	22.93, 25.71

CI: Confidence interval

DISCUSSION

Trypanosomosis is the major constraint to the utilization of the large land resources and also affect livestock, cattle in particular which have a major role in agricultural economics of Ethiopia. The introduction of drought oxen in to settlement areas in lowland area was severely constrained by the wide spread presence of trypanosomosis (Abebe, 2005, Dagnachew et. al., 2005, Cherente et. al., 2005). This work revealed the distinct difference in the prevalence of bovine trypanosomosis between tsetse controlled and uncontrolled areas of East Wollega Zone settlement sites. According to this finding, there was a

significantly higher infection rate of bovine trypanosomosis in uncontrolled area (22.77%) compared to the controlled area (7.5%).

This is clearly indicative of the continued exposure of cattle to tsetse flies during grazing as well as accessing the water sources where they could congregate with the tsetse flies. The detection of low infection rate in those sites where tsetse control intervention was carried out shows the apparent reduction of tsetse species with the resultant decline in trypanosome infection in cattle. This is reflective of the effectiveness of the control measures that have been taken or degree of human intervention (insecticides impregnated targets, traps, availability of veterinary clinic) and socio economic or cultural effects of human population residing in these areas, leading to reduction of tsetse ecology (MoA, 1983). However, a finding of about 7.5% infection incontrolled areas still indicates some tendency of either a start in build up of reinvasion; incomplete clearing of previous tsetse population remained in some pocket areas, or because of cattle movement. Cattle movement from controlled areas to uncontrolled areas in search of pasture and water was the usual incident during the study period like cattle moving from Gadisa Oda PA (controlled) to adjacently located Meti and Horo Aleltu PA's (uncontrolled).

The present study elucidated that the trypanosome species found in tsetse infested area were T.vivax and T.congolense. This study also showed that there was a predominance of infections with T. congolense over T. vivax. This is consistent with the previous work reports in different areas of Ethiopia of such by Abebe and Jobre (1996) in South west Ethiopia where they reported T. congolence (59%) and T. vivax (31%) infection, Muturi et. al. (2000) who reported 66.86% T. congolence and 20.57% T. vivax infection in the Southern rift valley.

The first two PA's of uncontrolled area (Meti & Horo Alelto) have shown a relatively higher infection rates of 30% and 16.94% respectively while the lowest infection rate (4.63%) was detected in Lugo PA (controlled area). Treatment of the results at PA level revealed significant variation which has likely arouse from high infection rates recorded in uncontrolled PA's. This is indicative of no any measurement taken/ human intervention and the area is under the tsetse belt (NTTICC, 1998) so tsetse flies can persist there feeding on alternative hosts (wild animals) and did not disappear by bush clearing, or spraying of insecticides, then there may be high chance of tsetse-cattle contact leading to increased prevalence rate in these uncontrolled areas whenever cattle are allowed to the site.

The prevalence of trypanosome infection of 16.73% in male and 13.29% in female showed insignificant variation that sex didn't justify a

relationship with occurrence of infection. This is due to the fact that cattle are driven to pasture and watering regardless of sex and allowed in the same ecology having comparable degree to acquire infection. A similar result was reported by Dagnachew et. al., 2005 who demonstrated about 18.45% for male and 13.87% for female sexes in late rainy season in Abay (Blue Nile) River Basin and 12.82% for male and 11.32% for female in dry season) without significant variation.

It was also tried to assess the relationship of infection with age category of sampled animals. As a result, among the age groups categorized the highest prevalence was recorded in adult cattle (19.03%) followed by young cattle (10.53%) with significant degree of variation. This variation has likely occurred as the husbandry system reflect young animals are less exposed since they are either tethered or kept close to the homestead where tsetse habitat has been destroyed (ISCTRC, 1999).

It is known that the development of anaemia is the most reliable indicator of the progress of trypanosome infection in cattle (ILRAD, 1988), and also to be assumed that numerous concurrent diseases (Mathewos et. al., 2001) and nutritional factors interfere with anaemia development (Radostits et. al., 2006). During PCV determination, a value of 24-36% was considered to be normal (Hoare, 1972) but anaemic if below 25%. Therefore, in this study (66/424) 15.56% of infected cattle as diagnosed by haematocrit centrifugation technique recorded a mean PCV value of 24.31 (95% confidence interval 22.92-25.70) was anaemic and 84.43% (358/424) of non-infected cattle was 25.97% mean PCV (95% confidence interval 25.50-26.44). So analysis showed that non-infected animals had a significantly higher PCV than parasitaemic animals. This reflects the effect of presence of infection in causing anaemia with a resulting decline in PCV values.

CONCLUSIONS AND RECOMMENDATIONS

The result obtained from this study shows that trypanosomiasis is very important diseases that brings about great economic losses to livestock a diversely in the uncontrolled area and then in controlled settlement since many cattle are dying because of this disease. In addition to this inchronic may reduced and the animals are too weak to be used for ploughing. This chronic infection often ends in the death of the animals. Totally the disease affects each household and in the area the socio-economic importance of the disease appears to be a single most important constraint to improve livestock productivity in the area. Therefore a very serious tsetse controlled operation should be taken by the concerned group. If possible manage the animals on the backyard, to avoid contact with flies (vectors). Control of the vector in affected area not

only reduces the prevalence of trypanosomosis and the huge economic loss but also helps in limiting the extension of the disease to the free adjacent areas.

The veterinary centres should be established and well organized to work autonomously, and to cop up with the fruitful expected end results. This requires adequate fund and financial administration on economic grounds.

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