

Prevalence of Bovine Trypanosomosis, Tsetse Density and Farmers Perceptions on the Impact of Control Program in Kellem Wollega Zone, Western Oromia, Ethiopia

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Abstract

A study was conducted from November 2011 to April 2012 Dale Wabera and Dale Sadi Districts of Kellem Wollega Zone of western Oromia. The objectives of the study were to assess the owners' perception on the impact of Trypanosomosis and its control, determine the prevalence of bovine Trypanosomosis and to assess the distribution and apparent densities of vectors of the Trypanosomosis. Blood samples from a total of 589 cattle randomly selected indigenous zebu cattle from 6 peasant association were taken and examined with conventional hematological and parasitological techniques. Among the total cattle examined 51(8.7%) animals were found to be positive for trypanosomosis infection. Most of trypanosome positive cases were due to *Trypanosoma congolense* which accounted for 86.3% and *T. vivax* which was 9.8%. Eventhough there were variation of infection rates within different age groups and body condition. Mean packed cell volume (PCV) of a parasitaemic animals were significantly lower than those of aparasitaemic ($P < 0.05$). For entomological survey, a total of 100 monoconical traps were deployed in 6 PAs. The apparent density of tsetse flies caught was 4.8 fly per trap per day. A total of 105 villagers were interviewed of which 56 were from Dale Wabera and 49 from Dale Sadi Districts. Based on the interview result, trypanosomosis is the most common disease of livestock disease. About 97% of respondents knew as tsetse flies are transmitter of the disease, about 87.6% of respondents indicate that the sources of trypanocidal drugs are veterinary clinic, while the remaining was bought from private legal and illegal shops. Most of the farmers (88.6%) brought their animal to the veterinary clinic and treat them by animal health science personnel while about 7.6% of farmers were treated by themselves at home. The diminazine aceturate and Isometamidium chloride are the commonly drugs used to treat trypanosomosis.

Keywords: Control; Impact; Kellem wollega; PCV; Tsetse fly density; Trypanosomosis

Abbreviations

BCT: Buffy coat technique; FTD: Fly Per trap per day; M.a.s.l: Meter above sea level; MSc Master of science; NTTICC: National tsetse and trypanosomosis control center; PATTEC: Pan african tsetse and trypanosomosis eradication campaign; PCV: Packed cell volume; rpm: Revolution per minute.

Introduction

Trypanosomosis is the most serious veterinary and animal production problem in sub-Saharan Africa and prevents the keeping of ruminants and equines over 10 millions of square kilometers of potentially productive land. Hence, it is transmitted by tsetse and other biting flies. Tsetse flies in Ethiopia are confined to southwestern and northwestern regions between longitude 33°E and 38°E and latitude 5°N and 12°N covers an area of 220,000 km² [1]. Tsetse infested areas lie in the low lands and also in the river valleys of Abay (Blue Nile), Omo, Didessa, Ghibe, and Omo [2]. Consequently, new areas are being invaded and settled communities are being continually evicted by the advancing tsetse. Five species of Glossina (*G. morsitans submorsitans*, *G. pallidipes*, *G. tachinoides*, *G. fuscipes fuscipes* and *G. longipennis*)

have been recorded in Ethiopia [3]. Apart from the cyclical transmission of trypanosomosis by the Glossina species, it is highly considered that mechanical transmission is a potential threat to livestock productivity in some parts of Ethiopia [3].

Trypanosomosis is a disease caused by protozoan parasites of different species found in the blood and other tissues of vertebrates including livestock, wild life and man [4]. The course of the disease may run from acute rapidly fatal one to a chronic long lasting state depending on the vector-parasite-host interactions [5,6]. The disease is caused by the pathogenic species of trypanosomes transmitted cyclically by tsetse flies and noncyclically by other biting flies except *Trypanosoma equiperdum*, which follows sexual means for transmission through coitus among equine species in its endemic area [7].

Trypanosomosis is the main constraint to the cattle production on the continent of Africa and prevents full utilization of land. Much of the best grazing land on which cattle can be raised is infested by tsetse flies which can transmit the pathogenic trypanosomes: *Trypanosoma congolense*, *T. vivax* and *T. b. brucei* [8]. Out of 165 million cattle found in Africa about 50 million are found within tsetse belt. These are mainly low producing breeds that are maintained on high drug management regimen to keep trypanosomosis in check. The presence of tsetse flies forced people and livestock to crowd into partially

environmentally fragile tsetse free areas leading to overgrazing and erosion [9].

Ethiopian cattle owners know trypanosomosis by the local name “Michi” or “Ghendi” and it is the most important and the first problem affecting livestock productivity and agricultural activities in many areas. According to a study in the bordering areas of Abbay and its tributaries, almost 100% of the respondents consider trypanosomosis as main disease of cattle followed by equine and small ruminants. The impact of trypanosomosis as explained by owners are loss of drought power, under cultivation, abortion, reduced fertility, cost of treatment, mortality, loss of milk yield and meat production [10].

Despite this fact, because of the presence of large fertile land in the area human settlement activities especially from Harar and wollo zones of the country have been undertaken (around 1977 E.C and then 1996 E.C) in areas such as Kelem Wollega Zone of the Oromia Regional State. Most of the settlement areas are tsetse-infested which poses major constraints to the programme and livestock keepers to sustain in their new home areas. In the majority of the newly established settlement schemes of Kellem Wollega, zone of Western Ethiopia bovine trypanosomosis is the most important disease. In the beginning year of the settlement, the disease caused heavy mortalities in certain settlements reaching to the extent of complete losses of a large number of introduced working oxen [11].

As sufficient information was lacking on the status of the disease and the attitude of farmers on tsetse and trypanosomosis intervention programs being practiced in the area, the present study was proposed. Understanding of the epidemiology of the disease will facilitates the choice of suitable control methods and help in planning for development programs in the areas. The objectives of this study were:

To assess the cattle owner's perception on the presence of trypanosomosis and the impact of intervention practices in the area.

To assess the prevalence of trypanosomosis and the associated risk factors.

To show the apparent density of tsetse flies in the districts.

Materials and Methods

Description of the study area

The study was conducted from November 2011 to April 2012 in two districts: Dale wabera and Dale Sedi of the Kellem Wollega Zone in Oromia Regional State in Birbir valley (Baro Akobo river system), Western Ethiopia (Figure 1). The two weredas are located 520-620 kms west of Addis Ababa. The agro-climate of the areas alternates with long summer rain fall (June to September) and winter dry season (December to March), with annual rainfall ranging from 1300 to 1600 mm. The mean minimum and maximum temperature is 11.0-15.5°C and 26.1-34°C respectively. The altitude range for Dale wabera is between 1100 and 1800 m.a.s.l. and 1400-2000 m.a.s.l. for Dale sadi. The livelihood of the society largely depends on mixed livestock and crop production. The crops that are commonly cultivated include: maize, sorghum, pepper, pulse and finger millet. Coffee is the dominant one and is the main source of income for the society. Cattle, sheep, goats and equines are the commonest animal species reared in the area.

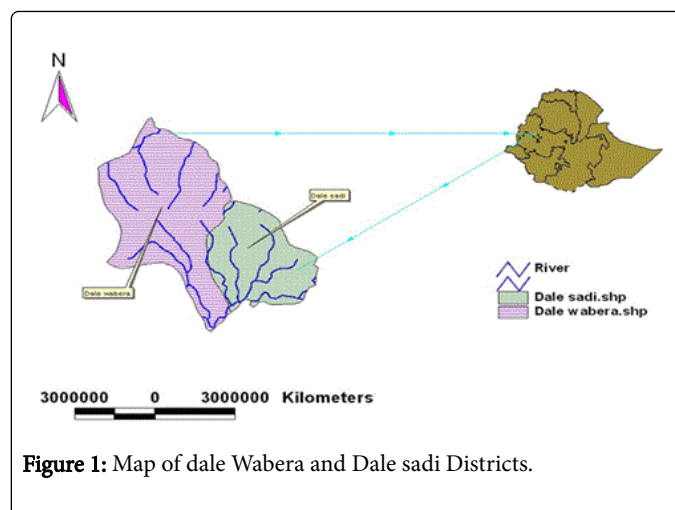


Figure 1: Map of Dale Wabera and Dale Sadi Districts.

All (100%) of the interviewed people were well responded to the prepared questionnaire format. Cattle, sheep, goats and equines are common livestock kept by farmers in the study Districts. A total of 105 villagers were interviewed of which 56 were from Dale Wobera and 49 from Dale Sadi Districts. Majority of the resident communities of the two districts have lived in the area for more than five years and were able to describe the animal disease situation of the woredas effectively (Figure 2).

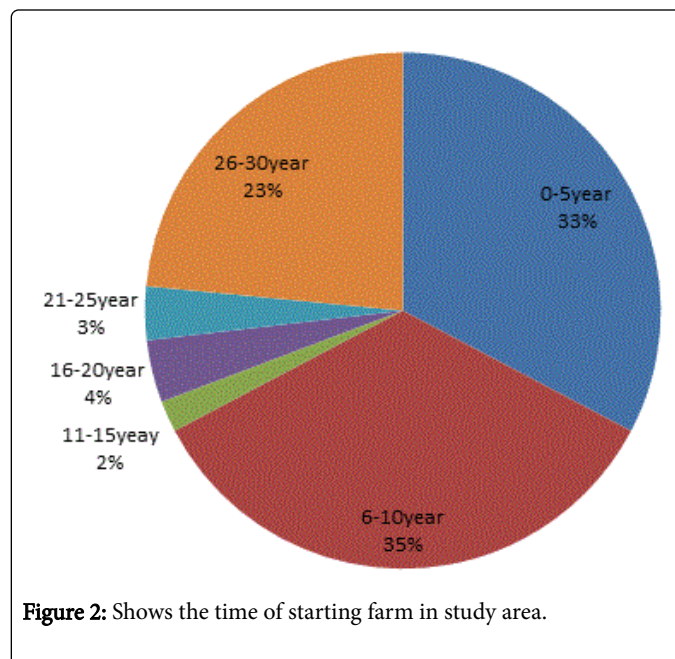


Figure 2: Shows the time of starting farm in study area.

The farmers in the area ascertained that they keep livestock mainly for agricultural activities. Accordingly, above 99% of the respondents' livelihood is depends on mixed crop livestock production system. The most common livestock species kept in the area based on interview response are cattle (53.3%), both cattle and small ruminants (34.3%) and others (12.4%). Most farmers kept the animals mainly for drought power and milk (Table 1). According to the description of respondents, there is no livestock feed problem but it is less available during the dry season when almost the grazing land is over grazed. Better feed is available during the late and early rainy season when the pasture is

green and the feed biomass is relatively high. Almost all (100%) of the respondents described Livestock disease as the main constraint of livestock production in the area, although shortage of grazing land and less availability of veterinary drugs were also mentioned.

Purpose of breeding	Frequency	%
Drought power	38	36.2
Milk	3	2.9
Milk and drought power	32	59.1
Fattening	1	0.95
Fattening and drought power	1	0.95

Table 1: purpose of animal breeding in the study area.

Constraints of livestock production in the study areas

Based on the interview result, the main livestock diseases in the order of importance are: trypanosomosis, pasteuriosis, ectoparasites, black leg, Lumpy skin disease and Anthrax as shown Figure 3 below.

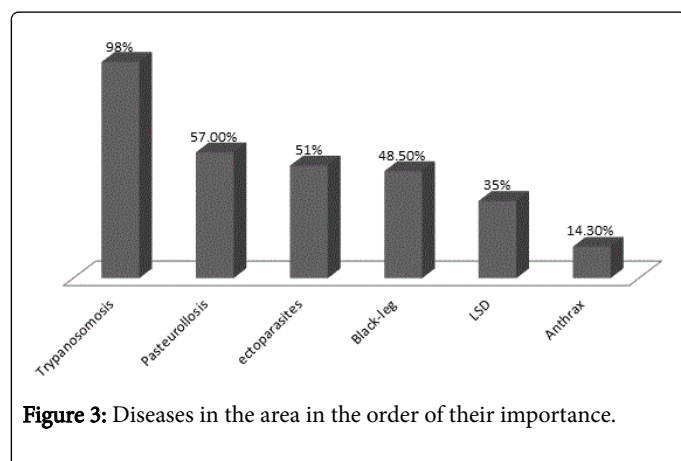


Figure 3: Diseases in the area in the order of their importance.

All the respondents think that trypanosomosis is a major constraint, and series threat to livestock production and utilization of the fertile arable land. It is known by all locally as “Ghendi” and mostly affects cattle (100% responders). Clinical signs observed by the farmers: emaciation, ruffle hair coat, constipation, change in color coat, lack of appetite, necrosis and cut off tail, weakness, eating soil, dry feces, grinding of teeth and finally death. Most farmers (91.4%) said that the incidence of disease (trypanosomosis) is high in rainy season but infection occurs throughout the year. Out of the 105 interviewed farmers, 14.4%, 48.6 and 29.5% respondents know the disease since last 5 years, last 10 years and last 15-20 years respectively. Almost all (99%) of them also affirmed that the situation of the disease is now improving as described by the reduction of its impacts on livestock.

Means of transmission

Out of the 105 respondents, 97% of them knew flies as transmitters of trypanosomosis to their cattle (Table 2). When asked to specify the fly type, they call it “Tisisa ghandi” and described it as having long legs, large size, brown in color biting their animals when the animals move to the forest and savanna vegetation types their equivalent might be tsetse fly other flies bigger in size, cause bleeding at point of bite locally

call as “*Warana*” their equivalent are tabanids and stomoxes flies. Most believe that the fly population is higher in the rainy (58.1%) and following after the rainy (41.9%) season. All respondents believe that fly density was high around water bodies and valley.

Source	No of respondents	%
Tsetse flies	102	97.14
Infected grass and water	1	0.95
Others	2	1.91

Table 2: Respondents perception of the source of trypanosomosis.

Trypanosomosis and vector control

All respondents acknowledged that tsetse and trypanosomosis control operations have been there for long time. They (88.6%) also added that control of trypanosomosis is carried out mainly through combination of treatment of affected animals with trypanocidal drugs and tsetse flies population control in the area. Only 7.6% and 3.8% of them believe that fly control alone and chemotherapy alone was the control option available respectively.

About 88% of respondents get trypanocidal drugs from government veterinary clinics, while others obtain the drugs from private clinics (8.6%) and illegal sources (3.8%). Most of the farmers (88.6%) send their animal to veterinary clinics and treat them by animal health personnel while 11.4% of them responded to treat by themselves/ family members at home. Diminazene aceturate (Berelin) and Isometamidium chloride (Samorin) are the commonly used drugs to treat trypanosomosis (Figure 4). Information gathered from the respondent farmers and animal health personnel emphasized it is a common practice to monthly send animals to animal health posts for trypanocidal treatment irrespective of the presence or absence of disease and this trend is locally called “*Ji’an/ Worawi*” (monthly) in the community.

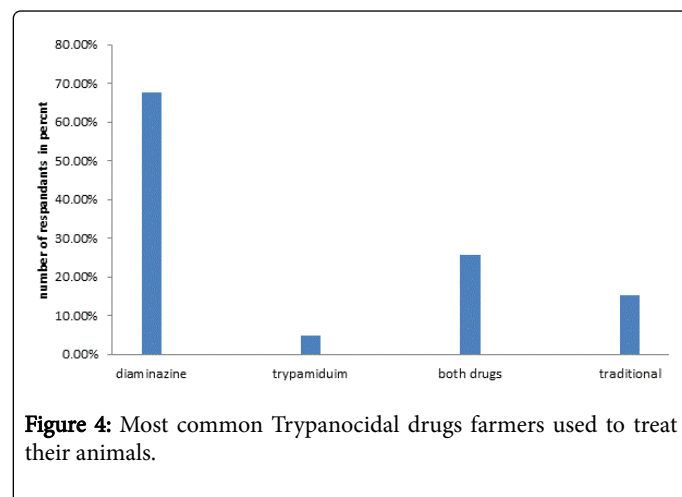


Figure 4: Most common Trypanocidal drugs farmers used to treat their animals.

As the respondents mentioned, the National Tsetse and Trypanosomosis Investigation and Control Center has been conducting surveillance, updating distribution maps, undertaking trypanocidal drugs sensitivity tests and implementing control schemes through integration of pour on with odor baited and insecticide impregnated target technologies for the last few years in the study area.

All the interviewed farmers also indicated that, this control program is the most essential, it brings good results in their area in terms of fly population reduction, and the activity is participatory (training of community on target deployment technique, about the impact of drug resistance and the vectors of the disease etc.). As information revealed by farmers, all techniques employed for control program are requiring their participation so that, about 99% of respondents said that they have been actively participating in the deploying target in site, extensively training and giving information to others farmers and supporting the technicians accordingly. After the launching of the control program, the 99% of the farmers said that the incidence of disease is getting better compared with previous periods. They describe the changes in terms of increasing number of their animals, increasing working efficiency, increasing milk yield, reduction in cost of treatment, increasing selling prices, improvement of animal body condition and decreasing mortality rate. The changes in the livestock health was so significant that all respondent farmers of the two woredas they want to continue and enhance their active participation in the control of tsetse and trypanosomosis by volunteering money and labor and protection of properties (traps, targets etc in the flied against theft and fire) so as to ensure the sustainability of the program.

Entomological survey

Fly catches in the two woredas shows that the dominant flies in the areas at the time of study were tsetse flies 1890 (92%) followed by stomoxes 159 (7.7%) and tabanids 6 (0.3%). The result of tsetse fly survey agrees well with the general knowledge on the ecology of tsetse species found in western Ethiopia. Typical habitat pattern was found in the area for the savannah species (*G. m. submorsitans* and *G. pallidipes*) which prefers the savannah grass land, Acacia and Combrutum trees and for the Reverine species patchy vegetation, forest and bush land. The savannah species i.e., *G. m. submorsitans* and *G. pallidipes* were concentrated in the savannah and the reverine species was concentrated along the riverbanks and in the bushes. The overall apparent density of tsetse flies was 18.9 F/D/T among this, 9.1 F/D/T was from Dale Wabera and 9.8 F/D/T was from Dale Sadi. The apparent density of tsetse flies in Dale Wabera was: *G. pallidipes* 1.8 fly/trap / day, *G. m. morsitans* 0.9 fly/trap/day, *G. tachinoides* 0.9 and *G. f. fuscipes* 1.6 fly/trap/day whereas the apparent density of tsetse flies in Dale sedi district was *G. pallidipes* 5.9 fly/trap/day/ *G. m. morsitans* 6.2 fly/trap/day, *G. tachinoides* 0.8 fly/trap/day and *G.f. fuscips* 1.1 fly/trap/day. Generally, Savanna species appear to be dominant in both districts.

Altitude has a significant effect on the apparent density of tsetse in Dale Wabera district. There was significant difference for *T. congolense* between the low altitude (1172-1190 masl) and higher altitude (1431-1488 m asl) ($p < 0.05$). However, it was not significant difference in case of *T. vivax*. The survey revealed that 93.3% of the total fly catch is from the low altitude whereas, 6.7% of the total catch is from higher altitude.

Parasitological survey

During the study period 394 and 195 cattle were examined in Dale Wabera and Dale Sedi districts respectively. The prevalence of trypanosomosis was 8.7% of which 78.9% was *T. congolense* infection, 15.8% was *T. vivax* infection and 5.3% was mixed infection in Dale Wabera Woreda. Similarly, in Dale sedi district the prevalence was 6.7% of which *T. congolense* accounted 84.6%, *T. vivax* accounted 15.4%. The risk of infection in the higher altitude was lower than that

of lower altitude with statistically significant difference in *T. congolense* infection ($P < 0.05$). Whereas no statistically significant difference was observed in *T. vivax* and mixed infection in Dale Wabera district. The prevalence was 11.9% in males and 6.5% in females in Dale Wabera districts which show statistically significant difference in between the sex groups ($P < 0.05$). Similarly, the prevalence of trypanosomosis was 10.7% in males and 1.2% in females in Dale sedi district. The difference was statistically significant too ($P < 0.05$). As to age groups, there was no significant difference in disease distribution in different age groups in both districts ($P > 0.05$). Prevalence of trypanosomosis infection between body conditions category were 6.3% in good body condition, 8.2% in medium body condition and 15% in poor body condition (Table 3). There was statistically significant difference between these different body conditions ($P < 0.05$).

Body condition	Animal sampled	Positive	Negative	%	%T.C	%T.V	%Mix
od	143	9	134	6.3	1	0	0
Medium	366	30	336	8.2	8	16.7	3.3
Poor	80	12	168	15	7.5	25	8.3
Total	589	51	538	8.7	86.3	9.8	3.9

Table 3: The prevalence of trypanosomosis in different body condition of animals.

Hematological findings

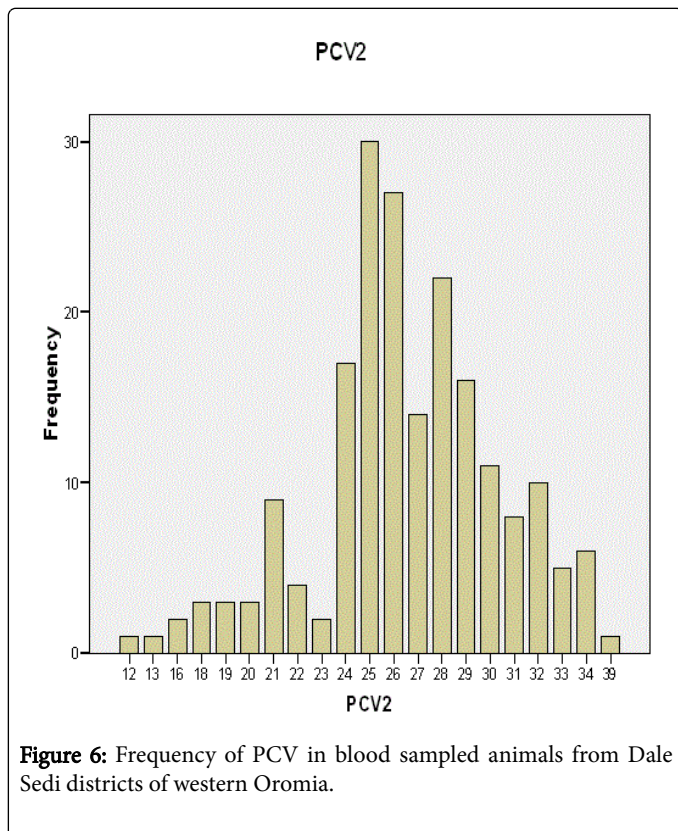
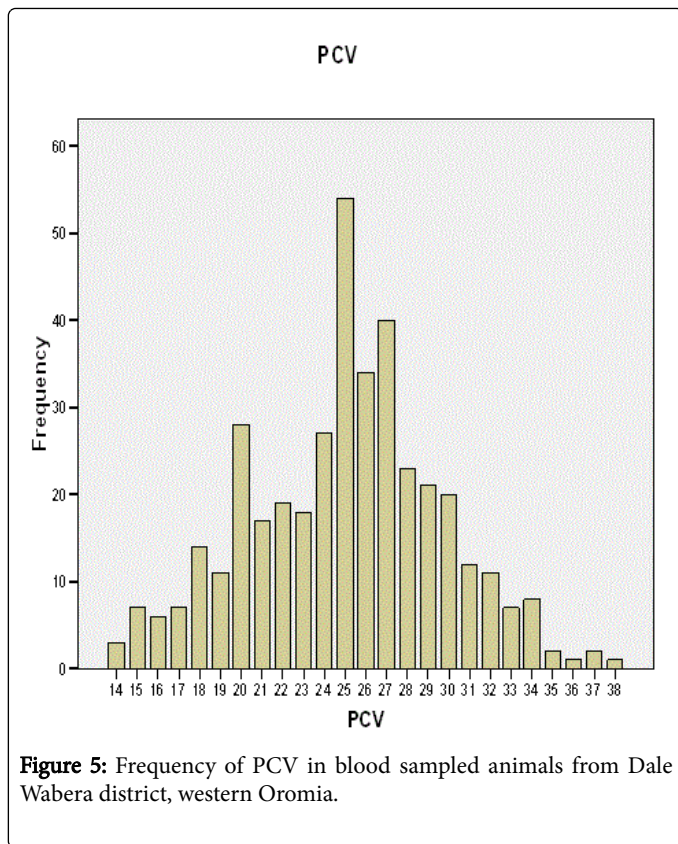
The study revealed that PCV values of cattle were generally low in both districts. The mean PCV (%) values of parasitaemic and aparasitaemic animals in Dale Wabera was 20.9% and 25.4% while in Dale Sedi 20.3% and 27%. The overall mean PCV values were significantly different between parasitaemic and aparasitaemic animals in both districts ($P < 0.05$). The frequency of PCV in the districts is shown in chart below (Figure 5 and 6).

Discussion

Questionnaire

The result of questionnaire survey revealed that trypanosomosis is the most important problem for agricultural activity and animal production in the study areas. Above 99% farmers' livelihood depends on mixed agricultural (crop-livestock) farming system. The majority of livestock reared in the area were cattle followed by small ruminants and equines. The livestock disease, shortage of grazing land and scarcity of modern veterinary services were the challenges for development of the area Shimelis [10] also reported the same constraints from the Abbay basin West of Ethiopia.

The disease trypanosomosis, locally called "Ghendi" was reported to be the most and the first important livestock constraint limiting the overall agricultural activity and livestock productivity by almost 100% of interviewed people. Tewelde [12] and Afework [13] reported similar findings. The incidence of disease reaches its peak during and after rainy seasons while infection is persistent throughout the year in the current study area. However, Afework [13] in Metekel and Tewelde [12] in west Ethiopia reported that incidence of trypanosomosis was high throughout the year.



Farmers acknowledged that tsetse and trypanosomosis control program is present in their area and the activity is participatory. They

also added that the situation is improving since the introduction of the intervention program through fly control by pour-on insecticide spray and fly trapping. Observations in other areas indicated that tsetse fly control schemes around Arbaminch Zuria have significantly reduced the prevalence of trypanosomosis and fly density followed by reduction in calf mortality [15]. However, due to the long history of the disease in the area they developed the habit of frequently treating their animals with chemotherapeutic such as Diminazene aceturate and Isometamidium chloride. Similar finding was reported about the drugs used by previous researches in many parts of the country [14,16]. The present study indicates that majority of the respondents affirmed that they use Diminasene may be due to its fast curative response. While the observation that majority of the respondents use veterinary service for their source of trypanocidal drugs and injections is encouraging, a proportion of them are still using drugs from illegal sources and administering it by their own. This casts suspicion on the development of drug resistance in the area. Zewdu [15] reported similar findings at Gojeb and Baro-Akobo river Basins.

Entomological finding

The entomological survey showed that total mean catches per trap per day of tsetse flies recorded across the dry season in study area was 18.9. *G. pallidipes*, *G. m. submorsitans*, *G. fuscipes*, *G. tachinoides* were the species recorded [17]. The current result is almost similar with the previous report from Gawo District of West Oromia [18]. However, these figures are higher than what was reported by Senbata [18] from the same area to current study and Hawa Gelan Districts. The number of traps deployed, the site of trap installation, the months of study etc., could contribute for the variation [19]. The fly species identified also agrees with the reports Terefa [20] and Senbata [18].

In this study District, *G. pallidipes* covered a vast area with high apparent densities. This could be because this species inhabits wide range of vegetation types, which are available in the area. While *G. m. morsitans* was found to be almost restricted to savannah vegetation and thus its distribution is highly dependent on the season and vegetation coverage [21]. *G. f. fuscipes* and *G. tachinoides* were distributed along the large river of Birbir and its tributaries like Keto, Chabal, Hindina, Kile and others, which cross the study area and thus provides conducive environment (tall gallery forests and thickets along the river bank) for the distribution of these two species. The sex ratio of flies was biased towards females. Age composition of the flies was also biased towards adult during the study (dry season). According to Msangi [21] and Leak [22] female flies comprise 70-80% of the mean population.

Trypanosomosis

Bovine trypanosomosis is present in the current studied Districts with an overall prevalence of 8.7% and dominance of *T. congolense* over *T. vivax*. This result is almost similar with previous report (8.5%) recorded by Senbata [18] in Southwestern Ethiopia. However, different figures were reported from different parts of tsetse infested areas in Ethiopia: a prevalence of 15.1%, in West Ethiopia [23], 21% in Southern Rift valley areas of tsetse infested regions [24], 17.2% in Metekel [25,26] and 17.5% in upper Didessa of tsetse infested regions. The dominant species in this area of tsetse infested regions was *T. congolense* [12] suggesting that exclusively tsetse transmitted trypanosomosis is the major problem in these areas. On the other hand, in the highland areas of Ethiopia, non-tsetse transmitted trypanosomosis is the major problem [27]. Lower prevalence was

found in this study compared to the works of these authors elsewhere in the country. This disparity emanates from many factors that explain the lower prevalence of trypanosomosis observed in this study area. The study period affects the vectors population in study area [13], expansion of Veterinary services up to peasant association, deforestation for crop cultivation (settlement), frequent usage of trypanocidal drugs and the husbandry practices on animals and presence of trypanosomosis and fly control programme in the area.

In this study age was not a risk factor for the prevalence of trypanosomosis in the study area. On the contrary, other reports show that *T. congolense* is a chronic disease increasing with age of animals and its infection is usually higher in adult animals than in young animals [28,29] and they found that cows >9 years old had 1.2 times higher trypanocidal drug treatment than <3 years old animals.

Different works were also reported that higher infection rate was observed in male cattle than females [13,30,31] and the possible suggestion to this finding could be that males are more used for drought purpose, travel long distances to an area of tsetse challenge for grazing, Plough and stressed by draft power and become susceptible to Trypanosomosis.

Hematological findings

The overall anemia prevalence in the studied Districts was 25.8% of which 23.3% was due to the presence of trypanosomes infection. However, large number of animals (76.7%) were anemic (PCV<24%) without having trypanosomes infection. Some animals 2.5% were positive to trypanosomosis but their PCV was normal (PCV ≥ 24%). This may suggest on the one hand the presence of other anemia causing factors and on the other hand individual variability in the maintenance of normal PCV in parasitemic animals. Trypanosomosis is also known to causes reduction in weight gain and productivity [32]. However, the difference in mean PCV value between parasitaemic and aparasitaemic animals indicates that trypanosomosis involves in reducing the PCV values in infected animals [33]. The damage of tissue due to trypanosomosis is probably multi factorial in etiology, but the underling feature is the progressive anemia throughout the cores of disease. The case of anemia is due to hemolysis caused by primarily by erythrophagocytosis due to simulation and expansion of mononuclear phagocytosis system [34].

Conclusion and Recommendations

The study revealed that tsetse and trypanosomosis are the most important constraints for agricultural activity and animal production in Dale Wabera and Dale sadi districts of Kellem Wollega Zone of Oromia regional state. Farmers are well aware of the problem, means of transmission and the different control methods. Respondents' testimony shows that there have been improvements in the situation of the disease and its impact since the establishment of control program in the area. In these two districts, the overall prevalence of trypanosomosis was found to be 8.7%. The most widely distributed and dominant species of trypanosomes was *T. Congolense*. There are four tsetse flies species; *G. pallidipes*, *G. m. morsitans*, *G. f. fuscipes* and *G. tachnoides*. Significant reduction in the level of PCV was observed due to the disease. The frequency of trypanocidal injections (by monthly routine treatment), the presence of illegal sources of these drugs and the practice of injection by cattle owners signals the presence of drug failures due to trypanocidal resistance. From the

above conclusion, the following points are recommended for further attention.

Although farmers' perceptions shows observable improvements, since the fly density and the prevalence of trypanosomosis is still significant, the control program should be intensified

Study on the socio-economic impact of the disease and control program being implemented should be undertaken.

Continuous community awareness creation should be done about drug resistance and use of veterinary services as appropriate source and administration of the drugs Trypanocidal drug efficacy studies should be undertaken using the common drugs circulating in the area

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