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Prevalence and community awareness of Bovine Trypanosomiasis in Wolaita Zone Kindo Koysha Woreda, Southern Ethiopia

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ABSTRACT

A cross-sectional study was carried out from October 2018 to April 2019 in Kindo Koysha Woreda of Wolaita Zone, Southern Nation Nationalities and People Region (SNNPR), Ethiopia. The general objectives were to find the prevalence and assess the community awareness on bovine trypanosomiasis and to identify predominant trypanosome species. Blood from marginal ear vein was collected from a total of 220 cattle for Packed cell volume (PCV) determination and trypanosome detection. Accordingly, the overall prevalence of bovine Trypanosomiasis in the area was 5.91% on Buffy coat examination. Of which, 61.57% (n=8), 30.76% (n=4) and 7.69% (n=1) were because of *T. congolense* or *T. vivax* or both species, respectively. The mean PCV values recorded were 23.77% in parasitemic and 28.27% in aparasitemic animals. The focus group discussion indicated that trypanosomiasis (Shulula) is the most important problem affecting the animals and hindering agricultural activity in the area. Generally, both focus group discussion and hematological findings revealed bovine trypanosomiasis is the major constraint for the livestock production in the area. So attention should be given to control trypanosomiasis and its vectors.

INTRODUCTION

In Ethiopia, agricultural development is considered a priority by the government for stimulating overall economic growth, reducing poverty and achieving food security. The agricultural sector of Ethiopia accounts for about 42% of GDP and between 80–85% of employment (MoFED, 2012).

Within agriculture, the livestock subsector provides an opportunity for further development. The sheer size of the national livestock herd, one of the largest in Africa, makes it a resource with potential to contribute

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significantly to national development, including poverty reduction. The Central Statistical Agency (CSA) survey of 2016 showed that the total cattle population of Ethiopia is about 59.5 million. Moreover, about 30.7 million sheep and 30.2 million goats are estimated to be found in the country, while the total poultry population is estimated to be about 59.5 million chickens (CSA, 2016).

The livestock subsector is also already a major contributor to the overall economy. The livestock sector contributes 19% of the GDP, and 16–19% of the foreign exchange earnings of the country (MoA 2012). It contributes some 35% of agricultural GDP; or 45% if indirect contributions are taken into account (Shapiro et al., 2017).

With a rapidly growing population, increasing urbanization, and rising incomes, domestic demand for meat, milk and egg is expected to increase significantly in the foreseeable future. Furthermore, the country's geographic location offers substantial opportunities for exportation, thus earning foreign exchange from livestock products, especially of red meat to the Gulf and within Africa, as well as leather, honey and other livestock products to Europe(Shapiro et al., 2017).

The livestock sector can also be a major contributor to poverty reduction by improving the livelihoods of rural people. Approximately 85% of Ethiopia's population is rural based, and livestock supports the livelihoods of about 80% of rural people (Shapiro et al., 2017). However, the income of 30% of the rural population is below the poverty line (MoFED, 2013). Livestock perform multiple functions in the rural household economy. Besides employment, livestock provides protein rich food, income for everyday expenses and social obligations, near liquid assets, a store of wealth for savings, manure for crop production and soil fertility, and transport (Shapiro et al., 2017).

Livestock development also has the potential to positively impact urban consumers through lower animal product prices. Despite large livestock population, Ethiopia fails to optimally utilize this resource due to different constrains facing the livestock subsector. Shortage of nutrition, reproductive insufficiency, management constraints and animal disease are the major constraints. One of the diseases hampering the livestock subsector is trypanosomiasis (Melak and Tewodros, 2018). Trypanosomiasis is a widely spread protozoan disease complex which affects cattle and other wide range of hosts in sub Saharan Africa. The major pathogenic tsetse transmitted trypanosome species are *Trypanosome congolense, T.vivax* and *T. brucei* in cattle, sheep and goats and *T. simiae* in pigs. Animal trypanosomiasis is also encountered outside the tsetse fly belt, where the most important pathogenic trypanosome species, *T. vivax* and *T. evansi*, are transmitted mechanically by biting flies, while *T. equiperdum* is transmitted sexually. The principal domestic animals affected by *T. evansi* are camels, pigs, water buffaloes and cattle. *T.equiperdum* causes the disease in horses and donkeys (Nantulya et al., 1986). The course of the disease may run from a chronic long lasting to an acute and rapidly fatal depending on the vector-parasite-host interactions. The disease is mainly characterized by intermittent fever, progressive anaemia, and loss of condition of susceptible hosts which if untreated leads to heavy mortalities (Bourn et al., 2001).

In Ethiopia, trypanosomiasis is widespread in domestic livestock in the Western, South and South western lowland regions and the associated river systems (Abay/Dedessa, Ghibe/Omo and Baro/Akobo and rift valley) (Abebe, 2005), limiting livestock productivity and agricultural development in the country. Currently, about 220,000 Km2 areas of fertile land are infested with five species of tsetse flies namely *Glossina pallidipes, G.morsitans morsitans, G. fuscipes, G. tachinoides* and *G. longipennis* (NTTICC, 2004). Six species of trypanosomes are recorded in Ethiopia and the most trypanosomes, in terms of economic loss in domestic livestock are the tsetse transmitted species: *T. congolense, T. vivax* and *T. brucei* group (Abebe, 2005). Trypanosomiasis was considered to be an important disease of cattle in different parts of the country (Mussa, 2002; Tesfaye, 2002; Cherenet et al., 2004; Sinshaw, 2004; Shimelis et al., 2005; Bitew et al., 2011). Even though, trypanosomiasis is an economically important disease, few studies were done in Ethiopia as well as in Wolaita Zone Kindo Koysha Woreda. Therefore, this study was conducted to determine the prevalence of bovine trypanosomiasis, to identify predominant trypanosome species involved and to recognize indigenous knowledge and correlate it with modern science in Kindo Koysha Woreda.

MATERIALS AND METHODS

Description of the study area:

The study was conducted in Kindo Koysha woreda of Wolaita zone, Southern Region of Ethiopia. It is located at about 420 Km of south west of Addis Ababa located at 7°58" N and 37°14" latitude and 37°56" E longitude and it has an altitude of 600-1700 meters above sea level. and its total area is estimated to be 17,187 hector of land. The distribution of rain is bimodal, with short rainy season extend from January to April and long rains from June to mid-September. The average annual rainfall is 904 mm, the maximum and minimum daily temperature is 29.20 and 21°C respectively. The vegetation is savanna type with scattered bush. The livestock populations that are found in Kindo Koysha Woreda include cattle, sheep, goat, horses, mule, donkey and poultry. Among these animals, cattle are the dominant species raised in the area and are estimated to be 174,346 (CSA, 2009).

Study design, sample size and sampling method:

Cross sectional study was conducted to determine the prevalence of bovine trypanosomiasis. 95% confidence interval and 5% precision was considered to calculate the sample size and 6.3% expected prevalence was taken (Adale and Yasin, 2013). The sample size was determined by using the formula given by Thrusfield (2005). Even though the sample size was calculated to be 91, a total of 220 animals were included in the current study to increase precision.

Study population:

Cattle population of Kindo Koysha Woreda which is managed under traditionally reared management system was selected to determine the prevalence of bovine Trypanosomiasis. Both local/indigenous and exotic breeds of cattle in the study area (Dada kariya, Fajanamata, Moliticho) were considered as study population. The study animals were selected by using

random sampling method by taking breed, age, sex and body condition into account. The animals examined were categorized into different age groups as less than 2 years (young), between 2 and 4 years (medium) and greater than 4 years (adult) according to their teeth dentition (Johnson, 2003). The body condition of animals was also grouped based on criteria described by Nicholson and Butterworth (1986) and they also categorized into poor, medium and good.

Study Methodology

Parasitological and Hematological Survey of Bovine Trypanosomiasis:

Buffy Coat Technique:

Blood was collected from an ear vein using heparinized micro haematocrit capillary tube and the tube was sealed. A heparinized capillary tube containing blood was centrifuged for 5 min at 12,000 rpm. After centrifugation, trypanosomes were usually found in or just above the Buffy coat layer. The capillary tube was cut using a diamond tipped pen 1 mm below the Buffy coat to include the upper most layers of the red blood cells and 3 mm above to include the plasma. The content of the capillary tube was expressed on to slide, homogenized on to a clean glass slide and covered with cover slip. The slide was examined under ×40 objective for the movement of parasite (Paris et al., 1982).

Measuring of Packed Cell Volume (PCV):

Blood samples were obtained by puncturing the marginal ear vein with a lancet and collected directly into a capillary tube. The capillary tubes were placed in micro haematocrit centrifuge with sealed end outer most. The tube was loaded symmetrically to ensure good balance. After screwing the rotary cover and closing the centrifuge lid, the specimens were allowed to centrifuge at 12,000 rpm for 5 min. Tubes were then placed in haematocrit and the readings were expressed as a percentage of packed red cells to the total volume of whole blood. Animals with PCV < 24% were considered to be anemic (Murray et al., 1988).

Focus group discussion:

Rural communities have a wealth of indigenous knowledge and skills related to diseases, including good diagnostic skills and an awareness of modes of disease transmission. It is imperative to make the best use of this knowledge and develop appropriate disease surveillance systems in rural areas. Such systems should be action oriented and result in disease control activities that are designed in partnership with livestock keepers (Catley, 2005). This study used focus group discussion technique to collect epidemiological information and intelligence about diseases of livestock especially bovine trypanosomiasis. The focus group discussion incorporated eight groups having 8-12 participants in each group.

Data management and analysis tools:

Raw data on individual animals and parasitological examination results were stored in MS excel spread sheets to create data base and transferred to Stata 11 software programs for data analysis. Chi square was used to compare the prevalence of trypanosome infection in different variables like kebeles / village, breed, age, sex and body condition,

while student-t test was utilized to compare the mean PCV of the infected animals and that of non-infected animals. Significance difference was set at $p < 0.05$ and 95% confidence level.

RESULTS

Results of focus group discussion:

According to the data from the group discussion, Trypanosomiasis is the predominant livestock disease in the Kindo Koysha followed by Babesiosis (14.75%), Blakleg (13%) and others (Table 1).

Table-1: Common cattle diseases with its respective proportional

Disease	Prevalence %
Shulula (Trypanosomiasis)	35
Tilikiya/tintichuwa (Blackleg)	13
Duluwa (Anthrax)	6.375
Aheera (Babesiosis)	14.75
Shattuwa (Skin diseases)	8.125
Danquwannecuuchcha (Tick and lice infestation)	7.5
Ullogiddoguxxuniya (GIT Parasite)	7.625
Duma dummahargiya (others)	7.625

Based on the response of the rural communities, the prevalent diseases in the area cause direct and indirect negative impacts on the cattle and their products (Table 2).

Table-2: Negative Impacts of diseases on the animals and animal's product

Diseases	Milk (%)	Meat (%)	Skin (%)	Dowry (%)	Abortion (%)	Decrease price (%)	Treatment cost (%)	Total loss (%)
Trypanosomiasis	23	14.5	1.5	9	10.75	13	24.5	3.75
Blackleg	6.25	5	1.75	1.75	2	-	34.5	48.75
Anthrax	-	-	-	-	-	-	1	99
Babesiosis	27	17.5	3	5	12.5	7	20	8
Skin diseases	15	12	23	9	-	20	21	-
Tick & lice infestation	21	16.25	16.75	8	2	18	17	1
GIT Parasite	24	22.5	-	7	-	15	31.5	-
Others diseases	15.5	12.5	5	6	11	8	22	20

According to the Wolaita Culture the year is divided into three seasons such as Boniya (Bega) which includes the months from October to February, Badheessa (Belg) from March to May and Silla (summer) which contains months from June to September. According to the respondents, the prevalent diseases in the area have different seasonality however majority of these diseases were observed during 'belg' and summer (Table 3).

Table-3: Disease occurrence in the different seasons of the year and age group of cattle

Disease	Age group			Season		
	Calf (%)	Young (%)	Adult (%)	'Bega' (%)	'Belg' (%)	Summer (%)
Trypanosomiasis	10	29	61	39.6	33.7	26.7
Blackleg	7.5	36	56.5	9.55	53.75	36.7
Anthrax	6	33	61	7.5	63	29.5
Babesiosis	12	31	57	19	49.5	31.5
Skin diseases	14	40	46	37	30.5	32.5
Tick and lice infestation	35	34	31	20	50	30
GIT Parasite	37	28	35	20	50	30
Others diseases	20	35	45	22	50	27

The major actions taken by the society to overcome the impacts of the prevalent diseases are detailed in the table 4.

Table- 4. Major disease prevention and control measures applied in the study area.

Disease	Vaccination (%)	Spraying (%)	Drug (%)	Traditional medicine (%)
Trypanosomiasis	-	38	62	-
Blackleg	50	-	37	13
Anthrax	96	-	4	-
Babesiosis	4	3	68	25
Skin diseases	29	25	46	-
Tick and lice infestation	-	72	25	3
GIT Parasite	-	-	95	5
Others diseases	44	8	41	7

Results of parasitological survey:

Prevalence: In this study a total of 220 cattle were examined for the presence of bovine trypanosomiasis. Out of these 220 cattle; 13 were found to be positive for bovine trypanosomiasis that results in the overall prevalence of 5.9%. Of which 61.57% were due to *T. congolense* and 30.76% were due to *T. vivax* whereas the rest 7.69% were due to mixed infection (Table 5). But there was no significant difference ($p>0.05$) between the prevalence of the different trypanosome species.

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Table -5. Relative proportion of Trypanosome species in the three kebeles

Kebeles	Number positive	Trypanosome species , n(%)			Proportion (%)	χ^2	P- value
		T.congolense	*T.vivax*	Mixed			
Fajenamata	7	4(30.77)	2(15.38)	1(7.69)	53.8	1.58	0.813
Moliticho	5	3(23.08)	2(15.38)	0	38.46		
Dadakariya	1	1(7.69)	0	0	7.69		
TOTAL	13	8(61.57)	4(30.76)	1(7.69)	100		

The highest prevalence of trypanosome infection was found in Fajenamata kebele (7%) followed by Moliticho (6.94%) and Dadakariya (2.08%). However, there was no significant difference (p>0.05) in the prevalence among the kebeles (Table 6). The prevalence of trypanosomiasis in male and female cattle were 5.31% and 6.54% respectively (Table 6). However, the difference in the prevalence between the two sexes was found to be statistically insignificant (p>0.05).

Table- 6. Prevalence of Trypanosome infection among the categories of the considered risk factors

Variables		Number examined	Number positive	Prevalence (%)	95% CI
Kebeke	Fajenamata	100	7	7.00	1.95 – 12.05
	Moliticho	72	5	6.94	1.00 – 12.89
	Dadakariya	48	1	2.08	-2.02 – 6.19
Age	< 2 years	15	0	0	-
	[2-4] years	95	5	5.26	0.72 – 9.80
	> 4 years	110	8	7.27	2.37 – 12.17
Sex	Female	107	7	6.54	1.81 – 11.27
	Male	113	6	5.31	1.13 – 9.49
Body condition	Poor	55	8	14.54	5.09 – 24.00
	Medium	120	5	4.17	0.56 – 7.78
	Good	45	0	0	-

CI=confidence interval

Hematological Finding:

The packed cell volume (PCV) of parasitemic animals falls in the range of 21.0 - 25.0% while in aparasitemic cattle was in the range of 21.0-37.0%. The mean PCV for the Parasitemic animals was 23.76%, whereas 28.27% for the aparasitemic animals. Moreover, the difference in the mean PCV of the parasitemic and aparasitemic groups was statistically significant (P<0.05) (Table 7).

Table -7. The packed cell volume of parasitemic and aparasitemic cattle in the study area

Status	No. Examined	Mean PCV(%)	Std. Err.	Std. Dev.	95% Conf. Interval]	t- test	P-value
Aparasitemic	207	28.271	0.245	3.52	27.78 - 28.75	4.575	0.0000
Parasitemic	13	23.770	0.395	1.42	22.91 - 24.63		
Total	220	28.005	0.242	3.59	27.53 - 28.48		

DISCUSSION

The results of the focus group discussion revealed that trypanosomiasis, locally called as 'Shulula', was reported to be the most important livestock constraint limiting the overall agricultural activity and livestock productivity in the study area. Similar result was also reported by Afewerk (1998) and Tewelde (2001) in the western and northwestern parts of Ethiopia where cyclically (tsetse) transmitted trypanosomiasis is the primary problem for livestock productivity and agricultural development.

Although trypanosomiasis occur throughout the year, major infections are observed in Boniya (Bega) (39.6%), Badheessa (Belg) (33.7%) and Silla (summar) (26.7%) based on the local calendar Afewerk (1998) and Tewelde (2001) reported consistent results. According to the result of focus group discussion, the occurrence of trypanosomiasis is higher in the adult (61%) followed by young (29%) and in calves (10%). This might be due to the management system in the area that the adult and young animals stay around Omo River basin for grazing where there were tsetse fly population exists, while the calves are confined at home and not exposed for tsetse. Also the discussion revealed that, trypanosomiasis control and prevention methods depends as much as 62% in the use of different trypanocidal drugs and the rest 38% relay on spraying of insecticides.

The overall prevalence of bovine trypanosomiasis recorded in the current study (5.91%) was much lower than the previous findings. Different researchers reported different prevalence in different parts of Ethiopia. Abraham and Tesfaheywot, 2012; Ataro et al., 2015; Tamirat et al., 2016; Dejen, 2017; Shimels and Bosona, 2017; Megersa et al., 2019 who reported 27.5%, 21.33%, 26.82%, 26.3%, 21.5% and 12.24% in Wozeka grid on the southern part of Arbaminch, Konta Special woreda, Southern Ethiopia, Loma woreda, Dawuro zone, Southern Ethiopia, Nyangatom Woreda of South Omo, SNNPRS, Ethiopia, Botor Tolay district, Bombasi Woreda, western Ethiopia and Jimma Zone, respectively. This might be due to the difference in using control methods of trypanosomiasis, climate and ecological conditions such as altitude, rainfall, and temperature and livestock management system. This is comparable with the previous studies of 6.3% (Adale and Yasin, 2013) in Wolaita Zone KindoKoysha district of Ethiopia and 8.3% (Eshetu et al,. 2017) in Mareka district of Dawuro Zone, Southern Ethiopia.

The lower prevalence of bovine trypanosomiasis in the current study area might be due to periodical measures taken by the government to

control tsetse population from the area. This may be due to increased and frequent use of different trypanocidal drug and easy accessibility of trypanocidal drugs, even there is home to home treatment service. Various studies reported the most prevalent trypanosome species in tsetse infested areas of Ethiopia were *T. congolense* and *T. vivax* sometimes *T. brucei* and mixed infection in some extent (Fikru et al., 2012; Leta et al., 2016). The finding of this study revealed that the majority of the infection was due to *T. congolense* (61.57%), *T. vivax* (30.76%) and the least was infection by mixed infection (*T. congolense* and *T. vivax*) (7.69%).

The higher infection rate of *T. congolense* in the study area was in agreement with trypanosome species prevalence data from other tsetse infested region of Ethiopia. Abraham and Tesfaheywot, (2012); Adale and Yasin, 2013 and Megersa et al., 2019 reported *T. congolense* 61.4%, 58.8% and 59.6% in Wozeka grid on the southern part of Arbaminch, Wolaita Zone Kindo Koysha district of Ethiopia and Botor Tolay district, Jimma Zone Ethiopia respectively. This study revealed the infection rate of *T. vivax*is 14.2%, 29.4% and 25.5% respectively. The species specific trypanosomiasis prevalence rate in Bombasi Woreda, Western Ethiopia was; *Trypanosome congolense* 51.76%, *Trypanosome vivax* 28.23%, *Trypanosome brucei* 11.76% and mixed 8.23% (Shimels and Bosona, 2017).

In the present study, T. *congolense* was the predominant species in the study area which may be due to the development of better immune response to *T. vivax* by the infected animal (Leak et al., 1999). However, it was statistically insignificant in the study area ($p>0.05$). Vector born trypanosome species are disseminated in most parts of Western and South Western parts of Ethiopia (Roeder et al. 1984).

The infection rate of female is higher than male cattle in the present study but there was no statistical difference ($P=0.698$). This result is comparable with the findings of Dejen, (2017) and Megersa et al., (2019). The present study is in agreement with the previous reports of Konta special woreda; which was 20.7% in female and 17.3% in male cattle which shows no significant statistical variation (Migbaru and Desta, 2015). Similar findings were also reported by Daya and Abebe (2008) and Tadesse and Tsegaye (2010). This may be due to the physiological difference between sex groups. The possible explanation for higher prevalence of trypanosomes in female animals in the present study area might be the fact that female animals were more likely exposed to tsetse flies as they were always released to common grazing sites of tsetse infestation, in contrast to male animals as they were kept in the house after ploughing and have little chance to be exposed to tsetse flies (Eshetu et al,. 2017).

The prevalence of trypanosomiasis on different age groups was 0%, 5.26% and 7.27% in young (<2 years), medium ($2\leq x\leq 4$) and adult (>4), respectively. The difference in prevalence among the different age groups was not statistically significant ($p>0.05$). This might be due to the less exposure of calves for the tsetse flies, since most of them were confined at homes whereas as the young and the adults move far distance in search of feed and water. Such areas are widely known for their high tsetse population thereby this may increase their probability to contract with the agent (Adale and Yasin, 2013).

The higher prevalence of trypanosomiasis in cattle with poor body conditioned than in medium and good body conditioned animals in the study area was recorded and it was comparable with the results of Abraham and Tesfaheywot et al. (2012) in Arbaminch area and, Adale and Yasin (2013) in Wolaita Zone Kindo Koysha district, Southern Ethiopia. This might be due to the fact that poor body condition animals are susceptible to the infectious disease and reduced performance of the animals may be created by lack of essential nutrients and poor management by the animal owner.

Regarding the PCV determination, the mean PCV of the parasitemic animals (23.76%) was lower compared to aparasitemic animals (28.27%) and the difference was significant ($p<0.05$). Likewise, Van den Boossche and Rowlands (2001) stated that the average PCV of parasitologically negative animals was significantly higher than that of parasitologically positive animals.

CONCLUSION & RECOMMENDATIONS

Based on focus group discussion bovine trypanosomiasis is the major constraint for the livestock production in the area. The current study also revealed an overall prevalence of 5.91% for bovine trypanosomiasis based ob Buffy coat examination. The predominant trypanosome species found were *T. congolense and T. vivax*. The mean PCV values indicated the trypanosome infection has been found to cause anemia in cattle. According to the community, bovine trypanosomiasis is the major problem than other livestock diseases in the area.

To reduce the prevalence of the disease in the area, appropriate tsetse and trypanosomiasis control action should be integrated and strengthened. Moreover, further studies on the tsetse challenge and the economic impact of trypanosomiasis on the agricultural productivity should be conducted

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