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Prevalence of bovine Trypanosomosis in three selected Kebele's of Damot Woide district, Southern Ethiopia

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Abstract

The study was conducted from November 2017 to June 2018 in three selected kebele's of Damot Woide district, Southern Ethiopia with objective of determining the prevalence of Bovine Trypanosomosis. Blood samples from 384 randomly selected cattle of both sexes and different age, color and body condition groups were collected and examined with conventional hematological and parasitological techniques. Out of the total 384 cattle examined for Trypanosomiasis, 43(11.19%) were found to be positive and *Trypanosome congolense* and *T. vivax* with the individual prevalence of 8.85% (34/384) and 2.34% (9/384), respectively. The area wise distribution of the Trypanosomosis infection highest prevalence was found in Anka Shashara which accounts (21.53%) while Ello Erasho and Tora Sadebo have similar prevalence (9.09%). The risk factor analysis revealed that the likelihood of the occurrence of the Trypanosomosis in male, age category of 3-7 years old, poor body conditioned animal, black colored animal was higher when compared to female, other age categories, and medium and good body condition and with other coat colored animals. The present study also indicated significant difference between mean PCV values of infected and non infected cattle.

Keywords: *T. congolense*, *T. vivax*, Trypanosomiasis, Damot Woide

Introduction

Ethiopia has high livestock resource potential with estimated number of 40.9 million head of cattle, 22.5 million of heads of sheep, 23.4 million of heads of goats and more than 7.5 million of equines and 2.3 heads of camels (CSA, 2005). However, much of livestock resources are not fully utilized to maximum due to various constraints. Major problems are attributed to poor genetic pool, poor management and animal disease. Trypanossomiasis are one of the major animal diseases affecting sub Saharan African countries in general western and southwestern parts of Ethiopia in particular (NTTICC, 2004,Enwezor*et al*., 2006).

Trypanosomiasis is a serious parasitic disease caused by different species of unicellular protozoan parasites of genus trypanosome found in the blood and other tissue of vertebrates including livestock, wildlife and people and transmitted by cyclically tsetse flies (*Glossina* species) (Tesfahywot and Abrham,2012). Animal Trypanosomiasis is an important livestock disease in Africa which is considered as a threat to the ongoing efforts on poverty alleviation in the content (Wint *et al*., 2010). It is a serious disease in domestic livestock that causes a significant negative impact in food production and economic growth in many parts of the world (Taylor *et al*., 2007), particularly in Sub-Saharan African (Cecchi *et al*., 2008).

In Ethiopia unlike human Trypanosomiasis which is distributed in south western administrative in distribution, animal Trypanosomiasis is among the most important diseases limiting livestock productivity and agricultural development due to its high prevalence in most arable and fertile lands of south west and north west parts of the country following the greater river basins of Abay, Gibe, Omo and Baro which has high potential for agricultural livestock species are at risk of contracting the diseases. More than 20,000 heads die per annual, and annual loss attributed to the disease is estimate to US$236 Million, whereas loss due to reduce meat, milk and draft power is not applicable to this figure (OAU, 2006).The most important trypanosome species affecting cattle in Ethiopia are *Trypanosoma congolense, Trypanosoma vivax* and *Trypanosoma brucei* in cattle,sheep and goats. Camels are affected by *Trypanosome evansi* which is common species in camel rearing area of the country while equines mainly horses are affected by *Trypanosoma equiperdum* in some highland parts of the country (Abebe, 2005).

The tsetse flies are widely distributed in the western, southern and south western low lands and river valleys and 15% of the land believed to be suitable for livestock production is affected by one or more of the following species of tsetse flies; *Glossinamorsitans submorsitans, G. pallidipes, G.tachinoides, G.fuscipesfuscepes and G.longipennis* (Abebe, 2005).

Apart from cyclical transmission of trypanosomiasis by *Glossina* species, mechanical transmission is a potential threat to livestock productivity in some parts of Ethiopia (Abebe and Jobre, 2005). *Trypanosoma vivax* infection can be transmitted mechanically by several *Tabnide* and large numbers of bitting flies (Chernet*et al*., 2006).Trpanosomiasis which takes the form of acute or chronic status is normally characterized by fever, anemia and loss of productivity. Among domestic animals, cattle are the most susceptible to *Trypanosoma congolense, T.vivax,* and *T.bruceiinfections* (Radiostitis *et al*., 2007).

Currently the livestock production and productivity of southern region is highly affected by the high incidence of Trypanosomiasis. The communities in the region in general and in lowlands lying along Ghibe and Omo river basins expand a lot of money to purchase trypanocidal drugs. Therefore, taking into an account the above mentioned statements, the following objectives will be designed to conduct studies.

❖ To determine the prevalence of bovine trypanosomes on the bases of age, sex, body condition score and color of the animals and on area basis.
❖ To determine the dominant species of trypanosomes in study area.

Materials and Methods

Study Area Description

Damot Woide district has a total area of 26,550 hector and lies with an elevation ranging from 1600-1800 meters above sea level. The woreda has 24 peasant associations with a total population of 489,448 (DWWAO, 2014). It was located about 406 km from Addis Ababa. Regarding the agro-ecology of the woreda out of the total land size 35% is lowland, 65% midland. The annual mean temperature 16-31^{o}c and the annual mean rain fall ranges 1100-1500mm according to the land utilization data of the region, 8,403 hectors is cultivated land, 4,380 hector grazing land, 2,229.5 hector forest, 969.83 hector bushes and shrub land. The livestock population was cattle (70,908), sheep (25,692), goats (27,460), equine (7,872) and poultry (81,478) (DWWAO, 2014).

Study Design

Study Population

The study population was constituting zebu cattle of various sexes, age groups and body condition scores, managed under smallholder mixed crop livestock farming system.

Study Type

A cross-sectional study was conducted in Damot Woide district in Wolaita zone to determine the prevalence of Bovine Trypanosomosis and to identify the prevailing of Trypanosomosis.

Sample Size and Sampling Method

Simple random sampling technique was followed to select the study animals. During sampling age, sex, color and body condition of animal was recorded. The age was categorized into three (less than 3 years, (3-7) years and greater than 8 years old and the body condition score was grouped into good, medium and poor based on the appearance of ribs and dorsal spines applied to zebu cattle (Nicholson and Butterworth, 1986). The desire sample also was calculated

according to the formula given by Thrusfield (2005) as follows:

$$N = \frac{1.96^2 x Pexp (1-Pexp)}{d^2}$$

Where; N=required sample
P=expected prevalence, d=desired absolute precision

Hence, with 14.2% an expected prevalence rate which is done by (Feyissa, *et al*., 2011), with desire absolute precision of 5% and 95% level of confidence, the sample size was calculated to be 187. But to increase the precision, 384 animals (samples) were selected during study period.

Study Methodology and Procedures

Parasitological Study

Buffy Coat Technique (BCT): Heparinized micro-hematocrit capillary tubes, containing blood samples were centrifuged for 5 minutes at 12,000rpm. After the centrifugation, trypanosomiasis usually found in or just above the Buffy coat layers. Buffy coat was drained on to microscope slide by cutting the capillary tube with sharp pointed diamond pencil 1mmbelow the Buffy coat to include the plasma. After which it was covered with a 22x22mm cover slip on microscope slide and examine under phase contrast or dark field microscope (40x power objective) and 10x eye pieces for the movement of the parasite (Paris et al., 1982). Typanosoma species is identified according to their morphological descriptions on Giemsa stained blood film as well as movement (motility) in wet blood film preparations provided (Radiostat *et al*., 2007)

Hamatologlogical Study

PCV Determination: blood samples was obtained by puncturing marginal ear veins with a lancet and collect directly into a pair of haparinized capillary tubes filled to their 3/4th of length. The tubes then sealed at one ended with crystal seal. The capillary tubes will be place in micro hematocrit centrifuge and allowed to centrifuge at 12,000rpm for 5minutes.After centrifugation, the capillary tube was placed in a hematocrit reader and recorded to demonstrate the general health status of the animal and estimated as a percentage of the total volume of blood.

Data Analysis

The samples were collected based up on the appropriate sample collection methodology accordingly with the time frame work. All the data were entered through Microsoft excel and will be analyzed by using STATA or SPSS for the sake of clarity. Descriptive statistics was used to determine the prevalence of trypanosomosis in cattle and Chi-square taste will be used to point out the possible association of risk factors with the prevalence of Trypanosomosis.

Results

Parasitological Finding

Out of 384 cattle examined 11.19 (43/384) were found carrying trypanosomes. The highest prevalence was observed in *T. congolense* (8.85%) while the lowest prevalence was observed in *T. vivax* (2.34%) (Table 1).

Table 1: Prevalence of Trypanosomosis based on Species

Trypanosome Species	Positive	Prevalence (%)
Trypanosome congolense	34	8.85
Trypanosome vivax	9	2.34
Total	**43**	**11.19**

Out of 384 cattle examined 11.19% (43/384) were found carrying trypanosomes. The highest prevalence was observed in Anka Shashara (21.53%) while Ello Erasho and Tora Sedebo have relatively equal prevalence (9.09%) was observed respectively (Table 2).

Table 2: Prevalence of Trypanosomosis based on area

PA	No. of examined	Positive	Prevalence (%)	T. *Congolence*	*T.vivax*
ElloErasho	198	18	9.09	12(6.06%)	6(3.03%)
AnkaShashara	65	14	21.53	13(20%)	1(1.53%)
Tora Sadebo	121	11	9.09	9(7.43%)	2(1.65%)
Total	**384**	**43**	**11.19**	**34(8.85%)**	**9(2.34%)**

Table 3: Prevalence of Trypanosomosis based on age

Age (years)	No. of examined	Positive	Prevalence (%)	T.Congolence	T.Vivax
< 3years	130	64.61	4(3.07%)	2(1.53%)	
[3, 7] Years	28	5	17.85	3(10.71%)	2(7.14%)
>Years226	32	14.15	27(11.94%)	5(2.21%)	
Total	**384**	**43**	**11.19**	**34(8.85%)**	**9(2.34%)**

Table 4: prevalence of Trypanosomosis based on body condition score (BCS)

BCS	No. of examined	Positive	Prevalence (%)	T.Congolence	T.Vivax
Poor	141	31 2	1.98	27(19.14%)	4(2.83%)
Medium	24	093.75		5(2.08%)	4(1.66%)
Good	99	33.0		32(2.02%)	1(1.01%)
Total	**384**	**43**	**11.19**	**34(8.85%)**	**9(2.34%)**

Table 5: prevalence of Trypanosomosis based on skin color

Skin color	No. of examined	Positive	Prevalence (%)	T.Congolence	T.Vivax
Black	53	20	37.73	19(35.84%)	1(14.3%)
White	34	25.88		1(2.94%)	1(2.94%)
Gray 595	8.473(5.08%)	2(3.38%)			
Red & White402	5.01(2.5%)	1(2.5%)			
Red 19814	7.0710(5.05%)	4(2.02%)			
Total	**384**	**4311.19**	**34(8.85%)**	**9(2.34%)**	

There was higher prevalence of trypanosome infection observed in black color [37.73%] when compared to other colors which were 8.47%, 7.07%, 5.88% and 5% in Gray, Red, White and Red &White colors respectively. [Table 5]

Table 6: prevalence of Trypanosomosis based on sex

Sex	No. of examined	Positive	Prevalence (%)	T.Congolence	T.Vivax
Female 246	15 6.0912(4.87%)	3(1.21%)			
Male136 28 20.58	22(16.17%)	6(4.41%)			
Total	**384**	**43**	**11.19 34(8.85%)**	**9(2.34%)**	

Relatively, higher level of trypanosome prevalence [20.58%] was observed in male cattle when compared to the prevalence of trypanosome observed female cattle [Table 6]

Table 7: prevalence of Trypanosomosis based hematological finding

PCV value	No. of examined	Positive	Prevalence (%)	T.Congolence	T.Vivax
PCV≤24	153	32	20.91	26(16.99%)	6(3.92%)
PCV>24	231	11	4.76	8(3.46%)	3(1.29%)
Total	**384**	**43**	**11.19**	**34(8.85%)**	**9(2.34%)**

Cattle having PCV≤24 (anemic) was 20.91% while the cattle having PCV>24 (non anemic) was (4.76%) as indicated in [Table 7].

Discussion

The overall prevalence of Bovine Trypanoosomosis in the study area 11.19% which was in agreement with the previous finding by Habtewold (1995), Feyisa *et al*. (2011), and Bitew *et al.* (2011)who reported 9.3% Humbo Larena of Wolaita zone,6.3% Humbo district, and 11.7% at Jabi Teheran district, West Gojam of Amhara Regional State, respectively. However, this finding is relatively lower than the reports of Terazu (2005), Mesfin and Getachew (2001), and Amare (1995) who reported 15.8%, 35.5%, and 21.0% prevalence of Bovine Trypanosomosis respectively at Omo river Basins of South Western Ethiopia. The possible explanations for the lower report in the current study could be attributed to the fact that action of Southern Valley Tsetse and Trypanosomosis Eradication Project (STEP), expansion of cultivation in the area which indirectly affects flies distribution, expansion of veterinary clinic, and awareness towards the control and treatment of the diseases.

T. congolense was the most prevalent trypanosome species in the study area that accounts for the percentage of about 79.07% (34/43). This result in line with Abebe and Jobre (1996) for the tsetse infested areas of Ethiopia (58.5%); Muturi (1999) at the Southern reft valley of Ethiopia (61.1%); Afework *et al*. (2001) at pawe, North West Ethiopia (60.9%); Terzu (2004) in selected site of Southern Region (63.4%) and Bitew *et al* (2011) in West Gojam (54.3%).the increased proportions of infection with *T. congolense* in the study area may be due to the major cyclical vector of savanna tsetse flies, (*Glossina morsitans* and *G. pallidipes*) which are effective transmitters of *T.congolense* and *T.vivax*, (Langride,1976) since the study is located at the tsetse belts of Ethiopia. Another reason also may be due to high number of seroderms of *T.congolense* as compare to *T.vivax* and the development of better immune response to *T.vivax* infected animals (Leak *et al*., 1999; MacLennan, 1970).

Higher infection rate was observed in male animals than in female animals. Similar results have been reported by different works (Afework,1998;Muturi, 1999, Tewolde, 2001 and Mulugeta *et al*.,2013) the possible explanation from the present findings would be that the male animals are more expose to traction power and also cross different vegetation for grazing and watering where tsetse challenge very higher than females.

In the present study the higher infection rate was observed in adult ([3,7] years)than young's (<3 years) and older(≥8years) animals. This result is in agreement with the previous research result reported by Sinshaw (2004). This could be due to the fact that adult animals travel to longer distance for grazing and drafting as well as harvesting of crops to the tsetse challenged areas. Rowlands *et al*.(1999) in gibe valley indicated that suckling calve do not go out with their dams but graze at home stead's until they are weaned off. Young animals are also protected to some extent by material antibodies (Fimmen *et al.,* 1999). This could result in low prevalence of trypanosome of that was observed in calves. *T.congolense* is usually higher in adult animals than the young one (McDermott *et al*.,2003).

In the present study body condition has shown with higher prevalence recorded (21.98%)at poor body condition. Animals with poor body conditions are more associated with disease as compare to animals with medium (3.75%) and good (3.03%) body condition. Obviously, the disease itself results in progressive emaciation of the infected animals; never the less, non infected animals under good condition have well developed immune status that can respond to any foreign protein better than those non infected cattle with poor body condition which can be immune compromised due to other disease or malnutrition and concurrent infections depress the immune responsiveness in the same case (Collins,1994).

Comparison conducted between the different skin colors of cattle indicated that higher prevalence was observed in cattle having Black skin color, (20%) followed by 8.47% in Gray,7.07 in Red,5.88% in White and 5% in White and Red skin color tsetse flies by nature are attracted to wards a black color, so in animals having black skin color there is high prevalence of trypanosomosis recorded (Wendwosen *et al*.,2012).

One of the main symptoms of the disease is anemia (Murry, 1979) consequently the present study also indicated significant difference between mean PCV values of infected and non infected cattle. Cattle having Packed Cell Volume (PCV) less than or equal to 24 (anemic) was prevalence of 20.94% while the cattle having Packed Cell Volume (PCV) greater than 24 (non anemic) was prevalence of 4.76% observed. The result of this study was in accordance with Rowlands *et al.* (2001) who observed in an increase in PCV value, the proportions of positivity decreases and hence mean PCV was a good indicator for the health status of animals in endemic area. The lower mean PCV value in parasitemic animals than the a parasitemic animals is reported by several authors (Leak, 1987; Afawork, 1998; Muturi, 1999; Tewolde, 2001).

Conclusion and Recommendation

The overall prevalence of trypanosomiasis in the current study area was 11.19% in selected kebele's (Ello Erasho, Anka Shashara and Tora Sedebo) in Damotwoide District, Wolaita Zone, Southern Ethiopia. Most of the infection was caused by T.congolense (8.85%) while only 2.34% was by T.vivax. According to the host risk factors, the prevalence of Bovine Trypanosomosis was higher in males than females; in adult cattle than in younger and older and it also higher in those animals with poor body condition. The black color animals are highly prevalent with disease than other color groups of animals. The mean PCV of aparasitemic animals (26.93±3.85) is higher than parasitemic animals (21.97±4.04). Hence the following recommendations are followed:

- Regular strategic prophylactic treatment and establishment of veterinary clinic health post of at PA level need to be enhanced to minimize the incidence.
- Community awareness about disease tsetse fly control should be intensively enhanced in the area.
- Active tsetse suppression and control program conducted by Southern Tsetse and Trypanosomosis Eradication Project (STEP), which has already been there, should be strengthened for the future.

References

Abebe, G. (2005):Trpanosomosis in Ethiopia, Ethiopia,*Journal biological science***4**:75-98.

Abebe,G. and Jobre,Y. (1996): Trypanosomiasis is a treat to cattle production in Ethiopia. *Revenue de medicine veterinaire*. **147**: 897-902

Afework,Y.(1998): Field investigation on the appearance of drug resistant population of trypanosome in metekel district, Northwest Ethiopia. Msc thesis, AAU with frey university, Berlin.

Amare,B.(1995): Prelimnary survey on tsetse distribution and prevalence of bovine trypanosomosis on selected wored as of north Omo and KAT zones.DVM theisis, Addis Ababa, University. Faculty of veterinary medicine,Debrezeit.

BitewM.,Amede,Y.,Abebe,A. and Tolosa,T.(2011): Prevalence of bovine trypanosomosis in selected area of JabiTehenandistruct, west Gojam of Amhara regional state, Northewestren Ethiopia. African *Journal of Agricultural Research*.**6**:140-144.

Cecchi,G.,Mattioli,R.C.,slingenbergh,J.andDelarocque ,S.(2008):Land cover and tsetse fly distributions in Sub Sahara Africa, *Medical and Veterinary Entomology*.**10**:1365-2915.

Cherinet,T., Sani.R.A, Speybroeck,N.,panadam,J.M., Nadzt,S.and van dem Bossche,p.(2006): a comparative longitudinal study of bovine trypanosomosis in tsetse freee and tsetse infected zones of amhara region, northwest Ethiopia.*Veterinary Parasitology*.**140**:251-258

Collins, F.M.(1994):The immune response to mycobacterium infection,development of new vaccine. *Veterinary Microbiology*.**40**:95-110.

CSA(Centeral Statistical Authority) (2005): Livestock population of EthipianCenteral Statistical Authority, Addis Ababa, Ethiopia.

Enwezor, F.N.C., Umoh.J.V.Esievo, K.A.N., Anere, J.J. (2006): Prevalence of trypanosomosis in sheep and goat s in the kachia grazing reserved of Kaduna state, North west Nigeria. *Bulletin of animal health and production.**54**:306-308.*

Feyisa, B., Samson, A. and Mihreteab, B. (2011): Bovine trypanosomosis in selected villages of villages of Humbo district, Southern Ethiopia. *Global Veterinarian.*

Fimmen, H.O.,Mehlitz,D., Horichners, F., Korb,E. (1999): Colostoral antibodies and trypanosome congolense infection in calves. Trypano tolerance research and application GTZ,No, 116,*Germany. Pp 173-178*

Habtewold, T.(1995) Community based tsetse and trypanosomiasis control pilot program using Deltametrin in Konso, Southern Ethiopia. Proceeding of 11th conference of the Ethiopian Vetrinary Association, Addis Ababa, Ethiopia. Pp 57-65.

Holmes, P.H. (1997): New approaches to the integrated control of trypanosomosis *Vet* Psarasitology.**71**:121-135.

Leak, S.G.A. (1999): Tsetse Biology and Ecology: Their role in Epidemiology and control of trypanosomiasis. Willingford, Oxon, UK:CABI publishing. Pp 152-210.

MacLennan, K.J.R. (1970): The Epizootology of trypanosomiasis in West Africa. In: THE African Trypanosomiasis (ed. Mulligan,H.W.). George Allen and unwin. London. Pp 756-765.

McDormott, J., Woitag, T., Sidibe, I., Buer, B.,Diarra, B., Ouedraago, D.,Kammuanga,M., Pergrine, A.,and Clausen, P.H. (2003): Field studies of drug resistance cattle in Kenedougou province, Burkina Faso. *Acta Tropica*.**86**:93-103.

Mesfin, A. and Getachew, A. (2001): Field studies on ug resistance trypanosome of cattle (Boss indicus) in Kindo Koyshe Woreda, Southern Ethipia. *Bulletin Animal Health production In Africa.* **48**: 131-138.

Mulugeta, D.R., Sisay M. and Ameha, K. (2013): Prevalence and seasonal incidence of bovine Trypanossomiasis in Bibir valley, Baro Akobo river system, West Ethiopia. **5**(5): 138-143.

Murry, M.S., Murry., P.K., Cliford, D.J., and Trial J.C.M.(1984): Trypanotolerance: A review. *World Anim.Rev*. **31**:2-12.

Muturi.., K.S. (1999): Epidemiology of bovine trypanosomosis in selected sites of the Southern Rift valley of Ethiopia. Msc Thesis, FVM, AAU, Ethiopia.

NTTICC (1996): National Tsetse and trypanosomosis investigation and control center (NTTICC) Report for the period 7th June 2003-6thJouly 2004, Bedele, Ethipia.

NTTICC (1996): National Tsetse and trypanosomosis investigation and control center (NTTICC) Annual report, Bedele, Ethipia.

OAU (Organizzation of African Union): Trypanosomosis, Tsetse and Africa. The year book Report.

Radostitis, O.M., C.C., Hnchiclff, K.W., Constable, P.D.,(2007): Veterinary medicine a text Book of the diseases of cattle, horse, sheep, pigs and goats, 10th edition, Saunders Elserier, Edin burgh, London,New York, Oxford, Philadelphia, St Louis, Syndney and Toronto. Pp 2047-1553.

Rowlands,G.S., Mulatu, W., Authie, E., Leak, S.G.A., Peregrine, A. (1999): Epidemkiology Of Bovine trypanosomosis in the Gibe valley, South west Ethiopia. *Acta Trop*.**53**: 135-150.

Shimels, D., Aran, K.S. and Getachew, A. (2005): Epidemiology of tsetse transmitted Trypanosomosis in Abay basins of North West Ethiopia. Proceeding of the 28th Meeting of International Scientific Council for Trypanosomosis.

Sinshaw, A. (2004): Prevalence of trypanosomosis of cattle in three woreda of Amhara region, Ethiopia. Msc Thesis, FVM,AAU,Debrezeit.

Terzu, D. (2004): Seasonal dynamics of tsetse and trypanosomosis in selected sites of SNNPRS, Ethiopia. Msc Thesis, FVM, AAU, Debrezeit.

Tesfahywot, Z. and Abrham, Z. (2012): Prevalence of bovine trypanosomosis in selected Distrct Of Arbaminch,SNNPR, Ethiopia. *Global veterinarian.***8**(2): 168-173.

Tewolde, N. (2004): The role of Trypanosomosis and tsetse flies in Africa Ecology. A Study of The tsetse flies problem. Oxford University Press.

Thrusfield, M. (2005); Data collection and management in veterinary epidemiology 3rd edition. Blackwell scientific Ltd, Oxford UK.

Toylor, A.M., Coop, L.R. and Wall, L.R. (2007): Veterinary Parasitology, 3rd ed.UK. Blackwell Publishing, Pp 44-102.

Wint, W., Shaw, A., Cecchi, G., and Rabinson, T. (2010): Animal trypanosomosis and poverty in the horn of Africa Workshop Report. IGAD Livestock policy Initiative, July 6-7, 2010 at regional centers for mapping of resources for development (RCMRD).

Wondewosen, T.T., Dechasa,T. and Anteneh.(2012): Prevalence study of bovine trypanosomosis And tsetse density in selected villages of Arbaminch, Ethiopia. *Journal of veterinary Medicine and Animal Health*. **4**(3): 36-46.

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