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PREVALENCE AND ASSOCIATED RISK FACTORS OF TRYPANOSOMOSIS IN CAMELS IN SELECTED DISTRICTS OF AFAR NATIONAL REGIONAL STATE, NORTH EASTERN ETHIOPIA

Bekalu Gerem[1], Muhammed Hamid[2*]

ABSTRACT

Camel trypanosomiasis or surra, is a life-threatening disease caused by *Trypanosoma evansi***,** with negative impacts on health, Production and working efficiency of camels in different camel-rearing areas of the world including Ethiopia. A cross sectional study was carried out from November, 2016 to May, 2017 with the aim of estimating the prevalence of camel trypanosomiasis (surra) and assessing of associated risk factors in Dubti and Asayita districts of Afar region, Ethiopia. Blood samples were collected from randomly selected 200 camels. Wet film blood smears and Giemsa-stain were used for the detection of trypanosomes. Out of 200 examined camels, 9(4.5%) were positive for *Trypanosoma evansi*. Higher prevalence of the disease was recorded in Dubti (6.97%) than in Asayita (2.63%). Camels of >4years age group (7.47%) showed higher prevalence of infection compared to those with <4years (1.07%). According to logistic regression analysis, previously aborted camels were found at higher risk (p= 0.698; OR=5.11, 95% CI = 1.174- 22.317). The Chi-square analysis showed that, there was no statistically significant difference between body condition categories and herd size of camels with the occurrence of the disease (X^2=3.839; p=0.147,) and (X^2=0.718; p= 0.698) respectively. The number of animals with lower PCV (anemic) was 49% and those with normal PCV were 51%. The result of this study revealed that camel trypanosomiasis was prevalent in the study area. Thus, designing of the control and prevention strategies with further identifying risk factors is desirable.

Keywords: Afar, Camel, Prevalence, Risk factors, Trypanosoma evansi

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Corresponding Author: Muhammed Hamid

Email: muhammedhamid8@gmail.com

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[1]College of Veterinary Medicine, Samara University, Samara, Ethiopia.

1. INTRODUCTION

The livestock sector support the food security and livelihood of almost a billion people and contributes up to 40% of the global values of agricultural output (Thornton, 2010). Livestock keeping is a multifunctional activity in many developing countries including Ethiopia. Beyond their direct role in generating food and income, livestock are a valuable asset, serving as a store of wealth, collateral for essential safety net and credit during times of crisis (FAO, 2009). Ethiopia is ranking first in Africa and ninth in the world by possessing largest number of livestock population (Yilma and Melese, 2016). The importance of animal products is increasing from time to time both at local and global markets in Ethiopia. Moreover, camel husbandry is the major source of living for millions of pastoralists in the arid and semi-arid areas of Ethiopia (MOA, 2013).

The Camels (*Camelus dromedaries*) are the most numerous species of animals in the arid areas of Africa and Asia, particularly in the arid lowlands of east African counties like Ethiopia, Sudan, Somalia, Djibouti and Kenya) (Abera *et al*., 2015). In Ethiopia camels inhabit almost in all peripheral drier lowlands of the country that generally fall below 1,500 meters above sea level which includes the major parts of the Somali and Afar National Regional States and some parts of the Oromyia National Regional State (Tezera and Kassa, 2002).Ethiopia is estimated to be the third largest camel herd in the world after Somalia, and Sudan (FAO, 2013).

Comparatively Camels are believed less susceptible to many of the devastating diseases that affect different livestock species, such as foot and mouth disease, rinderpest and contagious pleuropneumonia but yet they are affected by many other diseases (Kassa *et al*., 2011). Among the diseases constraints, Parasitism is one of the major problems that affect the productivity of camels. Of these parasitic diseases, camel trypanosmosis is the major problem in sub-Saharan African countries including Ethiopia (Donelson, 2003).

Camel trypanosomosis, also called Surra caused by *Trypanosoma evansi*, is the most important and serious pathogenic protozoan disease of camel. The disease is transmitted mechanically by haematophagous biting flies, especially tabanids (Bamaiyi *et al*., 2011). *Trypanosoma evansi* is the most widely spread endemic disease (surra) of camels and other different domestic animals throughout the world (Elhaig *et al.,* 2013; Shahid *et al.,* 2013). From the two strains of T. evansi: type A and B; strain type A only is believed to be found in Ethiopia whereas, type B has been isolated only from Kenyan dromedary camels (Birhanu *et al*., 2015).

The disease is highly prevalent in Ethiopia (22%) and it is an important cause of economic losses, causing morbidity of around 30.0% and mortality of up to 3.0% in camels in Ethiopia (Abera *et al*., 2015). The true prevalence of the disease is reported by Mohammed *et al.* (2011) in Dire Dawa (1.6%), Bekele *et al.* (2004), in Borona pastoral area (1.8%), in Borena Zone of southern Ethiopia (1.2%) and seroprevalence of 5.22% in Afar (Teshome *et al.,* 2003).

In camels, the disease induce fever, anemia, dullness, depression, weakness, nervous symptoms and these are responsible for major economic losses in terms of poor

production (meat, milk, draught power, fertility, and manure) and sometimes death (Desquesnes *et al.*, 2013). It may occur in both acute and chronic forms, the acute form of the disease is usually fatal within a few weeks, but the chronic form lasts for years and associated with secondary infection (Mihret and Mamo, 2007).

Even if camel trypanosomosis has its ecological, economic importance and significant role in the life of pastoral community, researchers and development planners were not given attention to studying about this disease in Afar region, Ethiopia. Moreover, limited documented information about camel trypanosmosis and associated risk factors in afar regional state, northern Ethiopia particularly in the study area, makes this study to focus on estimating the prevalence of camel trypanosomosis and assessing associated risk factors for camel trypanosomosis in the study area.

2. MATERIALS AND METHODS

2.1. Description of study area

The Afar national regional state is located 587.9 km far from Addis Ababa in northeastern Ethiopia. According to regional estimates, the livestock population of Afar is about 10.12 million, from which about 859,580 (8.5%) are camels. The Afar national regional State has five administrative zones, which are further subdivided into 32 districts. Afar regional state is located between 39^{o}34' and 42^{o}28' East longitude and 8^{o}49' and 14^{o}30' North latitude. It is characterized by an arid and semi-arid climate with low and erratic rainfall. The annual temperature and rainfall in the region is 30-50^{0}C and 200-600mm, respectively. Pastoralism and agro pastoralism is the major livelihood ways practiced in the region. The population of the region is estimated to be about 1.2 million of which 90% are pastoralists and 10% agro-pastoral (CSA, 2007). The study was carried out in two purposively selected districts of Afar region namely; Asayita and Dubti.

2.2. Study population

Study was carried out in indigenous one humped camels which vary with age, and body condition that reared under extensive husbandry system on different district. Herd size was classified into three categories as small (Up to 10 camels in a herd), medium (11-20 camels) and large (More than 20 camels in the herd) based on classification of Faye and Bengoumi, 2006. In addition body condition score of dromedaries was classified according to these authors, which range from 5 (Excellent) to 0 (Very poor). Estimation of age was both on subjective basis and based on information obtained from the owner.

2.3. Study Design

Across-sectional study was carried out to estimate the prevalence of camel trypanosmosis and to assess the associated risk factors in Asayita and Dubti from November 2016 to May 2017. Semi structured questionnaire was prepared and presented to the owner to obtain information about physiological status (dry, lactating or pregnant) and previous abortion history of sampled animals in the herd.

2.4. Sampling Methods

A multi-stage cluster sampling approach was used. The representative zones, kebeles (Peasant Associations) were selected purposely based on accessibility, willingness of pastoralists and camel population. Zones and woredas were the primary and secondary sampling units respectively. From the five administrative zones of Afar region, Zone one was selected and then, from zone one, two woredas (Asayita and Dubti from Zone-1), were selected purposively. Accordingly, 114 (57 %) and 86 **(**43%) camel were sampled from Asayita and Dubti district, respectively. camels were selected from a given herd by using simple random sampling method.

2.5. Sample Size Determination

Cluster sampling is the suitable method for this study as constructing sample frame for random sampling is not possible in pastoral production system. The required sample size was determined by Thrusfield (2007) formula within 95% Confidence Interval (CI) at 5% desired precision level.

$$N = \frac{1.96^2 \times Pex \times (1-Pex)}{d^2} \quad \text{----Equ.1}$$

where:-N= sample size

Pex^{-} Expected prevalence

d^2= desired level of precision

Expected prevalence was taken as 2% reported by Fikru *et al* (2012).

$$N = \frac{1.96^2 x 0.02 \times (1-0.02)}{(0.05)^2} = 30.10$$

Therefore, the minimum sample size required was 30, but in order to increase the precision 200 blood samples were collected.

2.6. Sample collection method

After physical restraining, the jugular furrow of 200 selected camels were cleaned with alcohol and dried well. Then, blood samples were collected by puncturing jugular vein using lancet needle in to 5ml ethylene tetra- acetic acid (EDTA) coated vacoutainer tubes and kept in cooler box and transported to Samara university multipurpose laboratory.

2.7. Laboratory examination procedures

2.7.1 Hematological Examination

Blood samples were drawn into paired heparinized microhaematocrit capillary tubes up to ¾th of their length. One end of the tubes were sealed with crista seal and symmetrically loaded in the hematocrit centrifuge, with the sealed end outwards, and then centrifuged at 12,000 rpm for 5 minutes. PCV levels of individual samples were determined on hematocrit-reader (Hawaksly, England) and the values were expressed in percentages. Animals with Packed Cell Volume (PCV < 25%) were considered to be anaemic (Morag, 2002).

2.7.2 Parasitological Examinations

For wet film, a drop of blood was placed on a clean glass slide and it was covered with cover slip, to allow the blood to spread as a thin layer of cells and then examined under microscope to observe the motile trypanosomes. The air dried smears were fixed in

absolute methylene alcohol for 2 minutes. The slides were immersed in Geimsa stain for 20-25 minute and washed with tap water to remove excess stain. After air drying, the slides were examined under oil immersion objective lens (100x) for the detection and identification of trypanosome species based on their morphological characteristics (Murray *et al.,* 1979*).*

2.8. Data analysis

The data obtained from the study was entered to the Microsoft excel spreadsheet and analyzed by SPSS version 20. The results of this study were taken as statistically significant when p-value is less than 0.05. A chi-square (X^2) test was employed to investigate associations between infection status and risk factors. To investigate the associations between *T. evansi* infections and associated risks, factors identified as significant were subsequently subjected to logistic regression analysis.

3. RESULT ANALYSIS

The parasitological examinations of collected samples revealed that camel trypanosomosis caused by *T. evansi* is widespread and a major threat to the well-being and productivity of the camel population in Asayta and Dubti districts of Awsi Rasu zone, Afar region, Ethiopia. It was detected in 9 (4.5%) of the 200 camels by at least one of the three/two (wet film) parasitological methods. The difference in prevalence between the two administrative districts was not statistically significant (p>0.05). But, the prevalence of trypanosome infection was slightly higher in Dubti (6.97%) than in Asayita (2.63%) (Table1).

Higher prevalence (7.47%) was observed in age group >4 years old compared to <4 years age old category (Table 2). The prevalence of Trypanosomosis was not significantly associated with body condition. However, higher prevalence was recorded in poor conditioned camels (7.52%) than medium (2.94%) and good body condition scored camels (1.36%) (Table2). The prevalence of trypanosomes infection was different between herd size categories, but not statistically significant (P>0.05) (Table 2). There were statistically significant association between the occurrence of the disease and physiological status (p=0.015) and abortion history (p=0.017) of camels.

Table 1. Prevalenceof camel trypanosomiasis in study area

Risk factor	Category	No tested	Positive (%)	Chi-square	P-value
Districts	Asayita	114	3 (2.63%)	2.154	0.142
	Dubti	86	6(6.97%)		
Total		200	9(4.5%)		

Table 2.Prevalence of camel trypanosomiasis among associated risk factors.

Risk factor	Category	No tested	Positive (%)	Chi-square	P-value
Age	Adult	107	8 (7.47%)	4.74	0.029
	Young	93	1 (1.07%)		
Body condition	Emaciated	93	7 (7.52%)		
	Moderate	34	1(2.94%)	3.839	0.147
	Good	73	1(1.36%)		
Herd Size	Small	40	1 (2.50%)		
	Medium	93	4 (4.30%)	0.718	0.698
	Large	67	4 (5.97%)		
History of abortion	Previously Aborted	20	3(15 %)	5.701	0.017
	Not aborted	180	6 (3.33%0		
Physiological status	Pregnant	67	7 (10.4%)		
	Lactating	86	1 (1.2%)	8.35	0.015
	Dry	47	1(2.1%)		

Table 3. Association between trypanosomiasis infection status and mean PCV in camels

PCV status	No.Examined	No.Infected	Mean PCV	Prevalence%	chi-square (X2)	p-value
PCV<25	98	5	20.8%	5.1%		
PCV>25	102	4	27.4%	3.9%	0.162	0.687
Total	200	9	24.2%	4.5%		

Table 4. Logistic regression analysis of risk factors and trypanosomiasis prevalence

Risk factors	No. Examined	No. Infected	P-value	OR	95% CI for EXP(B)
Age					
Adult	107	8	0.061	7.43	0.0912 - 60.59
Young	93	1			

Abortion history						
aborted	20	3		0.03	5.118	1.174- 22.317
Not Aborted	180	6				
Physiological status						
Pregnant		67	7	0.047	-	-
Lactating		86	1	0.034	0.101	0.638-45.169
Dry		47	1	0.122	0.186	0.033-8.854

4. DISCUSSION

The overall prevalence of camel trypanosomiasis in the study area was found to be 9 (4.5%). Trypanosoma evansi was the only species identified during this study, and it is reported to be the cause for camel trypanosomosis from different parts of the world (Swai *et al*., 2011). This study result was higher as compared to other findings in others parts of Ethiopia: 0.3% Issa (Afar) (Tefera, 1985), 2% Tigray (Hailu, 2000) and 3.9% Jijiga (Tadesse et a*l.*, 2012). On the other hand, the finding of this study is lower than the previous reports of 72% Bale Zone (Bogale *et al*., 2012) and 17.9% Jijiga Administrative Zone (Abera *et al*., 2014). The difference in the prevalence rate might be due to the difference in the ecology of the study areas and seasons of the year when the study was carried out. It is clear that season has direct effect on the distribution of biting flies, which are responsible for the mechanical transmission of *T. evansi* (Luckins, 1988).

The prevalence of trypanosomosis between the districts was not significantly (P =0.142) varied and this could be due to similarity in climatic condition. However, higher parasitological prevalence was recorded in Dubti district (6.97%) compared to Asayita (2.63%). The higher prevalence observed in Dubti district could be due to the relative ecological variation, hence, in Dubti district there are numerous communal watering points and the existence of big and medium sized trees and shrubs along with a year round river called Awash River.

In this study, age-wise analysis showed that there was statistically significant difference between age groups and the occurrence of the disease (X^2=4.74,P=0.029) in which higher infection rate was observed above 4 years (7.47%) compared to camels bellow 4 years (1.07%). This result is similar with other findings (Eshetu, 2011; Weldegebrial *et al*., 2012 and Tadesse *et al*., 2014). The higher prevalence of *T. evansi* infection noted in older camels may be due to heavy stress associated with their use for various purposes like transportation of goods and sub-optimal management practices.

In this study, body condition was investigated; higher prevalence of *T. evansi* infection was noted in 7.52% in Emaciated camels, 2.94% was in moderate and 1.3%was in good

body condition camels. However, this risk factor was not significantly associated with disease. This result was in line with the report of Khalid, 2015.

In this study, herd size analysis revealed that there was no statistically significant difference among herd group and the occurrence of the disease (X^2=0.718, p-value=0.698). In other study this risk factor was found statistically significant (Khalid, 2015). Accordingly (Bhutto *et al.,* 2009), reported that infection rate was highest in herds possessing more than 20 animals compared to herds possessing lower number of animals.

The infection rate was 15% in camel having previous history of abortion, and 3.3 % in camels without previous abortion history. Camels with history of abortion were more than 5 folds at risk (OR=5.11; 95% CI=0.045-.8521) of infection than camels with no history of reproductive disorder. This result agrees with (Schillinger and Rottcher, 1986) and (Yagil, 1982) who found that abortion could be due to the chronic form of trypanosomiasis.

Even though, there was no statistically significant difference observed between infection and PCV (P>0.05) (Table 3), this finding was disagreeing with what was reported by Tesfaheywet and Abraham (2012). A significant reduction in PCV was observed in the trypanosome infected animals signifying anemia to be one of the important consequence of infection. But, several factors are responsible for causing anaemia; the production of haemolysin by trypanosomes resulting in extravascular destruction of RBCs, haemolysis of RBCs, the erythrophagocytosis, depression of erythropoiesis, immune mediated and non-specific factors, which increase red cell fragility, might be responsible for anaemia (Atarhouch *et al*., 2003). So, anemia is a major component of the pathology of surra (Enwezor and Sackey, 2005).

There was statistically significant difference between the prevalence of camel trypanosome and physiological status of camels. Pregnant camels were found at high risk of infection by *T.evansi* followed by dry and lactating camels' respectively (P=0.047). This could be due to the occurrence of stress during pregnancy and lactation which may decrease resistance in female and render them more susceptible to *T. evansi* infection. On the other hand, some studies on prevalence and associated risk factors trypanosomiasis due to *T.evansi* in camel have been published, but no information concerning to assessments of prevalence of trypanosomiasis and physiological status of camels.

5. CONCLUSION AND RECOMMENDATION

Although disease is the major constraint, camel rearing has indispensable practice in Ethiopian pastoralists especially in afar regional state as their way of life is dependent on animal production. Camel trypanosomosis, also known as Surra caused by *Trypanosoma evansi*, is the most important and serious pathogenic protozoan disease of camel which continued to be the major problem in Ethiopia particularly in the study areas. The study revealed that camel trypanosomosis is prevalent in afar regional state particularly in the study area at relatively low levels during the study period using parasitological techniques. The present study provides useful baseline data on the

prevalence of camel trypanososmosis in the study area .Therefore, further studies should be carried out on trypanosomosis and associated risk factors in the study area, Effective prevention and control plans should be designed and implemented against the parasite and their vectors to control the disease and there should be expansion of veterinary services to serve the community in Afar region, Ethiopia.

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