International Journal of Scientific Research and Engineering Development-– Volume 3 Issue 6, Nov-Dec 2020

Available at www.ijsred.com

RESEARCH ARTICLE OPEN ACCESS

EPIDEMIOLOGY OF TRYPANOSOMAL INFECTIONS OF CAPRINE IN NONO DISTRICT, SOUTH WEST SHOWA ZONE, ETHIOPIA

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I. ABSTRACT

The study was conducted from November, 2009 to March, 2010 in Nono district, South West Showa Zone, Ethiopia with the objectives of investigating the existence and prevalence of caprine trypanosomosis. A total of 400 blood samples were collected from randomly selected goats and the blood films were examined using buffy coat technique for the detection of trypanosomes.

The result revealed that 4 (1 per 100 or 1%) of the goats were found to be infected with trypanosomes. Up-on examination on thin smears of infected blood, trypanosome congolense was the only species identified in this study. There was no statistical significant difference (P>0.05) between the prevalence of trypanosomal infections with regard to age, sex, color and body condition score of animals.

Key words: *goats, packed cell volume, prevalence, trypanosomosis*

II. INTRODUCTION

Ethiopia has the largest domestic animal population in Africa, with 31 million cattle, 23.2 million sheep, 18.1million horses, 0.63 millions mules, 5.2 million donkeys and 1.07 million camels (Bowman 2003). Of the total cattle, sheep and goats population in Africa, 15%, 11% and 10% are found in Ethiopia respectively (ILRI 2000). Eighty eight percent of the goat farming population lives on the high land areas, which occupy 40% of the country's total area (Getachew et al 2004).

The distribution of small ruminants in Ethiopia varies largely with different agro-climatic conditions. The highlands have 75% of the sheep but only 27% of the goats while the lowlands accommodate 25% and 73% of the total sheep and goats' population of the country respectively (Coppock 1994). Hence, an increase in small ruminants production could contribute to the attainment of food self sufficiency in the country particularly in response to the protein requirement for the growing human population as well as to enhance the export earnings (Getachew et al 2004).

Small ruminants play an important role in improving the economy of the small farmers, for those who are unable to keep larger animals such as cattle. Goats provide meat, milk, skins, manure and play an important role as liquid assets and source of saving as well as having important religious and social functions like payment of dowry, celebration and gift. Households may liquidate them in times of stress; during drought and agricultural crop failure (Osaer et al 1999). They can survive in a broad ecological zone range including harsh environment, utilize area which are unsuitable for crop production and feed on a variety of grasses, herbs and shrubs (Oyeyemi 2002).

Currently, animals are the major income for the poor peasant families in Ethiopia. Among these animals, goats are the relevant species for those living in a tropical and harsh environment, in which goats withstand tropical climate and supply benefit for their owners. But peasants who live in the tsetse infested area encountered the problem of tsetse and the trypanosomosis as one of the major constraints of livestock and crop production. They have been experiencing dramatic losses of their goats due to this disease which increase mortality and reducing fertility. Under village condition, the effects of trypanosomosis adversely affect people's health, welfare, food security and impede their socioeconomic development. Goats being important components of livestock sub-sector play a significant role in the socio economy of the developing countries. Their great popularity in these countries can be explained by their better adaptation to the unfavorable arid environment and their suitability for resource poor farmers (Gall 1981).

Parasitic diseases continue to be a major constraint in the world, especially in poor developing countries. Their effects are characterized by lower output of animal products, by-product and traction, thereby affecting the food security (Getachew et al 2004).

Among the parasites, trypanosomosis is arguable the single most disease constraint of animal production and productivity. In Ethiopia, tsetse – borne trypanosomosis is the single most important disease, which

excludes over 150,000 – 200,000 Km^2 fertile land in the west and south west of the country from agricultural production. Some 10 – 40 million heads of cattle in Ethiopia, and an equivalent number of small ruminants together with a significant number of equines and camels are considered to be the risk of the disease (MOA 1996).

Tsetse transmitted trypanosomosis is one of the most ubiquities and important constraints to agricultural development in sub humid and humid zone of Africa (Swallow 2000). Here in Ethiopia trypanosomosis is referred as 'Ghendi' and it is a serious constraint to cattle and small ruminant production in tsetse infested, south western part of the country (Abebe and Jobre 1996). Ethiopia is one of 37 sub–Saharan Africa countries now harboring about six species of trypanosome species. In Ethiopia especially south west, the low lands are infested by tsetse flies (Kalayou 2005).

Trypanosomosis is a serious disease that affects human and domestic animals caused by different species of trypanosomes and characterized by intermittent fever, anemia, lymphadenopathy, cachexia and splenomegaly often followed by death in untreated case. The disease is a group of infections but not contagious except dourine (non tsetse transmitted trypanosomosis) in equines (Radostits et al 2000).

The epidemiology of Africa trypanosomosis is almost entirely dependent on tsetse flies. But within the general ecological limits of distribution the problem of trypanosomosis is not static. The natural host of salivarian trypanosomes usually shows no clinical sign of infection, host and parasites being in equilibrium. The large numbers of naturally infected wild animal hosts constitute a huge reservoir of trypanosomes. Once infected, tsetse remains so for life and thus they too form a reservoir of infection. Consequently, when domestic animals are introduced into area in which Sylvatic cycles of trypanosome transmission occur, trypanosomosis always emerges as a serious disease (Jaw and RC Tustins 2004).

An animal entering a tsetse infested area risks becoming infected with potentially pathogenic trypanosomes may produce disease. The degree of risk depends largely on the 'challenge'. True challenge or risk is determined by the interaction of the number of infected tsetse bites, host preference, host susceptibility and the virulence of the parasite. There are also various reasons why a particular animal species may be subjected to greater challenge than another. The behavior of a potential host can influence the ease with which a tsetse can engorge and this may contribute to observed preference (FAO 1998).

For many years, it was widely believed that goats were little affected by trypanosomosis. These small ruminants survive light to medium tsetse challenge without any specific intervention to reduce or remove tsetse flies or the infection that they transmit (Stephen 1970). Trypanosomal infection in goats is sometimes difficult to detect because of the low parasitaemias that occur. However, the disease in goats produce acute, sub acute, chronic or sub clinical forms, being trypanosome vivax, trypanosome congolenseand trypanosome evansi, the most invasive trypanosomes for goats. Also untreated goats often revealed pale mucous membranes and a rapid thready pulse; enlarged prescapular lymph nodes are easily palpable in many chronically affected goats (Dinka and Abebe 2005).

Goat has been reported to be resistant to Trypanosomosis. However several studies on the prevalence of Trypanosomosis in goats in different countries including Nigeria, Ethiopia and Kenya revealed that goats acquire natural infection resulting in economic losses (Irungu et al 2002). Infected goats that survive the infection become reservoir of the parasite for other domestic animals as well as human beings. Goats have been experimentally infected with trypanosomes in studies of experimental Trypanosomosis to observe how the infection affects different body parameters such as live weight, birth weight and reproductive performance like abortion and stillbirth. The experimental infection also affects the hematological changes observed including anemia, red blood cell count, hemoglobin level and lower packed cell volume in different breeds of goat (Azab and Abdel-Maksoud 1999).

The opportunity given by international livestock research institute (ILRI) for a short term project on trypanosomosis of goats in Nono district, South West Showa Zone is due to the limited research program on goats at this station that appropriate research is needed to assist peasants in order to improve better production. Therefore the objectives of this study were to estimate the prevalence of trypanosomosis and to assess associated risk factors and also to know the epidemiology of goat trypanosomosis in the study area.

III. MATERIAL AND METHODS

A. Study area

The study was conducted from November, 2009 to March, 2010 in Nono district, South West Showa, Ethiopia. The area is situated about 230km south west of Addis Ababa within the altitude range of 1500-

1600 meters above sea level bordering the Ghibe river system. The district is located latitude 8^0 50'N and longitude 37°45'E. The area covers about 50,000 hectares of land with the total population 250,494 (human population density). Topographically the area is marked by hilly, flat, sleep slopes and gorges and a number of streams. The area has a sub-humid climate and a moderately hot temperature with a mean annual temperature of 20°c. The highest average monthly temperature occurs in January when the mean maximum temperature is 28°c.The lowest monthly temperature occurs in August when the average monthly minimum temperature is 12°c. It receives high and reliable annual rain fall averaging 1100mm/annum with low inter annual variation.

The livestock species in the area include bovine, caprine, ovine and equine (donkey). But, bovine and caprine are the predominant species in the area and depend upon communal grazing field as feed source and watering points are the tributaries of large rivers. Livestock management system is mixed farming system that the local human populations are principally engaged in livestock crop (mixed) farming system.

B. Study animals and design

A cross sectional study design was designed for the study. The sample size was determined based on the formula given by Thrusfield (1995) considering 5% absolute precision, 95% level of confidence and, since there was no previous study conducted at the study area, 50% of an expected prevalence was adopted to determine the prevalence of caprine trypanosomosis in study area.

$n = \underline{1.96^2 \text{ X P exp } (1\text{-}P_{exp})}/ d^2$.

Where n = required sample size, P_{exp} = expected prevalence, d = desired absolute precision (usually 0.05), for n=384. A total of 400 goats were selected for the study i.e.16 additional goats were examined to increase precision. Ninety six (96) households in the district were randomly selected from which 1-4 goats per households were examined for the presence of trypanosomosis.

Animals involved in the study were goats of all ages and sexes. The age of goats were categorized base on their teeth condition as kid under 1 year: Eight sharp incisors, yearlings (1-2) years: Central pair of body teeth replaced by permanent ones, young adult (3-4) years: 4 permanent teeth, adult (4-5) years: 8 permanent teeth and older adults >5 years: Worn teeth and some missing and also the animal's body condition score was classified as starving (Extremely thin; nearly dead; no muscle between skin and bone),

very thin (spinous processes harp sticks up. Transverse processes are sharp and your fingers easily pushed under thin end. There is hollow between the end of each processes, lion muscle are shallow), thin (spinous processes feel less sharp; your fingers can be pushed under the transverse processes with the little pressure, lion muscles are of moderate depth), moderate (spinous processes only sticks up very slightly; they are smooth and rounded. Firm pressure is needed to detect each one separately. Transverse processes are smooth and well covered; firm pressure is required to push your fingers under the ends, lion muscles are full), fat (spinous processes can just be felt with firm pressure as hard line and level with the flesh on either side. The end of the Transverse processes cannot be felt, lion muscle are full) and very fat (spinous processes cannot be felt at all, Transverse processes can be felt; lion muscles are very fully developed) on the bases of criteria set by Mike (1996).

C. Study protocol

A cross sectional study was conducted to determine the prevalence and epidemiology of caprine trypanosomosis. Based on the facilities available in the Biotechnology department of International Livestock Research Institute (ILRI), the following diagnostic methodologies were performed in order to cross check the overall trypanosomal infection load and to determine which species of trypanosome show a greater prevalence in caprine at the study area.

D. Routine clinical examination

Although in many tsetse-infested areas diagnostic facilities are not readily available, clinical signs of trypanosomosis are well recognized. Such clinical signs were recognized during the study period by visual and physical (palpation) inspection of every sampled animal for caprine trypanosomal infection. The diseased animals revealed mainly anemia by inspecting and visualizing their pale mucosal membrane of the eye and poor body conditions.

E. Parasitological and hematological examination

To determine the prevalence of caprine trypanosomosis cross- sectional parasitological and Hematological survey was conducted. Blood samples were collected after properly securing the animal and aseptically preparing around the ear vein. Blood sample were obtained by puncturing the ear veins using sterile blood lancet and sucked up by heparinzed capillary tubes. A pair of capillary tubes was filled with blood from

animals until the tubes are filled to three forth of their height and sealed at one end with crystal seal. Then the capillary tubes were loaded on the microhematocrit centrifuge symmetrically and centrifuged at 12,000rpm for 5 minutes (Kalayou 2005).

Packed cell volume (PCV) was determined using hematocrit reader (Woo 1996). After the PCV was read, capillary tubes were broken 1mm below the Buffy coat using diamond pencil to include the red blood cell layer and the content were expressed on microscopic slide and covered with a 22x22mm cover slip. The content was examined under (x40) objective using dark ground Buffy coat technique (Kalayou 2005). From positive samples, thin blood smears were made, fixed with methanol for 5 minutes and stained with Giemsa solution for 30 minutes and examined using oil immersion under x10objective to detect the species of trypanosomes.

IV. DATA MANAGEMENT AND ANALYSIS

The data collected from the study area were entered in to MS-excel spread sheets and analyzed using SPSS statically software. During the processes the chi-square test were applied to test statically significant association between outcome variable (positive / negative) and risk factors such as age, sex, body condition scoring, and their coat color. For all the analysis performed, $P \leq 0.05$ were taken as statistically significant (Thrusfield 1995).

V. RESULT

A. Laboratory result

Out of the 400 animals examined 243 were males and 157 were females. The overall prevalence of trypanosomosis, which was predominantly due to Trypanosme congelense was 4 (1%) out of 400 animals examined.

TABLE 1 Species based prevalence of caprine trypanosomosis in the study area

Trypanosome species	Positive No.	Prevalence %

T. congolense	4	1
T. vivax	0	0
Overall	4	1

The chi – square test showed that there was no statically significant difference in infection rate between different sex groups ($x^2 = 0.20$, $P>0.05$) (table 2).

TABLE 2 Sex based prevalence of caprine trypanosomosis

Sex	**Examined No.**	**Positive No.**	**Prevalence %**
Male	244	2	0.5
Female	156	2	0.5
Total	400	4	1

$X^2 = 0.20$, $P = 0.66$

The chi – square test showed that there was no statically significant difference in infection rate between different age groups ($x^2 = 2.73$, $P>0.05$) (table 3).

TABLE 3. Age based prevalence of caprine trypanosomosis

Age (Years)	**Examined No.**	**Positive No.**	**Prevalence %**
< 2 years	238	4	1%
2-4 years	125	0	0%
> 4 years	37	0	0%
Total	400	4	1%

$X^2 = 2.73$, P = 0 .26

B. The PCV value of individual caprine

Out of 400 tested goats, 85.2% had PCV value greater than 22% and 15% had PCV value less than 22%. The mean PCV of total parasitaemic (goats diseased due to parasites) and aparasitaemic (goats not diseased due to parasites) was found to be 27.4% and 26% respectively.

TABLE 4Relation of PCV with trypanosomosis infection

PCV %	**valuePositive No.**	**Negative No.**	**Total sample**
15-21	0	30	30
21-26	2	150	152
26-31	1	147	148
31-36	1	69	70
Total sample	4	396	400

X^2= 0.75, P= 0 .87

VI. DISCUSSION

The households included in the study area keep goats flock of mean size ranging from 1-4. The same range has been reported in Tanzania, Nigeria, Cameroon, and Gambia (Matthewman 1980; Ndamukong 1987 and Rawlings et al 1992). The small flock size may be due to problems encountered in livestock production which include water and land scarcity, risk of predators, conflict between livestock keepers and diseases.

Human activities such as bush clearing intended for buildings and cultivation disturb the habitat for tsetse which transmit trypanosomiasis (Reid et al 2000; Thornton et al 2006). In the study area goats were grazed at the bush grassland area which is good habitat for tsetse fly. In Tanzania namely Glossina morsitans centalis and Glossina morsitans morsitans are found in bushy grass land (Rodgers and Williams 1993; MOA and Co-operatives 1998).

Results obtained during this study showed that there are less (1%) cases of trypanosomosis found in sampled goats. This may be due to several factors including the study season i.e. dry season, by which tsetse fly (vector) density is lower in dry seasons than rainy season, the low feeding success of tsetse on goat related to the small size and anti-feeding behavior such as leg kicks and stamping, tail and ear flicks, head movement and skin rippling (Vale 1977; Snow et al 1996). Also biting flies prefer cattle than small ruminants on account of larger size. In communal grazing area they attack cattle and leave most of the small ruminants uninfected (Kniepert 1981). Goats are considered to be resistant to trypanosome infection, showing only a mild or sub clinical manifestation of disease under natural condition (Stephen 1970; Oladele and Adenegan 1998). According to the study done by Sinshaw et al (2006) on the prevalence of trypanosomosis in cattle, small ruminants and equidae, it was revealed that the problem of diagnosis in sheep and goats may be due to existence of some degree of trypanotolerance.

Another reason for the reported low prevalence (1%) of trypanosomosis in goats may be due to the weakness of the diagnosis method used, the Standard Trypanosome Detection Methods (STDM). The study done by Connor (1985) on trypanosome prevalence rates in cattle, goats and sheep in Mtwara and Lindi district (Southern Tanzania) using thick and thin blood smears revealed no parasite out of 208 goats sampled. Another study done by Fison (1987) on the prevalence of trypanosomosis in Southern Highlands Region in Tanzania by using the Buffy coat method showed one (1.3%) goat out of 76 goats sampled had the parasites while by using IFAT method out of 514 goats twenty (3.9%) had the parasites. In the study done by Ng'ayo et al (2005) on the prevalence of trypanosomosis in small ruminants in Kenya it was demonstrated that by using microscopic method the number of positive samples was five whereas using PCR method number of positive samples increased to 86 out of 402 animals sampled.

Households in the study area use diminazene aceturate to control trypanosomosis. The absence of positive cases in the study area may be contributed to by the use of combination of acaricide and antitrypanosomal drugs (Ilemobade 1988). Deltamethrin has been reported to reduce tsetse fly population by 99% and the

trypanosomosis cases in Mkwaja ranch in Tanga region and NARCO ranches in Kagera and nearby farming areas in Bukoba and Karagwe districts (Thompson 1987; MOA and Co-operatives 1998).

In the study area the average PCV obtained was 27%. The minimum and maximum PCV from the area was 18% and 36% respectively. With exception of a few goats most of them (342) have the PCV within the normal range of 22-38% for goats(Dinka and Abebe 2005).The lowest PCV was found in goats which were tethered around the homestead and in those flocks where deworming was not done. The low PCV could be due to high worm infestation and nutrition deficiency. Tethering of goats results in nutritional deficiency, poor body condition, stunted growth and increased contamination of the area with worm eggs infestation due to lack of enough pastures (Fritsche et al 1993 ; Kusiluka 1995 and Wassink et al 1997).

Taylor (1998) indicated that anemia persists during the chronic stages of infection when parasitaemia is generally quite low, probably because different mechanisms are involved in its genesis during the acute and chronic stages of infection. This suggests that control of parasitaemia and control of anemia is unrelated in the chronic phase when immune infections are depressed and anemia is sustained through dyserythropoiesis. In the present study, infected and/or non infected goats' PCV was negatively associated with sex, age and color.

The major limitations of the study were the short study period of five months (November to March). In order to get better results the study would have taken longer period at least 12 months to take care of seasonal changes. In trypanosomosis studies it is better to compare two seasons since the distribution of tsetse flies varies with seasons. Tsetse fly density is higher in rainy seasons than dry season resulting in higher and lower rates of trypanosomosis infection respectively.

VII. CONCLUSION AND RECOMMENDATIONS

The present study revealed that trypanosomosis is not important problem for goat production in the study area in which they are highly resistant for trypanosomal infection. The prevalence of goat trypanosomosis was found to be equal level in both sexes. Trypanosoma congolense was found to be most prevalent trypanosome species in the area. The mean PCV value indicated an overall poor health status of livestock in the study area. The trypanosome infection has been found to cause further poor condition by declining the PCV value among the infected goats.

Tsetse flies and biting flies such as stomoxis were considered to be the main vector for transmission of the disease. Therefore, considering the effects of these vectors and trypanosomosis on goats further studies should be carried out in the area of assessing the diurnal actives pattern of tsetse fly and drug resistant which will have essential roles for overall control of tsetse transmitted trypanosomosis. Designing and implementing of control strategies of trypanosomosis focusing on sustainable, community based, simple, cost effective, and integrated approach (vector control and chemotherapy) are also recommended.

ACKNOWLEDGEMENT

The authors would like to thank the International Livestock Research Institute including its Biotechnology department staffs and capacity strengthening department staffs for their inestimable cooperation during the study period.

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