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# Hematopathology and Hematological Parametric Alterations in Indigenous Cattle Due to Trypanosomosis

*Mersha Chanie, Chemirew Arega and Basaznew Bogale*

Department Veterinary Paraclinical Studies, Faculty of Veterinary Medicine,
University of Gondar, P.O.Box 196, Gondar, Ethiopia

**Abstract:** Across-sectional study was conducted from September 2010 to January 2011 in Dugda Dawadistrict of Oromia National Regional State. The objectives of the study were to determine the prevalence of bovine trypanosomosis, determine the species of trypanosomes and to see the hepatopathological changes, which affect bovine in and determine PCV values in parasitaemic and non-parasitaemic animals. The methods employed during the study were parasitological and hematological examination. 384 local Borena cattle breed were randomly selected from the study population and out of the total cattle, examined 53 (13.8%) cattle were positive for trypanosomes. The identified trypanosomes species were *T. congolese* and *T. vivax*. Out of 53 infected animals 29(54.7%) were infected by *T. congolense* and 24 (45.3%) were infected by *T. vivax*. Comparatively *T. congolense* was more prevalent than *T. vivax*. Prevalence of0%, 12.5% and 16.5% trypanosomiasis was recorded in age groups of < 1, 1-3 and >3 years respectively and those in sexes groupsit was 12.3% inmale and 14.9% in females. However, the association between the infection rate within different age and sex groups was statistically insignificant. The mean packed cell volume (PCV) values of parasitaemic and aparasitaemic animals were 23.79% and 25.66% and over all mean PCV value was 25.41%. Analysis of the mean PCV values of parasitaemic and aparasitaemic animals showed statistically significant difference (P= 0.004). The present study indicated that trypanosomiasis is important disease entity in the study area and therefore attention should be given since it usually produces grave consequences on cattle production.

**Key words:** Cattle · Dugda Dawa · Hematopathology · PCV · Prevalence · Trypanosomosis

## INTRODUCTION

In Ethiopia, trypanosomosis is one of the most important disease limiting livestock productivity and agricultural development. Two major transmission methods are mainly by tsetse flies cyclically and biting flies mechanically [1]. Trypanosomosis of cattle locally known as "Gendi"andis found in many of the National Regional States (Southern Nations, Amhara, Oromia, Beneshangule-Gumuz and others) of Ethiopia where it has been found greatly hindered development. The most important trypanosomes species affecting livestock in Ethiopia are *T. congolense*, *T. vivax* and *T. brucei*in cattle, sheep and goats; *T. evansi* in camels and *T. equiperdum* in horses [2, 3].

The epidemiology of trypanosomes depends on the distribution of the vectors, the virulence of the parasite and the responses of the host. Of the three groups of Glossina, the savannah and the reverie are the most important vectors since they inhabit areas settable for grazing and watering. Tsetse flies in Ethiopia are confined to the southern and western regions between longitude 33°E and latitude 5°N and 12°N they infest areas which together amount to 220,000 $km^2$. Tsetse infested areas lie-in the low lands and in the river valleys of Abay (Blue Nile), Baro, Akobo, Didessa, Ghibe and Omo [3].

Anemia, enlargement of the superficial lymph nodes, lethargy and progressive loss of body condition are the major signs of trypanosomosis. Infected animals can easily be exhausted and lag behind the herd. Breeds can be recovered if the nutrition condition is good and the infection severity is low [4]. Trypanosomosis can be diagnosed based on either detection of the parasite by the light microscope (parasitological) or demonstration of the circulating antibody (serological) in conjunction with clinical observation [5]. The stained thin blood

**Coresponding Author :** Basaznew Bogale , Department Veterinary Paraclinical Studies, Faculty of Veterinary Medicine, University of Gondar, P.O.Box 196, Gondar, Ethiopia.

smears afford the best means of identifying species of trypanosomes [6]. Diminazeneaceturate and homidium salts are curative drugs that are used in the treatment of trypanosomosis [5].

According to Shemelis *et al*. [2], the control strategies in trypanosomosis concentrate on vector control, parasite control with chemotherapy and chemoprophylaxis and use of inherent trypanotolerant trait in some breed of animals.Despite the wide distribution and grater loss due to cattle trypanosomosis in Ethiopia, studies conducted are not enough to since they were concentrated only to those areas, which have good transport facilities and laboratories. This study is intended to highlight the hematological and hematopathological investigations in the far southern part of Ethiopia where researchers so far have not touched. Therefore, the objective of the present study is to assess the hematological parameters of cattle infected with trypanosomes andtoassess the current prevalence in DugdaDawa pastoral area.

## MATERIALS AND METHODS

**Study Area:** The study was conducted from September 2010 to November 2010 in district of Dugda Dawadistrict. The district found in Borena zone of the Oromia National Regional State at 575 kms southeast of Addis Ababa. The climate is semi-arid, which receives average annual rainfall ranging from 500 $mm^3$ in the south to over 700 $mm^3$ in the north. The rainfall is bimodal 56% of the annual rainfall occurs with long (Ganna) expected from March to May and 27%, the short (Hagayya) from mid-September to mid-November [1]. Annual mean daily temperature varies from 19ºc to 24ºc with moderate seasonal variation. The Borena pastoral system is dominated savanna vegetation containing mixtures of perennial and woody bush land. The major sources of water are ponds and deep wells during rainy and dry periods respectively[7]. Livestock is an integral part of the Borena people that serve several purposes as source of food, income generation and social prestige[8].

The livestock population is approximately 1.7 million cattle 2 million sheep and goats, 700,000 camels and 64,000 equines [8]. The Borena pastoralists manage their cattle in a traditional pastoral system. The herd is split in two groups; "Warra" herd comprising of small number of animals, especially milking cows and calves which are kept around the olla's (encampments), whereas "Forra" herd encompass the majority of animals which are driven long distance in search of good pasture and surface water, irrespective of national boundaries [9]. The latter system exposes the animals to cross border contiguous diseases one of which istrypanosomosis.

**Study Population and Management:** Animals from both sexes and all age groups from tsetse-infested area were selected randomly for the study. Animals were maintained under traditional management system. These are comprised of cattle belonging to several owners, were herd together each morning, and looked after by herds' men during the day and returned to their individual owner's homestead each evening. They fed with natural pasture. During the dry season, they were kept under pastoralist means of herding andtranshumance.

**Study Design:** A cross-sectional study was carried out to invstigate this results from indegenous cattle species,

**Sampling Technique and Sample Size:** The samples were taken using the simple random sampling technique. A total of 384 cattle were selected from three peasant associations to study the hematologic characteristics and possible prevalence of bovine trypanosomosis. The sample size was determined using the formula stated by [10].

**Sample Collection and Laboratory Procedure:** Blood samples were obtained by puncturing of the marginal ear vein with a lanced and collected directly into a capillary tube, which has been treated with heparin seated one end with crystal seal [11]. The capillary tubes were placed in micro haematocrit centrifuge with sealed end outer most load the tube 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 five minutes. Tubes were then placed in haematocrit reader and expressed the reading as a percentage of packed red cells to the total volume of whole blood. Animals with PCV < 24% were considered to be anemic.

**Parasite Survey:** A small quantity of blood sample was taken from the marginal ear vein after pricking the vein with the tip. Then the sample was stained with wrights' and Giemsa to examine the parasites.

**Buffy Coat Technique:** It was used to examine the movement or motility of parasite to identify species of trypanosomes and to increase the concentration of the

agent in buffy coat. 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 capillary tube was expressed on to slide, homogenized onto a clean glass slide and covered with cover slip. The slide was then examined under 40 x objective and 10xeyepieces for movement of parasite [12].

**Thin Blood Smear:** A small drop of blood from micro-haematocrit capillary tube was applied to a clean slide and spread by using another clean slide at angle of 45º. The smear was dried by blowing it in the air and fixed for 2 minutes in ethylene alcohol. It was flood with Giemsa stain (1:10 solution) for 30 minutes,drain and wash of excess stain using distilled water, allowed it to dry by standing upright on the rack and finally it was examined under the microscope (100X) oil immersion objective lens.

**Data Management and Analysis:** Raw data generated for this study were entered in to Microsoft Excel and the prevalence of bovine trypanosomosis in different age and sexgroupswere analyzed by using SPSS 17 software. Chi-square was used to compare the prevalence of trypanosome infection with different variables and to determine association between variables and the disease. Data collected on PCV values were analyzed to compare mean PCV values of parasitaemic animals against that of aparasitaemic animals. In all cases, differences between parameters were tested for significance at probability levels of 0.05 or less.The prevalence rate of trypanosome infection was calculated as the number of parasitological positive animals as examined by Giemsa strain of thin blood film and buffy coat method [11] divided by the total number of animals examined at that particular time.

## RESULT

The overall prevalence rate of 13.8 % (53/384) (CI=10.104-16.979) of bovine trypanosomosiswas detected in the study period. *Trypanosomacongolense* and *Trypanosomavivax*were the only two species detected at 7.5% and 6.3% respectively. Mixed infection was not detected (Table 1). The prevalence of trypanosomiasisin peasant associations were 18.9% (24/127), 13% (15/130) and 11% (14/127) in Hemakinsho, Jigesa Nanesa and Burkitumagada respectively.

Animals examined were classified into three different age categories, these age groups werebelow one year, between one and three years and above three years. The maximum infection rate was recorded in the age group of less than three years (39.1%) and the least was 60.9% recorded in the age groups greater than three years. There was statistically significant variation existed between the age groups of examined animals (Table 1).

The prevalence of trypanosomes infection were high in females (14.9%) (CI=9.80-19.16) than in males (12.3%) (IC=7.27-17.36). But there is no statically significant difference between the sex groups ($P$>0.05).

Table 1: The relative prevalence of trypanosomosis in the different age categories

| Risk factors | No of samples | No of positive | Prevalence (%) | Chi square/P value |
|---|---|---|---|---|
| Age | | | | |
| < 1 year | 24 | 0 | 0 | |
| 1-3 years | 160 | 20 | 12.5 | $\chi^2$ = 15.381; P = 0.000 |
| > 3 years | 200 | 33 | 16.5 | |
| Sex | | | | |
| Male | 163 | 20 | 12.3 | |
| Female | 221 | 33 | 14.9 | $\chi^2$ = 0.559; P = 0.445 |
| Body condition | | | | |
| Good | 16 | 0 | 0 | |
| Medium | 307 | 19 | 4.9 | $\chi^2$ =107.667; P = 0.004 |
| Poor | 61 | 34 | 8.9 | |
| Total | 384 | 53 | 13.8 | |

Table 2:Species of trypanosomes Relative proportion of trypanosomes species

| Species | Number examined | Number of infected | % infected |
|---|---|---|---|
| *T.congolense* | 384 | 29 | 7.5 |
| *T.vivax* | 384 | 24 | 6.3 |
| Total | 384 | 53 | 13.8% |

Table 3:Mean PCV values of parasitaemic and aparasitaemic cattle

| Description | Number of examined | Mean PCV(%) +SE |
|---|---|---|
| Aparasitaemic | 331 | 25.66 + 0.29 |
| Parasitaemic | 53 | 23.79 + 0.78 |
| Total | 384 | 25.41 0.28 |

Body condition of the sampled animal was classified in to three categories asgood, medium and poor. In this study, we found out thatsignificant effects of trypanosomes were detected on animal ($P$ <0.05). The maximum prevalence rate was recorded in animals with poor body condition scoring (55.7%). Animals with good body condition scores were found to free of the infection.

**Hematological Finding:** In this study, the mean PCV values of both parasitaemic and aparasitaemic animals were compared. The total mean PCV values of parasitaemic and aparasitaemic animals were 23.8% and 25.7% respectively. The overall mean PCV value of the studied animal was 25.4% (CI=24.86-25.95). There was statistically significant difference between trypanosomes infections and PCV values changes of the animals (P=0.0003).

## DISCUSSION

From the current study, we detected that the overall prevalence of trypanosomes in cattle was 13.8%. This is higher than reports of [13] in which their finding showed that the results of trypanosome infection rate during late dry season at Badaye was 8.6%.*T. congolense* contribute higher proportion than *T. vivax* the reason for this in cattle at Badaye by Leak [13] may be due to contact with riverine species (*G. fuscipes*) at mechancho river which is the only watering point used during late dry season (January to February).

The species of trypanosome identified were *T.congolense* and *T. vivax*. *T. congolense* was accounted 54.7% of the total infection but *T. vivax*comprises 45.3%. *T. congolense* was dominant parasite in the study area, which is in agreement with reports in savannah species of tsetse reported byMc Dermott *et al*., Murray *et al* and Muturi *et al*. [14-16] who had reported prevalence rates of 37% for *T. congolense*in Southwest Ethiopia [17] reported an infection rate of 58.5% for *T. congolense*, 31.2% for *T. vivax* and 3.5% for *T. brucei* in southwest Ethiopia. Different studies [14, 15, 18, 19] reported a prevalence rate of 17.2%, 21% and 17.5% in Metekel district, respectively and the dominant specie was *T. congolense*.

A high *T. vivax* ratio in cattle is expected where the palpalisgroup of tsetse flies specially *G. fuscipes*where they are the main or sole vectors [19-22] High prevalence of *T. congolense* may be associated with high number of sevodems of *T. congolense* as compared to *T. vivax* and development of better immune response to *T. vivax* by the infected animal [19, 23, 25- 27]. In addition, the dominance of *T. congolense* is believed to be cattle exposure to *G. morsitans* and *G. pallidipes*, which are efficient in transmission *T. congolense* than *T. vivax* [20, 28].

In the present study, higher infection rate was recorded in female animals than males. This disagrees with results reported by Murray *et al* and Paris *et al* and Molalegne *et al*. [15, 18, 29] that male animals were infected in greater proportions than females. The possible suggestion for this could be male animals were kept homestead for pastoral purpose so that not getting to the valley floors for tsetse contact. In addition to this, there is no statistically significant difference in the prevalence of trypanosomes on the sex group.

Higher infection rate was observed in animals above three years of age (16.5%). However, 0% and 12.5% infection rates were recorded for animal of age groups under a year and between 1-3 years. The difference of infection rates in the age groups were statistically significant ($\chi^2$= 15.38 $P$=0.00). Higher prevalence in adult animals could be associated with the fact that animals travel long distance for grazing during draught as well as harvesting crops to tsetse challenged areas [2, 16], from Ghibe valley indicated that suckling calves do not go out with their dams but graze at homesteads until they are weaned. Young animals are also naturally protected to some extent by maternal antibodies [22, 25]. *T. congolense* infection is a chronic disease, which increases with age and usually higher in adult animals than young [1, 20].

Trypanosome infection and mean PCV value obtained from parasitaemic and aparasitaemic animals has shown statistically significant difference. This was in agreement with the previous work in Ghibe, valley, southwest Ethiopia where treatment was given for animals with PCV valueof less than 26% and for positive animals The resulting low PCV value may not solely be due to trypanosomosis however, the difference inthemeans of the PCV values between parasitaemic and aparasitaemic

animals indicated that trypanosomosis involves in reducing the PCV values in infected animals. Other diseases considered to reduce the PCV values of the animals in the study area include helminthosis tick borne diseases and nutritional imbalances.

Observation of effect of trypanosomes indicated higher infection rate record in animals with poor body condition scores (55.7%) and zero (0 %) in good body condition. Majority of studied animals were categorized under the medium body condition scoring and lower prevalence rate was recorded (6.7 %).

## CONCLUSION

The major species of trypanosomes are *T. congolense* followed by *T. vivax*. Infection with trypanosomosis negatively affects PCV and body condition. Inversely, trypanosome infection causes loss of body weight and production.

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