

Prevalence of Bovine Trypanosomiasis in Konta Special Woreda, Southern Ethiopia

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Abstract: A cross sectional study was conducted on bovine trypanosomiasis from October 2013 to June 2014 in Konta special Woreda to estimate disease prevalence, to identify species of trypanosomes involved and to assess associated risk factors. Blood samples were collected from 272 randomly selected local cattle breed (zebu) in three purposively selected peasant associations (PAs). The buffy coat and Giemsa stained thin blood films examination techniques were used for parasite detection and identification. Also the packed cell volume (PCV) estimation was carried out. In this study 19.1% over all prevalence of bovine trypanosomiasis was recorded with the proportion of 21.6%, 18.7% and 16.7% in Seri, Chebera and Cheta peasant associations respectively. Two species of trypanosomes, *T. congolense* and *T. vivax* were detected with prevalence of 11.8% and 5.5% respectively with 1.8% mixed infection. Out of the total cattle examined infection was recorded 20.7% in females and 17.3% in males. In addition, 4.8%, 16.7% and 24.7% in cattle of less than one year, one to three years and greater than three years of age respectively. Based on body condition score a prevalence of 7.5%, 17.6% and 27.7% was recorded in good, medium and poor conditioned animals respectively. From all the risk factors significant association was observed in age and body condition variations of the animals ($p < 0.05$). Based on hematological finding PCV < 24 and PCV ≥ 24 in parasitaemic animals were 86.5% and 13.5% respectively with the mean of 21.08% whereas in aparasitaemic cattle 26.4% and 73.6% was observed respectively with 24.8% mean which revealed significant variation ($t=6.79$, $p < 0.05$). In conclusion, this study indicated that bovine trypanosomiasis is considered as a major constraint of livestock production in the study area. Therefore concerned bodies should have to design and implement appropriate and environmentally safe controlling strategies.

Key words: Bovine Trypanosomiasis • Konta Special Woreda • Prevalence • Ethiopia

INTRODUCTION

Trypanosomiasis is the main haemoparasite disease in domestic animal caused by the protozoan parasite Trypanosoma. It is one of the major constraints on animal production in area of African which have the greatest potential for significant increase in domestic livestock productivity. The parasite is transmitted biologically by the tsetse fly /Glossina/ species and infects animal over an area known as the 'tsetse belt', which extends approximately 10 million km² across 37 countries in Africa, from the Sahara Desert in the North to South Africa [1].

The disease is more prevalent in the southern, western and North western parts of Ethiopia where the primary vectors exists along the great river basin of Abay, Omo, Ghibe and Baro river [2]. The fly has infested an estimated 130,000 -200,000 square kilometer of fertile land in the country. But the report showed that the disease to be important even in non-tsetse infested high land part of the country [3].

In Africa the overall loss /both direct and indirect is estimated as 500 billion dollars a year in terms of mortality, abortion, reduced fertility, milk and meat production, loss of ability to work in traction animals. In addition to these,

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the disease is also responsible for an annual loss of millions of dollars in livestock production as a result of the cost related to treatment, prevention and vector control efforts. In Ethiopia 14 million heads of Bovine are at risk of contracting trypanosomiasis at any time [4]. In addition 20,000 heads of cattle die in every year and it declines the number of cattle particularly drought oxen. Therefore, trypanosomiasis are the major impediments to livestock development and agricultural production contributing negatively to the overall development in agriculture in general and to food self-reliance efforts of the nation in particular [5].

Trypanosomiasis can be transmitted through cyclical or mechanical transmissions. In cyclical transmission there is always development and replication of parasite in invertebrate host (arthropod). The most important trypanosome species are *T. congolense*, *T. vivax* and *T. brucei* [6].

In mechanical transmission the trypanosomes are introduced through feeding by biting flies or tsetse from one animal to the other biting flies, tabanus (Horse flies or Notorious flies) and stomoxys (Stable flies or Swift flies). Mechanically transmitted species are *T. evansi* (disease of camel) *T. equinum* (in horse) and also *T. vivax*. So, *T. vivax* transmitted in both cyclical and mechanical due to this its' distribution is very wide even in tsetse free areas. *T. equiperdum*, cause infection known as Dourine in equines, is transmitted ventrally (coitus) and then penetrate the genital mucosa and developed at the site of entry for up to 3 months [7].

The main clinical manifestations were anemia, emaciation intermittent fever, weight losses, lymphoid enlargement and loss of the body condition. Mortality varies from 50 to 70%. Infected cattle also had significantly lower packed cell volume values than non-infected cattle. In acute case death may coincide with crises when there is massive destruction of red blood cells [8].

Thin smear examination is the best means used for identification of morphology of species of parasite and in thick smear examination is used to detect the movements of the parasite but difficult to appreciate the typical morphology of the parasite. Concentration technique by using microhaematocrit centrifuge at 1500 revolution by the end of 4 minutes and identification motile trypanosomiasis in the buffy coat zone of micro hematocrit capillary tube using dark field illumination is most accurate of all diagnostic methods. In general diagnosis is solely attained by parasitological methods like dark ground phase contrast buffy coat technique

which can be used under field condition to detect the presence or absence of trypanosomes [9].

Controlling animal trypanosomiasis is a key component of poverty alleviation in tsetse-infested areas, improving productivity of livestock, as a set out to improve productive opportunities and living conditions of the rural poor. The control of trypanosomes involves control of tsetse fly population, chemotherapy and prophylactic treatment of animals at risk and use of trypanotolerant animals. However, combating African animal trypanosomiasis presents a highly challenging and complicated task and is hampered by several factors such as great fluctuation in the apparent tsetse density and variations in the composition of variant surface glycoproteins (CSGs) of trypanosomes that allows the parasite to escape the host's immune system [10].

The problem was seen to be prominent in areas bordering the Omo river basin where both cyclically and mechanically transmitted trypanosomiasis were reported. Konta special woreda is one such Woreda where there was serious complaint of the disease. Several attempts have been made to control trypanosomiasis in the woreda with chemotherapy and chemoprophylaxis being the most widely applied method [3]. Tsetse control currently practiced by means of insecticide (deltamethrin 1% spray) and targets and traps [17]. Both controlling methods have been implemented mainly through specifically designed joint project of the sciences and technology ministry but the disease is still a serious threat to the Konta special Woreda. Therefore this study was conducted to estimate the prevalence of bovine trypanosomiasis in the Woreda, to identify the existing trypanosomes species in study area and to assess the possible risk factors of the disease.

MATERIALS AND METHODS

Study Area: Konta special Woreda is located about 464 km south of Addis Ababa and 372 km west from Hawassa. The Woreda has total area of 250376 hectare. Altitude of the woreda ranges from 870 to 2850 m.a.s.l. with the proportion of 40% lowland, 54% midland and 6% highland but the selected peasant associations are lowland (Seri and Chebera) and midland (Cheta). Mean annual rainfall ranges from 500mm-2200mm and annual temperature is 22°C to 29°C and mixed agricultural production system is practiced in all highlands, midlands and lowlands. About 9.5% of the total area is used for livestock herding as extensive grazing area. The district comprises the population of 98,262 cattle 21,614 sheep 24,214 goats 588 donkeys 553 mule 521 horse and 43,074 poultry [11].

Study Population: The study population were local breed zebu cattle found in the three selected peasant associations of Konta special Woreda namely Seri, Chebera and Cheta. The animals used in the study are managed under small holder mixed crop- livestock farming system. Animals were allowed to graze freely during the day and housed at night. During sampling all sexes and all age groups were considered with the categories of less than 1year, 1-3 years and greater than 3 years of age [12]. The body condition of animals was also grouped as 'good' medium and poor' based on the method of body condition scoring for zebu cattle [13]. The animals in area mainly depend up on communal grazing fields and crop residues as feed source and watering points (spring and rivers).

Sampling Method and Sample Size Determination: The sampled animals were randomly selected from three purposively selected peasant associations (Chebera, Seri and Cheta). The sample size was determined by considering 23% expected prevalence [14] using 5% absolute precession at 95% confidence level [15], a total of 272 animals were sampled.

Trypanosome Survey: Parasitological and haematological techniques were employed. Accordingly, blood samples were obtained by bleeding marginal ear veins of cattle using a sterile lancet and drawing the blood in to the heparinized capillary tube up to 3/4th of the length. A small drop of blood from a micro-haematocrit capillary tube was applied to a clean slide and spread by using another clean slide at an angle of 45°. The smear was dried by moving it in the air and fixed for 2 minutes in methyl alcohol. The thin smear was flooded with Giemsa stain (1:10 solution) for 30 minutes. Excess stain was drained and washed by using distilled water. Then it was allowed to dry and examined under the microscope (x100) oil immersion objective lens [9].

The collected blood was sealed with crystal sealant and centrifuged for about 5 minutes with 12,000 rpm. After centrifugation the PCV (packed cell volume) level was measured using haematocrit capillary reader and the length of the packed red cells column is expressed as a percentage of the total volume of blood. Animals with PCV below 24% was designated to be anaemic [9].

Blood smear was done via cutting the centrifuged blood containing capillary tube 1mm above and below the Buffy coat layer using a diamond tipped pencil so as to include plasma and RBC (red blood cell) in the blood smear. The blood then expanded on to the clean glass slide, mixed well and covered with a clean cover glass.

Examination was done under 40x objective lenses and 10x eye piece magnification and the parasites were identified based on their morphology and movement in wet film preparation [16].

Data Management and Analysis: The collected raw data and the results of parasitological and haematological examination were entered into a Microsoft excel spread sheets program and then was transferred to SPSS version 20 for analysis. The prevalence of trypanosome infection was calculated as the number of positive animals as examined by Giemsa stain of thin blood film and buffy coat method divided by the total number of animals examined at the particular time. Pearson's chi-square (χ^2) was used to evaluate the association of different variables with the prevalence of trypanosome infection and independent t-test was used to compare the mean PCV value between parasitaemic and non parasitaemic animals. P-value less than 0.05 were considered as significant.

RESULTS

Out of 272 cattle examined. 52 (19.1%) were infected trypanosomes. The highest and the lowest prevalence were observed in Seri (21.6%) and in Cheta (16.7%) PAs respectively and the identified trypanosomes were 11.8% *T. congolense*, 5.5% *T. vivax* and 1.8% mixed (*T. congolense* and *T. vivax*). But there was no significant variation among the three PAs to the overall prevalence and trypanosome species identified ($P > 0.05$) (Table 1).

Based on sex variation higher trypanosomes infection was observed in females 30(20.7%) than males 22(17.3%) but there was no statistically significant difference ($P > 0.05$) (Table 2).

Based on the body condition the prevalence of trypanosomiasis was 7.5%, 17.6% and 27.7% in good, medium and poor body condition animals respectively which shows statistically significant variation ($p < 0.05$) (Table 3).

According to age category prevalence of bovine trypanosomiasis was 4.8%, 16.7% and 24.7% in animals less than one year, from one to three years and above three years of age respectively which showed statistically significant difference ($P < 0.05$)(Table 4).

Out of the total 52 parasitaemic animals 45(86.5%) were anaemic (PCV<24) however from 220 aparasitaemic animals only 58(26.4%) were anaemic (PCV<24). There was significant difference between the mean PCV values of parasitaemic and aparasitaemic animals ($t=6.8$, $P < 0.05$) (Table5).

Table 1: Prevalence of trypanosomiasis and identified trypanosome species in the three PAs

| PAS | No Examined | No Positive (%) | [95% CI] | T.congolense | T. vivax | Mixed |
|-------------------------------|-------------|-------------------------------|-----------|--------------|----------|----------|
| Seri | 97 | 21(21.6) | 13.9-31.2 | 14(14.4%) | 6(6.2%) | 1(1.03%) |
| Chebera | 91 | 17(18.7%) | 11.3-28.2 | 10(11%) | 5(5.5%) | 2(2.2%) |
| Cheta | 84 | 14(16.7%) | 9.4-26.4 | 8(9.5%) | 4(4.8%) | 2(2.4%) |
| Total | 272 | 52(19.1%) | 14.6-24.3 | 32(11.8%) | 15(5.5%) | 5(1.8%) |
| χ^2 (p-value)=0.74(0.69) | | χ^2 (p-value)=1.84(0.93) | | | | |

Table 2: Prevalence of Trypanosomosis based on sex of animals

| Sex | No of animals Sampled | No of positive animals | [95% CI] | χ^2 (p-value) |
|--------|-----------------------|------------------------|-----------|--------------------|
| Female | 145 | 30(20.7%) | 14.4-28.2 | 0.5(0.48) |
| Male | 127 | 22(17.3%) | 11.2-25 | |
| Total | 272 | 52(19.1%) | 14.6-24.3 | |

Table 3: Prevalence of Trypanosomosis based on body condition score of animals

| Body condition | No of animals Sampled | No of positive animals | [95% CI] | Odds ratio | χ^2 (p-value) |
|----------------|-----------------------|------------------------|-----------|----------------|--------------------|
| Good | 53 | 4(7.5%) | 2.1-18.2 | 1 | 8.48(0.014) |
| Medium | 125 | 22(17.6%) | 11.4-25.4 | 2.6[0.85-7.9] | |
| Poor | 94 | 26(27.7%) | 18.9-37.8 | 4.9[1.46-13.5] | |
| Total | 272 | 52(19.1%) | 14.6-24.3 | | |

Table 4: Prevalence of Trypanosomosis based on age of animals

| Age | No of animals Sampled | No of positive animals | [95% CI] | Odds ratio | χ^2 (p-value) |
|-----------|-----------------------|------------------------|-------------|----------------|--------------------|
| ≤1 year | 42 | 2(4.8%) | (0.58-16.2) | 1 | 8.82(0.012) |
| 1-3 years | 84 | 14(16.7%) | 9.4-26.4 | 4[0.86-18.5] | |
| >3 years | 146 | 36(24.7%) | 17.9-32.5 | 6.54[1.5-28.4] | |
| Total | 272 | 52(19.1%) | 14.6-24.3 | | |

Table 5: Comparison of mean PCV between parasitaemic and aparasitaemic cattle

| Condition | No examined | No Examined (PCV <24%) | No. Examined (PCV >24%) | Mean PCV | [95% CI] | t-test (p-value) |
|---------------|-------------|------------------------|-------------------------|----------|-----------|------------------|
| Parasitaemic | 52 | 45(86.5) | 7(13.5) | 21.08 | 19.9-23 | 6.8(0.00) |
| Aparasitaemic | 220 | 58(26.4) | 162(73.6) | 24.89 | 24.4-25.4 | |
| Total | 272 | 103(37.9%) | 169(62.1) | 24.2 | 23.7-24.6 | |

DISCUSSION

The present study revealed that from total of 272 randomly Selected cattle is in study area 52(19.1%) of animals were positive of which 21(21.6%), 17 (18.7%) and 14(16.7%) in Seri, Chebera and Cheta were recorded respectively. The overall prevalence of this study agree with the study reports of Ayele *et al.* [14] 23.0% in Daramallo district of Gamogoffa zone) but higher than the other reports of Ayana, Tesfaheywet and Getnet [17] (2.1%) and Rowlands *et al.* [18] (10.67%) in Amhara region. This is due to the presence of high tsetse fly density in this area [19].

In this study, two species of trypanosomes *T.congolense* and *T.vivax* have been identified. Out of the 52 trypanosomes identified *T.congolense* contributes 60.4% (32 of 52) while the rest 28.8% and 9.6% were contributed by *T.vivax* and mixed infection respectively. *T.congolense* was identified at higher proportion in all the three peasant associations which is in agreement with previous work of Rowlands *et al.* [20] who reported the proportions of 84%,in Ghibe valley. The reason for the high ratio of *T.congolense* then *T.vivax* could be partly associated with cattle may more readily develop immunity to *T.vivax* than *T.congolense* [21]. Also Cherenet *et al.* [3] reported as *T. vivax* was responsible for 90.9% of the

cattle trypanosome infections in the tsetse-free zones, which is due to the fact that *T.vivax* can be transmitted by mechanical vectors other than tsetse.

Based on sex the prevalence of bovine trypanosomiasis showed a slight increment in female (20.7%) than and male cattle (17.3%) but there was no significant difference ($P>0.05$). This result agreed with the reports of Feyissa *et al.* [22] with the prevalence of 15% and 13.7% and Abraham and Tesfaheywet [23] 30.7% and 26% in females and males respectively. This variation might be due to physiological differences [24].

In this study prevalence of trypanosomiasis was higher (24.7%) in cattle greater than three years of age followed by 16.7% in 1-3 years age and lower (4.8%) was detected from calves (<1 year age) with p-value <0.05. This great difference in prevalence between calves and the rest two age groups of cattle might be explained from the point of differences in management practices. Since adult animals travel long distance for grazing, watering and draft to the high tsetse challenged areas however calves are managed by keeping them around houses i.e. less exposed to tsetse flies also calves are slightly protected by maternal antibodies [25] and also tsetse flies are attracted significantly more by odour of large animals [26]

Based on body condition of the animals significantly high rate of infection was found in poor body conditioned animals (27.7%) followed by 17.6% in medium whereas lowest proportion (7.5%) was recorded in cattle having good body condition ($P<0.05$). This finding is come to an agreement with the findings of Samson and Mihreteab [22] 4.1%, 25.9% and 35% in good, medium and poor body conditioned animals respectively. This indicates that body condition loss might be as a result of infection. Trypanosomiasis is a chronic wasting disease characterized by slow progressive loss of condition [27].

In the present study the higher proportion (86.5%) of parasitemic cattle has PCV < 24% whereas only 26.4% were anaemic from aparasitaemic animals which showed significant difference ($t=6.8$, $P<0.05$). This results is relatively agreed with the previous findings of Feyissa *et al.* [20] in Gihibe valley, which was stated that the average PCV of parasitologically negative animals was significantly higher than the average PCV of parasitological positive animals [23].

CONCLUSION

In this cross-sectional study an overall prevalence of 19.1% Bovine trypanosomiasis was recorded. This indicates that trypanosomiasis is still an important disease

of cattle in Konta special Woreda. A bit prevalence variation was observed among selected PAs and with sex difference but significant association was observed with age and body condition of the animals. Two species of trypanosomiasis, *T. congolense* and *T. vivax* were identified and high proportion of lower PCV value (< 24) was recorded in infected animals whereas in aparasitaemic animals' higher proportion were found none anaemic. In conclusion, the study indicated that trypanosomiasis was the major constraint of livestock production in the study area. Therefore strategic control of bovine trypanosomiasis including vector control should be strengthened.

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