Trypanosomosis and its Associated Risks in Cattle Population of Dangur District of Benishangul Gumuz Regional State, Western Ethiopia

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Abstract: Cross sectional study was conducted in Dangur district of Benishangul Gumuz Regional State between May and June, 2015 to determine the prevalence of cattle trypanosomosis, the prevailing species of trypanosomes and to identify associated risks. Parasitological (buffy coat technique) and haematological (measuring packed cell volume) procedures were employed to analyze the blood samples collected from (n=408) randomly selected cattle (Bos indicus). The overall prevalence of trypanosomosis was 46(11.27%). The infection was mainly caused by T. vivax 38  (77.55%)  followed  by  T.  congolense 9(18.37%)  and  mixed infection of T. Congolense and T. vivax 2(4.08%). The variation in prevalence was statistically significant. The mean packed cell volume (PCV) value of parasitaemic animals was statistically significantly (p <0.05) lower (21.75%) than that of aparasitaemic animals (25.52%). Statistically significant (p =0.007, \( \chi^2=9.984 \)) trypanosomosis prevalence difference was recorded among the study sites. The prevalence showed no significant difference in susceptibility between sex categories, age groups and body conditions. The study revealed that trypanosomosis is an important disease of cattle in the study area signifying the need to devise control strategies towards the diseases to alleviate its adverse impact.

Key words: Cattle · Dangur district · PCV · Prevalence · Risk factor · Trypanosome · Trypanosomosis

INTRODUCTION

Trypanosomosis is a complex disease caused by unicellular parasites found in the blood and other tissues of vertebrates including livestock, wild life and people [1]. It is one of the most prevalent and important disease in Ethiopia limiting livestock productivity and agricultural development [2].

The general distribution of tsetse flies is determined principally by climate and influenced by altitude, vegetation and presence of suitable host animals. Ethiopia is located at the East end of the African tsetse belt and tsetse flies are confined to Western, Southwestern and Southern regions [2,3] between longitude 33° and 38°E and latitude 5° and 12°N of an area covering 220,000 km²[4]. These areas are located in the low lands and along the country’s larger rivers such as the Blue Nile/Abay, Baro/Akobo, Didessa, Ghibe and Omo. Five species of Glossina namely: Glossina morsitans submorsitans, Glossina pallidipes, Glossina tachinoides, Glossina fuscipes fuscipes and Glossina longipennis were recorded in Ethiopia [5].

There are five economically important animal trypanosome species in Ethiopia: Trypanosoma congolense, Trypanosoma vivax, Trypanosoma brucei brucei, Trypanosoma evansi [6] and Trypanosoma equiperdum [7]. The most prevalent trypanosome species in tsetse-infested areas of Ethiopia are T. congolense and T. vivax. In Africa, T. vivax is transmitted both cyclically by Glossina and mechanically by other biting flies such as horse flies (Tabanidae) and stable flies (Stomoxys). It circulates in several species of ungulates including cattle, small ruminants, equids, camelids and wild animals such as antelopes [8].

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Earlier works [9, 10] have described that as the distance from recognized edge of tsetse belt areas increase, the species of trypanosome most encountered and diagnosed is *T. vivax*, because *T. vivax* has the ability to adopt and establish itself in the absence of tsetse flies and is transmitted by other biting flies. The knowledge of the status of the disease prevalence and the associated risks are very important for understanding the epidemiology of the disease and to devise suitable control measures. Therefore, the aims of the present study were to determine the prevalence of trypanosomosis and its associated risks.

**MATERIALS AND METHODS**

**Study Area:** Ethiopia is divided into administrative regions. Each region is divided into zones and zones are divided into districts which are further divided into kebeles. The study was conducted between May and June, 2015 in Dangur district of Metekele zone, Benishangul Gumuz Regional State. The region consists of three administrative zones namely: Asossa zone, Kemashi zone and Metekele zone and twenty districts. Dangur district is located in Metekele zone covering an area of 8387km² with altitudinal range of 1200-3131 meters above sea level. The study was conducted in three kebeles hereafter called sites namely: Beles no.2, Borenja and Dangur town. The average annual rainfall is 1250mm and its average temperature is 28°C [11]. The livelihood of the society largely depends on mixed livestock and crop production having livestock population of 38300 cattle, 31597 goats, 15056 sheep, 7102 equines and 68088 poultry [12, 13]. The major livestock diseases of the area are trypanosomosis, PPR, sheep and goat pox, Lumpy skin disease and Newcastle disease.

**Study Design and Study Animals:** Cross sectional study design was employed. The animals used for this study were local zebu cattle (*Bos indicus*), which are usually kept under an extensive husbandry system grazing the communally owned pastureland throughout the year. The studied cattle were herded together during the day time and returned to their individual owner’s farmstead each evening. The body condition of each of the study cattle was scored as good, medium and poor [14]. Concurrently, their age was determined based on De-Lahunta and Habel [15] principles as young (≤ 2 years old) and adult (> 2 years old).

**Sampling Techniques and Sample Size Determination:** The study sites (Beles no.2, Borenja and Dangur town) were purposively selected as convenient. The animals were sampled randomly involving both sexes, all age groups and all types of body conditions. The desired sampling size was calculated according to the formula given by [16]. As there have been no published studies reported in this area, the sample size was determined based on the expected prevalence of 50%, confidence level of 95% and 5% desired absolute precision. As result a total of 384 cattle were calculated but increased to (n=408) to increase precision and these cattle were sampled at their communal grazing area using simple random sampling.

**Study Methodology**

**Packed Cell Volume (PCV) Determination:** Blood samples were obtained by puncturing the marginal ear vein with a lancet and collected directly into a pair of heparinised capillary tubes. The tubes were then sealed at one end with crystal seal. PCV was measured in a micro-haematocrit centrifuge (Hermunle Labortechnik, type Z, Germany). The capillary tubes were placed in microhaematocrit centrifuge with sealed end outermost. Then the tube was loaded 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 5 minutes. After centrifugation, the capillary tubes were placed in a haematocrit reader. The length of the packed red blood cells column is expressed as a percentage of the total volume of blood. Animals with PCV less than 24% were considered to be anaemic [17].

**Buffy Coat Technique:** Heparinised microhaematocrit capillary tubes, containing blood samples were centrifuged for 5 minutes at 12,000 rpm. After the centrifugation, trypanosomes were usually found in or just above the buffy coat layer. 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 the capillary tube was expressed onto a glass slide and covered with cover slip. The slide was examined under x40 objective and x10 eye piece for movement of parasite (18). Trypanosome species were identified according to their morphological descriptions as well as movement in wet film preparations [17].
Data Analysis: All the collected raw data and, the results of parasitological and haematological examination data were entered into a Microsoft excel spread sheets program and then was transferred to Intercool STATA version 10.0 for analysis. The prevalence of trypanosome infection was calculated as the number of positive animals as examined by buffy coat method divided by the total number of animals examined at the particular time. Pearson’s chi-square ($x^2$) was used to evaluate the association of different variables with the prevalence of trypanosome infection. In all of the statistical analysis, a confidence level of 95% is used and P-value of less than 0.05 (at 5% level of significance) was considered as statistically significant.

RESULTS

Trypanosomes Infection Prevalence: Out of (n=408) total cattle examined, 46(11.27%) cattle were infected with trypanosomes. The proportion of trypanosomes infection rate indicated that $T.\text{vivax}$ 38(77.55%) was the predominant species followed by $T.\text{congolense}$ 9(18.36%) and their mixed infections 2 (4.08%) as indicated below (Table 1). The infection rate difference between the trypanosomes species was statistically significant ($p =0.0001, x^2=315.75$).

Packed Cell Volume Measurement Findings: The overall mean PCV values of examined cattle were 25.1%. The mean PCV value of infected cattle was lower (21.75%) than that of uninfected cattle (25.52%) as shown below (Table 2). These differences in PCV values between infected and uninfected cattle were statistically significant ($p =0.0001, x^2=15.663$).

Trypanosomosis Prevalence and its Associated Risks: Among the study sites, the highest trypanosomosis prevalence (19.13%) was recorded in District by National Tsetse and Trypanosomosis Control Measures. The trypanosomosis prevalence differences among the sites was statistically significant ($p =0.007, x^2=9.984$). Higher trypanosomosis prevalence (13.75%) was recorded in young animals ($\leq$ 2 years old) than (9.13%) in adults ($>2$ years old) but the variation in prevalence between the age groups was statistically non-significant ($p =0.141, x^2=2.168$). Similarly, higher infection rate was determined in females (12.6%) than males (9.3%), though, the difference was not statistically significant ($p =0.430, x^2=0.512$). The highest infection rate 11(15.27%) was recorded in poor body condition cattle, however, the variation of trypanosomosis prevalence among the different body conditions was not statistically significant ($p =0.343, x^2=2.142$). The relationship between trypanosomosis prevalence and associated risks such as study sites, age, sex and body condition was summarized as follows (Table 3).

DISCUSSION

The overall prevalence of bovine trypanosomosis in the study area was 46(11.27%). The finding of the current study is in agreement with previous works conducted in Ethiopia by different researchers: Shimelis et al. [19] studied epidemiology of tsetse transmitted trypanosomosis prevalence in Dembecha and Jabitehenan of Abay (Blue Nile) basin of Northwest Ethiopia and indicated prevalence rate of 12%. Mekuria and Gadisa [20] reported 12.41% prevalence in Metekele and Awi zones of Northwest Ethiopia. NTTICC, [21] demonstrated prevalence of 12.24% in Dangur district, the current study area. Regasa et al. [22] reported a prevalence of 12.28% in Bedele, southwest Ethiopia.

However, lower trypanosomosis prevalence (1.48%) was recorded in the study district [23]. This might be attributed to the control measures undertaken in the district by National Tsetse and Trypanosomosis Control.
Table 3: The prevalence of bovine trypanosomosis and its association with various risk factors in Dangur district

<table>
<thead>
<tr>
<th>Variables</th>
<th>No. examined</th>
<th>No. positive</th>
<th>Prevalence (%)</th>
<th>p-value</th>
<th>$x^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sites</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Beles no.2</td>
<td>115</td>
<td>22</td>
<td>19.13</td>
<td>0.007</td>
<td>9.984</td>
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<tr>
<td>Dangur town</td>
<td>185</td>
<td>16</td>
<td>8.65</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Borenja</td>
<td>108</td>
<td>8</td>
<td>7.41</td>
<td></td>
<td></td>
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<tr>
<td>Total</td>
<td>408</td>
<td>46</td>
<td>11.27</td>
<td></td>
<td></td>
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<tr>
<td>Age, years</td>
<td></td>
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<td></td>
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<tr>
<td>≤2</td>
<td>189</td>
<td>26</td>
<td>13.76</td>
<td>0.141</td>
<td>2.168</td>
</tr>
<tr>
<td>&gt;2</td>
<td>219</td>
<td>20</td>
<td>9.13</td>
<td></td>
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<tr>
<td>Total</td>
<td>408</td>
<td>46</td>
<td>11.27</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>151</td>
<td>15</td>
<td>9.93</td>
<td>0.430</td>
<td>0.512</td>
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<tr>
<td>Female</td>
<td>257</td>
<td>31</td>
<td>12.06</td>
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<tr>
<td>Total</td>
<td>408</td>
<td>46</td>
<td>11.27</td>
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<tr>
<td>Body condition</td>
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<tr>
<td>Good</td>
<td>149</td>
<td>18</td>
<td>12.08</td>
<td>0.343</td>
<td>2.142</td>
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<tr>
<td>Medium</td>
<td>187</td>
<td>17</td>
<td>9.09</td>
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<tr>
<td>Poor</td>
<td>72</td>
<td>11</td>
<td>15.28</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>408</td>
<td>46</td>
<td>11.27</td>
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</tbody>
</table>

Investigation and Control Centre (NTTICC) from 2012 to 2014. The higher trypanosomosis prevalence in the current study could possibly be attributed to the re-invasion of the area by biting flies.

Out of the 11.27% overall prevalence of trypanosome infection, 9.31% was due to *T. vivax*, 2.2% was due to *T. congolense* and 0.5% was due to mixed infections of these trypanosomes. The finding of this study showed that of the total trypanosome positive animals 38(77.55%) were found to be infected with *T. vivax*, 9(18.37%) were infected with *T. congolense* and the remaining 4.08% were infected with mixed infections of these trypanosomes. The higher proportion of *T. vivax* in this study was in agreement with the previous results of Bishaw, *et al.* [24] who reported 80% *T. vivax* for tsetse infested areas of West Gojam zone, Northwest Ethiopia. Lelisa *et al.* [25] reported *T. vivax* proportional prevalence of 81.82% in the neighboring Mandura district, western Ethiopia. Mihret and Mamo, [26] reported a higher *T. vivax* infection rate (90.5%) at districts of East Gojam zone of Ethiopia bordering Blue Nile valley. This predominance of *T. vivax* infection in cattle could possibly be attributed to the presence of major mechanical vectors and more efficient transmitters of *T. vivax* in the study area.

The overall mean PCV value of examined cattle was 25.1%. The mean PCV value of infected cattle was statistically significantly ($p = 0.0001, x^2 =15.663$) lower (21.75%) than that of uninfected cattle (25.52%). This finding was demonstrated by earlier works [27-29]. This study substantiated the fact that anemia is characteristic of trypanosomosis; though, other factors are also anticipated to affect the PCV profile of animals. Bosche and Rowlands, [30] showed that diseases such as fasciolosis, gastrointestinal parasitism, vector-borne diseases and nutritional deficiencies can also cause reduced PCV.

Higher trypanosomosis prevalence (13.75%) was recorded in young animals (≤2 years old) than (9.13%) in adults (>2 years old), though, the variation in prevalence between the age groups was statistically non-significant ($p = 0.141, x^2=2.168$). Previous works report similar results [31, 32, 25]. Similarly, higher infection rate was determined in females (12.6%) than males (9.3%), however, the difference was not statistically significant ($p =0.430, x^2=0.512$). The result agrees with earlier reports [25, 28, 33]. This study showed the highest trypanosomosis infection rate in poor body condition cattle 11(15.27%). However, the discrepancy in prevalence among the body conditions was statistically non-significant ($p = 0.343, x^2=2.142$). This result coincides with prior findings [34, 25].

Trypanosomosis prevalence varies statistically significantly across the district with the highest trypanosomosis prevalence (19.13%) in Beles no.2 and the lowest (7.4%) in Borenja. This agrees with previous reports [35]. This might be attributed to the relative ecological pattern variation such as microclimate of the sites, distance between herds, animal herd density and other factors which, in turn, influences tsetse fly and/or other biting flies’ population and type present in each study sites.
CONCLUSIONS

The present study indicated that *T. vivax* was the most prevalent trypanosome species in the area. Also, it revealed that trypanosomosis causes anaemia in cattle lowering the PCV values. Moreover, animal level parameters like sex categories, age groups and body condition were not found to be associated risks. Further, it was showed that trypanosomosis is a prevailing disease and a potential threat that affects the health and productivity of cattle. Therefore, proper strategies have to be designed and implemented targeting both cyclically and mechanically transmitted trypanosome infections to minimize its effect on livestock production in Dangur district.

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REFERENCES


