Original Article

Veterinary Medicine

Haematological Response of West African Dwarf Bucks Experimentally Infected with *Trypanosoma brucei* and, treatment with Diaminazene Aceturate (Diminaze®)

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ABSTRACT [ENGLISH/ANGLAIS]

Changes in the haematological values were studied in fifteen West African Dwarf (WAD) goats experimentally infected with *Trypanosoma brucei* and later treated with Diminaze®. They were divided into two groups and housed in separate fly proof pens. Data on parasitaemia, rectal temperature, weight, packed cell volume (PCV), red blood cell (RBC), haemoglobin (Hb) concentration, mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCHC), and mean corpuscular haemoglobin concentrations (MCHC) were determined before infection, during infection and after treatment. Infected bucks developed chronic trypanosomosis which was characterized by intermittent pyrexia, slight drop in body condition and irregular parasitaemia. There was a significant difference ($p<0.05$) in the mean values of PCV, Hb concentration, RBC, MCH and MCV but a non significant difference ($p>0.05$) in MCHC when compared with the control animals. However, it was observed that, for all parameters studied, treatment with Diminaze® led to rapid improvement to its initial status prior to infection and no statistical significant difference was observed when compared with the control animals. The result from this investigation show that *T. brucei* infection caused significant changes in the haematological values WAD goats but recovery was rapid following treatment with Diminaze®.

Keywords: West African Dwarf goats, *Trypanosoma brucei*, haematology, diminazene aceturate

RÉSUMÉ [FRANÇAIS/FRENCH]

Changements dans les valeurs hématologiques ont été étudiés dans une quinzaine de nains d'Afrique de l'Ouest (WAD) chèvres infectés expérimentalement avec Trypanosoma brucei et plus tard traités avec Diminaze ®. Ils ont été divisés en deux groupes et logées dans des mouches stylos preuve distincts. Les données sur la parasitémie, la température rectale, le poids, l'hématocrite (PCV), de globules rouges (RBC), de l'hémoglobine (Hb), le volume globulaire moyen (VGM), la moyenne de l'hémoglobine corpusculaire (CCMH), et les concentrations moyennes d'hémoglobine corpusculaire (CCMH) ont été déterminées avant l'infection, l'infection pendant et après le traitement. Mâles infectés ont développé la trypanosomose chronique qui se caractérise par la fièvre intermittente, légère baisse de la condition physique et la parasitémie irrégulière. Il y avait une différence significative ($p <0,05$) dans les valeurs moyennes de l'hématocrite, de la concentration d'hémoglobine, RBC, MCV et MCH mais non une différence significative ($p > 0,05$) MCHC en comparaison avec les animaux témoins. Cependant, on a observé que, pour tous les paramètres étudiés, le traitement avec Diminaze ® a conduit à une amélioration rapide de son état initial avant l'infection et pas de différence statistiquement significative n'a été observée en comparaison avec les animaux témoins. Le résultat de cette enquête montrent que l'infection à T. brucei a provoqué des changements importants dans les valeurs hématologiques chèvres WAD mais la reprise a été rapide après le traitement avec Diminaze ®.

Mots-clés: Chèvres naines d'Afrique de l'Ouest, Trypanosoma brucei, l'hématologie, diminazène

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INTRODUCTION

Haematological changes have been reported in African animal Trypanosomiasis [1- 6]. The severity of trypanosomiasis is highly variable and depends on the trypanosome species and strain [7, 8]. *Trypanosoma vivax (T.vivax)* and *Trypanosoma congolense* has been reported to be the most prevalent species encountered in small ruminants in Benue State, Nigeria [8] while *Trypanosoma brucei* is more virulent than *T. vivax* in Savannah brown infected goats [6]. However, not much is known about trypanosome infections on the haematological changes of the trypanotolerant West African Dwarf (WAD) goats infected with *T. brucei* and changes after treatment.

Therefore, this study was designed to investigate the haematological values of West African Dwarf (WAD)

goats experimentally infected with *T. brucei*, and their response to treatment with diaminazene aceturate.

MATERIALS AND METHODS

A total of 15 adult (1.5 and 2 years old) apparently healthy WAD goats, weighing between 8 and 12kg were used for this study. The goats were purchased from two different goat markets, Imo State and Abia State respectively, Nigeria. They were housed in various pens at the College of Veterinary Medicine, Michael Okpara University of Agriculture, Umudike for a 21 days period of acclimatisation. During this period, clinical examination and screening of haemoparisties was carried out on all animals. Furthermore, all the animals were treated intramuscularly with Diaminazene aceturate at 3.5mg/kg body weight, vaccinated against PPR (obtained from Nigeria Veterinary Research Institute,Vom) and oxytetracyclin L.A (Global organies Ltd) at 20mg/kg. A broad spectrum anthelmintics; ivermectin (Hebei Yanuzheng Pharmaceuticals co. Ltd) was also administered subcutaneously. Body weight was recorded weekly. Animals were later transferred to a fly proof pen were they were randomly selected into two groups (A and B) containing eight and seven bucks respectively. Each group kept in separate pens. All animals were fed commercial concentrate at 12-14% crude protein. Fresh grasses, water and salt licks were also given to them ad-libitum.

The animals were conditioned for 2 weeks during which they were examined clinically as well as for the presence of trypanosomes after which, they were infected. To infect the designated bucks (day 0), blood was obtained from the infected mice and diluted in a phosphate buffer solution, and 2ml of the latter, containing 10^4 parasites, was then injected through the jugular vein of each Group A bucks. Group B bucks were kept as controls. The parasite *T. brucei* (Federe CT/28 strain) was obtained from the National Institute for Trypanosomosis Research Vom, Plateau State, Nigeria and inoculated into mice for multiplication and maintained until required. Parasitaemia was estimated according to the method described by Murray *et al*. [9].

Clinical examination began 2wks before infection and continued throughout the experiment in all the bucks. Weight and rectal temperature were taken daily using electronic weighing balance and digital thermometer respectively. Blood samples were collected from all bucks on weekly basis throughout the experiment through the jugular vein with vaccutainer tubes containing EDTA. Samples were labelled legibly and transported to the laboratory for analysis. All Infected bucks were treated intramuscularly with Diaminazene aceturate (Diminaze®) at 3.5mg/kg body weight after Ten weeks of infection (day 70).

Clinical and haematological parameters were continually monitored for six weeks to ascertain the pattern of recovery. Presence of trypanosome was done by the buffy coat method [9]. The packed cell volume (PCV) was determined by the standard microhaematocrit method described by [10] the red blood cell (RBC) by the haemocytometer method and haemoglobin (Hb) concentration by the cyanomethaemoglobin method. Mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCHC), and mean corpuscular haemoglobin concentrations (MCHC) were calculated based on the method described by (10). Data were subjected to Student's 't' test using the Statistical Analysis System software package (SAS). Data are presented as mean ± SE. The level of significance was set at $p<0.05$.

RESULTS

Following infection, clinical disease was characterized by marked pyrexia, pale mucous membrane and enlarged lymph nodes which was seen in two bucks. All infected goats had intermittent, irregular parasitaemia and only few parasites were seen per 100microscopic fields. As the level of parasites detected in the blood rose, there was a steady rise in rectal temperature in the first week post infection, thereafter it became intermittent on day 14 and 21, peaking at day 28 (average of 40°C) till day 70 post infection. A reduction in body weight was not observed until day 56 and became obvious at day 70 post infection. The bucks were generally in good condition throughout the duration of the experiment, even though the control animals were ultimately heavier than the infected animals. A reduction in body weight was not observed until day 56 and became obvious at day 70 post infection. All infected bucks showed a decrease in total body weight when compared with the control post infection. Improvement in their body condition was noticed 1-2 weeks post treatment.

The changes in the hamaetological values of *T. brucei* infected bucks and control are shown in figures 1-6. With a steady rise in parasitaemia, all infected bucks developed

anaemia with a drop in erythrocyte (Hb, PCV and RBC) values (fig. 1, 2 and 3). The mean Hb concentration, PCV and RBC value results of all infected bucks deferred significantly ($p<0.05$) from the control bucks. The mean values for *T.bucei*-infected and control bucks were PCV (19 and 27%), Hb concentration (48 and 56%), and RBC counts (4.4 and 5.5) respectively. However, a steady decline in these values was observed within 7 days post treatment. There was no appreciable variation in the electrolyte mean values of the controls. There was also a significant increase ($p<0.05$) in the MCH and MCV values of infected bucks during the infective phase from the mean values for the control bucks (fig. 4 and 5). A sharp increase was recorded 7 days post infection and remained elevated until treatment. The changes in the MCH values followed a similar pattern with that of MCV. The mean MCHC values of infected bucks fluctuated throughout the course of the experiment; however, there was no statistical significant difference ($p>0.05$) when compared to the control bucks (fig. 6).

There was no significant difference ($p>0.05$) in all the haematological values of the infected animals post treatment when compared with values of the control bucks (fig 1-6).

DISCUSSION

The results from this investigation clearly demonstrate that *T.brucei* infection had adverse effect on the haematological values of WAD bucks. This result agrees with the result by Ogunsanmi *et al.* [5] on ewe infected with *T.brucei.* The slight reduction in body weight observed in this study agrees with reports of Adeiza *et al.* [6] and Adenowo *et al.* [11]. The predominant symptoms seen even though not pathogonomic were similar to finding by Raheem *et al*. [12] in *T. congolense* infected bucks but differs to Anosa *et al*. [13] in *T.vivax* infected goats and sheep. No death was recorded despite the gradual decline in body condition post infection in all infected animal unlike a report by Anosa *et al.* [13] where death was recorded. Therefore, the high survivability of these bucks may be attributed to the trypanotolerance of WAD goats, good plane of nutrition and management provided, and the trypanosome specie. The intermittent and irregular parasitaemia seen in this study confirms previous observation [3, 14, 5]. Previous reports [7, 12] partly attributed pyrexia to the toxic metabolites produced by the trypanosomes and this may be the case in the present study.

Anaemia observed during the post infection was the major haematological changes in *T. brucei* infected bucks. This was characterized by the decrease in erythrocyte values (i.e PCV, Hb concentration and RBC counts) and this result is in agreement with observation of Anosa [7] in sheep and goats infected with *T.vivax,* bulls infected with *T.vivax* and *T.congolense* [4], ewe infected with *T.brucei* [5] and [6] in goats infected with*T.brucei* and *T.vivax.* The decrease in the PCV, Hb concentration and RBC count post infection may be attributed to the inverse relationship between pyrexia and anaemia due to the effects of toxic metabolites produced, and the effect of the parasite on host erythrocytes as reported [15].

The increase in MCH and MCV values may be due to increased erythropoiesis indicating that the erythroid response peaks as anaemia rises. This result is in agreement with observations of Fiennes [1] in cattle infected with *T. congolense* and [5] in sheep infected with *T.brucei*. However, a sharp decrease in MCH and MCV values were seen within one week post treatment. MCHC values of infected bucks were within normal range during the infection phase suggesting that anaemia was normochromic. Pathological and haematological changes are associated with trypanosome infection. The onset of anaemia and the extent, to which these values vary from normal, correlate closely with the appearance and duration of parasitemia. However, it was observed that following treatment with Diminaze®, there was a remarkable improvement in the clinical condition and haematological characteristics to its initial status prior to infection within one week of treatment.

CONCLUSION

The present study demonstrated that despite the trypanotolerance of WAD goats, *T. brucei* had significant effect in the haematological values of these goats, and that the severity of the infection is proportional to the duration of parasitemia, adequate nutrition and a good management practice. Also, treatment with Diminaze® showed rapid improvement to its initial status prior to infection.

Figure 1: Mean Hb (g%) in T.brucei post infection (day 0-70), post treatment (day 70-112) and control bucks.

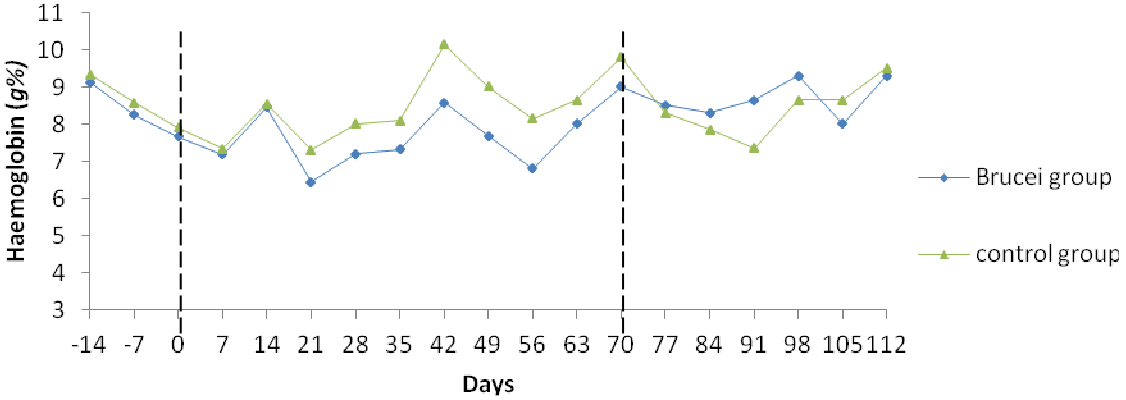


Figure 2: Mean PCV (%) levels in T.brucei post infection (day 0-70), post treatment (day 70-112) and control bucks.

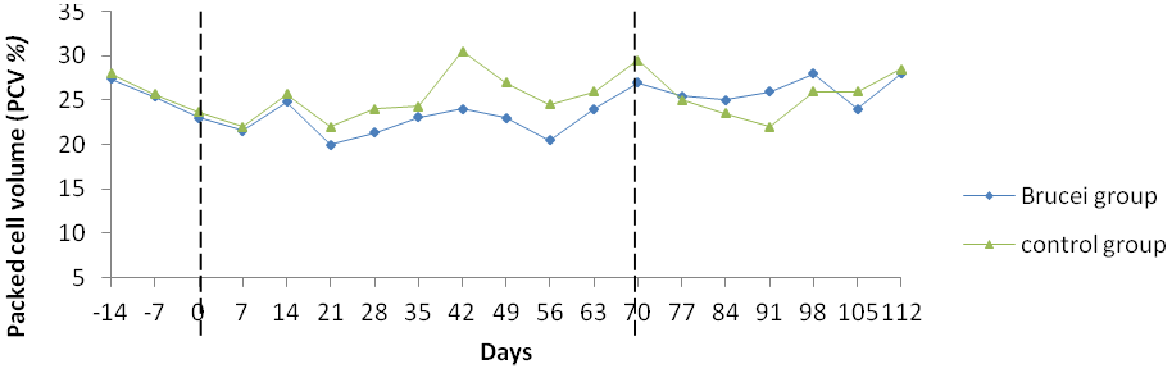


Figure 3: Mean RBC ($x10^6/\mu l$) counts level in T.brucei post infection (day 0-70), post treatment (day 70-112) and control bucks

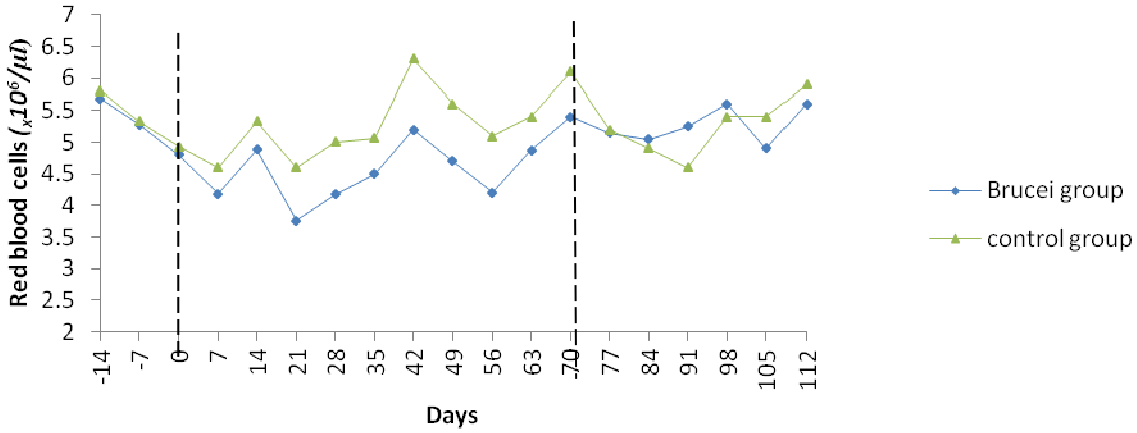


Figure 4: Mean MCH (pg) in T.brucei post infection (day 0-70), post treatment (day 70-112) and control bucks.

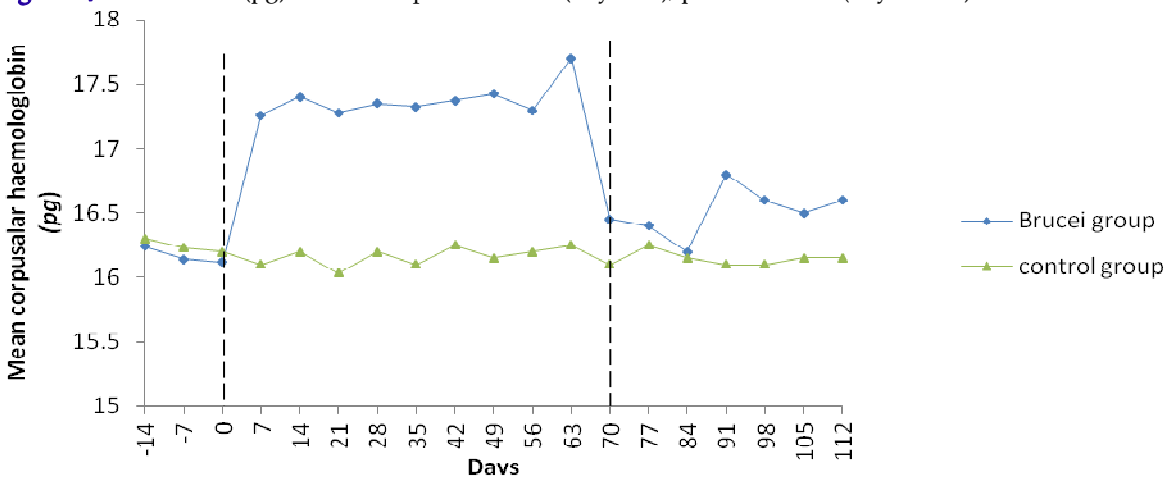


Figure 5: Mean MCV (fl) in T.brucei post infection (day 0-70), post treatment (day 70-112) and control bucks.

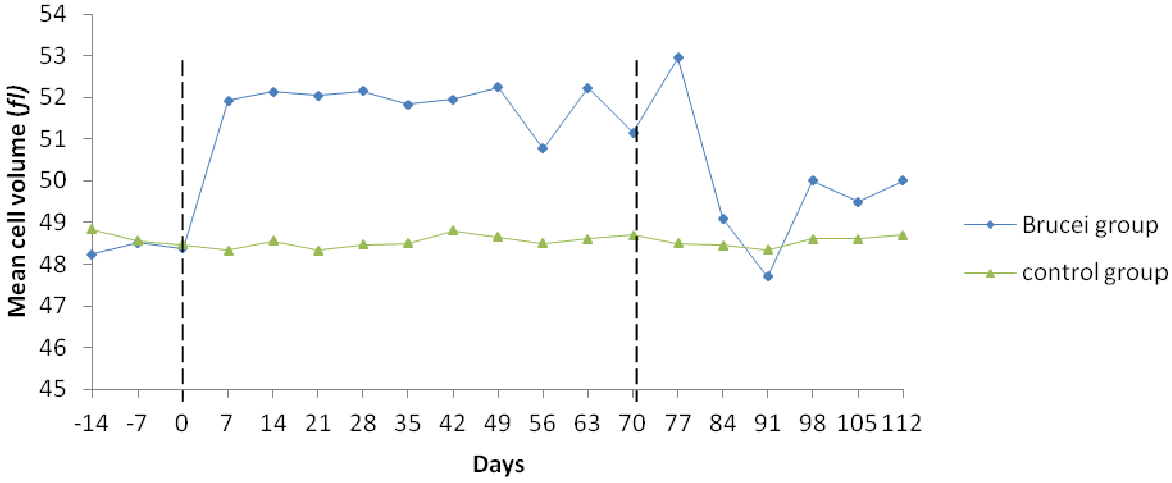
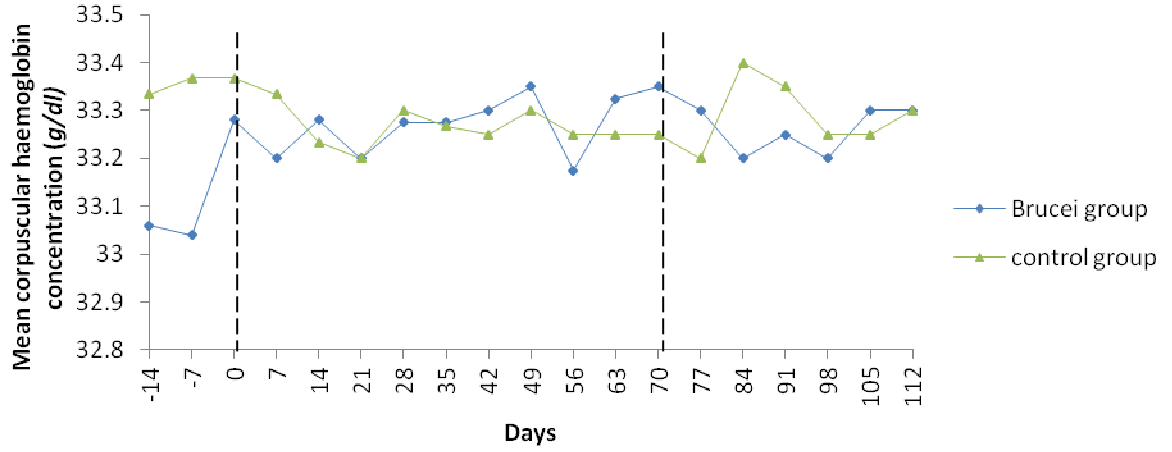


Figure 6: Mean MCHC (g/dl) in T.brucei post infection (day 0-70), post treatment (day 70-112) and control bucks.



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CONFLICT OF INTEREST

No conflict of interests was declared by author(s).