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Effect of Treatment on Haematology and Glucose Levels in *Trypanosoma brucei*-infected Grasscutters (*Thryonomys swinderianus*)

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SUMMARY

Captive reared grasscutters were experimentally challenged with *Trypanosoma brucei*, while the therapeutic effect of two trypanocides were compared based on animals' clinical, haematologic, glucose level and microscopic assessments. Red blood cell indices of all the rats were determined using standard procedures while blood glucose levels were determined *in situ* using glucometer. There was a significant difference in the packed cell volume and blood glucose levels, red cell count across groups, before infection, after infection and after treatment. There are no significant changes in the weight of the experimental animals. Histopathology showed liver and kidney vacuolar and tubular epithelial degeneration, respectively, with thrombosis in alveolar blood vessels.

KEY WORDS: Grasscutter, Trypanosomosis, Hematology, Glucose, Trypanocides, Efficacy.

INTRODUCTION

Rodents are known to be susceptible to the stercoraria trypanosomes (Jittapalapong *et al.,* 2008). Wildlife may not readily come down with trypanosomosis but they are strongly indicted in the zoonosis (Radostits *et al.,* 2006). The endemicity of the disease in Sub-saharan Africa is due to the abundance of the vector (tsetse fly), host and parasite factors. The narrow wildlife-human interphase in Eastern and Central Africa has aided morbidity and mortality patterns of human and animal trypanosomosis in man and animals respectively. *Trpanosoma brucei* has a distinguishing morphology; longer incubation period in the animal host coupled with its tissue invasiveness may precipitate a wasting condition eluding diagnosis (Ikede & Losos, 1972).

Haematology and blood biochemistry analyses are valuable tools for evaluating health of wildlife in respect to diagnosing diseases and clinical monitoring of the patient (Lanzarot *et al.*, 2001; Lanzarot *et al.*, 2005).

Since the primary aim of grasscutter farming is protein production, there is need to know the

diseases that affect them in the wild. Studies have shown that certain factors influence haematological and biochemical parameters of grasscutter. Haematological and biochemical analyses of an animal's blood represent a good diagnostic aid for the assessment of physiological, nutritional and pathological conditions of animals. Many researchers have carried out different studies on the haematology and biochemical parameters on grasscutters especially when infected with trypanosome species such as *T. congolense and T,vivax,* however they are still insufficiently investigated especially the most virulent trypanosome species, *T. brucei.* Also, no comparative work has been carried out on the effect of blood glucose levels in trypanosome infected grasscutter. Knowledge of the haematological and plasma biochemistry values may be applied in physiological study, health diagnosis or in-depth study directed towards wildlife conservation while some other fast diagnostic methods like cytology may help in monitoring and screening of wildlife for any quick intervention and to monitor the activities, signs and future occurrence (tolerance) of *T. brucei* infected grasscutters. The result would be useful in improving the health status of Grasscutter (*Thryonomis swinderianus*) in captivity and for better understanding on the roles or economic implications of trypanosomosis in grasscutter farming.

MATERIAL and METHODS

Experimental animals & Design

Twenty sexually mature grasscutters comprising 10 males and 10 females were purchased for this experiment. The rats were well fed and adequately stabilized. The rats were divided into two treatment groups; Group A & Group B and three additional grasscutters serving as negative control (C). The rats were housed in the same pen under uniform atmospheric conditions. They were regularly fed throughout their period of acclimatization. The cages of the rats were well ventilated. The animals in the treatment group served as their positive control as samples were taken prior to infection.

Handling for infection

The rats were so handled as not to injure them. They were usually picked up from the cage by a handling net, and examined gently. Each cane rat was then held by using hard gloves one hand on the head region and the other at the tail region.

The strain of trypanosome used was the virulent *T brucei* obtained from Cattle and passage into albino rats from the National Trypanosomiasis Research Institute, Kaduna, Nigeria. Each of the cane rats in A & B was infected with $1x10^4$ /ml of the parasites intraperitonially, while those in C were not infected and serving as negative controls.

Sample collection

The grasscutters were restrained carefully according to the technique described by Donovan (2008) for bleeding before infection, after infection and after treatment. Whole blood samples were collected in heparinised sample bottles for hematology.

Treatment

The infected cane-rats were treated with two brands of trypanocidal drugs; Pantezine[R] and Berenil[R], 8 days after infection when the parasitaemia was about 1x 10^3/ml in each rat. The drugs were administered intramuscularly. The dosage for both treatments was 0.35mg/kg body weight.

Sample analysis

The blood samples were analyzed for hematological parameters pre & post infection and post treatment. Blood glucose level for each cane rat was determined *in situ* by the modified glucose oxidase method using glucometer (One Touch Basic[R], patent number D456, 083, Life Scan, California USA). The whole blood was sent to the clinical laboratory of Veterinary Pathology, University of Ibadan for haematological examination; red cell indices such as packed cell volume PCV, red cell count RBC were evaluated according to Jain 1986 using haemocytometric methods.

Statistical analysis

Results were expressed as the means ± standard deviation of the values for each parameter in each of the groups before infection, after infection and after treatment and these values were compared using dependent t-test while effect of treatment from control was inferred using ANOVA.

RESULTS

Table 1 shows the basal values of packed cell volume; weight, blood glucose levels and red blood cell count of the experimental grasscutter *T brucei* infected & Berenil treated group (A) showing their mean ± standard deviations post infection and treatment.

Table 2 shows the basal values of packed cell volume; weight, blood glucose levels red blood cell and white blood cell counts of the experimental grasscutter- *T brucei* infected & Pantezine treated group (B) showing their mean ± standard deviations post infection and treatment. Table 3 compares the infected and non-infected groups for efficacy of treatment.

The trypanocides revealed different efficacies. Even though there was 85% mortality across groups (A&B), the Berenil treated group showed signs of recovery clinically and haematologically post treatment significantly ($P<0.05$) than the Pentezine treated group where acute and drastic changes were observed. Others included fluctuating fever, loss of appetite, weakness and lymphadenomegally. Histopathology from some of the tissues of trypanosome infected grasscutters included liver and kidney vacuolar and tubular epithelial degeneration, respectively, with thrombosis in alveolar blood vessels.

There was statistical significance ($p<0.05$) in the difference in glucose values and red cell indices in between groups. Thus the effect of the trypanocides was felt in group A as the animals seemed to recover.

DISCUSSION

The study has shown that the haematological values of the experimental grasscutters are very much comparable with those of the captive reared grasscutters as reported by Ogunsanmi *et al.*, (2002). The packed cell volume (PCV) for the basal value before infection is 45.1±3.8

which is slightly higher than that of the wild grasscutter and captive reared grasscutter: 41.5±1.2 and 43.2±5.3 respectively. Packed cell volume (PCV) was found to be lower in the grasscutters than in African giant rat, but higher than those of pangolin, White Fulani cattle, West African Dwarf sheep and goats. The PCV dropped six days after infection and after comparing the means, there were significant changes in these values ($p>0.05$). It is known that trypanosomes cause significant level of anaemia in mammals. This is because the parasites cause haemolysis in the circulatory system of the animals.

There are changes in the white blood cell counts post-treatment. After infection, the WBC of group A was 6.7±1.2 and that of group B was 8.6±1.2. Six days after treatment, the WBC of group A increased significantly to 9.0±0.9 but not much change in group B. The WBC decreased nine days after treatment in group A to 6.4±0.6. This value obtained is much comparable with the work of Ogunsanmi *et al*., (2002), who reported the basal value of WBC in captive reared grasscutter to be 6.1±1.1. Thus, indicating that trypanosomiasis in grasscutters also causes leucopenia **(**Seifert, (1996**),** which further reduces the animals' immunity and thereby exposing them to other infections.

There was a sudden decrease in the blood glucose of each animal after infection. This finding also agrees with Soulsby (1982)**,** who reported that blood form of trypanosomes absorb nutrients such as glucose by a mediated mechanism of membrane transport. Information on the blood glucose levels in animals in Nigeria is very scarce however Lasisi & Isehunwa (2011) determined minimum blood glucose levels required to maintain normal physiologic processes in farm animals as 53.2-65.0 mg/dl; the blood glucose levels of grasscutter (*Thryonomis swinderianus*) have not been reported in Nigeria. In this work, the mean basal blood glucose values of grasscutters (*Thryonomis swinderianus*) were 230±23.1mg/dl.

Pathological lesions observed in some of the tissues of trypanosome infected grasscutters were liver and kidney vacuolar and tubular epithelial degeneration, respectively, with thrombosis in alveolar blood vessels. These are in agreement with Soulsby (1982) and Shah-Fischer and Say (1989), who also reported organ degenerative changes in animal trypanosomiasis.

There is no significant changes in the weight changes of the experimental animals which showed that though the animals may be weak but the infection don't have much effect on the weight.

The fact that it was only the Berenil group which is the treatment group A that survived makes the trypanocide an effective one, even when compared to the uninfected group there marked degree of recovery.

The distribution of grasscutters in Africa, south of Sahara, the management system required, nutrition and reproductive performance have all been well studied. Variables such as nutrition, reproductive status, environment and degree of activity may change the ex-situ and in-situ situations of grasscutters. It is therefore

concluded that the results of this study can be employed as indices in the evaluation of the dietary quality and health clinical status of captive reared grasscutters. Nonetheless, the grasscutter is known to be economically important as an agricultural pest and its' meat is widely accepted by all classes of people. It is also a good laboratory animal for research studies.

For further and detailed information on health and disease of captive reared grasscutter, sexes should be used in evaluating the hematological parameters; also, animals should be collected from different location hence higher number of animals should be used.

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Table 1: shows the mean values of the hematological parameters from grasscutters pre and post infection with *T. brucei* and treatment Berenil

Parameter	Basal	Post infection	Post treatment
Weight kg	1.3±0.1	1.3±0.1	1.2±0.03
PCV %	45.1±3.8	36±2.0	34.5±2.1
Blood Glucose g/dl	230±23.1	154.8±20.1	140.5±61.5
RBC $*10^3/\mu l$	10.9±1.2	11.6±0.5	7.1±0.6
WBC $*10^3/\mu l$	6.7±1.2	6.7±1.2	9.0±0.9

Table 2: shows the mean values of the hematological parameters from grasscutters pre and post infection with *T. brucei* and treatment with Pantezine

Parameter	Basal	Post infection	Post treatment
Weight kg	1.3±0.1	1.4±0.1	1.2±0.1
PCV %	46.5±3.5	33.3±2.5	18±1.5
Blood Glucose g/dl	218±25.5	159.8±28.4	214±30.5
RBC $*10^3/\mu l$	11.2±1.4	10.1±0.7	6.1±0.4
WBC $*10^3/\mu l$	8.6±1.2	8.6±1.3	8.8±1.3

Table 3 compares the infected and non-infected group for efficacy of treatment.

Parameter	Control (uninfected)	Group A (post treatment)	Group B (post treatment)
Weight kg	1.3±0.1	1.2±0.03	1.2±0.1
PCV %	42±2.2	34.5±2.1	18±1.5
Blood Glucose g/dl	250±30	140.5±61.5	214±30.5
RBC $*10^3/\mu l$	11.9±0.8	7.1±0.6	6.1±0.4
WBC $*10^3/\mu l$	8.5±1.5	9.0±0.9	8.8±1.3

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