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Experimental trypanosomiasis in Yankasa Ewes: the body weight response

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Summary

Sleeping sickness (African Trypanosomasis) is an anthropozoonosis transmitted primarily by the tsetse fly. It is associated with a host of clinical indices ranging from fever, aneamia and anorexia to reproductive failures in man and his domestic animals. The main objective of this study is to appraise the responsiveness of the body weight as a clinical indicator of sleeping sickness in experimentally infected Yankasa ewes. Twelve mature Yankasa sheep (6 infected and 6 control ewes) were used in this study. Weekly body weights and daily rectal temperature were taken while blood samples for haematology were collected twice a week from all animals before and after the experimental infection. Undulating parasitaemia was observed, two days post infection and was sustained through out the study period of about fifty days in all the infected ewes. Decreased body weight was found to be very prominent in the infected animals. All the infected ewes progressively lost weight during the experiment with a decrease of about 17.9% of the original weights while the control ewes had increased by 4.2% at the end of the study period.The body weight is therefore a very sensitive parameter in the surveillance and management of Trypanosome infections especially in Yankasa ewes as experimental animal models.

Keywords: *Experimental African sleeping sickness; body weight; clinical parameters; yankasa ewes.*

Résumé

La maladie du sommeil est une anthropozoonose tranmsmie primairement par la mouche tsé-tsé. Il est associé avec les indices cliniques du récipient variant de la fiévre, anémie et manqué d'appetit a la perte de la reproduction chez l'homme et les animaux domestiques. Cette étude appreciait la reponse du poids corporel comme une indicateur clinique de la maladie du sommeil chez les yankassa ewe infectés experimentallement. Leurs poids corporel hebdomadaire et leur temperature rectale journaliére étaient prise pendant les échantillons de sang pour les analyses hématologiques étaient collectés 2 fois par semaine avant et aprés l'infection et analysés. Une parasitémie ondulante était observée 2 jour après l'infection et restait consistent durant la période de 50 jours chez tous les moutons infectés. On apercut une perte de poids durant l'experience avec une baisse de 17.9% du poids avant l'infection alorsque les controlles avaient une augmentation de 4.2% à la fin de l'étude. Le poids corporel est donc un véritable indicateur sensitif de l'infection trypanositaire chez les yankassa ewe.

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Introduction

African trypanosomiasis (African sleeping sickness) had constituted a major barrier to economic and social development in Africa; being a zoonotic disease of man and other lower animals [1]. Progressive weakness, emaciation, marked weight-loss and reduced growth rate had been reported as some of its clinical manifestations in infected humans [2], goats [3], sheep [4], calves [5] and pregnant cows [6]. The concept of growth monitoring has been globally accepted for the assessment of nutritional status in man [7]. However, the effectiveness or benefit of growth-monitoring in disease conditions had not been clearly spelt out in recent times.

Somatotropin (STH) or growth hormone (GH) is produced by the anterior lobe of the pituitary gland. This hormone stimulates the growth of various cells of the body, particularly effective with bone and muscular tissues [8]. Polyglandular endocrine failure due to inflammation of the pituitary, thyroid, adrenal and gonadal glands had however been reported in *Trypanosoma brucei* [9] and *T. vivax* [1] infected animals. Pituitary function tests conducted by Martin Reincke, *et al* [9], also suggested an unusual combined central (hypothalamic/pituitary) and peripheral defects in hormonal secretions in patients. This paper therefore reports our findings on the sensitivity of the body weight in experimental ovine trypanosomiasis.

Materials and methods

Twelve mature Yankasa ewes were accommodated in fly-proof house for a period of 6 months of acclimatization before the commencement of this investigation. During

this period, the animals were given Thiabendazole, orally and sprayed with pfizona (Pfizer Nigerian Ltd.) to control ectoparasitosis. Blood screening was also carried out to make sure that all the animals were free of endoparasites. The animals were fed 2% body weight of concentrates comprising of 40% cotton seed cake and 60% wheat bran or brewers dried grain. Local gamber hay, water and mineral salt-lick were provided *ad libitum* in the pens throughout the experiment.

Animals were selected into control and infected groups with 6 animals per group by stratified randomization of packed cell volume. Body temperature, body weights, parasitaemias, haemoglobin concentrations and packed cell volumes were monitored for about 32 days before infection and 50 days following *T. vivax* infection.

A stock of *T. vivax* (kabam/84-NITR-14)[1] was used for this study. Stabilates were cryopreserved at – 196°C in liquid nitrogen until used.

A donor ewe was inoculated with the trypanosome stabilate. On the second day of detectable parasitaemia, blood from the donor ewe was sub-inoculated intravenously to each of the 6 experimental ewes. Each inoculum contained approximately 3.5 X 10^7 trypanosomes in 10ml. of donor blood [10].

The packed cell volume (PCV) was determined by the micro-haematocrit centrifuge technique and values were read using the Hawksley microhaematocrit reader (Gelman Haksley Ltd. England). The haemoglobin (HB) concentration was measured by the cyanomethaemoglobin method using an electronic haemoglobinometer (Coulter Electronics Hearts, England), Parasitaemia was estimated daily using the haematocrit centrifuge technique HCT [11].

Daily body temperatures were taken using the clinical rectal thermometer and the weekly body weights were taken early in the morning using animal weighing balance (Mettler, England).

Values of all the above parameters were pooled, pre and post *T. vivax* infections for all ewes and the means ± SD compared using students-t-tests [12]. [1]Supplied by Dr. Elizabeth Kangwa Kyewalabye of the Department of Parasitology and Entomology, Faculty of Vet-Medicine, A.B.U., Zaria.

Results

All the infected ewes developed parasitaemia two days post infection. Parasitaemia was sustained throughout the experiment (Fig 1), while all the control ewes remained free of parasites throughout the study period. All the infected ewes were hyperthermic showing fluctuations of rectal temperatures from normal value (38.8°C) up to 42°C,

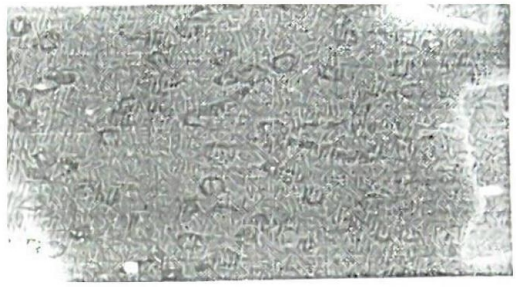

Fig. 1: A thin blood film of an infected ewe, showing low parasitaemia of *T. vivax*. H &E x100.

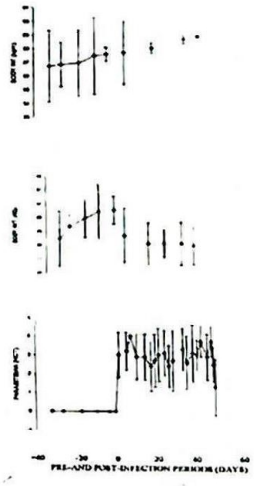

Fig. 2: The body weights of *T. vivax* infected and control Yankasa ewes during the study periods. The control ewes were not infected through out the experiment.

Table 1: The body weights of T. vivax infected and control Yankasa ewes during the study periods

Pre/Post Infection (Days)	Yankasa Ewes T.vivax Infected Ewes* (n=6)	Control Ewes* (n=6)
-32	24.9±4	26.7±2.6
-26	26.7±3.2	26.8±1.6
-17	27.8±2.7	26.9±2.4
-9	28.8±3.9	27.4±2.8
0	29.64±2	27.5±0.5
6	25.3±4	27.5±2.3
20	24.1±3.8	27.6±0.4
29	24.7±2	
39	24.1±3.1	28.5±0.3
40	23.8±2.3	28.7±0.1

* *Sig. diff. ($P \leq 0.01$).*

while the control ewes had normal temperatures throughout the experiment. Following the onset of parasitaemia, all the infected ewes developed anemia. Their PCV and Hb. dropped from respective pre-infection values of 29± 2.9% and 10.3± 0.9g/dl to 12.3± 2.1% and 6± 1.4g/dl. at about 50 days following *T. vivax* infection. There were no significant changes in PCV and Hb of the control ewes throughout the experiment (P= 0.01).

All the infected ewes progressively lost weight during the experiment in which about 17.9% of the original body weights had been lost, while the body weights of the control ewes had increased by 4.2% at the end of the experiment (Fig 2/table 1).

Discussion

The body weight had not received adequate attention itdeserves in African sleeping sickness compared to other recently studied diseases, considering the significant percentage decrease that was observed in this study. Yankasa ewes were chosen for this study because of their availability and sensitivity to African sleeping sickness. This study demonstrated clearly that experimental African trypanosomiasis significantly decreased the body weights of mature Yankasa ewes (P=0.01). The body weights decreased so consistently in the infected ewes and also increased consistently in the control ewes throughout the period of experiment (Fig 2). Similar weight loss had previously been reported in infected rats contrary to the control animals [13]. A dramatic drop in food intake was however found to have preceded this drop. Similar relationship had also been reported in *T.brucei. gambiense* infected patients dying in severe cachexia [14,15]. The present report, to our knowledge is its first kind to document a decrease as low as 17.9% in the body weight of Yankasa ewes post *T.vivas* experimental infection. Ikede and Losos [16] had earlier attributed some of the clinical signs in trypanosomiasis to pituitary damage in such infections. Neurological alterations had also been reported, using the Open-field test [13] method of behavioral assessment of trypanosome infected animals. The total distance covered, (motor activities) and latency to leave the central zone of the Open-field maize (exploratory ability) were found to be significantly different between both groups of rats at different weeks of this experiment. Cerebellar lesions might have been responsible for the observed decrease of locomotive activities of trypanosome infected animals. Locomotive disability on the other hand may adversely affect animal movements toward the feeding troughs and mastication of feed may also be painful and difficult.

Although growing pigs infected with *T. brucei* or *T. congolense* had been reported [17] to have mild infections with no significant effects on the voluntary feed intake, mean live-weight gain and feed conversion efficiency; the authors however concluded that growth failure or weight-loss could appear to have been due to combined effects of reduced feed intake and impaired efficiency of feed conversion in mammalian trypanosomiasis. In this study, the observed decrease in body weight of all the infected ewes corresponded with the parasitemia right from its onset; two days post infection till the end of the experiment, 50days later. Parasitemia had been reported as the cause of hyperthermia in the infected ewes [1] and Man [15]. Significant hyperthermia which accompanied peaks of parasitemia in trypanosomiasis had been postulated to be responsible for the anemia and anorexia observed in infected sheep and goats [1,18]. Apart from this clinical stress, pituitary lesions had also been found to be of primary significance [1], in the observed weight loss in trypanosomiasis. Parasitemia, hyperthermia, anemia, reduced locomotion and difficult mastication might have been responsible for the altered feed intake and impaired feed conversion efficiency of infected animals; which might have resulted to anorexia and cachexia observed as gross weight loss in these ewes.

In conclusion, the main finding of this study is that *T.vivax* infection remarkably affected the body weight of experimental animal model of sleeping sickness. Such a significant decrease in body weight could constitute an accurate index of trypanosomiasis. However, parasitological, hematological and histopathological investigations are necessary for confirmatory diagnosis; in order to carry out a cost effective management and surveillance of African sleeping sickness in Man and his domestic animals.

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