EFFECT OF NUTRITION ON THE RED BLOOD CELLS OF TRYPANOSOME-INFECTED FEMALE RATS

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ABSTRACT

Trypanosomiasis is of great interest to farmers in Sub-Saharan Africa. It is a disease that retards agricultural development in general and needs urgent attention. It has been noted that it causes aneamia in its host which often may lead to death. Many researches showed that dietary supplement can enhance trypanotolerance in various hosts. Diet is important in modulating the severity of its pathophysiological effects and can also influence the rate of recovery. Using a control diet (Diet 1)) was only chicks' mash. this research was conducted to determine the effect of moderate protein (mixture of 250 g of corn meal, 240 g of soyabean meal and 10 g of crayfish meal in chicks' marsh (Diet 2)), high dietary protein (mixture of 400 g of caseinogen and 300 g of soyabean meal in chicks' mash (Diet 3)) and high dietary carbohydrate (mixture of 400 g of dextrose and 300 g of corn meal in chicks' mash (Diet 4)) supplementation on rodent trypanomiasis. Diet 1 was used to feed rats in Cage A, Diet 2 was used to feed rats in Cage B, Diet 3 was used to feed rats in Cage C while Diet 4 was used to feed rats in Cage D. At the end of the experiment, it was observed that rats fed with Diet 2 (moderate protein diet) had the highest and significantly different (P < 0.05) red blood cell count than other treatments. This indicated that adequate nutrition reduces the effect of trypanosome and hence trypanotolerance in rats since trypanosome is known to attack red blood cells and vascular endothelium.

Keywords: Nutrition, Red blood cells, Trypanosome-infected female rats, Trypanomiasis, Pathophysiology

INTRODUCTION

Red blood cells are derived from haemopoietic stem cells (HSCs) (Rotti *et al.*, 1989). In foetal mammals, HSCs are found in the liver, spleen and bone marrow, but after birth and throughout adult life, they are found only in the bone marrow. The HSCs give rise to four major cell lineages. These are: erythriod (erythrocytes), megakaryocytiod (platelets), myeloid (granulocytes and monocytes) and lymphoid (lymphocytes) (Rotti *et al.,* 1989).

The embryonic development of an individual is influenced by many factors in which nutrition and disease are not left out. Good maternal nutrition is vital for the health and reproductive performance of women and the health, survival and development of their children (Mora and Nestel, 2000). It has been suggested that a brief period of under-nutrition may result in permanent alterations in growth that may be translated into pathology in later life (Barker, 1995).

Trypanosomiasis as a disease affects embryonic and adult development of an individual. An estimated 60 million people living in rural parts of East, West and Central Africa between latitude 14°N and 29°S are at risk of contracting the disease with an estimated 300,000 cases diagnosed and treated each year (WHO, 1998). Human African trypanosomiasis constitutes a major health problem in the African region. Given the resurgence of both human and animal trypanomiasis from the 1970s to the present, the epidemic potential, the high fatality rate, and significant impact on socioeconomic development, many countries requested more active support from WHO for the control of the disease (WHO, 2005).

Trypanosomiasis is one of the most important livestock diseases in sub-Saharan Africa (Morrison *et al.,* 1981). It affects both man and livestock (Siegmund *et al.,* 1979; Vaclav, 1980). The protozoan parasite that causes it is *Trypanosoma* species and is transmitted by tse tse flies (*Glosina* species) (Vaclav, 1980). The disease known as *nagana* retards livestock production (Stephen, 1986). It is caused by *Trypanosoma brucei*, *Trypanosoma congolense* or *Trypanosoma rhodesiense.*

Trypanosome is known to attack red blood cells and vascular endothelium. It concentrates more in the peripheral circulation (Jackson, 1979). The parasite causes tissue damage by utilization of metabolites, excretion of toxic substances, mechanical damage to the host's tissue and immune mediated injuries. Trypanosome infection is associated with anaemia, pyrexia (hyperthermia), cochexia, loss of appetite, reproductive disorders including abortions in pregnant animals and eventually death (Shaw and Dusanic, 1973; Ogwu *et al.,* 1980; Ogwu and Nuru, 1981; Tizard, 1985; Stephen, 1986). Improvement on host's nutrition is important in moderating the severity of pathophysiological effect of trypanosomiasis and also influences the rate of recovery (Katungka-Rwakishaya, 1996). It was also discovered that

supplementary feeding significantly reduces the severity of trypanosomiasis (Agyemang *et al.,* 1990; Little *et al.,* 1990). In line with this, the research was conducted to determine the effect of dietary supplementation of moderate protein diet, high protein diet and also high carbohydrate diet on the red blood cells of trypanosome infected female rats, using chicks' mash as control diet.

MATERIALS AND METHODS

Twenty 120-day-old female rats were used for this experiment. The rats were marked for identification and held in stainless wire-rats-cages in clean experiment animal house. The rats were placed five per cage and the cages were labeled A to D corresponding to four diets (treatments) given to each group. Diet 1 was given to rats in cage A (Treatment 1) which is the control. Diet 2 (Treatment 2) was given to rats in cage B. Diet 3 (Treatment 3) was given to rats in cage C and Diet 4 was given to rats in cage D (Treatment 4). These diets contained different levels of protein and carbohydrate – a control diet (Diet 1) of only chicks' mash, moderate dietary protein (mixture of 250 g of corn meal, 240 g of soyabean meal and 10 g of crayfish meal) in chicks' marsh (Diet 2), high dietary protein (mixture of 400 g of caseinogen and 300 g of soyabean meal) in chicks' mash (Diet 3) and high dietary carbohydrate (mixture of 400 g of dextrose and 300 g of corn meal) in chicks' mash (Diet 4). The diets were analysed for proximate composition by the method of Windham (1996). Each experimental set up was replicated three times. The rats were allowed unlimited supply of clean water.

The female rats were infected with 8000 trypanosomes per 1 ml of blood. At the end of the experiment, the total red blood cell count was taken. The data were analysed for significant differences by descriptive statistics and analysis of variance (ANOVA) using Statistical Package for Social Sciences (SPSS) computer package. Multiple comparisons of significant difference were done using least significant difference (LSD) and the Duncan's Multiple range Test post hoc tests (Steel and Torrie, 1980).

Table 1: Nutrient and Proximate Composition of Diets fed to trypanosome-infected rats

Diets	Ingredient composition		Proximate composition	
	Ingredient	Weight (g)	Ingredient	%
Diet 1 (Control)	**Chicks' mash**	1000	Moisture	10.90
			Protein	18.39
			Ash	8.40
			Fibre	10.25
			Fat	10.25
			Carbohydrate	41.81
Diet 2	**Chicks' mash**	500	Moisture	16.25
	Corn meal	250	Protein	13.70
	Soyabean meal	240	Ash	20.01
	Crayfish	10	Fibre	13.40
			Fat	3.95
			Carbohydrate	32.69
Diet 3	**Chicks' mash**	300	Moisture	14.65
	Caseinogen	400	Protein	29.95
	Soyabean meal	300	Ash	10.75
			Fibre	15.20
			Fat	11.50
			Carbohydrate	17.95
Diet 4	**Chicks' mash**	300	Moisture	12.25
	Corn meal	300	Protein	10.39
	Dextrose	400	Ash	11.05
			Fibre	10.25
			Fat	5.55
			Carbohydrate	50.51

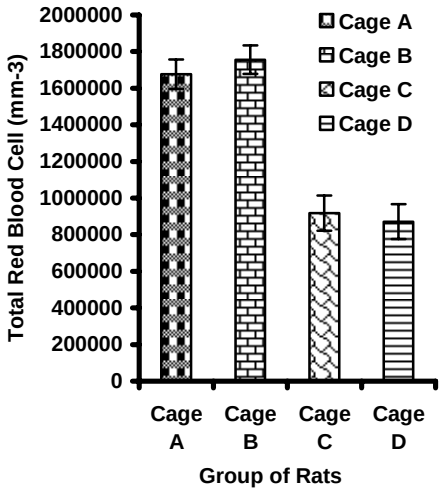

Figure 1: Mean of Total Red Blood Cell Count of trypanosome-infected female rats fed various protein-enriched diets

RESULTS

The ingredient and proximate compositions of the diets are shown in Table 1. There were significant differences ($P < 0.05$) among all the groups of rats in their total red blood cell count (Figure 1). On comparing the total red blood cell counts of all the rats fed different diets, there was no significant difference ($P > 0.05$) between the rats in Cage B (fed with Diet 2) and rats in Cage A (fed with Diet 1) and also between rats in Cage C (fed with Diet 3) and rats in Cage D (fed with Diet 4). However, it was observed that there was significant difference ($P < 0.05$) between rats in Cage A and those in Cages C and D and also between rats in Cage B and those in Cages C and D.

DISCUSSION

From the above result, it was observed that rats fed with Diet 2 had the highest total red blood cell count when compared with rats fed with Diets 1, 3 and 4. This indicated that adequate nutrition enhanced trypanotolerance. This agreed with Katungka-Rwakishaya (1996) observation that improvement on

host's nutrition was important in modulating the severity of pathophysiological effect of trypanosomiasis and also influenced the rate of recovery. The above result showed that balanced diet suppressed the aneamia caused by trypanosomiasis. Aneamia during trypanosomiasis has been reported by Shaw and Dusanic (1973), Ogwu *et al.* (1980), Ogwu and Nuru (1981), Tizard (1985), Stephen (1986). This also corresponds to the statement of Mora and Nestel (2000) that good maternal nutrition is vital to the health and reproductive performance of pregnant rats and the health, survival and development of the offspring. It is therefore inferred that Diet 2, a balanced diet having 20.1% crude protein produced the highest red blood cell count, showing the best suppression of aneamia in trypanosome-infected pregnant rat.

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