EFFECT OF NUTRITION ON THE BIRTH WEIGHT AND MULTIPLE BIRTHS OF TRYPANOSOME INFECTED FEMALE *Rattus norevegicus*

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ABSTRACT

Trypanosomiasis is a disease of agricultural interest in livestock. The research was therefore aimed at finding out if adequate nutrition would ameliorate reproductive disorder in trypanosome-infected pregnant rats. Twenty female rats of 120 days old were used. They were kept 5 rats in each cage replicated three times. Four treatments diet each containing trypanotolerant; 80 mg of Vitamin E and 0.3 mg of selenium (additives) were used. In Treatment 1, trypanosome infected reproducing female rats were fed Diet 1 (Control) comprising chick mash mixed with the additives. In Treatment 2, the rats were fed Diet 2 comprising dietary protein and carbohydrate mixed with the additives. In Treatment 3, the rats were fed Diet 3 made up of dietary protein and the additives. In Treatment 4, the rats were fed Diet 4 made of dietary carbohydrate and the additives. The birth weight was measured and number of ratlets from each treatment was also counted to determine the effect of the diets on the birth. At the end of the experiment, it was observed that trypanosome-infected pregnant rats fed Diet 2 (with adequate concentrations of carbohydrate and protein) significantly (P < 0.05) had higher birth weight of offspring and multiple births than the rats fed with other treatments diets indicating that adequate nutrition promoted reproduction in trypanosome-infected rats.

Keywords: Nutrition, Birth-weight, Multiple births, Trypanosome-infection

INTRODUCTION

Nutritional status of female reproducing animals before and during gestation affects the offspring. Carbohydrate, protein and micronutrients deficiencies in female either before conception or in early pregnancy have been implicated in causing low birth weight in offspring (Galloway et al., 1994). Birth weight is crucial to the survival of an individual animal (Wynn *et al.,* 1991). Modest restrictions or under-nutrition in maternal nutrition around the gestation period can lead to premature births and long term adverse health effects for the offspring (Wong, 2003). It was noted that genotype interacts with nutrients intake in pregnant females and their effect on birth can be modulated nutritionally (Harggarty, 2002). The nutrient, Vitamin E enhances fertility in animals (Bieri et al., 1983; Mino *et al*., 1985). Also, Vitamin E enhances multiple births (Levine *et al.,* 1976).

Trypanosomiasis is one of the most important livestock diseases in Sub-Saharan Africa that retards livestock production (Morrison *et al*., 1981). Trypanosome infection is associated with reproductive disorders including abortion in pregnant animals among others (Ogwu *et al*., 1980). Improvement on host's nutrition is important in modulating the severity of patho-physiological effect of trypanosomiasis and also, it influences the rate of recovery (Katungka-Rwakishaya, 1996).

Against the background, the objective of this study therefore was to find out the effect of adequate nutrition on the birth weight and multiple births of trypanosome-infected female rats. We were also interested in finding out if adequate nutrition will ameliorate the adverse effects of trypanosomiasis on low birth weight and abortions in trypanosome-infected pregnant rats.

MATERIALS AND METHODS

Induction of Rodent Trypanosomiasis: Twenty 120-days old female albino rats (*Rattus norvegicus*) were used for this experiment. The rats were marked for identification and held in stainless wire-rats-cages in clean experimental animal house. The cages were labeled A to D corresponding to four treatments while each experimental set up was replicated three times. The rats had unlimited supply of clean water.

Twenty female rats were paired with male rats so as to ensure mating. The female rats were monitored for pregnancy. Pregnancy was detected by presence of pan plug which was released when pregnancy occurred (Cukierski *et al*., 1991). These rats were infected within 10^{th} to 14^{th} day of pregnancy with NITR type of trypanosomes from Faculty of Veterinary Medicine, University of Nigeria, Nsukka by injecting the rats with 0.1 ml of trypanosome-infected rat's blood in normal saline.

Table 1: Ingredient and proximate composition and of diets fed to trypanosome-infected rats

Ingredient	Composition			
	Diet 1 (control)	Diet 2	Diet 3	Diet 4
Chick mash (g)	1000	500	300	300
Corn meal (g)	-	250	-	300
Dextrose (g)	-	-	-	400
Caseinogen (g)	-	-	400	-
Soyabean meal (g)	-	240	300	-
Vitamin E (mg)	80	80	80	80
Selenium (mg)	0.3	0.3	0.3	0.3
Crayfish meal (g)	-	10	-	-
Nutrients				
Moisture	10.9	16.25	14.65	12.25
Protein	18.39	20.01	29.95	10.39
Ash	8.4	13.40	10.75	11.05
Fibre	10.25	13.70	15.20	10.25
Fat	10.25	3.95	11.50	5.55
Carbohydrate	41.81	32.69	17.95	50.51

The blood of the infected rats was examined under the microscope to detect level of parasitemia using a matching chart (Herbert and Lumbsden, 1976).

Diets: The rats were fed with diets 1 - 4 containing different levels of protein and carbohydrate (Table 1). Each diet additionally had a constant level of 80 mg of vitamin E and 0.3 mg of selenium thoroughly mixed with the other ingredients to enhance trypanotolerance (Mgbenka and Ufele, 2004). The rats were fed in cages whose labels were identical to the diets (A – D). The proximate composition of the diets was determined by the method of Windham (1996) (Table 1).

Birth: At the end of gestation, the number of ratlets delivered by each rat was recorded and the weights of the ratlets were taken using triple beam balance.

Data Analysis: The data were analysed for significant differences by analysis of variance (ANOVA) using SPSS version 11.0 for windows. Specific differences in treatment means were determined using Least Significant Difference (LSD) and the Duncan's New Multiple Range Test (DNMRT) (Steel and Torrie, 1990).

RESULTS

The ingredient and proximate compositions of the diets are shown on Table 1. Figure 1 showed the mean birth weight (g) of ratlets of the groups of rats and the corresponding diets. From Figure 1, it is seen that ratlets of rats fed with Diet 2 had the highest birth weight (29.40 ± 3.54 g) compared to ratlets from rats fed other diets 10.53 ± 3.30, 11.93 ± 3.60, 12.80 ± 3.43 g for Diets A, C and D respectively. The birth weights of the ratlets from rats fed other diets in reducing sequence were Diet 4 > Diet 3 > Diet 1, but were not significantly different ($P < 0.05$) from one another. Figure 2 showed the mean multiple births of groups of rats and corresponding diets.

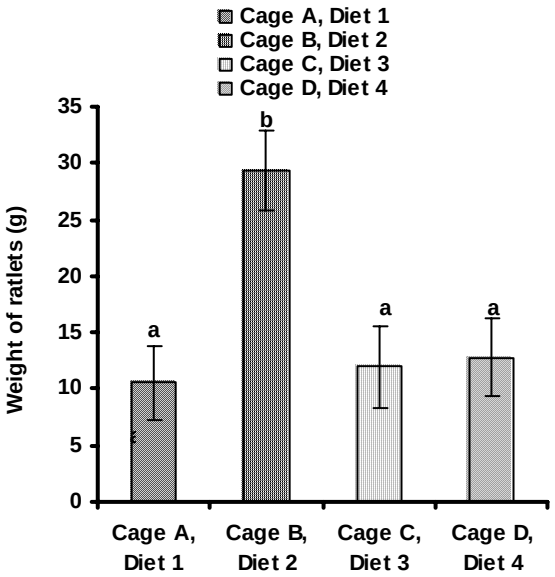

Figure 1: Mean birth weight (g) of ratlets of the groups of rats and the corresponding diets. Bars with different letters on top are significantly different ($P < 0.05$).

From Figure 2, it was observed that rats fed with Diet 2 also had the highest multiple births (4.80 ± 0.59) when compared to rats fed other diets 2.10 ± 0.65, 2.33 ± 0.71, 2.53 ± 0.68 ratlets for rats fed Diets A, C and D respectively. It was observed that rats fed with diets 1, 3 and 4 aborted some of the pregnancy. Rats fed Diet 2 had a very minimal abortion rate (6.6 %) compared to the rats fed other diets (46.7, 53.3 and 46.7 % for Diets A, C and D respectively). The number of ratlets rats fed other diets in reducing sequence were Diet 4 > Diet 3 > Diet 1, but not significantly different ($P < 0.05$) from one another.

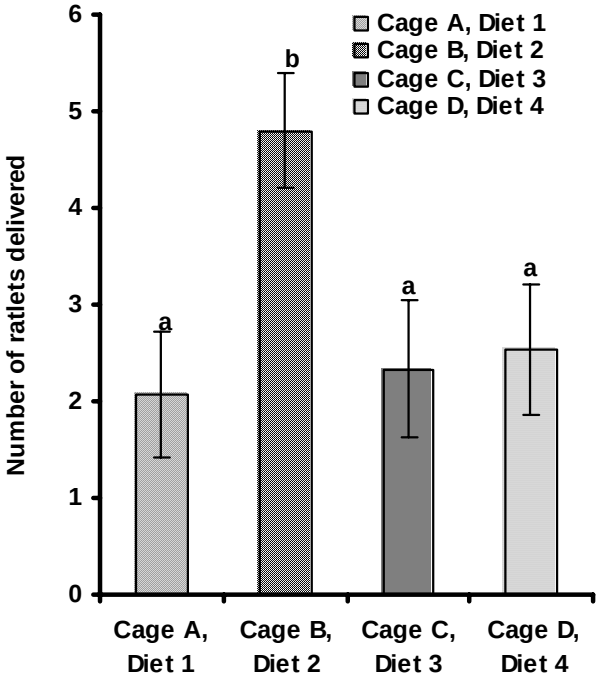

Figure 2: Mean multiple births of groups of rats and corresponding diets. Bars with different letters on top are significantly different (P < 0.05)

DISCUSSION

Diet 2 which contained 20.01 % protein and 32.69 % carbohydrate provide satisfactory nutrient to alleviate the effect of trypanosomes on trypanosome-infected pregnant rats. The abortion rates exhibited by the rats on different diets is corroborated by total the number of ratlets delivered (Figure 2). Langley-Evans and Nwagwu (1998) had earlier reported that protein range above 18 % was adequate for pregnant rats. Adequate nutrition therefore mitigated abortion in the trypanosome infected rats contrary to Ogwu *et al*. (1980), report that trypanosomiasis causes abortion in pregnant animals. From the results of the experiments it was observed that adequate nutrition enhances trypanotolerance. Our study was in agreement with the statement of Katungka-Rwakishaya (1996) that improvement on host's nutrition was important in modulating the severity of patho-physiological effect of trypanosomiasis and also influences the rate of recovery from the infection. The rats fed Diet 2 also had high birth weight. Wynn *et al*. (1991) had noted that birth weight was crucial for the survival of offspring. Our results indicated that adequate concentrations of carbohydrate and protein produced ratlets with higher birth weights. Furthermore, from our results, it was observed that malnutrition in pregnant rats can lead to physiological stresses and low birth weight of offspring. Our finding was similar to those of Galloway *et al*. (1994) who reported low birth weight in malnourished pregnant rats. The observed high multiple births in most of the rats may be attributed to the vitamin E contents of the diets. Vitamin E has been reported to enhance multiple births in pregnant rats (Bieri, *et al*., 1983; Mino *et al*., 1985).

Conclusively, adequate nutrition of trypanosome-infected expectant mother rats promoted trypanotolerance. It also promoted multiple births and enhanced high birth weight of the ratlets which in turn promoted survival of the offspring.

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