

Original article

FURTHER STUDIES ON THE PLASMA BIOCHEMISTRY OF THE AFRICAN GIANT RAT (*Cricetomys gambianus*, Waterhouse).

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Blood samples collected from the orbital sinus of sixteen mature immature male and female African giant rats were analyzed for the levels of some enzyme and metabolite of nine of their plasma. The alkaline phosphate (ALP) level in the immature group was significantly higher ($P < 0.05$) than that of male the group. In the immature (ALT) aspartate amino transferase (AST) and alanine amino transferase (ALT) were also significantly ($P < 0.001$) higher than in the adult group. The blood urea nitrogen (BUN) level was significantly ($P < 0.01$) lower in the immature group, while the triglyceride level was significantly ($P < 0.01$) lower in adult group. Within the immature group, no significant ($P > 0.05$) sex differences were evident in the mean values of ALP, AST, ALT, CK, BUN, U.A, CHOLEST, TRIG and TBL. The mean value of ALP in adult male was significantly ($P < 0.05$) lower than in adult female while TRG was significantly ($P < 0.05$) higher. TRIG level in adult male than in adult female. Furthermore, the mean values of AST and ALP in immature females were significantly ($P < 0.01$) higher than in adult males. Similarly, there was higher significant ($P < 0.05$) age and sex difference in the mean value of ALP in immature females compared to the ALP value in adult males. Likewise, the mean values of ALT and TRIG, were significantly ($P < 0.05$) higher in immature males than in adult females. ASP level was significantly ($P < 0.05$) higher in immature male while the BUN level was significantly ($P < 0.05$) higher in adult females. There were age difference in the plasma mean values of AST and ALT in immature females which was significantly ($P < 0.01$) higher than in adult females. Also, the TRIG mean value was significantly ($P < 0.05$) lower in adult females than immature females. Significant ($P < 0.05$) age differences were evident, with higher plasma levels of ALP, ASP and ALT in immature males and lower BUN level in adult males.

Key Words: Enzymes, Metabolites, Plasma Giant Rat

INTRODUCTION

As indicated in a previous paper (Nssien *et al*, 2001) an increasing amount of interest is currently being expressed in the biology of the African giant rat. In the paper under reference the authors provided valuable information of aspects of the plasma biochemistry of this rodent which will soon become staples not only in laboratories but also on dinner tables as they serve to supplement dietary animal protein for a vast majority of people in Africa.

This paper provides more information on this subject being a continuation of the previous study.

MATERIALS AND METHODS

This investigation was carried out on adult African giant rat that had been in captivity for over seven months and had

littered during the period. The young ones were gradually introduced to the adult diet after about two months of age. They were fed with commercially available diet of mouse cubes (protein 21% min, fat 3.5%min., fibre 6%max., calcium 0.8% and phosphorous 0.8%[total], Lodokun Feeds Limited, Ibadan, Nigeria) and water given *ad libitum*. Their daily intake was supplemented with processed cassava (fufu) (*Manihot utilissima* Pohl.); palm kernel fruits (*Elaeis guineensis*); pawpaw (*Carica papaya*) and locally milled groundnut cake.

Each animal was anaesthetized using a 50mg/ml ketamined 500 solution (manufacturer – Waterland Laboratories, Germany. Batch No. 116400) which was given at the calculated dose of 0.3ml and 0.6ml for young and adult giant rats, respectively. Blood was collected from

the orbital sinus using heparinised capillary tubes and centrifuged at 3,000g for 10 minutes to obtain plasma. (TRIG), aspartate amino transferase (ASP), and alanine amino transferase (ALT) were determined as described by TORO and ACKERMANN (1975). Alkaline phosphatase (ALP) was determined according to the method of King and Armstrong (1934). Blood urea nitrogen (BUN) and creatine kinase (CK) were determined according to Harrison (1947). Cholesterol (CHOLE) was estimated as described by Pesce and Bodourian (1977). Uric acid (U.A) was determined by the method of Feichtmeir and Wrenn (1955). Total Bilirubin (TBL) was determined by the method described by COLES (1986).

The results were statistically evaluated using student's t-test

RESULTS

Results of plasma enzyme and metabolite analyses in mature and immature giant rats are presented in Tables 1 and 2.

There were no significant differences in plasma urea, uric acid, cholesterol and total bilirubin levels (Table). However, the mean levels of ALP, AST, ALT, CK and TRG were higher in the immature rats

than the adult rats to the levels of significance indicated on Table 1.

Table 1: Plasma Enzymes and metabolites

	Immature (N = 8)	AGR	Adult AGR (N = 8)
ALP	165.88 ± 9.02 ^a *		153.88 ± 11.02 ^b *
	(150 – 180)		(139 – 171)
AST	42.88 ± 1.81 ^a ***		35.63 ± 4.14 ^b ***
	(41 – 46)		(28 – 41)
ALT	38.38 ± 1.41 ^a ***		27.38 ± 6.09 ^b ***
	(36 – 40)		(18 – 36)
Creatinine	29.63 ± 4.57 ^a **		36.12 ± 3.2 ^b **
	(20 – 35)		(31 – 40)
BUN	1.20 ± 0.13		1.23 ± 0.2
	(1.0 – 1.4)		(1.0 – 1.5)
Uric Acid	3.03 ± 0.57		3.40 ± 0.72
	(2.3 – 4.1)		(2.8 – 4.6)
CHO	104.13 ± 11.47		102.13 ± 4.941
	(92 – 120)		(98 – 110)
TRIG	95.50 ± 8.67 ^a **		83.25 ± 5.90 ^b **
	(85 – 110)		(75 – 91)
TBL	0.26 ± 0.05		0.2750 ± 0.05
	(0.2 – 0.3)		(0.2 – 0.3)

Mean ± S.D (range) * = P < 0.05; ** = P < 0.01; *** = P < 0.001. Means with different superscripts are significantly different. Creatinine Kinase (CK), Blood Urea Nitrogen (BUN)

Within the same sex (Table 2) immature female giant rats had significantly higher AST (P < 0.01) ALT (P < 0.01) and TRG (P < 0.05) than the adult female rats differences in the levels of the other parameters were not statistically significant.

Table 2: Plasma Enzymes and Metabolites Same sex Vs Age

Parameters	AF (N = 4)	IM (N = 4)	AM (N = 4)	AF (N = 4)
ALP	(150 – 180) ^a *	(152 – 171)	(159 – 170) ^a *	(139 – 155) ^b *
	168.600 ± 12.754	161.500 ± 8.021	163.750 ± 4.856	146.250 ± 7.974
AST	(40 – 46) ^a **	(28 – 38) ^b **	(41 – 45) ^a *	(36 – 41) ^b *
	433.250 ± 1.893	33.500 ± 4.796	42.500 ± 1.915	37.750 ± 2.217
ALT	(38 – 40) ^a **	(18 – 32) ^b **	(36 – 39) ^a *	(29 – 36) ^b *
	39.250 ± 0.957	23.500 ± 6.028	37.500 ± 1.291	31.250 ± 3.202
Creatinine (CK)	(20 – 35)	(32 – 38)	(29 – 34) ^a *	(31 – 40) ^b *
	28.500 ± 6.351	35.750 ± 2.63	30.750 ± 2.217	36.500 ± 4.041
BUN	(1.0(1.0 – 1.4)	(1.0 – 1.5)	(1.1 – 1.3)	(1.0 – 1.5)
	1.225 ± 0.171	1.175 ± 0.236	1.175 ± 0.096	1.275 ± 0.222
U.A	(2.3 – 4.1)	(2.8 – 3.9)	(2.5 – 3.5)	(2.8 – 4.6)
	3.125 ± 0.741	3.175 ± 0.492	2.925 ± 0.419	3.625 ± 0.911
CHOLE	(92 – 120)	(99 – 110)	(91 – 119)	(98 – 110)
	102.000 ± 12.570	102.500 ± 5.066	106.250 ± 11.701	101.750 ± 5.560
TRIG	(85 – 110)	(75 – 81) ^b *	(89 – 100)	(80 – 90)
	95.000 ± 12.247	79.000 ± 2.708	96.000 ± 4.967	87.500 ± 5.066
TBL	(0.2 – 0.3)	(0.3)	(0.2 – 0.3)	(0.2 – 0.3)
	0.247 ± 0.050	0.300 ± 0.000	0.250 ± 0.058	0.250 ± 0.058

Mean ± S.D (range) ; * = P < 0.05; ** = P < 0.01; *** = P < 0.001; Means with different superscripts are significantly different; Creatinine Kinase (CK)

Within same sex also, the immature male giant rats had significantly more ALP ($P < 0.05$) but less ($P < 0.05$) than the adult male giant rat. Again differences in the other parameters were not significant statistically.

Within the same age group, there were minor differences in the levels of the parameters assessed but none of any statistical significance. But adult more TRG ($P < 0.05$) than the adult female counterpart. Differences between the adults in the levels of the other parameters were not significant. Cross comparisons between age and sex revealed that immature female giant rats had more ALP ($P < 0.05$) more AST ($P < 0.01$) and more ALP ($P < 0.01$) than the mature male rat while the immature male rat had more AST ($P < 0.01$) more ALT ($P < 0.01$) but less CK ($P < 0.05$) than the mature female giant rat.

DISCUSSION

There were differences due to age and sex in the mean values of the parameters assessed in this study. The levels of ALP, AST, ALT and CK than the adults. The levels of TRG was also higher in these immature rats. The reasons for these disparities are not known nor is their significance. They may, however, not be unrelated to differences in metabolic rates between the two age groups. Immature or growing animals usually have higher turn over in metabolic activities than adult animals as new cells come into existence and dead ones are replaced. The enzymes such as the ones assessed in the present study catalyze such anabolic and catabolic activities. ALP levels, for instance, have been shown to increase in situations of increased osteoblastic and biliary activities – (Robbins *et al*, 1984; Cornelius, 1989).

The musculoskeletal and biliary systems of immature animals are in dynamic flux until the mature status is attained. Our findings in this regard agree with some existing reports in the literature. Bush *et al* (1981) observed a four - fold increase in juvenile and almost

ten - fold increase in neonate serum ALP values over the adult values in captive Dorcas gazelles (*Gazella dorcas*). Also, English and Lephard (1981) found age - related differences in serum enzyme parameters assessed for fawns (2 - 12 weeks) and adult does of the Fallow deer (*Dama dama*). More recently, too, Nottidge *et al* (1999) reported highly significant difference in some components of the plasma biochemistry of Nigerian cats and their kittens. All these differences were attributed to higher growth activities in the younger animals.

The sex - related differences observed in this study included higher levels of ALP in adult females over their male counterparts and higher TRAINING in adult male over their female counterparts. Within the immature age group there was no significant sex - related differences. Osteoporotic or other bone metabolic activities and biliary system dysfunction could account for increased levels of serum ALP (Robbins *et al*, 1984). If that were the case in this study it would mean that the adult female giant has weaker bones than their male counterparts - a situation not dissimilar to what obtain in hormones (Robbins *et ai* 1984). Our findings also agree with what Kamalu *et al* (1985) and Nottridge *et al* (1999) found respectively 12 goats and cats in Nigeria.

However, the most interesting comparison of our findings in this study would be with those of Oyewale *et al* (1998). The two studies were conducted comparable conditions except the degree of acclimation of the animals to captivity. That our findings in this study for the adult African giant rat whether male or female in all the parameters assessed were higher than those of Oyewale *et al* (1998) must be due to this single factor of acclimation. We used animals that had been so used to captivity (7 months) that they were able to breed. They used animals that were almost fresh from the wild (barely 6 weeks in captivity). African giant rat in the wild are nocturnal animals and in this environment nocturnal conditions are cooler (wilder) than day

time condition in the same season (Janski, 1976). So one would expect a lower basal metabolic rate in the wild animals than in the captivity or domesticated ones. If that be the case we submit that the values got in this study represent a more authentic or plausible baseline data as "normal" for laboratory investigations that have to do with those aspects of the serum biochemistry of African giant rats.

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Received: June 2000

Accepted in final form: September 2001