

**Plasma biochemical values in the African giant rat (*Cricetomys gambianus*, Waterhouse) and the West African hinge backed tortoise (*Kinixys erosa*)**

**Funsho Olayemi\*, and Emmanuel Adeshina**

*Department of Veterinary Physiology and Pharmacology, University of Ibadan, Ibadan, Nigeria.*

---

**OLAYEMI, F., E. ADESHINA: Plasma biochemical values in the African giant rat (*Cricetomys gambianus*, Waterhouse) and the West African hinge backed tortoise (*Kinixys erosa*). Vet. arhiv 72, 335-342, 2002.**

**ABSTRACT**

The plasma biochemical values of apparently healthy adult wild African giant rat (*Cricetomys gambianus* Waterhouse) and those of adult wild West African hinge backed tortoise (*Kinixys erosa*) were determined. The sodium (Na), chloride (Cl), bicarbonate (HCO<sub>3</sub>), total protein and globulin levels were significantly higher but the glutamate oxaloacetate transaminase (GOT), cholesterol and urea levels were significantly lower in the African giant rat than in the hinge backed tortoise. The levels of potassium (K), calcium (Ca), albumin, glutamate pyruvate transaminase (GPT), gama-glutamate transferase (GGT), triglyceride and creatinine were similar in the two species of animals.

**Key words:** plasma electrolyte, enzyme, proteins, African giant rat, West African hinge backed tortoise

---

**Introduction**

In recent times it has been observed that a great deal of attention is being focused on the African giant rat (*Cricetomys gambianus*, Waterhouse) and there are efforts being made at domesticating them. This is because they are source of supplementary dietary protein and there are attempts to

---

\* Contact address:

Dr. Funsho Olayemi, Department of Veterinary Physiology and Pharmacology, University of Ibadan, Ibadan, Nigeria, Phone: +23 48 023 516 577, E-mail: funsho\_olayemi@yahoo.com

use them as laboratory animals. Similarly, the hinged backed tortoise is a potential source of animal protein, especially for local people in West Africa where protein deficiency is acute.

There are studies on the haematology of the African giant rat (DUROTOYE and OKE, 1990; OYEWALE et al., 1998a; OKE et al., 2000; OLAYEMI et al., 2001). Similarly, the plasma biochemical parameters of the African giant rat have been reported (OYEWALE et al., 1998b and NSSIEN et al., 2002). Also, the normal haematological and plasma biochemical values of the West African hinge backed tortoise were studied by OYEWALE et al. (1998c).

SHEELER and BARBER (1964) compared the haematological values of turtle, rabbit and rat. However, to the best of our knowledge there has been no report on the comparison of plasma biochemistry of the tortoise and the African giant rat. Therefore, in this paper we compare the plasma biochemical values of the African giant rat and the West African hinge backed tortoise.

### **Materials and methods**

Nineteen adult African giant rats of both sexes were captured from the wild and were transported to our animal house at the Faculty of Veterinary Medicine, University of Ibadan, Ibadan, Nigeria. They were each housed in a separate cage and fed with a commercial pelleted feed (feed contained 21% protein; 3.5% fat; 6% fibre; 0.8% phosphorus; 0.8% calcium, Ladokun Feed Limited, Ibadan, Nigeria.)

Forty-nine days after capture each of the African giant rats was anaesthetized using ether, and blood was collected from the orbital sinus into a bottle containing lithium heparin (20 units/ml). The blood was then centrifuged at 3.000 g for ten minutes to obtain plasma.

Six wild West African hinge backed tortoises of both sexes, purchased from a local market in Ibadan, Nigeria, were also used for this study. The tortoises were kept in the animal house in our faculty for sixty days, during which period they were given water *ad libitum* and fed with pawpaw, bananas, oranges and vegetables. Blood from these reptiles was obtained from the jugular vein into a bottle containing heparin (20 units/ml). The blood was then centrifuged at 3.000 g for ten minutes.

Plasma from the two species of the above animals were then analyzed to establish the levels of electrolyte, enzyme, protein, and metabolite. Sodium (Na) and potassium (K) concentration of plasma were determined by standard flame photometry, chloride (Cl) by the method of SHALES and SCHALES (1941) and calcium (Ca), triglyceride and bicarbonate ( $\text{HCO}_3$ ) according to TORO and ACKERMANN (1975). Cholesterol was determined as described by PESCE and BOUDOURIAN (1977).

Total protein was determined by the biuret method (REINHOLD, 1953) and albumin by the method of DOUMAS et al. (1971). Globulin was calculated by subtracting albumin from total protein. Urea and creatinine were determined according to HARRISON (1947) .

Glutamate oxaloacetate transaminase (GOT) and glutamate pyruvate transaminase (GPT) were determined by the colorimetric method described by MOHUN and COOK (1957) and gama-glutamate transferase (GGT) by method of SZAS (1969). Alkaline phosphatase (ALP) was determined by the method of KING and ARMSTRONG (1934).

Obtained data were subjected to statistical analysis using Student's t-test.

## Results

Table 1. shows a comparison between the value of plasma electrolyte and protein obtained in the African giant rat and the West African hinge backed tortoise. The African giant rat had higher sodium ( $P<0.001$ ), chloride ( $P<0.001$ ), bicarbonate ( $P<0.001$ ), total protein ( $P<0.05$ ), and globulin ( $P<0.01$ ) values than the hinge backed tortoise. However, the mean values of potassium, calcium, albumin, albumin/globulin ratio were similar in the two species of animal.

Table 2. presents a comparison of the plasma metabolite and enzyme values in the giant rats and hinge backed tortoise. The difference in the mean value of alkaline phosphatase, glutamate pyruvate transaminase, gama-glutamate transferase and triglyceride were not significant. However, the giant rat had lower urea ( $P<0.001$ ), creatinine ( $P<0.01$ ), glutamate oxaloacetate transaminase ( $P<0.05$ ) and cholesterol ( $P<0.05$ ) values than the hinge backed tortoise.

F. Olayemi and E. Adeshina: Plasma biochemical values in the African giant rat and the West African hinge backed tortoise

Table 1. Plasma electrolyte and protein levels (mean  $\pm$  s.d.) in the African giant rat and the West African hinge backed tortoise

Parameters	Giant rat (n=19)	Tortoise (n=6)
Na (mmol/L)	167.40 $\pm$ 12.93	117.80 $\pm$ 6.17*
K (mmol/L)	5.73 $\pm$ 1.37	6.38 $\pm$ 1.11
Cl (mmol/L)	114.70 $\pm$ 4.57	85.83 $\pm$ 7.19*
HCO <sub>3</sub> (mmol/L)	23.32 $\pm$ 1.57	16.17 $\pm$ 3.19*
Ca (mmol/L)	2.17 $\pm$ 0.03	2.18 $\pm$ 0.03
Total proteins (g/L)	62.95 $\pm$ 1.39	61.83 $\pm$ 0.98**
Albumin (g/L)	29.68 $\pm$ 1.53	31.00 $\pm$ 2.19
Globulin (g/L)	33.26 $\pm$ 1.85	30.83 $\pm$ 1.33***
Albumin/globulin ratio	0.90 $\pm$ 0.09	1.01 $\pm$ 0.13

Value significantly different from giant rat at \*P<0.001, \*\*P<0.05 and \*\*\*P<0.01.

Table 2. Plasma enzyme and metabolite levels (Mean  $\pm$  s.d.) in the African giant rat and the West African hinge backed tortoise

Parameters	Giant rat (n)	Tortoise (n)
ALP (i.u/L)	138.4 $\pm$ 27.25 (15)	162.30 $\pm$ 22.10 (4)
GOT (i.u/L)	27.07 $\pm$ 7.91 (15)	35.75 $\pm$ 6.45* (4)
GPT (i.u/L)	17.53 $\pm$ 7.20 (15)	25.50 $\pm$ 8.58 (4)
GGT (i.u/L)	9.46 $\pm$ 3.95 (15)	11.25 $\pm$ 2.50 (4)
Cholesterol (mg/dL)	99.40 $\pm$ 2.19 (15)	117.60 $\pm$ 10.75* (4)
Triglyceride (mg/dL)	70.93 $\pm$ 25.05 (15)	84.25 $\pm$ 17.48 (4)
Urea (mg/dL)	8.83 $\pm$ 1.69 (19)	18.70 $\pm$ 5.19** (6)
Creatinine (mg/dL)	11.60 $\pm$ 2.97 (15)	14.75 $\pm$ 0.96*** (4)

Value significantly different from giant rat at \*P<0.05, \*\*P<0.001 and \*\*\*P<0.01

Table 1. Specification of myomorphus mammals examined by renoculture and microscopic agglutination according to the trapping area with corresponding results

F. Olayemi and E. Adeshina: Plasma biochemical values in the African giant rat and the West African hinge backed tortoise

### Discussion

The values of plasma electrolyte, enzyme, metabolite and protein observed in the present study in the African giant rat and the West African hinge backed tortoise are similar to those obtained in previous studies (OYEWALE et al., 1998b, 1998c). Nevertheless, the mean values of Na, Cl and HCO<sub>3</sub> were significantly higher ( $P < 0.001$ ) in the African giant rat than in the hinge backed tortoise (Table 1.) This is probably due to species differences. Similarly, the mean values obtained for Na and Cl in the hinge backed tortoise in this study were significantly lower than the mean values obtained for the Pangolin (OYEWALE et al., 1998d), Nigerian goat (ODUYE and ADADEVOH, 1976), White Fulani cattle and humans (McFARLANE et al., 1970). Also, the value of HCO<sub>3</sub> of the hinge backed tortoise in the present study was similarly lower than that of Pangolin (OYEWALE et al., 1998d) and humans (McFARLANE et al., 1970).

Total protein and globulin values were significantly higher ( $P < 0.05$  and  $P < 0.01$ ), respectively, in the African giant rat than in the hinge backed tortoise (Table 1.) Difference in nutrition may be responsible for this. It would appear that the commercial pelleted feed given to the African giant rat possessed a higher protein content than the fruit and vegetables given to the tortoise .

The higher GOT ( $P < 0.05$ ), cholesterol ( $P < 0.05$ ) and creatinine ( $P < 0.01$ ) in the hinge backed tortoise than in the giant rat (Table 2.) may be because the temperature of our animal house ( $29 \pm 2$  °C) is not comparable to that of the natural habitat of the hinge backed tortoise, which is much lower. The hinge backed tortoise is known to stay on the shores of the river in the rain forest zone, where they have unrestricted access to drinking water (MLYNARSKI and WERMUTH, 1975). STURBAUM and BERGMANN (1981) reported increases in serum GOT and GPT levels in the box turtle (*Terrapene carolina triunguis*) when subjected to two hours of heat exposure. CHRISTOPHER et al. (1994) also observed that *Gopherus agassizzi* has higher cholesterol value when subjected to high environmental temperature.

In the present study, it was also observed that the mean value of urea was higher ( $P < 0.001$ ) in the hinge backed tortoise than in the African giant

rat. It has been observed that the tortoise can shift from urea to uric acid excretion. This was reported to be due to increased environmental temperature (SCHMIDT-NIELSEN, 1990) and could be the reason why the value of urea is higher in the hinge backed tortoise than the African giant rat, although the values of total protein and globulin were lower in the tortoise.

### References

- CHRISTOPHER, M. M., R. BRIGMON, E. JACOBSON (1994): Seasonal alterations in plasma beta-hydroxybutyrate and related biochemical parameters in the desert tortoise (*Gopherus agassizii*). *Comp. Biochem. Physiol.* 108 A, 303-310.
- DOUMAS, B. T., W. WATSON, H. G. BIGG (1971): Albumin standards and the measurement of serum albumin with bromocresol green. *Clin. Chim. Acta.* 31, 87-96.
- DUROTOYE, L. A., B. OKE (1990): A comparative study of the haemogram of the African giant rat (*Cricetomys gambianus*, Waterhouse) and the Wistar rat. *Trop. Vet.* 8, 29-38.
- HARRISON, G. A. (1947): *Chemical methods in clinical medicine*. 3<sup>rd</sup> ed. Churchill. London. pp. 73-77.
- KING, E. J., A. R. ARMSTRONG (1934): A convenient method for determining serum and bile phosphatase activity. *Can. Med. Asso. J.* 31, 376-381.
- McFARLANE, H., O. O. AKINKUGBE, A. C. ADEJUWON, I. A. O. OKOROFUO, O. A. ONAYEMI, O. LONGE, O. A. OJO, S. REDDY (1970): Biochemical normals in igerians with particular reference to electrolytes and urea. *Clin. Chim. Acta* 29, 273-281.
- MLYNARSKI, M., H. WERMUTH (1975): The Turtles. In: Grzimek's *Animal Life Encyclopedia*. (B. Grzimek, Ed.), Van Nostrand Reinhold Company, New York, Vol. 6 pp. 75-123.
- MOHUN, A. F., P. COOK (1957): Simple methods for measuring serum levels of the Glutamateoxaloacetate and glutamic-pyruvate transaminase in routine laboratory. *J. Clin. Path.* 10, 374-399.
- NSSIEN, M. A. S., F. O. OLAYEMI, S. K. ONWUKA, A. OLUSOLA (2002): Studies on some plasma biochemical parameters in the African giant rats (*Cricetomys gambianus*, Waterhouse). *Afr. J. Biomed. Res.* 5, 63-66.
- ODUYE, O. O., B. K. ADADEVOH (1976): Biochemical values in apparently normal Nigerian goats. *J. Nig. Vet. Med. Asso.* 5, 51-55.
- OKE, O. A., B. O. OKE, F. O. OLAYEMI (2000): Haematological changes during the oestrous cycle of the African giant rat (*Cricetomys gambianus*, Waterhouse). *Trop. Vet.* 8, 83-86.

F. Olayemi and E. Adeshina: Plasma biochemical values in the African giant rat and the West African hinge backed tortoise

- OLAYEMI, F. O., O. A. OKE, J. O. OYEWALE, A. O. OGUNSANMI (2001): The Effect of season on the blood profile of the African giant rat (*Cricetomys gambianus*, Waterhouse). *Israel J. Vet. Med.* 56, 147-150.
- OYEWALE, J. O., F. O. OLAYEMI, O. A. OKE, (1998a): Haematology of the wild adult African giant rat (*Cricetomys gambianus*, Waterhouse). *Vet. arhiv* 68, 91-99.
- OYEWALE, J. O., O. A. OKE, F. O. OLAYEMI, A. O. OGUNSANMI (1998b): Electrolyte, enzyme, protein and metabolite levels in the blood plasma of the wild adult African giant rat (*Cricetomys gambianus*, Waterhouse). *Vet. arhiv* 68,127-133
- OYEWALE, J. O., C. P. EBUTE, O. A. OGUNSANMI, F. O. OLAYEMI, L. A. DUROTOYE (1998c) Weights and blood profiles of the West African hinge-backed tortoise, *Kinixys erosa* and the desert tortoise, *Gopherus agassizii*. *J. Vet. Med. A* 45, 599-605.
- OYEWALE, J. O., A. O. OGUNSANMI, P. C. OZEGBE (1998d): Plasma electrolyte, enzyme, protein, and metabolite levels in the adult African white-bellied pangolin (*Manis tricuspis*). *Trop. Vet.* 16, 73-79.
- PESCE, M. A., S. H. BOUDOURIAN (1977): Enzymatic rate method for determining cholesterol in serum. *Clin. Chem.* 23, 757.
- REINHOLD, J. G (1953): Standard method of clinical chemistry (M. Reiner, Ed.), Academic Press, New York, Vol. 1, p. 88.
- SCHALES, O., S. S. SCHALES (1941): A simple and accurate method for determination of chloride in biological fluids. *J. Biol. Chem.* 140, 879-884.
- SCHMIDT-NIELSEN, K. (1990): Animal physiology (adaptation and environment) 4<sup>th</sup> ed. University Press, Cambridge, pp. 371-372.
- SHEELER, P., A. A. BARBER (1964): Comparative haematology of the turtle, rabbit and rat. *Comp. Biochem. Physiol.* 11, 139-145.
- STURBAUM, B. A., J. L. BERGMANN (1981): Changes in select blood components of The three-toed box turtle, *Terrapene Carolina triunguis*, during heat stress. *Comp. Biochem. Physiol.* 70A, 599-602.
- SZAS, G. (1969): A kinetic photometric method for serum glutamyl transferase. *J. Clin. Chem.* 15, 124-136.
- TORO, G., P. ACKERMANN (1975): Practical Clinical Chemistry. 1<sup>st</sup> ed. Little Brown and Company, Boston, pp. 237-238.

Received: 26 January 2000  
Accepted: 20 December 2002

---

**OLAYEMI, F., E.ADESHINA: Biokemijske vrijednosti plazme afričkog divovskog štakora (*Cricetomys gambianus*, Waterhouse) i zapadnoafričke šumske uzglobljene kornjače (*Kinixys erosa*). Vet. arhiv 72, 335-342, 2002.**

**SAŽETAK**

Određene su biokemijske vrijednosti plazme zdravog odraslog afričkog divovskog štakora (*Cricetomys gambianus*, Waterhouse) i odrasle zapadnoafričke šumske uzglobljene kornjače (*Kinixys erosa*). Natrij (Na), klor (Cl) bikarbonat ( $\text{HCO}_3$ ), ukupni proteini te razine globulina bile su značajno više u štakora nego u kornjače. Vrijednosti za glutamat oksaloacetat transaminazu (GOT), kolesterol i ureju bile su značajno niže u štakora u usporedbi s kornjačom. Razine kalija (K), kalcija (Ca), albumina, glutamat piruvat transaminaze (GPT), gama glutamat transferaze (GGT), triglicerida i kreatina bile su slične u obje vrste.

**Ključne riječi:** elektroliti plazme, enzimi, proteini, divovski afrički štakor, zapadnoafrička šumska uzglobljena kornjača

---