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Relationship of the amino acid composition of the muscle and skin of African giant pouch rat (*Cricetomys gambianus*)

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ABSTRACT

The amino acid composition of the muscle and skin of the matured female African giant pouch rat (*Cricetomys gambianus*) was determined on a dry weight basis. The total essential amino acids ranged from 29.8-41.2 g/100 g crude protein or from 48.6-53.2 % of the total amino acid. The amino acid score showed that lysine ranged from 0.73-1.06 (on whole hen's egg comparison), 0.82-1.20 (on provisional essential amino acid scoring pattern) and 0.78-1.14 (on suggested requirement of the essential amino acid of a preschool child). The predicted protein efficiency ratio was 1.89-2.41 and the essential amino acid index range was 0.84-1.21. The correlation coefficient (r_{xy}) was positive and significant at $r_{=0.01}$ for the total amino acids, isoelectric points and amino acid scores (on whole hen's egg basis) in the two samples. Comparison of the samples with the muscle and skin amino acid compositions of the Greater Cane Rat showed that positive and significant differences existed at $r_{=0.01}$ between their muscles and their skins respectively. Results have good comparison with whole hen's egg protein.

Introduction

The Gambian pouch rat (*Cricetomys gambianus*), also known as the African giant pouch rat is a nocturnal rat of the giant pouched rat genus *Cricetomys*. It is the largest muroid in the world. It is native to Africa (http://en.wikipedia.org/wiki/Gambian-Pouch-Rat).

The giant rat *Cricetomys gambianus* (*Okete*) is a common rodent found around buildings and gardens in many parts of Nigeria. It digs long deep burrows with several entrances and stores found there. It eats roots, bulbs, young shoots and fruits. Other types of rats prefer grains. The female and young are communal and live in burrows. Each community consists of about thirty individuals; male giant rats live apart by themselves. Nests prepared from vegetable matter occur in the terminal chamber of the burrow[1].

The Gambian pouch rat can grow to be as big as a raccoon and can weigh up to 4 kg. It has very poor eyesight and so depends on its senses of smell and hearing. Its name comes from the large, hamster- like pouches in its cheeks. It is not a true rat, but is part of a uniquely African branch of muroid rodents. In its native Africa, this rat lives in colonies of up to twenty or more, usually in forests and thickets, but also commonly in termite mounds. It is omnivorous, feeding on vegetables, insects, crabs, snails, and other items, but apparently preferring palm fruits and kernels[2].

Unlike domestic rats, it has cheek pouches like a hamster. These cheek pouches allow it to gather up several kilograms of nuts per night for storage underground. It has been known to stuff its pouches so full of date palm nuts so as to be hardly able to squeeze through the entrance of its burrows. The burrow consists of a long passage with side alleys and several chambers, one for sleeping and the others for storage[3]. The African giant pouch rat belongs to the Order Rodentia, Superfamily Muroidea, Family Nesomyidae, Subfamily Cricetomyinae, Genus *Cricetomys*, Species *C. gambianus*, Binomial name: *Cricetomys gambianus* Waterhouse, 1840 (http://en.wikipedia.org/wiki/Gambian-Pouch-Rat). In Africa it is routinely eaten as bushmeat. It (and other mammals) is referred to by the pidgin name of "beef".

A study carried out in Nigeria showed that the giant rat produces about the same amount of meat as the domestic rabbit[4]. The meat's nutritional value compares favourably with that of domestic livestock and African villagers know how to prepare it by smoking or by salting[5]. The African giant pouch rat is a delicacy in Africa; however, no literature is available on the amino acids profile of the skin and muscle. The amino acids profile of the brain and eyes of African giant pouch rat had been published[6]. This work was therefore set out to evaluate the amino acids profile of the muscle and skin of the African giant pouch rat, the information derived here may also improve the information on food composition Tables.

Materials and methods

Cricetomys gambianus matured female samples were caught in the wild by a local hunter commissioned for the purpose at Iworoko Ekiti, Nigeria; identified, immersed in hot water (10 min), hair removed and the animals dissected. The muscle and skin were then separately removed, washed with distilled water and dried to constant weight; milled into flour and kept in a freezer, pending analysis.

The micro-Kjeldahl methods as described by Pearson (1976)[7] was followed to determine the fat-free crude protein. The fat was extracted with a chloroform/methanol (2:1 v/v) mixture using Soxhlet extraction apparatus[8].

About 35 mg defatted samples were weighed into glass ampoule, 7 ml of 6M HCl added and hydrolysed in an oven

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preset at 105±5 ^{o}C for 22 h. Oxygen was expelled in the ampoule by passing nitrogen gas into it.

Amino acid analysis was done by ion-exchange chromatography[9] using a Technicon Sequential Multisample Amino Acid Analyzer (Technicon Instruments Corporation, New York, USA)[10]. The period of analysis was 76 min, with a gas flow rate of 0.50 ml/min at 60 ^{o}C, and the reproducibility was ±3 %. Tryptophan was not determined.

The amino acid values were calculated from the chromatogram peaks as follows. The net height of each peak produced by the chart recorder of TSM (each representing an amino acid) was measured. The half- height of the peak on the chart was found and the width of the peak on the half-height was accurately measured and recorded.

Approximate area of each peak was then obtained by multiplying the width at half-height.

The norleucine equivalent (NE) for each amino acid in the standard mixture was calculated using the formula:

NE = Area of norleucine peak/area of each amino acid

A constant S was calculated for each amino acid in the standard mixture:

$$S_{std} = NE_{std} \times \text{mol. weight} \times \mu MAA_{std}$$

Finally the amount of each amino acid present in the sample was calculated in g/16 N or g/100 g protein using the following formula:

$$\text{Concentration (g/100 g protein)} = NH \times W@NH/2 \times S_{std} \times C$$

$$C = \frac{\text{Dilution} \times 16}{\div NH \times W\,(Nleu)\ \text{Sample wt (g)} \times N\,\% \times 10\ \text{vol. loaded}}$$

Where: NH = net height

W = width @ half-height and

Neu = norleucine

The estimation of the isoelectric point (pI) for a mixture of amino acids was calculated using the equation below:

$$IPm = \sum_{i=1}^{n} IPiXi$$

whereIPm is the isoelectric point of the mixture of amino acids, IPi is the isoelectric point of the ith amino acid in the mixture and Xi is the mass or mole fraction of the ith amino acid in the mixture[11].

Total amino acid scores were calculated based on the whole hen's egg amino acid profile[12]while the essential amino acid scores were calculated using the following formula[13]:

Amino acid score = Amount of amino acid per test protein [mg/g]/amount of amino acid per protein in reference pattern [mg/g] and scores based on essential amino acid suggested pattern of requirements for preschool child[14].

Predicted protein efficiency ratio (P-PER) was determined using one of the equations developed by Alsmeyer et al. (1974)[15] as follows:

P-PER = -0.468 + 0.454 (Leu) -0.105 (Tyr).

Essential amino acid index was calculated by using the ratio of test protein to the reference protein for each of the eight essential amino acids plus histidine in the equation [16]:

$$\text{Essential amino acid index} = 9 \sqrt{\frac{\text{mg lysine in 1 g test protein}}{\text{mg lysine in 1 g reference protein}} \times \text{etc. for all 8 essential amino acids + His}}$$

Determination of the ratio of total essential amino acids (TEAA) to the total amino acids (TAA), i.e. (TEAA/TAA), total sulphur amino acid (TSAA), percentage cystine in TSAA, total aromatic amino acid (TArAA), total neutral amino acid (TNAA), total acidic amino acid (TAAA) and total basic amino acid (TBAA) were estimated from the results of amino acid profile. The leucine/isoleucine ratio was also calculated.

All data generated were analysed statistically. The statistical analysis carried out included the determination of the grand mean, standard deviation (SD) and the coefficients of variation percent (CV %). Other calculations made were the simple linear correlation coefficient (r_{xy}), coefficient of determination (r_{xy}^2), coefficient of alienation (or index of lack of relationship) (C_A) and index of forecasting efficiency (IFE) and subjected to Table standards to test for significance difference, the level of probability was set a $r_{=0.01}$ at n-2 degrees of freedom (df)[17].

Results and discussion

Amino acid compositions (g/100 g crude protein, cp) for the different samples are shown in Table I. Glutamic acid was the most concentrated amino acid (AA) in the samples with values of 13.0 (muscle) – 7.95 g/100 g cp (skin). This was the exact trend in the AA profiles of ostrich, beef and chicken[18]. While our Lys levels were lower than in ostrich, beef and chicken[18] (with respective values of 8.48, 9.12, 8.96 g/100 g cp); muscle (7.01) and skin (5.94) in turkey hen[19]; our levels of Lys was better than in the muscle and skin of Greater Cane Rat (*Thryonomysswingerianus*) with respective levels of 5.19 and 4.01 g/100 g cp[20].Our His levels were close to 2.06-2.25 g/100 g cp in Greater Cane Rat[20]; 2.03 in ostrich, beef (3.20), chicken (3.04)[18]; turkey-hen: muscle (2.60) and skin (2.47)[19]. Phenylalanine levels (4.11-3.50 g/100 g cp) were close to these literature values (g/100 g cp): ostrich (4.84), beef (4.48), chicken (4.48)[18]; turkey -hen: muscle (4.79) and skin (3.80)[19]; Greater Cane Rat: muscle (4.05) and skin (4.80)[20]. Our values in Ile (3.60-3.40), Val (5.03-2.68) and Met (3.04-1.95) were close with regard to corresponding values in ostrich (4.71, 5.00, 2.82 respective AA of Ile, Val, Met), beef (5.12, 5.28, 2.72 respective AA of Ile, Val, Met), chicken (4.64, 4.80, 2.40 respective AA of Ile, Val, Met)[18]; muscle (3.41, 4.35, 2.55 respective AA of Ile, Val, Met) and skin (3.52, 3.94, 2.70 respective AA of Ile, Val, Met) in turkey-hen[19]; muscle (3.18, 6.20, 4.25 respective AA of Ile, Val, Met) and skin (3.95, 4.61, 2.05 respective AA of Ile, Val, Met) in Greater Cane Rat[20]. The remaining non-essential AA were very close to the corresponding levels in ostrich, beef, chicken, turkey-hen and Greater Cane Rat. On comparison with pork[21] and mutton[21], the following AA were better concentrated in pork and mutton than in African giant pouch rat muscle: Leu, Ile, Lys, Cys, Tyr, Thr, His and Val and total essential amino acids; however it was a reverse case in Met and Phe; whereas in skin the reverse was in Met, Cys and Phe. This trend was also observed for Greater Cane Rat[20]. The protein levels are also shown in Table 1. The value in the muscle (80.6 g/100 g) was close to the value of 80.8 g/100 g in Greater Cane Rat[20], 84.2 g/100 g in turkey-hen muscle[19] whereas the skin protein (39.1 g/100 g, fat free) was much lower than the value in the skin of Greater Cane Rat (90.8 g/100 g, fat free)[20] and 79.3 g/100 g in the skin of turkey-hen[19]. While the sample muscle would produce an energy density of 1370 kJ/100 g, it would produce 665 kJ/100 g in the skin.

Histidine is a semi-essential AA particularly useful for children growth. It is the precursor of histamine present in small quantities in cells. When allergens enter tissues it is liberated in larger quantities and is responsible for nestle rash. The value of Ile was 3.60-3.40 g/100 g cp in the samples. It is an EAA for all ages. Male Syrup Urine Disease is an Inborn Error of Metabolism in which brain damage and early death can be

avoided by a diet low in Ile and two other EAA, Leu and Val. These EAAs are slightly higher than what obtains in plant sources[22]. Methionine is an EAA which is needed for the synthesis of choline. Choline forms lecithin and other phospholipids in the body. When the diet is low in protein, for instance in alcoholism and kwashiorkor, insufficient choline may be found; this may cause accumulation of fat in the liver[23]. Phenylalanine was high in the samples (4.11-3.50 g/100 g cp). It is the precursor of some hormones and pigment melanin in hair, eyes and tanned skin. Phenylketonuria (the presence in urine and serum of phenylpyruvic acid or phenylketone bodies due to the incomplete breakdown of phenylalanine, a hereditary abnormality leading to severe mental deficiency) (PKU) is the commonest Inborn Error of Amino Acid Metabolism successfully treated by diet low in protein. The absence of enzyme (phenylalanine hydroxylase) in the liver blocks the normal metabolism of phenylalanine and the brain is irreversibly damaged unless a diet low in Phe is given in the few weeks of life. Hyperphenylalaninaemia is excess of phenylalanine in blood which results in phenylketonuria. Tyrosine was 3.02-2.22 g/100 g cp in the samples. It is the precursor of some hormones (like the thyroid hormones)and the brown pigment melanin formed in hair, eyes and tanned skin. It reduces the requirement of Phe. Permanent deficiency of the enzyme (tyrosine hydroxylase) leads to formation of hypertyrosinaemia, a rare Inborn Error of Amino AcidMetabolism –can cause liver and kidney failure unless treated with a synthetic diet low in Phe and Tyr[23, 24]. Phenylketonuria (PKU), an inborn error of metabolism marked by inability to convert phenylalanine into tyrosine, so that phenylalanine and its metabolic products accumulate in body fluids; it results in mental retardation, neurologic manifestations, light pigmentation, eczema, and a mousy odour, all preventable by early restriction of dietary phenylalanine[25]. Tyrosinemia is an aminoacidopathy of tyrosine metabolism with elevated blood levels of tyrosine and urinary excretion of tyrosine and related metabolites. *Type I* shows inhibition of some liver enzymes and renal tubular function. *Type II* is marked by crystallization of the accumulated tyrosine in the epidermis and cornea and is frequently accompanied by mental retardation. *Neonatal t.* is asymptomatic, transitory and may result in mild mental retardation. The fourth type is *hawkinsinuria* (a rare form of tyrosinemia manifested by urinary excretion of hawkinsin, a cyclic amino acid metabolite of tyrosine). Valine, an EAA is restricted in the treatment of Maple Syrup Urine Disease.

The various categories of the AA are shown in Table II. The present total EAA (TEAA) is comparable to some literature values (g/100 g cp): 36.1-45.0 in three different snails consumed in Nigeria[26]; 35.1 in variegated grasshopper[27] and 35.0[28] in the white ants; it is 38.2-35.0 in Great Cane Rat muscle and skin respectively[20]. The P-PER values of 2.41-1.89 were close to 2.49-2.42 in Greater Cane Rat[20] and 1.93-2.27 in turkey-hen[19] as well as to the reference casein with PER of 2.50[29]. The Leu/Ile ratio was low (1.96-1.68) hence no concentration antagonism might be experienced in the African giant pouch rat meat. In the results of isoelectric points, there was a shift from 3.24 in the skin to 4.91 in the muscle (51.5 %shifts). The calculation of pI from AA would assist in the production of the protein isolate of an organic product. Most animal proteins are low in Cys, examples of some literature values of % Cys/TSAA are: 36.3 in white ants[28], 25.6 in variegated grasshopper[27], 21.0-38.3 in three different snails[26], 19.8-36.1 in Greater Cane Rat[20]; our present results of 28.1-22.0 corroborated these earlier observations. In plants, the % Cys/TSAA in most cases was equal or greater than 50 %, like in the endosperm of coconut with a value of 62.9 %[22]. The percentage of Cys in TSAA has been set at 50 % in rat, chick and pig diets[30]. Cys has positive effects on mineral absorption particularly zinc[31, 32].

Tables III, IV and V contain the various amino acid scores (AAS). Scores based on whole hen's egg showed that Ser was limiting in both muscle (0.49) and skin (0.16). Under the provisional EAA scoring pattern, Thr (0.69) was limiting in the muscle and Val (0.54) was limiting in the skin; in the pre-school (2-5 years) child suggested requirements, Thr (0.81) and Thr (0.66) was limiting in both muscle and skin. To correct the limitingAA, we use the lowest value for correction which is 100/16 or 6.25 times as much of muscle/skin African giant pouch rat protein would have to be eaten when any of them serves as the sole protein source in the diet. The high score for Gly (1.67-0.78) could be interesting; this AA could have enhanced the delicacy of African giant pouch rat meat. Monosodium glutamate is made from glutamic acid extracted from sugar beet and wheat gluten[23].

Table VI shows the statistical summary of the results in Tables I-V, Table II being only for the pI alone. The Table showed that the linear correlation coefficient (r_{xy}) was positively and significantly high at $r_{=0.01}$ and n-2 degrees of freedom (df) for amino acids from Table I, pI from Table II and amino acid scores from Table III. The coefficient of determination was also high from Tables I and II (pI). The regression coefficient (R_{xy}) showed that, for example from Table 1, for every one unit increase in the muscle AA (X) there was a corresponding decrease of 0.05 units in the skin (Y). The coefficient of alienation (C_A) was low from Tables I and II (pI) with value range of 32.8-30.6 % whereas the index of forecasting efficiency (IFE) was high at 67.2-69.4 % from Tables I and II (pI). The IFE is actually the reduction in the error of prediction of relationship; meaning that relationship would be a bit difficult to predict between the AA of muscle and the AA skin in all the amino acid scores where IFE ranged from 28.2 % down to 9.0 %.

Table VII is a summary of all the results of the AA compositions of the muscle and skin in the categories of essential and non-essential AA into factors A and B. However the mean of factor A means and factor B means gave a value of 35.2 g/100 g as a total summary.

In Table VIII is shown the comparative amino acid profiles of muscle/muscle of Cane rat/Pouch rat and skin/skin of Cane rat/Pouch rat. Many of the CV % values were low showing the closeness of the values in each comparison. The comparisons were subjected to statistics and the results were: Cane rat/Pouch rat muscle, r_{xy} calculated ($r_{xy}C$) was 0.8367 whereas Cane rat/Pouch rat skin, $r_{xy}C$ was 0.8956 but the $r_{xy}T$ was 0.606 at $r_{=0.01}$ at n-2 df showing that significant differences existed in the Cane rat/Pouch rat muscle as well as Cane rat/Pouch rat skin

Conclusion

The African giant pouch rat (*Cricetomys gambianus*) has high levels of most of the essential amino acids and non-essential amino acids particularly Glu and Asp; has pI value close to hen's egg (5.64) has essential amino acid index

(EAAI) close to hen's egg (1.54); P-PER close to egg (2.88) and % Cys/TSAA close to egg (36.0). The samples were also very highly comparable to the muscle and skin of greater Cane rat and turkey-hen.

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Table I. Muscle and skin amino acid compositions of African giant pouch rat (g/100 g dry weight)

Amino acid	Muscle	Skin	Mean	SD	CV %
Lys	6.60	4.50	5.55	1.48	26.7
His	2.46	1.25	1.86	0.86	46.2
Arg	6.55	4.60	5.58	1.38	24.7
Asp	10.2	7.25	8.73	2.09	23.9
Thr	2.76	2.24	2.50	0.37	14.8
Ser	3.88	1.25	2.57	1.86	72.4
Glu	13.0	7.95	10.5	3.57	34.0
Pro	3.26	1.44	2.35	1.29	54.9
Gly	5.00	2.35	3.68	1.87	50.8
Ala	4.10	3.15	3.63	0.67	18.5
Cys	1.19	0.55	0.87	0.45	51.7
Val	5.03	2.68	3.86	1.66	43.0
Met	3.04	1.95	2.50	0.77	30.8
Ile	3.60	3.40	3.50	0.14	4.00
Leu	7.04	5.70	6.37	0.95	14.9
Tyr	3.02	2.22	2.62	0.57	21.8
Phe	4.11	3.50	3.81	0.43	11.3
Protein (fat free)	80.6	39.1	59.9	29.3	48.9

Table II. Summary of some essential parameters of African giant pouch rat muscle and skin amino acid composition (g/100 g crude protein)

Amino acid	Muscle	Skin	Mean	SD	CV %
Total amino acids (TAA)	84.8	56.0	70.4	20.4	29.0
Total non-essential amino acid (TNEAA)	43.6	26.2	34.9	12.3	35.2
Total EAA (TEAA)					
-with His	41.2	29.8	35.5	8.06	22.7
-no His	38.5	28.6	33.6	7.00	20.8
% TNEAA	51.4	46.8	49.1	3.25	6.62
% TEAA					
-with His	48.6	53.2	50.9	3.25	6.39
-no His	46.8	52.2	49.5	3.82	7.72
Total neutral amino acid (TNAA)	46.0	30.4	38.2	11.0	28.8
% TNAA	54.2	54.3	54.3	0.07	0.13
Total acid amino acid (TAAA)	23.1	15.2	19.2	5.59	29.1
% TAAA	27.2	27.1	27.2	0.07	0.26
Total basic amino acid (TBAA)	15.6	10.4	13.0	3.68	28.3
% TBAA	18.4	18.6	18.5	0.14	0.76
Total sulphur amino acid (TSAA)	4.23	2.50	3.37	1.22	36.2
% TSAA	4.99	4.46	4.73	0.37	7.82
% Cys in TSAA	28.1	22.0	25.1	4.31	17.2
Total aromatic amino acid (TArAA)	7.13	5.72	6.43	0.997	15.5
% TArAA	8.41	10.2	9.31	1.27	13.6
P-PER	2.41	1.89	2.15	0.37	17.2
Leu/Ile ratio	1.96	1.68	1.82	0.20	11.0
Leu-Ile (difference)	3.44	2.30	2.87	0.81	28.2
% Leu-Ile (difference)	48.9	40.4	44.7	6.01	13.4
EAAI	1.21	0.84	1.03	0.26	25.2
Isoelectric point (pI)	4.91	3.24	4.08	1.18	28.9

Table III. Amino acid scores of the muscle and skin of the African giant pouch rat based on whole hen's egg amino acid profile

Amino acid	Muscle	Skin	Mean	SD	CV %
Lys	1.06	0.73	0.90	0.23	25.6
His	1.03	0.52	0.78	0.36	46.2
Arg	1.07	0.75	0.91	0.23	25.3
Asp	0.95	0.68	0.82	0.19	23.2
Thr	0.54	0.44	0.49	0.07	14.3
Ser	0.49	0.16	0.33	0.23	69.7
Glu	1.08	0.66	0.87	0.30	34.5
Pro	0.86	0.38	0.62	0.34	54.8
Gly	1.67	0.78	1.23	0.63	51.2
Ala	0.76	0.58	0.67	0.13	19.4
Cys	0.66	0.31	0.49	0.25	51.0
Val	0.67	0.36	0.52	0.22	0.42
Met	0.95	0.61	0.78	0.24	30.8
Ile	0.64	0.61	0.63	0.02	3.17
Leu	0.85	0.69	0.77	0.11	14.3
Tyr	0.76	0.56	0.66	0.14	21.2
Phe	0.81	0.69	0.75	0.08	10.7

Table VI. Summary of the statistical analysis of the data in Tables I, II, III, IV and V

From Table	r_{xy}	r_{xy}^2	R_{xy}	C_A	IFE	Remark
I	0.9445	0.89	-0.05	32.8	67.2	*
II (pI)	0.9519	0.91	-1.48	30.6	69.4	*
III	0.6957	0.48	0.17	71.8	28.2	*
IV	0.5197	0.27	0.32	85.4	14.6	NS[a]
V	0.4144	0.17	0.50	91.0	9.0	NS

[a]Not significant. *, significant at $r_{=0.01}$ at n-2 degrees of freedom.

Table VII. Summary of the amino acid profiles into factors A and B

	Factor A		
	Muscle	Skin	Factor B means
Amino acid composition (Factor B)			
Total essential amino acid	41.2	29.8	35.5
Total non-essential amino acid 43.6	26.2	34.9	
Factor A means	42.4	28.0	35.2

Table IV. Amino acid scores of the muscle and skin of the African giant pouch rat based on provisional amino acid scoring pattern

Amino acid	Muscle	Skin	Mean	SD	CV %
Lys	1.20	0.82	1.01	0.27	26.7
Thr	0.69	0.56	0.63	0.09	14.3
Met + Cys	1.21	0.71	0.96	0.35	36.5
Val	1.01	0.54	0.78	0.33	42.3
Ile	0.90	0.85	0.88	0.04	4.55
Leu	1.01	0.81	0.91	0.14	15.4
Phe + Tyr	1.19	0.95	1.07	0.17	15.9
Total	1.04	0.76	0.90	0.20	22.2

Table V. Amino acid scores of the muscle and skin of the African giant pouch rat based on the suggested requirement of the essential amino acid of a preschool child

Amino acid	Muscle	Skin	Mean	SD	CV %
Lys	1.14	0.78	0.96	0.25	26.0
His	1.29	0.66	0.98	0.45	45.9
Thr	0.81	0.66	0.74	0.11	14.9
Val	1.44	0.77	1.11	0.47	42.3
Met + Cys	1.69	1.00	1.35	0.49	36.3
Ile	1.29	1.21	1.25	0.06	4.80
Leu	1.07	0.86	0.97	0.15	15.5
Phe + Tyr	1.13	0.91	1.02	0.16	15.7
Total	1.18	0.85	1.02	0.23	22.5

Table VIII. Muscle and skin amino acid compositions of the Greater cane Rat compared with those of the muscle and skin of the African giant pouch rat (g/100 g crude protein, dry weight)

Amino acid	Muscle			Skin		
	Cane rat	Pouch rat	CV %	Cane rat	Pouch rat	CV %
Lys	5.19	6.60	16.9	4.01	4.50	8.14
His	2.06	2.46	12.5	2.25	1.25	40.4
Arg	7.02	6.55	4.90	4.95	4.60	5.18
Asp	8.11	10.2	16.1	7.17	7.25	0.78
Thr	2.00	2.76	22.6	3.00	2.24	20.5
Ser	3.20	3.88	13.6	3.11	1.25	60.3
Glu	15.0	13.0	10.1	14.0	7.95	39.0
Pro	3.02	3.26	5.40	2.20	1.44	29.5
Gly	12.2	5.00	59.2	3.05	2.35	18.3
Ala	2.39	4.10	37.3	4.08	3.15	18.2
Val	6.20	5.03	14.7	4.61	2.68	37.4
Cys	10.5	1.19	8.84	1.16	0.55	50.4
Met	4.25	3.04	23.5	2.05	1.95	3.54
Ile	3.18	3.60	8.76	3.95	3.40	10.6
Leu	7.22	7.04	1.79	6.90	5.70	13.5
Tyr	3.00	3.02	0.47	2.30	2.22	2.50
Phe	4.05	4.11	1.04	4.80	3.50	41.7