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**Amino Acids Profile of the Fancy Meats of the African Giant Pouch Rat (*Cricetomys gambianus*)**

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**Abstract.** The levels of amino acids were determined in the tongue, liver, kidney and heart (fancy meats) of African Giant pouch rat (*Cricetomys gambianus*) on dry weight basis. The results showed that the total essential amino acids ranged from 40.2-43.8 g/100 g crude protein or 46.4-48.4% of the total amino acids. The amino acid scores showed that Lys ranged from 0.97-1.12 (on whole hen's egg comparison), 1.10-

1.27 (on provisional essential amino acid scoring pattern), and 1.04-1.20 (on suggested requirement of the essential amino acid of a pre-school child). The predicted protein efficiency ratio was 2.15-2.62, the essential amino acid index range was 1.14-1.31 and the calculated isoelectric point range was 4.82-5.22. The chi square (X2) test was low and none of the parameters were significantly different at *a* = 0.05 on all the comparisons made. Results had good comparison with whole hen's egg protein and other standard

proteins.

**Keywords:** red viscera, amino acids profile, *Cricetomys gambianus*

# Introduction

The Gambian pouch rat (*Cricetomys gambianus*), also known as the African Giant pouch rat is a nocturnal rat of the giant pouch rat genus *Cricetomys*. It is the largest muroid in the world. It is native to Africa (Oyarekua and Adeyeye, 2011).

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, 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 (Novak and Paradiso, 1991).

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 (Oyarekua and Adeyeye, 2011). The African Giant pouch rat belongs

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to the order Rodentia, superfamily Muroidea, family Nesomyidae, subfamily Cricetomyinae, genus *Cricetomys,* species *gambianus*, Binomial name: *C. gambianus* Waterhouse, 1840 (Oyarekua and Adeyeye, 2011). In Africa, it is routinely eaten as bush meat.

A study carried out in Nigeria, showed that the Giant rat produces about the same amount of meat as the domestic rabbit (Den Hartog and de Vos, 1973) and its nutritional value has been compared favourably with that of domestic livestock. African villagers know how to prepare it by smoking or by salting (NRC, 1991). Oyarekua and Adeyeye (2011) have reported the amino acids profile of its brain and eyes.

In many developing countries meat animals are frequently slaughtered only for the carcass, whereas, a number of by-products, which can be obtained quite easily, could help to improve the supply of low-cost high-protein foods for people. They are generally consumed either as main ingredients in traditional dishes or as ingredients in meat products. The so-called red viscera: liver, heart, kidneys, tongue and neck sweetbread (thymus) are normally obtained and marketed as "fancy meats" (Fornias, 1996), who has reported the main characteristics (recovery, preparation, microbiology, shelf-life and utilisation of edible by-products) in meat products. The African giant pouch rat is a delicacy in Nigeria, however, no literature report is available on the amino acids profile of its red viscera. This work

was therefore, set out to evaluate the amino acids profile of the tongue, liver, kidney and heart of the African Giant pouch rat. The information derived here would also likely improve the information on different food compositions.

# Materials and Methods

**Sample collection and treatment.** Matured female

*C. gambianus* were caught in the wild by a local hunter commissioned for the purpose at Iworoko Ekiti, Nigeria, identified and immersed in hot water for 10 min. After hair removal the animals were dissected and the red viscera was separately removed and dried to constant weight then milled into flour and kept in freezer in McCartney bottles for analysis.

**Crude protein determination and fat extraction.** The micro-Kjeldahl method as described by Pearson (1976) 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 (AOAC, 2005).

**Amino acid analysis.** About 30 mg defatted samples were weighed into glass ampoule, 7 mL of 6 M HCl added and hydrolysed in an oven preset at 105±5 °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 (Spackman *et al*., 1958) using a Technicon Sequential Multisample Amino Acid Analyser (Technicon Instruments Corporation, New York, USA). The period of analysis was 76 min, with a gas flow rate of 0.50 mL/min at 60 °C, and the repro- ducibility was ± 3%.

**Estimation of isoelectric point (pI).** The theoretical estimation of isoelectric point (pI) was determined using the equation of Olaofe and Akintayo (2000) and information provided by Finar (1975):

n

IPm = *I* IPiXi

i = 1

where:

IPm = isoelectric point of amino acid, IPi = isoelectric point of the ith amino acid in the mixture and Xi = mass or mole fraction of the ith amino acid in the mixture (Olaofe and Akintayo, 2000).

**Estimation of predicted protein efficiency ratio (P- PER).** The predicted protein efficiency ratio (P-PER)

was estimated by using the equation of the form (Alsmeyer *et al*., 1974):

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

**Estimation of dietary protein quality.** The amino acid scores were calculated using three different procedures:

1. scores based on amino acid values compared with whole hen's egg amino acid profile (Paul *et al*., 1976);
2. scores based on essential amino acid scoring pattern (FAO/WHO, 1973);
3. scores based on essential amino acid suggested required pattern for preschool child (FAO/WHO/ UNU, 1985).

**Estimation of essential amino acid index (EAAI).** The essential amino acid index (EAAI) was determined using the method of Steinke *et al.* (1980).

**The leucine/isoleucine ratios.** The leucine/isoleucine ratio, their differences and their percentage differences were calculated.

**Statistical analysis.** The coefficients of variation per cent (CV%) were calculated for the parameters investi- gated. Also calculated was the chi square (X2) test for all the parameters and subjected to table standards to test for significance difference, the level of probability was set 0.05 at n-1 degrees of freedom (Oloyo, 2001).

# Results and Discussion

Amino acids composition of the samples has been presented in Table 1. Glu and Asp were the most concentrated amino acids (AA) in all the samples. Tryptophan was not determined. Table 1 shows that the essential amino acid (EAA) of the samples were mostly concentrated (on pair wise comparisons) in the liver; the trend was: Lys, Leu, Ile, Thr and Val (five EAA, 5/9 or 55.6%) in liver; Arg and Phe (two EAA, 2/9 or 22.2%) in tongue; His and Met (two EAA, 2/9 or 22.2%) in kidney. The coefficient of variation per cent (CV%) ranged between 4.20-28.9 in the AA, with Arg having the least CV%. Table 2 shows the EAA together with Cys and Tyr for the heart, kidney, liver and tongue of cattle, pig and sheep as observed by Fornias (1996). With these literature values, the present results could be said to be very favourably comparable to them, as (g/100 g): His (2.30-3.13); Thr (2.60-4.20); Val (3.64-

5.60); Met (2.16-2.55); Ile (3.65-4.20); Leu (6.50-6.94);

Phe (4.11-4.80); Tyr (3.17-3.65) and Cys (0.88-1.20).

The comparisons showed that His and Met were better

concentrated in the African giant pouch rat than in cattle, pig and sheep red viscera, whereas, the present samples were also better than the minimum in Phe, Tyr and Cys. Total EAA from literature for cattle, pig and sheep red

**Table 1.** Amino acid composition of fancy meats of African giant pouch rat (dry weight)

Amino Tongue Liver Kidney Heart CV % acid (g/100 g crude protein)

viscera were (g/100 g) as shown in Table 2 (including Try), whereas, the present results (without Try which was not determined in this work) had heart (36); kidney (34.7); liver (42.2) and tongue (37.4), which were all favourably comparable to the literature values, respectively.

The FAO/WHO/UNU (1985) EAA standards for pre- school children between 2-5 years (g/100 g protein) are also shown in Table 2. Based on this information, the tongue would provide enough or even more than enough of Leu, Phe +Tyr, Val, Ile, Lys, Met + Cys, His and total EAA, this trend was followed by EAA in the heart; liver satisfied all the requirements, whereas, kidney satisfied all the requirements except in Leu (6.50 <

6.6 g/100 g). Histidine is a semi-essential amino acid particularly useful for children growth. It is the precursor of histamine present in small quantities in cells. Methio- nine is an EAA with value range of 2.16-2.55 g/100 g cp in this report or 3.26-3.60 g/100 g cp with Cys. Methionine 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 formed; this may cause accumulation of fat in the liver (Bingham, 1977). Phenylalanine formed a value range of 4.11-4.80 g/100 g cp of the samples. It is the precursor of some hormones and the pigment melanin in hair, eyes and tanned skin. Phenylketonuria is the commonest inborn error of metabolism which can be

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Lys | 6.75 | 6.96 | 6.37 | 6.03 | 6.31 |
| His | 2.32 | 2.30 | 3.13 | 3.03 | 16.6 |
| Arg | 6.99 | 6.38 | 6.81 | 6.50 | 4.20 |
| Asp | 10.6 | 9.70 | 10.5 | 10.6 | 4.21 |
| Thr | 2.60 | 4.20 | 3.95 | 2.65 | 25.2 |
| Ser | 3.95 | 3.72 | 3.55 | 3.00 | 11.4 |
| Glu | 15.2 | 13.0 | 14.2 | 12.9 | 7.89 |
| Pro | 2.87 | 4.22 | 3.20 | 3.50 | 16.7 |
| Gly | 4.85 | 8.00 | 6.20 | 4.20 | 28.9 |
| Ala | 4.48 | 4.18 | 3.94 | 4.07 | 5.53 |
| Cys | 0.88 | 1.20 | 1.05 | 1.20 | 14.1 |
| Val | 3.64 | 5.60 | 4.20 | 5.02 | 18.8 |
| Met | 2.38 | 2.16 | 2.55 | 2.40 | 6.77 |
| Ile | 4.02 | 4.20 | 3.65 | 3.65 | 7.10 |
| Leu | 6.70 | 7.65 | 6.50 | 6.94 | 7.22 |
| Tyr | 3.65 | 3.65 | 3.17 | 3.49 | 6.48 |
| Phe | 4.80 | 4.30 | 4.11 | 4.19 | 7.13 |
| Protein |  |  |  |  |  |
| (fat free) | 70.3 | 86.9 | 80.5 | 86.3 | 9.50 |

 treated successfully by diet. The absence of an enzyme

**Table 2.** Essential amino acid composition of fancy meats of cattle, pig, sheep and FAO/WHO/UNU (1985) standards for preschool children

Amino acid Tongue Liver Kidney Heart

Ca Pb Sc C P S C P S C P S FAO/WHO/UNU

(g/100 g crude protein)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Lys | 7.7 | 8.2 | 7.1 | 6.9 | 7.7 | 5.4 | 6.6 | 7.2 | 6.5 | 8.2 | 8.3 | 7.5 | 5.8 |
| Met +Cys | 3.4 | 2.2 | 3.2 | 4.0 | 4.4 | 3.1 | 2.9 | 4.3 | 3.1 | 3.9 | 4.4 | 3.0 | 2.5 |
| Ile | 4.3 | 4.6 | 3.9 | 4.6 | 5.1 | 4.3 | 4.1 | 5.3 | 4.0 | 4.4 | 4.8 | 4.3 | 2.8 |
| Val | 4.8 | 5.2 | 4.8 | 6.2 | 6.2 | 5.5 | 6.2 | 6.0 | 5.9 | 5.2 | 5.3 | 5.0 | 3.5 |
| Tyr | 0.8 | 1.2 | 1.0 | 1.4 | 1.4 | 1.2 | 1.4 | 1.3 | 1.4 | 1.1 | 1.2 | 1.1 | 1.1 |
| Thr | 4.4 | 4.2 | 4.5 | 4.6 | 4.2 | 4.5 | 4.8 | 4.1 | 4.7 | 4.7 | 4.4 | 4.7 | 3.4 |
| Phe +Tyr | 7.3 | 4.1 | 6.6 | 9.3 | 8.3 | 8.1 | 8.6 | 8.3 | 8.2 | 8.1 | 7.8 | 7.4 | 6.3 |
| Leu | 7.5 | 8.0 | 7.1 | 9.4 | 8.9 | 8.2 | 8.0 | 9.0 | 7.5 | 8.8 | 9.0 | 8.5 | 6.6 |
| His | 2.6 | 2.5 | 2.2 | 2.7 | 2.7 | 2.4 | 2.6 | 2.5 | 2.6 | 2.7 | 2.5 | 2.3 | 1.9 |
| Total | 45.8 | 40.2 | 40.4 | 49.1 | 48.9 | 42.7 | 45.2 | 48.0 | 43.9 | 47.1 | 47.7 | 43.8 | 33.9 |

a = cattle; b= pig; c= sheep.

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 first few weeks of life. Tyrosine 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-hypertyrosinaemia, a rear inborn error of metabolismcan cause liver and kidney failure unless treated with a synthetic diet low in Phe and Tyr (Bingham, 1977). Valine, an EAA is restricted in the treatment of maple syrup urine disease. When the present results were compared to amino acids profile of the eyes and brain of the African Giant pouch rat, it was observed that the following AA were all (in all the samples) more concentrated in the red viscera than in the eyes and brain (Oyarekua and Adeyeye, 2011) (g/100 g cp): Lys, Arg, Asp, Ser, Glu, Pro, Gly, Ala, Cys, Leu, Phe, whereas, His, Thr, Met, Val, Ile and Tyr had very close relationships.

Table 3 presents parameters on the quality of the protein of the samples. The EAA ranged between 40.2-43.8 g/ 100 g cp with a variation of 3.99%. These values were more than half the average of 56.6 g/100 g cp of the egg reference protein (Paul *et al*., 1976). The total sulphur AA (TSAA) of the samples were 3.26-3.60 g/ 100 g cp and these values were close to the value of

5.8 g/100 g cp recommended for infants (FAO/ WHO/ UNU, 1985). The aromatic AA (ArAA) range suggested for infant protein (6.8-11.8 g/100 g cp) (FAO/ WHO/ UNU, 1985) was very favourably comparable with the present report of 7.28-8.45 g/100g cp showing that the samples protein could be used to supplement cereal flours (Adeyeye, 2008a). The percentage ratio of EAA to the total AA (TAA) in the samples ranged between 46.4-48.4%. These values were well above the 39% considered adequate for ideal protein food for infants, 26 % for children and 11% for adults (FAO/WHO/UNU, 1985). The percentage of EAA/TAA for the samples could be favourably compared with other animal protein sources: 46.2% in *Zonocerus variegatus* (Adeyeye, 2005a), 43.7% in *Macrotermes bellicosus* (Adeyeye, 2005b), 54.8% in *Gymnarchus niloticus* (Trunk fish) (Adeyeye and Adamu, 2005) and 48.1-49.9% in brain and eyes of African giant pouch rat (Oyarekua and Adeyeye, 2011), whereas, it is 50% for egg (FAO/WHO, 1990). The TEAA in these results were close to the value of 44.4 g/100 g cp in soybean (Kuri *et al*., 1991), melon and gourd oilseeds with respective values of

**Table 3.** EAA, non-EAA, acidic, neutral, sulphur and aromatic acid contents of the fancy meats of African giant pouch rat (dry weight)

Amino acid Tongue Liver Kidney Heart CV% (g/100 g crude protein)

Total amino acid (TAA) 86.6 91.4 87.1 83.4 3.77 Total non-essential amino

acid (TNEAA) 46.4 47.7 45.9 43.0 4.34

Total EAA - with His 40.2 43.8 41.3 40.4 3.99

- no His 37.9 41.5 38.2 37.4 4.81

% TNEAA 53.6 52.2 52.7 51.6 1.61

% Total EAA - with His 46.4 47.9 47.4 48.4 1.80

- no His 45.0 46.6 45.5 46.5 1.70

Total neutral amino

acid (TNAA) 44.8 53.1 46.1 44.3 8.68

% TNAA 51.7 58.1 52.9 53.1 5.25

Total acidic amino

acid (TAAA) 25.7 22.7 24.7 23.5 5.47

% TAAA 29.7 24.8 28.4 28.2 7.53

Total basic amino

acid (TBAA) 16.1 15.6 16.3 15.6 2.24

% TBAA 18.6 17.1 18.7 18.7 4.29

Total sulphur amino

acid (TSAA) 3.26 3.36 3.60 3.60 4.99

% TSAA 3.76 3.68 4.13 4.32 7.64

% Lys in TSAA 27.0 35.7 29.2 33.3 12.5

Total aromatic amino

acid (TArAA) 8.45 7.95 7.28 7.68 6.2

P-PER 2.19 2.62 2.15 2.32 9.17

Leu/Ile ratio 1.67 1.82 1.78 1.90 5.34

Leu-Ile (difference) 2.68 3.45 2.85 3.29 11.8

% Leu-Ile (difference) 40.0 45.1 43.8 47.4 7.03

EAAI 1.l4 1.31 1.23 1.20 5.80

Isoelectric point (pI) 4.97 5.22 5.02 4.82 3.30

53.4 g/100 g cp and 53.6 g/100 g cp (Olaofe *et al*., 1994). The percentage of total neutral AA (TNAA) ranged from 51.7-58.1, indicating that these formed the bulk of the AA; total acidic AA (TAAA) ranged from 24.8-29.7 which were much lower than % TNAA, while the percentage range in total basic AA (TBAA) was 17.1-18.7 which made them the third largest group among the samples. The predicted protein efficiency ratio (P-PER) was 2.15-2.62. These results were highly comparable to the following literature values: 2.27 (skin) and 1.93 (muscle) of turkey hen (Adeyeye and Ayejuyo, 2007); 1.58 (brain) and 2.08 (eyes) of African giant pouch rat (Oyarekua and Adeyeye, 2011); 2.22 (*Clarias anguillaris*), 1.92 (*Oreochromis niloticus*) and

1.89 (*Cynoglossus senegalensis*) (Adeyeye, 2009a) but lower than in the values from various parts of fresh water female crab: 3.4 (whole body), 3.1 (flesh), 2.6 exoskeleton (Adeyeye, 2008b); fresh water male crab:

2.9 (whole body), 2.8 (flesh), 2.4 (exoskeleton) (Adeyeye and Kenni, 2008); 4.06 (corn ogi) and reference casein with PER of 2.50 (Oyarekua and Eleyinmi, 2004); 2.56

(cattle brain), 3.04 (pig brain), 2.68 (sheep brain), 3.26

(pig heart), 3.24 (pig kidney), 3.22 (pig liver), 3.00 (sheep heart), 2.57 (sheep kidney), 2.88 (sheep liver),

2.45 (sheep tongue) but better than 1.15 (cattle heart),

0.99 (cattle kidney), 1.20 (cattle liver), and 1.14 (cattle tongue) (Fornias, 1996). Other literature values were

1.21 (cowpea), 1.82 (pigeon pea) (Salunkhe and Kadam, 1989); 1.62 (millet ogi) and 0.27 (sorghum ogi) (Oyarekua and Eleyinmi, 2004); greater than 0.00 (raw sorghum), 0.23 (steeped sorghum) and 0.29 (malted sorghum) (Adeyeye, 2008a).

The Leu/Ile ratio was low in the samples (1.67-1.82) with CV% of 5.34; hence no concentration antagonism might be experienced in the giant pouch rat red viscera when used as protein source in food. The essential AA index (EAAI) ranged from 1.14-1.30. EAAI is useful as a rapid tool to evaluate food formulations for protein quality, although it does not account for difference in protein quality due to various processing methods or certain chemical reactions (Nielsen, 2002). The EAAI of defatted soybean is 1.26 (Nielsen, 2002); 1.10 (brain) and -1.10 (eyes) of African giant pouch rat (Oyarekua and Adeyeye, 2011), the present EAAI values were much better than the cited literature values. In the results of the isoelectric points (pI), there were various values (4.82-5.22). This type of observation had been made in African Giant pouch rat (Oyarekua and Adeyeye, 2011) in brain (4.28) and eyes (4.25); also in turkey meat: skin (4.41) and muscle (5.01) (Adeyeye and Ayejuyo, 2007). The calculation of pI from AA would assist in the quick production of the protein isolate of an organic product without going through the protein solubility determination to get the pI. Most animal proteins are low in Cys, for example: 36.3% in *M. bellicosus* (Adeyeye, 2005b), 25.6% in *Z. variegatus* (Adeyeye, 2005a); 35.5% in *Archatina marginata,* 38.8% in *Archatina archatina* and 21.0% in *Limicolaria* sp., respectively (Adeyeye and Afolabi, 2004); 27.3% - 32.8% in female fresh water crab body parts (Adeyeye, 2008b); 23.8-30.1% in three different Nigerian fishes (Adeyeye, 2009a); 13.3%-15.9% in male fresh water crab body parts (Adeyeye and Kenni, 2008); 26.0-26.5

% in turkey hen meat (Adeyeye and Ayejuyo, 2007); 20.8-28.2% in skin and muscle of African giant pouch rat (Oyarekua and Adeyeye, 2011) in their (Cys/TSAA)

% values. The present results corroborated these literature observations with values of 27.0-35.7%. This type of results had also been observed in guinea fowl egg

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Amino acid | Tongue | Liver | Kidney | Heart | CV % |
| Lys | 1.09 | 1.12 | 1.03 | 0.97 | 6.32 |
| His | 0.97 | 0.96 | 1.30 | 1.26 | 16.3 |
| Arg | 1.15 | 1.05 | 1.12 | 1.0 | 4.17 |
| Asp | 0.99 | 0.91 | 0.98 | 0.99 | 3.99 |
| Thr | 0.51 | 0.82 | 0.77 | 0.52 | 24.9 |
| Ser | 0.50 | 0.47 | 0.45 | 0.38 | 11.3 |
| Glu | 1.26 | 1.09 | 1.19 | 1.08 | 7.43 |
| Pro | 0.76 | 1.11 | 0.84 | 0.92 | 16.5 |
| Gly | 1.62 | 2.67 | 2.07 | 1.40 | 28.9 |
| Ala | 0.83 | 0.77 | 0.73 | 0.75 | 5.61 |
| Cy | 0.49 | 0.67 | 0.58 | 0.67 | 14.3 |
| Val | 0.49 | 0.75 | 0.56 | 0.67 | 18.7 |
| Met | 0.74 | 0.68 | 0.80 | 0.75 | 6.63 |
| Ile | 0.72 | 0.75 | 0.65 | 0.65 | 7.30 |
| Leu | 0.81 | 0.92 | 0.78 | 0.84 | 7.19 |
| Tyr | 0.91 | 0.91 | 0.79 | 0.87 | 6.50 |
| Phe | 0.94 | 0.84 | 0.81 | 0.82 | 7.00 |

(Adeyeye, 2010); 26.2% (muscle) and 30.2 (skin) in guinea fowl (Adeyeye, 2011). In contrast, many vegetable proteins contain substantially more Cys than Met, examples (Cys/TSAA)%: 62.9% in coconut endosperm (Adeyeye, 2004) and in *Anacardium occidentale* it is 50.5% (Adeyeye *et al*., 2007); 58.9-72.0% (raw, steeped, germinated sorghum) (Adeyeye, 2008a); 51.2-53.1% (raw, steeped, germinated millet) (Adeyeye, 2009b). Thus, for animal protein diets or mixed diets containing animal protein, Cys is unlikely to contribute up to 50% of the TSAA (FAO/WHO, 1991). The percentage of Cys in TSAA had been set at 50% in rat, chick and pig diets (FAO/WHO, 1991). Cys can spare with Met in improving protein quality and also has positive effects on mineral absorption, particularly zinc (Mendoza, 2002; Sandstrom *et al*., 1989).

Table 4 shows the AA scores (AAS) of the samples based on whole hen's egg profile (Paul *et al*., 1976). The scores had values greater than 1.0 in Lys, Arg, Glu, and Gly (tongue); Lys, Arg, Glu, Pro and Gly (liver); Lys, His, Arg, Glu and Gly (kidney) and His, Arg, Glu and Gly (heart). Only Lys, Arg, Glu and Gly were greater than 1.0 in all the samples. Glycine had the highest score (1.40-2.67) in all the samples; the least score was Ser across the samples (0.38-0.50). The AAS

**Table 4.** Amino acid scores of the fancy meats of the African giant pouch rat based on whole hen's egg amino acid profile

(14.0%) (Adeyeye, 2010); 44% in domestic fowl

values in these results followed the pattern observed in the African Giant pouch rat skin and muscle (Oyarekua and Adeyeye, 2011). The red viscera of the African Giant pouch rat generally showed good comparisons with AA profile of the whole hen's egg. The CV% of

**Table 6.** Amino acid scores (g/100 g)of the fancy meats of the African giant pouch rat based on suggested requirement of the essential amino acid of a preschool child

Amino acid Tongue Liver Kidney Heart CV %

the AAS ranged between 3.99-28.9. Table 5 contains

the essential AA scores (EAAS) based on provisional amino acid scoring pattern (FAO/WHO, 1973). The EAAS greater than 1.0 in the tongue were Lys , Ile, Phe

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Lys | 1.16 | 1.20 | 1.10 | 1.04 | 6.22 |
| His | 1.22 | 1.21 | 1.65 | 1.59 | 16.6 |
| Thr | 0.76 | 1.24 | 1.16 | 0.78 | 25.4 |
| Val | 1.04 | 1.60 | 1.20 | 1.43 | 18.8 |
| Met + Cys | 1.30 | 1.34 | 1.44 | 1.44 | 5.16 |
| Ile | 1.44 | 1.50 | 1.30 | 1.30 | 7.30 |
| Leu | 1.02 | 1.16 | 0.98 | 1.05 | 7.33 |
| Phe + Tyr | 1.34 | 1.26 | 1.16 | 1.22 | 6.06 |
| Total | 1.15 | 1.29 | 1.18 | 1.18 | 5.14 |

+Tyr and total; in liver they were Lys, Thr, Val, Ile, Leu, Phe +Tyr and total; for kidney Lys, Met +Cys, Phe +Tyr and total; for heart Lys, Met +Cys, Val, Phe

+Tyr and total. Lys, Phe +Tyr and total were consistently greater than 1.0 in all the samples. The limiting AA (LAA) in the tongue was Thr (0.65), it was Met +Cys (0.95) in liver, it was Val (0.84) in kidney and Thr (0.66) in the heart. Although these would have been described as the LAA, however, the EAA most often acting in a

limiting capacity are Met (and Cys), Lys, Thr and Try (FAO/WHO/UNU, 1985). Since Try was not determined, Thr would be limiting in tongue, liver and heart, whilst Met +Cys would be limiting in the liver. To make corrections for the LAA in the samples if they serve as sole sources of protein food therefore, it would be 100/65 (or 1.54) *x* protein of tongue, 100/95 (or 1.05) *x* protein of liver, 100/99 (or 1.01) *x* protein of kidney and 100/66 (or 1.52) *x* protein of heart (Bingham, 1977). The highest EAAS in the tongue was Phe +Tyr (1.41), it was Phe +Tyr (1.33) in the liver, it was Phe +Tyr in the kidney (1.21) and it was Phe +Tyr (1.28) again in the heart. The Table 6 shows the EAAS based on suggested requirement of the EAA of a preschool child (FAO/WHO/UNU, 1985). In the liver all the EAAS were greater than 1.0 whereas only Thr was less than

**Table 5.** Amino acid scores of the fancy meats of the African giant pouch rat based on the provisional amino acid scoring pattern

Amino acid Tongue Liver Kidney Heart CV %

1.0 in the tongue (0.76) and the heart (0.78); hence Thr would be the LAA in both (tongue and heart), whereas, no LAA in the liver and Leu (0.98) would be the LAA in the kidney. Therefore, the corrections would be 100/76 (or 1.32) *x* protein of tongue, 100/78 (or 1.28) *x* protein of the heart and 100/98 (or 1.02) *x* protein of the kidney. The following values would show the position of the quality of the African giant pouch rat red viscera protein: the EAA requirements across board are (values with His) (g/100 g protein): infant (46.0), preschool (2- 5 years) (33.9), school child (10-12 years) (24.1) and adult (12.7) and without His: infant (43.4), pre-school (32.0), school child (22.2) and adult (11.1) (FAO/ WHO/UNU, 1985); from the present results based on these standards, we have: 37.4 g protein (with His) and

35.1 (no His) in tongue; 42.2 g protein (with His) and

39.9 (no His) in liver; 34.7 g protein (with His) and

31.6 (no His) in kidney; 36.0 g protein (with His) and

33.0 (no His) in heart. While, the present results would satisfy a high percentage of infant needs, they will satisfy the requirements of preschool children and

 above.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Lys | 1.23 | 1.27 | 1.16 | 1.10 | 6.33 |
| Thr | 0.65 | 1.05 | 0.99 | 0.66 | 25.3 |
| Met +Cys | 0.93 | 0.95 | 1.03 | 1.03 | 5.34 |
| Val | 0.73 | 1.12 | 0.84 | 1.00 | 18.7 |
| Ile | 1.01 | 1.05 | 0.91 | 0.91 | 7.34 |
| Leu | 0.96 | 1.09 | 0.93 | 0.99 | 7.00 |
| Phe +Tyr | 1.41 | 1.33 | 1.21 | 1.28 | 6.44 |
| Total | 1.01 | 1.14 | 1.02 | 1.02 | 5.90 |

Table 7 gives a brief summary of the AA profile in the four samples. Column under factor B means showed that the values were close with a range of 41.4 -45.8. However, the mean of factor A means and factor B means gave a value of 43.6 g/100 g as a total summary.

The chi square (X2) test results were all low for all the parameters determined and the values were not significantly different at *a* = 0.05 among the samples.

**Table 7.** Summary of the amino acid profiles into factors A and B

Amino acid *Cricetomys gambianus* (Factor A)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| composition (Factor B) | Tongue | Liver | Kidney | Heart | FactorB means |
| Total essential |  |  |  |  |  |
| amino acid | 40.2 | 43.8 | 41.3 | 40.4 | 41.4 |
| Total non-essential |  |  |  |  |  |
| amino acid | 46.4 | 47.7 | 45.9 | 43.0 | 45.8 |
| Factor A means | 43.3 | 45.8 | 43.6 | 41.7 | 43.6 |

# Conclusion

This study has presented the amino acids data of the fancy meats (red viscera) of African Giant pouch rat (*Cricetomys gambianus*) female. It was found that the samples were good source of high quality protein of almost adequate or more than adequate essential amino acids, low Leu/Ile ratio and high protein efficiency ratio values thereby providing a probable premium quality meat. The samples were also very highly comparable to the red viscera of cattle, pig and sheep. The analytical results would also add information in the food composition of different meat.

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