FREE AMINO ACIDS AND CONSTITUTED AMINO ACIDS OF PROTEIN OF FOUR MUSCLES AND LIVER FROM RUBIA GALLEGA

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Keywords: amino acids, beef, taurine

Introduction

Nowadays, consumers wish to have better knowledge about the nutritive quality of food; in the case of meat, this depends on nitrogenous components, basically protein of high biological value, free amino acids, dipeptides and other non-protein nitrogenous compounds (NPN), because of their contribution to taste and flavour in food (Kato *et al*., 1989). It has been established that oxidative muscles are tastier than their glycolytic counterparts; this is due, in part, to their content of free amino acids and dipeptides (Cournet y Bousset, 1990). On the other hand, amino acids play an important biological role, for example accumulation of taurine is necessary for functional regulation of the eyes, heart, brain and central nervous system (Stapelton *et al*., 1997). Taurine needed in the human body is synthesised from the dietary sulphur amino acids; methionine and cysteine; the metabolism of babies is not able to form it. Taurine is highly recommended in heart diseases like congestive heart failure (Azuma *et al*., 1982). Protein content is constant in muscle, but the ageing process produces liberation of peptides, amino acids and other NPN due to protein hydrolysis. The amount of essential/non-essential (E/NE) amino acids in different muscles can vary and from a commercial point of view, better muscles have not necessarily got a favourable E/NE ratio. Amino acid determination at 24 hour *postmorten* is useful; at this point the carcass is cold and the ageing process has not started yet. The aim of this work was to determine amino acids in different commercial muscles and the liver of Rubia Gallega calves.

Materials and Methods

24 hours *post morten* steak was excised from middle of each following muscle: *Semitendinosus* (ST), *Gluteus biceps* (GB), *Semimembranosus* (SM), *Longisimus Thoracis* (LT) and liver of two animals. External fat and connective tissue were removed and each sample was ground and freeze-drying. Samples were stored at -20 ºC until analyzed. Free amino acids were extracted according to the method of Konosu *et al*. (1974). Protein precipitate with TCA was hydrolyzed 2with 6M HCL in sealed ampoules for 24 hours in a oven at 110 ºC. Amino acids were determined by HPLC using AccQ-Tag derivatization reagent. Amino acids were separated on a Water AccQ-Tag column (3.9 mm x 150 mm with a 4 µm of particle size) and detected by fluorescence (Waters 2475) according to methodology developed by Vandelen and Cohen, (1997). Amino acids were identified by retention time using an amino acid standard (Sigma Aldrich) to which taurine (Panreac) was added.

Results and Discussion

The content of free amino acids (FAA) and constituted amino acids of protein (HAA) in the muscles studied is shown in Table 1. With regard to free amino acids, the amount of essential and non-essential are similar apart from SM and liver where the amount of non-essential amino acids are higher (59.01 and 43.57 vs 79.94 and 113.79 mg free amino acid/100 g fresh muscle respectively). It is interesting to note that the free amino acid at highest concentration in all muscles is taurine ,except LD in which 17.82 mg taurine/100 mg fresh muscle is found as against 74.26 mg/100 mg fresh muscle in SM. In the case of liver, taurine is a minor component. There is little information about taurine levels in beef and our results are in the same range as stated by Spitze *et al*., (2003) and Purchas *et al*. (2004). However taurine values in liver were lower than these authors reported, because taurine quantity in liver is very variable (Spitze *et al*. 2003).

In general, amino acid composition (g/100 g protein) in different muscles showed a similar pattern; this result is in agreement with Schweigert (1987) who found that amino acid composition of protein remains constant in different commercial cuts. Glutamic acid and aspartic acid were quantitatively the most important non-essential amino acids in all muscles, whereas lysine and leucine were quantitatively the most important essential fraction. Limiting amino acids in dietary protein are typically the sulphur-containing amino acids, like threonine and lysine. The amount of threonine and lysine in the LD muscle were 2.5 and 1.7 times higher respectively than in hen egg protein ,commonly used as a reference protein with regard to amino acid composition in other food items (Matthews, 1999).

Table 1: Free amino acid contents (mg free amino acid/100 g fresh muscle) and amino acid composition of Rubia Gallega meat (g /100 g protein).

	ST		GB		SM		LD		Liver	
	FAA	HAA	FAA	HAA	FAA	HAA	FAA	HAA	FAA	HAA
Essential										
Histidine	37.58	1.58	41.10	1.73	20.85	1.73	9.71	1.63	14.8	1.63
Isoleucine	10.43	6.60	5.02	5.80	5.55	7.32	2.16	6.16	5.10	5.14
Leucine	5.99	6.55	2.90	9.04	2.40	7.49	1.55	10.37	2.36	9.14
Lysine	7.46	9.12	4.35	10.53	4.52	9.90	1.64	11.61	5.67	7.70
Methionine	4.00	2.97	1.55	3.38	1.77	3.52	0.87	4.21	1.81	2.74
Phenylalanine	7.57	4.40	3.77	5.04	4.09	5.05	2.46	6.69	4.16	5.80
Threonine	11.77	4.71	14.01	5.25	15.14	4.78	5.88	5.62	6.01	4.56
Valine	8.52	5.51	4.10	6.13	4.69	6.26	1.48	7.26	3.66	6.51
Total	93.32	41.44	76.8	46.9	59.01	46.05	25.75	53.55	43.57	43.22
Non-essential										
Arginine	10.90	6.39	21.81	6.98	18.92	7.04	nd	8.25	5.52	6.38
Alanine	21.18	6.12	20.83	6.54	19.01	6.46	5.22	7.77	8.33	5.80
Aspartic acid	2.84	9.80	2.61	10.98	2.39	10.62	2.36	12.52	4.58	9.53
Cystine	8.62	0.85	6.05	1.19	7.35	0.99	2.62	1.25	10.20	0.89
Glutamic acid	20.10	15.73	8.87	17.49	11.18	16.94	5.00	20.32	49.8	12.34
Glycine	9.38	4.39	6.81	4.43	7.77	4.44	3.04	5.14	21.69	4.79
Proline	5.86	3.64	3.66	3.85	4.05	3.76	2.55	4.47	3.96	4.25
Serine	10.08	3.45	5.54	4.04	5.74	3.78	3.02	4.25	6.99	3.90
Tyrosine	6.87	3.68	3.08	4.29	3.53	4.23	1.50	5.04	2.72	3.60
Other										
Taurine*	59.81	nd	69.03	nd	74.26	nd	17.82	nd	1.93	nd
Total	95.83	54.05	79.26	59.79	79.94	58.26	25.31	69.01	113.79	51.48
E/NE ratio	0.97	0.77	0.97	0.78	0.74	0.79	1.02	0.78	0.38	0.84

nd. not detected, * taurine not included in Total.

Conclusions

Taurine is the most important free amino acid in all muscles, with a maximum content of 74.26 mg per 100 g of fresh muscle Although there is not a recommended daily intake of taurine, "Ternera Gallega" meat is an important taurine source. The best E/NE ratio was found in liver so from a nutritive point of view its intake should be recommended.

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