

INVESTIGATIONS OF AMINO ACID
COMPOSITION OF CATTLE MUSCLES

A. B. Lisitsyn, A. D. Nekludov, A. N. Ivankin, G. I. Mosina, A. N. Petrakova, B. S. Carpo
All-Russian Meat Research Institute, 109316, Moscow, Talalikhina 26, Russia

Key words: amino acid composition, muscles of the cattle

Study of amino acid composition and determination of the content of free and "combined" amino acids in muscle tissue makes it possible to obtain data, characterizing qualitative and quantitative composition of muscle proteins, as well as evaluate the primary structure of the proteins, character of metabolic processes and possibility of subsequent digestion by other heterotrophic organisms during inclusion into their feed ration. In this work the muscles as removed from the beef carcass were used: from hip and pelvis: - m. glutaeus medius, m. semitendineus, m. semimembranosus, m. adductor femoris, m. pectineus, m. quadriceps femoris, m. biceps femoris, m. triceps brahii, m. supraspinatus, m. infraspinatus, m. longissimus dorsi, m. longissimus dorsi lumborum, subcutaneus colli.

The extracts of muscle tissue were obtained using generally accepted procedures and used for determination of free amino acids, as well as combined amino acids, obtained as a result of complete hydrolysis of muscle protein.

Table 1 shows the results of studying the amino acid composition of cattle muscles, i. e. determination of the so called "combined" amino acids, obtained as a result of full hydrolysis of muscle protein by 6N solution of HCl at 105°C during 20 hours.

As can be seen from Table 1, the muscles amino acid composition differs from the content of similar amino acids in a free intercellular state. The results of determination of free amino acids, extracted by usual water-alcohol extraction of meat are presented in table 2.

The correlation of the content of "combined" amino acids to the total sum of amino acids of muscular protein is practically constant for all the muscles and constitutes 39-41%, i. e. is a constant value within the error of the experiment. The correlation of the content of methionine to isoleucine was practically a constant value, equal to 0.6 in all the cases.

The presence of free amino acids characterizes indirectly the metabolic processes and conversion of amino acids into other chemical compounds, which are the construction blocks or utilizable substrates in biosynthesis of vitamins, proteins, fats, carbohydrates, pigments of high-energy phosphates, etc.

Table 1

Amino acid composition of beef muscle proteins, g/100 g protein

NN	Name of muscles	Asp	Thr	Ser	Glu	Pro	Gly	Ala	Cys	Val	Met	Ile	Leu	Tyr	Phe	His	Lys	Arg	Trp	Oxy- pro- line
1	glutaeus medius	8,9	3,3	2,0	17,8	2,7	2,3	3,8	1,0	4,5	2,9	4,8	7,2	3,4	5,2	3,6	8,2	8,3	1,0	0,5
2	semitendineus	7,9	3,2	2,1	17,2	4,6	2,6	4,1	1,1	4,6	3,0	4,9	7,4	3,9	5,2	3,7	8,7	8,6	1,2	0,6
3	semimembranosus	9,8	3,6	2,2	19,3	3,5	2,4	3,8	1,1	4,7	3,1	5,1	7,9	3,8	5,3	3,4	7,8	8,6	1,3	0,4
4	adductor femoris	9,6	3,2	1,7	18,8	3,8	2,5	3,8	0,9	4,7	3,1	5,0	7,6	4,0	5,2	3,6	9,0	8,2	1,1	0,4
5	pectineus	9,2	3,3	2,0	18,6	3,3	2,6	3,7	1,0	4,5	2,9	5,1	7,7	4,2	4,1	4,5	7,5	8,8	1,0	0,6
6	biceps femoris	9,0	3,3	1,9	19,0	4,2	2,9	4,5	0,8	4,8	3,2	5,1	8,0	4,4	5,5	3,8	8,8	8,9	0,9	0,8
7	quadriceps femoris	9,5	3,1	1,6	19,5	3,5	2,7	3,9	0,9	4,6	3,2	4,2	7,4	3,8	5,4	3,8	8,8	8,8	1,2	0,6
8	triceps brahii	9,4	2,5	1,7	18,9	3,3	2,6	4,0	1,1	4,8	3,2	5,1	7,8	3,9	5,5	3,9	9,3	8,4	1,0	0,6
9	supraspinatus	9,4	3,1	1,8	18,7	3,5	2,6	3,8	0,9	4,6	2,9	4,9	7,6	3,8	4,9	3,2	8,8	9,4	1,0	0,6
10	infraspinatus	9,2	3,0	1,6	18,8	5,5	2,6	3,7	0,8	4,6	3,0	4,8	7,3	3,6	5,2	3,4	8,3	7,8	0,9	1,2
11	longissimus dorsi	10,3	3,9	2,0	19,8	2,4	2,7	4,2	1,1	4,7	2,8	4,5	8,4	3,7	5,6	3,8	8,6	8,9	1,3	0,3
12	longissimus dorsi lumborum	8,0	2,5	1,4	15,5	4,2	2,1	3,3	1,2	4,1	2,6	4,0	6,2	3,1	4,2	1,7	7,1	7,2	1,3	0,3
13	subcutaneus colli	9,9	3,4	1,9	20,1	3,8	3,9	4,1	-	4,8	3,3	5,2	8,1	4,1	5,6	2,9	7,0	7,0	1,0	0,8

Table 2

Content of free amino acids in beef muscles. g/100 g of free amino acids without tryptophane

NN	Name of muscles	Asp	Thr	Ser	Glu	Pro	Gly	Ala	Cys	Val	Met	Ile	Leu	Tyr	Phe	His	Lvs	Arg
1	glutaeus medius	1,2	1,1	18,2	3,0	3,0	3,5	8,0	0,6	1,7	1,0	1,1	2,3	1,3	2,3	45,3	2,7	3,6
2	semitendineus	0,2	1,3	18,9	3,1	4,1	4,1	10,2	1,0	2,1	1,1	1,3	2,5	1,6	3,1	40,1	2,4	3,3
3	semimembranosus	4,7	1,8	10,5	7,9	11,3	6,2	10,8	1,2	1,0	1,2	1,4	2,8	2,4	4,7	27,7	4,0	4,4
4	adductor femoris	2,4	1,2	13,9	6,4	3,5	5,1	6,5	0,5	2,6	0,8	1,0	1,9	1,3	2,4	47,6	2,5	2,6
5	pectineus	4,0	1,1	27,2	5,6	2,6	3,9	15,3	0,4	1,7	0,6	1,0	1,9	1,2	2,0	25,0	3,4	3,5
6	biceps femoris	0,7	0,3	20,2	3,5	3,2	5,1	12,8	0,7	1,7	0,8	1,1	1,8	1,5	3,1	30,3	3,1	4,2
7	quadriceps femoris	1,0	1,5	16,5	5,0	3,5	4,7	12,8	1,1	2,3	1,1	1,4	2,7	1,9	2,9	34,1	3,1	3,2
8	triceps brachii	1,2	1,0	23,2	2,2	3,8	4,9	9,2	0,4	1,4	0,8	0,8	1,8	0,8	1,8	39,5	3,0	3,5
9	supraspinatus	3,5	1,4	28,3	3,5	1,6	3,1	13,1	0,3	2,0	0,9	1,2	2,3	3,8	2,2	26,8	3,8	2,8
10	infraspinatus	1,2	1,5	23,8	5,7	2,6	5,7	16,5	0,9	2,0	0,8	1,1	2,1	1,3	2,0	24,2	4,9	4,7
11	longissimus dorsi	0,7	1,2	14,5	5,9	2,7	3,5	9,3	0,7	1,6	0,8	1,0	1,6	1,4	1,4	48,8	1,7	2,4
12	longissimus dorsi																	
13	lumborum subcutaneus colli	0,4	1,1	9,6	3,4	5,3	4,2	7,8	1,0	1,8	1,2	1,2	2,0	1,6	2,9	49,6	3,5	3,6
		0,9	0,3	18,6	6,9	4,5	4,8	15,8	0,7	1,8	0,8	1,0	1,8	1,4	2,5	29,0	3,8	4,0

As can be seen from Table 2, for isoleucine and methionine, in all the investigated muscle extracts there was observed a constant content, close on the average to value 1% from the total sum of the available free amino acids.

The ratio of the content of isoleucine to methionine is a constant value, close or equal to 1, and exceeding by 35-40% the value of the same figure for the "combined" amino acids. The amount of leucine in all the investigated muscles practically exceeds the content of isoleucine by 1.6-2.0 times.

For non-essential amino acids there are positive differences in the content of aspartic acid in hip and pelvis semitendineus muscle, histidine - in subcutaneous colli, glutamic acid - in hip and pelvis semitendineus and m. glutaeus medius muscles, serin - in longissimus dorsi lumborum and in hip quadriceps as well as tyrosine - in m. longissimus dorsi lumborum.

Summarizing all the above-mentioned, one can come to a conclusion that in studying the amino acids composition of beef muscles and apparently other objects of the mammals, an essential information about possible ways of synthesis and degradation of amino acids can be obtained from the investigations as carried out on samples of meat products. In these studies it is a composition of intercellular muscle liquid (liquor) can be analyzed, but not the muscles themselves, because from the composition of the pool of free amino acids one can conclude indirectly about metabolic intensity in the investigated muscle, and judge about loading of one or another muscle.