Change of protein amino acid composition in the production of fish sausages

KJOSEV, D.*, DONTCHEV, V.*, RIBAROVA, P.**
* Higher Institute of Food and Flavour Industries, 4002 Plovdiv
** Research-Scientific Institute of Gastroenterology and Nutrition, Medical Academy, 1431 Sofia

Fish meat is used comparatively recently for the production of fish sausages. In combination with domestic animals meat some products with high nutritional value and biological worth can be obtained. For the purpose different kinds of industrial fish can be used. Sea fish, however, (1) have advantage up to now and freshwater fish raw materials which have a specific composition are more rarely used.
Recently an importance aquires the Hypophthalmichtys molitrix. According to our investigations its meat has very suitable for the production of sausages technological properties. Besides that it has very well expressed flavour properties without tasting the slime flavour of Hypophthalmichtys molitrix. When juxtaposing our own experimental data taken from other studies (2, 3) it has been obtained that protein substances of Hypophthalmichtys molitrix are in greatest quantity in comparison with other fish from the family of H.molitrix. Having made the analysis of protein amino acid composition we have determined that the H.molitrix composition is similar to those of H.molitrix, and the sum total quantity of amino acids is in percents more than that in the meat of cattle and calves. Comparing the quantity of irreplaceable amino acids expressed towards treonine having in mind H.molitrix meat of ruminant cattle and H.molitrix, conformable to man needs (according to the FAO requirements) it can be seen that having in mind its biological value the H.molitrix does not yield to veal and beef and to the meat of H.molitrix. Consequently, this a valuable fish with a high nutritional and biological value which can satisfy completely the needs of human organism from energy and the necessary for the processes of biosynthesis amino acids.

Having in mind these formulations we created a technology and subjected to study the obtained fish sausage as regards the changes in the protein amino acid composition in the raw material, in the half-finished material and in the ready products. The identification and determining the quantity of the separate amino acids we did by means of laboratory samples, hydrolisis with the help of amino-analyser "Perkin Elmer", model KLA-5, according to the method of Moore and Stein (4).

The prescriptions have been created with the help of mathematical modelling. Some limitations have been put as regards the percent contents of fish filling, beef and bacon as regards protein quantities and dry substances. As a purpose function the condition for the production of a product having a comparatively reasonable price has been assigned. On this basis the production of a cooked sausage with the following composition : minced meat of H.molitrix - 60 % beef, beef - 25 %, and bacon - 15 %, has been experimented.

The technological diagramme that has been created by us for the production of sausages is the following : production and preparation of H.molitrix farce, as well as a preparation of other meat components, including salting and ripening; production of a filling mass; filling in coats; scorching; cooking and cooling. The production of the filling mass is done on a cuter. With the purpose of studying the thermal processing influence as well as the structuring the filling mass on the change of protein amino acid composition, three variants of fish sausages have been studied : I variant : to the homogenized filling in the cuter bacon is added and the latter is cut to definite dimensions - i.e. the so called structural sausage is obtained. It is filled into artificial coats having a diameter of 20-22 mm, it is subjected initially to a scorching at a temperature of 85-80°C in the course of 50-60 min., and after that to a cooking at 76-78°C in the course of 30-35 min.

II variant : to the homogenized filling mass in the cuter bacon is added and it is cut to definite dimensions. The filling should be done in natural coats having a diameter of 27-35 mm, the scorching being done at 95°C in the course of 70-80 min., and the cooking at 76-78°C in the course of 35-40 min.

III variant : in the cute homogenizing is being done of the three basic components, and the obtained uniform mass is also filled into natural coats with a diameter of 20-22 mm and is being processed thermally in the same conditions as with variant I, and as a result nonstructural sausage.

Regardless of the different modes of thermal processing the cooking stops when reaching a temperature in the centre of t_c = 72°C. After the cooling of the so called sausages laboratory samples have been prepared, which are subjected to analysis. The data obtained for the proteins amino acid composition in the samples studied by us are introduced in tables 1 and 2. Some characteristic changes appearing in amino acid composition can be noticed in their consideration.

The differences in the different amino acid contents between the samples of the three variants filling mass and the raw material are due probably to the addition of other meat raw materials which change their percent ratio. For example, that is the way to decrease the relative contents of leucine, lysine, aspartic acid, while that of threonine, alanine, glycine, proline and hydroxiproline increases.

The thermal processing of fish sausages does not cause such changes in the ready products which could lead to a lowering of their biological value. The contents of irreplaceable amino acids as regards the filling mass are almost not changed.

AMINO ACID COMPOSITION OF RAW FISH MATERIAL, SEMIMANUFACTURE AND READY SAUSAGES

TABLE 1

Amino acid g/100 g protein	Fish farce	Filling mass			fish sausage		
		I variant	II variant	III variant	I variant	II variant	III variant
VALINE	4,98	4,94	5,05	5,02	4,98	4,96	4,97
ISOLEUCINE	4,39	4,39	4,41	4,42	4,74	4,52	4,58
LEUCINE	8,46	7,84	8,01	8,11	8,35	7,99	8,23
LYSINE	10,92	9,89	9,68	9,90	9,67	9,66	10,03
METHIONINE	2,96	2,68	2,73	2,67	2,76	2,82	2,89
CYSTINE	0,39	0,50	0,40	0,43	0,77	0,64	0,68
THREONINE	4,13	4,29	4,36	4,55	4,48	4,37	4,48
TRYPTOPHAN	1,05	0,88	0,82	0,92	0,89	1,09	0,97
TYROSINE	3,68	3,09	3,53	3,36	3,44	3,48	3,46
PHENILALANINE	4,36	3,92	4,28	4,08	4,32	4,31	4,34
ALANINE	6,01	6,38	6,52	6,33	6,15	6,27	6,17
ARGININE	6,48	6,58	6,29	6,21	6,18	6,30	6,50
ASPARTIC ACID	11,56	10,22	10,21	19,49	9,62	9,64	9,76
GLYCINE	5,08	6,60	7,00	5,94	5,55	6,10	6,70
GLUTAMIC ACID	14,92	14,26	14,17	14,40	14,86	14,68	14,53
PROLINE	3,02	4,36	4,46	3,71	3,86	4,23	3,71
SERINE	3,84	3,78	4,01	4,04	4,15	4,10	4,14
HYDROXIPROLINE	0,55	2,20	1,56	1,06	1,78	1,40	1,22
HISTIDINE	3,21	3,22	3,50	3,36	3,44	3,45	3,53

A certain decrease can be noticed in aspartic acid, proline, and hydroxiproline. As regards the fish raw material in the final product the contents of leucine, lysine, aspartic acid, glutamic acid decreases, while that of cystine, threonine, glycine, proline, hydroxiproline increases, etc.

We should notice that having in mind the mode with a more continuous thermal processing a product with decreased contents of some of the irreplaceable amino acids (variant II) can be produced which influences negatively upon the index E/T (43,83 %). The value of the biological validity of the index chemical score (Table 2) shows that after the thermal processing the amino acid numbers are preserved comparatively high. The three variants are used for the production of products having a certain reserve of aminogramme of FAO/SZO, 1973, as regards the contents of amino acids named lysine, tyrosine, phenilalanine.

AMINO ACIDS SCORE

Table 2

Amino acid g/100 protein	Fish farce	Filling mass			Fish sausage		
		I variant	II variant	III variant	I variant	II variant	III variant
VALINE	100	99	101	100	100	99	99
ISOLEUCINE	110	110	110	111	118	113	115
LEUCINE	121	112	114	116	119	114	118
LYSINE	199	180	176	180	176	176	182
METHIONINE CYSTINE	96	91	89	88	101	99	102
TRYTOPHAN	105	88	82	82	89	109	97
TYROSINE PHENILALANINE	134	117	130	124	129	130	130
irreplaceable/ total quantity amino acids /index E/T/	45,32	42,42	43,27	43,45	44,41	43,83	44,63

The same can be said in a way for leucine, isoleucine, but these amino acids have a lower score at variant II, as a result of a more continuous thermal influence. The following amino acids can limit the biological value : tryptophan at variant I and III, and at variant II - sulphurcontaining amino acids methionine and cystine. Besides that valine has lower amino acid number at the three variants, too.

Literature

1. Budina, V.G. Technologija ribniih kolbasniih izdjelii, M.1983.
2. Petrenko, V.P. VNII po ezerno ribno stopanstvo, Sbornik nautchni trudove, .15, 1975.
3. Bojadziev, A. and co. Izvestija na Instituta po sladkovodno ribovadstvo, Plovdiv, v.XIV, 1980.
4. Moore, S., W.H. Stein, Journal of Biological Chemistry, 1951, 2.