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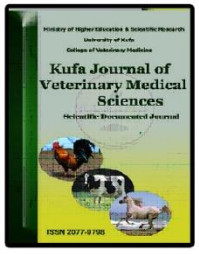

Content of Amino Acids in Poultry Meat Products

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Summary:
This work presents the results of detailed studies of protein quality of 13 kinds of poultry products; presents the results of the determination of amino acids from a total of 108 samples. Demonstrates the results of protein studies and discusses the importance of poultry fats (content of selected fatty acids), salts, nitrates and minerals. Based on the appraisal of the manufacturing process steps the study considers their possible impact on the biological value of the final products that are consumed in standard amounts, pointing out some of the possible adverse effects on the biological value of poultry raw material, adverse impacts of some added substances, increased by final processing. Results of studies of poultry products also prove that the use of additives must be prudent and there should be the maximum extent of use limited as much as possible; there must be carefully considered the necessity of each technological step and its impact on the raw material, finished product as well as the consumer's health.

Key words: Poultry meat products, meat protein, amino acids

محتوى الأحماض الأمينية في منتجات لحوم الدواجن

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العراق, جامعة الكوفة, كلية الطب البيطري, فرع الصحة العامة

الخلاصة :
العمل يعرض نتائج نوعية البروتين الموجود في 13 نوع من منتجات لحوم الدواجن ويظهر نتائج انواع ومقادير الأحماض الأمينية المتواجدة فيها, وتوضح الدراسة نتائج البروتين ومناقشة اهمية الدهون والأملاح والنترات والمعادن في منتجات لحوم الدواجن مستندة الى تقييم خطوات عمليات التصنيع والفحص البكتريولوجي وتاثيراتها المحتملة على القيم البايولوجية لهذه المنتجات ومراقبة الأثار السلبية لبعض المواد المضافة والتي يجب ان تستخدم بكميات محدودة قدر الأمكان وان تدرس بعناية قصوى كل خطوة من عمليات التصنيع وتاثيراتها على المواد الخام او المنتج النهائي ومدى تأثيراتها على صحة المستهلك.

Introduction:
Meat and meat products make up a significant proportion of the consumption of foods of animal origin and contain a number of nutritionally important components, especially proteins (1, 2).The importance and economics of fattening poultry broiler is studied in detail and described (3). The fat content in the meat of various kinds of poultry varies according to age, sex, feedstuff used and also in

various parts of the body of the animal. "Dry" chicken breast muscles have in average only 1.2% of fat content, in thigh muscles the fat content is higher; thighs are therefore more tasty. For slaughter chickens, the average fat content varies from 3.5 to 5%. Resources (1) bring a lot of information about the nutritional importance of meats, especially poultry meat. Poultry meat is there usually decribed as fine, delicate and easily digestible, which can be well combined with other foods that have good taste characteristics and can be prepared in various ways, ie. cooked, braised, baked or fried; It is also an essential part of modern and rational nutrition. Therefore, the chicken meat is one of the most popular meats in our kitchens. Another favourite poultry meat there is turkey meat, but we choose also meat of geese, ducks, pheasant (4) or even ostrich, and a wide range of wild game, particular feathered game.

Poultry meat is an important food raw material, processed by numerous technological processes, and subsequently used to produce a wide range of meat products from poultry meat. Its broad use ability for processors and high popularity among consuments share in, when compared with the share of beef and pork meat, on its long-term stable and relatively high consumption. On the poultry meat market we encounter the "fresh" and "frozen" goods but the legislation recognizes even goods "refrigerated" and "fresh", "frozen" and "deep frozen".

An important material is fresh poultry meat, whose processing temperature ranges from 0 to 2 °C, should not exceed 4 ° C, and temperature below -2 °C is not permitted. The cooling process can´t be interrupted and high level of hygiene during all handling, particularly in the household, must be still kept (5). Under these conditions, fresh poultry meat can be kept fresh for about seven days, which also contributes to its popularity among consumers. Repetitive freezing of food, especially of meat, is not allowed and that brings the occasional need to prove the number of freezing. It may be too subjective sensorically but in laboratory it can be relatively reliably proved (6) when used the enzyme aconitase.

In the already mentioned consumption of poultry meat,which is 24.6 kg/person/year (7), whole chickens and parts of bodies whose consumption is roughly two-thirds of the total consumption of poultry meat create the major position. Production of the selected poultry was introduced on the basis of the requirements of customers, in half's, quarters and in certain parts thighs, breasts, wings, or slices. Dividing of bodies takes place with the minimal contact of the hands of workers on automatic or semi-automatic lines, adjustable to fit the size of the pieces for a quick, accurate and smooth cuts that don´t unnecessarily uncover the muscle; separating the wings and thighs in the joints. Because the surface of the inner and outer surface of the processed body, i.e. the contact with the processing environment is relatively very high, all handling with the poultry meat requires high technological and hygienic discipline. Specialized literature (8) define amply what tribes of microorganisms are of high attention. As poultry may be carrying some thermotolerant microorganisms, as documented in the work of the National Reference laboratory (9) for *Campylobacter spp*, or even resistant to some antibiotics. German authors (10) claim poultry as carriers and

transmitters of microorganisms, enumerate and characterize microorganisms on live poultry and poultry meat in detail as zoonotic agents, causes of spoilage and the source of foodborne infections and intoxications. They describe microorganisms in poultry as well as on bodies of slaughtered poultry such as salmonella, Campylobacter, *Listeria monocytogenes*, *Aeromonas,Yersinia*, *Escherichia coli*, Chlamydia, *Staphylococcus aureus* and clostridia. For the latter they describe the findings as *Clostridium perfringens*, as well as *Cl.botulinum*, that is for poultry meat products, in which we are considering a reduction of the level of nitrites used, particularly significant. The importance of uninterrupted cooling chain is emphasized by the detailed study of the growth of the most often present tribes or species of microorganisms under defined temperature conditions. To prevent neglecting any health risk or danger, especially in fresh poultry process, the HACCP system for processing poultry and poultry meat together with the correct technology systems (GTP-GMP) and hygiene practices (GHP) must be very rigorously respected. They demonstrate their importance by a very careful and detailed presentation of the HACCP system and individual control and critical articles (10).

Chicken meat dominates the production of poultry meat. Despite a certain stagnation over the past few years, its share of the total consumption has the long-term upward trend; prognosis shows that for the year 2014 there is no fall well below the level of 24 kg / person and year awaited (3). The biggest increase in consumption of chicken meat were registered in the United States. One of the key players in the meat trade is Russia; with the nearly balanced share of poultry meat(11). The leader in the poultry meat production in the European Union now is Poland. Some polish companies also work on non-EU markets, where they are on the third position among the largest exporters behind France and Netherland.

Materials and methods:

The experiment could not involve all products from poultry meat and eggs produced by poultry industry, as the sortiment is very rich, consisting of tens products of various kinds. The choice fell on products with clean-cut different properties and technologies representing at the same time group of products of similar properties and technological produces.

The products were mostly collected directly from production so as to correspond with required optimum standard and set down processing procedures, as only under these conditions, the analytic results could offer the best suggestions of real biological values, or of selected indicators of biological values of these products. The biological value could be influenced only by the composition of a product and by technological procedures, and by no means by changes resulting from long term storage or by the onset of food spoilage.

Totally, the experiments included 13 products from poultry meat and eggs following main features of the technological procedure.

To study the chemical composition, i.e. the content of amino acids in poultry meat products, we made a pilot experiment, asked one manufacturer and produced following products: turkey à la salmon, poultry brawn, poultry roll, poultry salami, poultry sausages, chicken ham, poultry

luncheon meat, chicken stomachs and hearts on red pepper, mild poultry pâté, egg spread with poultry meat, smoked pork with eggs, goose and duck blood with lard and poultry delicacy. These groups of products were examined in sensory evaluation, determination of dry matter, nitrogen, amino acids, fatty acids, nitrite, common salt and of iron, manganese, zinc and copper. The average results of the dry matter content, of fat, protein, salt and nitrite have already been published[4]. Proteins in the samples from these groups of poultry products were carefully chemically processed in the acidic medium and thus prepared for subsequent analysis in order to determine their amino acid composition, to be able to judge the benefits of different materials and in particular the influence of subsequently used production technology of the final product. Consequently, according to the amino acids content, determine the biological value of various types of products and to emphasize our experiment factors that may have affected it.

Average results obtained, the number of samples tested and the protein content in these groups of poultry products are recorded in the following table (table1).

Protein determination using the Kjeldahl method

Nitrogen is determined by heating a substance in sulfuric acid in the presence of a catalyst, during which nitrogenous substances are converted into ammonium sulfate. Alkaline hydroxide is used on the ammonium sulphate to displace the ammonia, which using water vapor, is distilled and captured in a solution of boric acid and is determined by titration.

Determination of amino acids

Qualitative and quantitative determination of amino acids in protein is carried out after hydrolysis of given samples, i. e. in hydro lysates. The whole procedure of determination may be divided in three phase:

- preparation of the samples – hydro lysates,
- proper measurement,
- evaluation of obtained results.

a) Under our conditions, the sample acid hydrolysis is performed with 6 N HCl p. a. A homogenized sample of 0.2 - 0.4 g±1mg is placed into glass ampules washed with 1N HCl p. a., the residua of which are removed at a 100 ^{o}C in a dessicator. 6 N HCl p. a. is then added in a 100 - 200-fold excess, i. e. in a quantity of about 50 ml. To remove the dissolved and aerial oxygen, the solution in allowed to bubble with nitrogen for 20 minutes and the neck of the ampule is sealed above a gas burner. The proper hydrolysis takes place at 100 ^{o}C ±1^{o}C for 24 hrs. in a drying Owen. The sealed end of the ampule is broken off after hydrolysis is finished and the hydro lysate is filtered into 100 ml flasks; the samples evaporated in an oil bath on a vacuum evaporated at 80 ^{o}C and at under pressure 44o mm Hg. The dry evaporated residue dissolved with 10 ml of citrate-sodium buffer, pH 2.2. Previous to measurement, this solution is further diluted 1:5 with a mixture of citrate sodium buffer, pH 2.2 and internal standards (L-alpha-amino-beta-guanidine propionic acid and norleucin) so that the arised mixture contained each of the internal standards at the amount of 100 NM per a dose of 0.2 ml of the solution. This dilution use the basic solution of both the substances containing 1250 µM/500 ml of each of the standards.

b) The samples were analyzed on automatic amino acids analysator AAA 861 (Mikrotechna Praha). The dose rate was 0.2 ml of the solution per column. Elution column chromatography divides the mixture of amino acids into individual components. Following colour reaction with ninhydrine, a continual colorimetric measurement is run at wave length of 570 nm and 440 nm. Its results are recorded. The peak position on the chromatogram determine the quantitative aspect of each of the amino acids, while the integration of the peak'surface its qualitative aspect.

c) The obtained results must be recalculated to grams of an amino acids in100 g of solid by means of the method of standards.

Results and Discussion:

To evaluate the presented results in table no. 1, it is necessary to emphasize that for an objective assessment of the examined products, in expressing their biological values, there have been respected not only the values of the raw material of the poultry meat, but also the influence of the processing technology and other incoming components auxiliary material and additives. Taking into account the content of proteins as the main indicator of the biological value of animal food and the contain of essential amino acids, which are irreplaceable in human nutrition, the results clearly shows that this criterion may be affected even devalued by the wrong choice of the manufacturing process or added chemicals. Product "turkey la salmon "does have the highest protein content of all the studied products, i.e. 24.03 g/100 g, and the highest content of essential amino acids monitored, i.e. a total of 36.16 mg / 100 g in dry matter, and even considerable amount of limiting amino acid methionine (2.48 mg / 100 g in dry matter), yet nutritionally, and particularly in terms of diet, the product is not highly evaluated as is has almost double salt content (5.52 g / 100 g), due to the technological process used, than is usual for poultry meat products. Also, the biological value has been badly affected by nitrites[4] (5.15 mg / 100 g), which were used in an effort of the manufacturer to fix all available red pigmenting muscle tissue myoglobin, contained in poultry meat commonly at the lowest level of all animals for slaughter.

Its light color is conversely considered a characteristic feature of diet meatus highlighting the presence of the pigment by using of nitrite not only suppresses the expected and typically sensory feature, but even brings some risk of formation of carcinogenic nitrosamines in this way processed poultry meat. The importance of well or badly chosen step in the technological process may be, as in this case, even involved by the next step, i.e. smoking; in cold smoke for at least 24 hours, in hot smoke for at least 3 hours, which finally significantly reduces the importance of using nitrite. Thus assembled technological process for the combined use of additives classifies poultry meat into groups of diet meat products, nevertheless the final product should be consumed in limited quantities - just occasionally, although there is no need to limit consumption of the simple poultry meat in any way.

We can conclude that it is necessary to utilize the high content of quality protein in poultry meat properly, use a minimal amount of salt and add no nitrite salting mix. Sensory difference eg. from poultry ham, will be maintained and the product will expand

the range of products of poultry meat, the recommended amount consumed will not be limited and the product itself will not bring even minimal health risks to the consumer.

In evaluation of the results of another product, e.g. chicken ham that is not smoked just cooked and pasteurized, also has a relatively high protein content (20.03 g / 100 g) and a high content of essential amino acids (13.67 mg / 100 dry matter). Because of the low ratio of salt, nitrite and fat it is objectively characterized as a product that meets the requirements of rational nutrition. The necessity of nitrite addition to poultry meat because of the color is highly questionable and its use should be considered or entirely excluded, as the final product has significantly bright light color. However, beware some already mentioned contaminants, anaerobic spore-forming and growing groups of microorganisms in the meat, which are inhibited in growth and toxin production only by certain amount of nitrogen salts; as a proof of this fact was a big problem with an unexpected discovery of Clostridia in Europe, as a result of substitution of salt for coloring matter e.g. in the ham production.

Poultry brawn is a product to which there is added raw material with a higher proportion of connective tissue components for technological reasons. Therefore there can be expected a lower protein content in comparison to previous products (17.48 g / 100 g), and most of the amino acid proline (4.29 mg / 100 g in dry matter) of all the examined groups of poultry meat products, because proline is the kind of amino acid indicating the use of connective tissue components or leather. Reasonable salt content (2.06 g / 100 g), and the absence of nitrite ranks poultry brawn among nutritionally very appropriate products; This excellent ranking also supports non-use of smoking, which even excludes the presence of undesirable smoke constituents.

Chicken roll in foil (18.83 g / 100 g) and chicken sausage (22.3 g / 100 g) is another product that can be evaluated as a good source of proteins. However, these products have higher fat content, 18.87 g / 100 g of chicken roll and 20.28 g/ 100 g of salami, and the presence of nitrite is detrimental to the good review; for these reasons they can´t be assigned to high-quality products in terms of optimal nutrition.

Regarding various amino acids assessment, the content of lysine is worth the attention. Present in many mammal bodies, e.g. in pigs, a kind of amino acid limitating use of all received nutrients and optimum growth effect; its content in the feedstuff is placed on the packaging (per unit mass or energy feed). For product groups studied its content is relatively high (4.38 mg / 100 g dry weight) for poultry luncheon meat; although this product has only 14.38 g / 100 g of protein, the fat content (10.46 g / 100 g) and content of salts (1.2 g / 100 g) are at appropriate values in healthy human nutrition. Fat in products of poultry meat must be regarded as an important source of necessary essential fatty acids, particularly of linoleic acid (LA, C18-2, ω-6). The ham and the roll has 8.8% of a fatty acid and a smoked pork with eggs has 9%. However, it should be noted that the fat of the egg yolk is a certain potential source of cholesterol that is not desirable in higher levels. Evaluation of the biological value of fat is often expressed by certain index formed by the sum of essential fatty acids, palmitic acid. For smoked pork with

eggs the index of palmitic acid is 0.6, for poultry ham and poultry roll it is even 0.5. In this respect threating's e.g. for poultry luncheon meat is less favorable, as the lysine acid content is only 3.5% and the index of essential fatty acids: palmitic acid is only 0.2. Lack of some of the mentioned elements in the above listed products of poultry meat caused by the technological processing and material composition are relatively easy to by adjusted; e.g. smoked pork with eggs can easily be enriched by adding of suitable vegetable oils, that particularly adjust the lack of essential amino acids, particularly of lysine acid, without affecting the essential sensory characteristics.

Conclusion:

The presents work investigated products of poultry meat and eggs of different composition and procedures of their production. Relationship between the employed technology and organoleptical, basic and chemical properties of the products was subjected to investigation with respect to the main indicators of their biological value, as protein and amino acids. Is has been established that the main source of protein and amino acid sis found in turkey a la salmon, ham of chicken ham, poultry headcheese. The highest yield of limiting amino acid methionine is from turkey a la salmon, and that of proline from poultry headcheese.

Average content of amino acids in poultry meat products (in mg/100 g dry matter; n = 10) Table 1

amino acids / products	LYS	HIS	ARG	ASP	THR	SER	GLU	GLY	ALA	VAL	MET	ILEU	LEU	TYR	PHE	protein in g/100 g
turkey à la salmon	8.02	5.85	6.42	9.51	4.37	3.31	15.476	4.554	5.952	5.026	2.478	4.684	7.056	3.572	3.511	24.03
poultry brawn	5.01	1.96	4.41	5.68	2.48	2.21	9.15	5.941	4.382	2.825	1.288	2.566	4.299	1.737	2.108	17.48
poultry roll	4.48	2.34	2.83	4.89	3.18	1.84	7.08	2.809	3.123	2.565	1.227	2.343	3.421	1.581	1.818	18.93
poultry salami	3.94	2.09	2.67	5.08	2.36	1.81	8.36	2.926	3.381	2.783	0.866	2.713	4.301	1.601	2.033	22.3
poultry sausages	2.35	1.35	1.73	2.74	1.29	1.11	4.31	1.702	1.893	1.499	0.614	1.361	2.214	0.917	1.08	12.95
chicken ham	3.65	1.91	2.47	3.24	1.52	1.38	5.29	1.615	2.134	1.867	0.721	1.783	2.871	1.347	1.254	20.03
poultry luncheon meat	4.37	2.13	3.02	4.91	1.56	1.08	9.08	3.894	3.69	2.477	1.086	2.182	3.889	1.391	1.79	14.36
chicken stomach and hearts on red pepper	3.27	1.21	2.83	4.16	1.63	1.21	7.64	3.321	3.055	2.185	0.945	2.061	3.451	1.251	1.627	13.03
mild poultry pâté	2.18	1.29	2.07	2.6	1.33	1.22	4.09	2.421	1.924	1.234	0.644	1.168	2.11	0.944	1.051	14.78
egg spread with poultry meat	2.41	0.96	1.91	3.14	1.47	1.49	4.47	1.938	1.981	1.876	0.589	1.474	2.378	0.96	1.17	13.22
smoked pork with eggs	1.94	0.98	1.52	2.75	1.34	1.76	3.79	1.332	1.738	1.694	0.421	1.323	2.292	1.028	1.254	11.92
goose and duck blood with lard	2.45	1.64	1.28	2.58	1.19	0.95	2.72	1.166	2.443	2.02	0.278	1.044	2.864	0.731	1.745	14.11
poultry delicacy	0.79	1.6	2.31	3.74	1.49	1.23	5.77	2.463	2.371	1.864	0.622	1.716	2.845	1.228	1.375	11.12

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