Minced fish enriched with OMEGA-3 and OMEGA-6 for gerontological nutrition

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Abstract. The article provides an overview of the use of secondary fish raw materials, namely trout trimming to increase content. The work shows an increase in the content of OMEGA-3 and OMEGA-6 in semi-finished fish products using trimming. The results of these studies showed that semi-finished fish products prepared from minced trout using minced trout trimmings can increase the content of OMEGA-3 and OMEGA-6 by more than 50% with the addition of 25% minced trout trimmings. The use of minced trout trimming makes it possible to reduce the cost of the finished product and make it more affordable for low-income groups of the population.

1 Introduction

Fish and fish products have excellent nutritional and biological value and good protein absorption. Hydrobionts contain vitamins, micro- and macroelements, polyunsaturated fatty acids, which help prevent various human diseases, so seafood is a good food product for nutrition of all segments of the population [1-2].

Fish oil contains large amounts of OMEGA-3 and OMEGA-6, which help reduce the risk of cardiovascular diseases and also have a beneficial effect on brain function [3-6]. Due to the high content of polyunsaturated acids in fish oil, WHO recommends the consumption of fish and fish products several times a week. Thus, it is necessary to develop semi-finished fish products enriched with OMEGA-3 and OMEGA-6, including for gerontological nutrition.

The development trends of the domestic fish products market are accompanied by a constant rise in prices, so it is necessary to develop fish products for social purposes, but while maintaining the beneficial properties of the final product. [7-8] The production of food from raw materials inevitably leads to the formation of by-products and waste. Therefore, proper processing of by-products is important to create value-added food products that will have good nutritional and biological value [9-10]. Modern trends in improving technologies for the production of fish products are aimed at creating fish products that are balanced in terms of biological and nutritional value and are safe to consume.

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In this work, trout was used as research objects, which is a fish accessible to consumers, with good nutritional and biological value, and is also a fatty fish that can be recommended for all segments of the population, including the older generation [11-12].

The purpose of this work was to develop semi-finished fish products from minced meat systems obtained from trout, taking into account the increase in the content of unsaturated fatty acids.

2 Materials and methods

The objects of study were minced trout fillet with the addition of minced trimming prepared from the remains of trout filleting. Minced trout trimming was made from the remains of trout after filleting, it included trimmings, skin, etc., which were homogenized, the head of the fish, as well as the entrails, were separated and not used in the study.

Research methods: mass fraction of protein substances, mass fraction of fat, mass fraction of water were determined according to GOST 7636-85 “Fish, marine mammals, marine invertebrates and their processed products. Methods of analysis". The fatty acid composition of triglycerides of the fat base was determined according to GOST 31663-2012 “Vegetable oils and animal fats. Determination by gas chromatography of the mass fraction of methyl esters of fatty acids.” The amino acid composition of minced meat was determined according to the method M 04-38-2009 “Feed, compound feed and raw materials for their production. Methodology for measuring the mass fraction of amino acids by capillary electrophoresis using the Kapel capillary electrophoresis system.

3 Results

To reduce the cost of semi-finished fish products, it seems promising to use fish trimming for processing to prepare minced fish in order to reduce the cost of raw materials and preserve the beneficial properties of fish as much as possible, since trimming contains a large amount of meat and subcutaneous fat, rich in polyunsaturated fatty acids, which are ground until smooth substances. Trimmed minced meat contains a large amount of polyunsaturated fatty acids.

In this work, minced trout fillet was prepared, which is usually used for preparing semi-finished fish products. This minced meat is a control sample with which all other variations of minced meat are compared.

From Table 1 it can be seen that minced meat prepared from trout trimming contains approximately 3 times more mass fraction of fat, as well as OMEGA-3 and OMEGA-6 compared to trout minced meat. By adding trimming minced meat to trout minced meat, it is possible to increase the amount of unsaturated fatty acids in the finished minced meat. In order to estimate how much the amount of polyunsaturated fatty acids in semi-finished products will increase, mixtures of minced trout were prepared and calculated with the addition of minced trout mince in amounts of 25%, 50%, 75%. In the further description, the following conventions were adopted: minced meat 1 is minced trout with the addition of 75% minced trout trimming; minced meat 2 is minced trout with the addition of 50% minced trout trim; minced meat 3 is minced trout with the addition of 25% minced trout trimmings.

Table 1. Chemical composition of minced trout.

Indicator name	Minced trout	Minced trout trimming	Minced meat 1	Minced meat 2	Minced meat 3
Mass fraction of protein substances, %	20.66±1.65	17.89±1.43	18.59 ± 1.49	19.28 ± 1.54	19.97 ± 1.59
Mass fraction of fat, %	5.10±0.41	14.9±1.19	12.45 ± 0.99	10.00 ± 0.80	7.55 ± 0.61
Moisture contents, %	66.06 ± 0.27	55.70 ± 0.54	56.66 ± 0.53	56.84 ± 0.70	61.63 ± 0.50
OMEGA-3, g per 100 g of product	0.52±0.04	1.62±0.12	1.35 ± 0.10	1.08 ± 0.08	0.80 ± 0.06
OMEGA-6, g per 100 g of product	0.88±0.07	2.66±0.21	2.22 ±0.18	1.77 ± 0.14	1.33 ± 0.11

In semi-finished products containing 25% trout trimming minced meat in the recipe, the content of OMEGA-3 and OMEGA-6 increases by 53% and 51%, respectively, when the trout trimming minced meat composition increases to 50%, the content of OMEGA-3 and OMEGA-6 increases 2 times, when the trout trimming minced meat composition increases to 75%, the content of OMEGA-3 and OMEGA-6 increases 2.5 times.

Minced meat obtained from trimming contains less myofibrillar proteins, more elastin and collagen fibers, and the total amount of proteins decreases. Table 2 shows the amino acid composition of the minced meat systems studied.

The fatty acid composition of the minced meats studied is presented in Table 2.

Table 2. Composition of fatty acids in minced trout (% of the total fatty acids).

Name of fatty acid	Mass fraction of fatty acid, % of the total fatty acids				
	Minced trout	Minced trout trimming	Minced meat 1	Minced meat 2	Minced meat 3
Lauric C12:0	less than 0.1	less than 0.1	less than 0.1	less than 0.1	less than 0.1
myristic C14:0	1.7±0.14	1.8±0.14	1.8±0.14	1.8±0.14	1.7±0.14
pentadecane C15:0	0.2±0.02	0.2±0.02	0.2±0.02	0.2±0.02	0.2±0.02
palmitic C16:0	12±0.96	11.4±0.91	11.6±0.92	11.7±0.94	11.9±0.95
palmitoleic C16:1	3.1±0.25	3.0±0.24	3.0±0.24	3.1±0.24	3.1±0.25
heptadecanic C17:0	0.2±0.02	0.3±0.02	0.3±0.02	0.3±0.02	0.2±0.02
stearic C18:0	3.4±0.27	3.2±0.26	3.3±0.26	3.3±0.26	3.4±0.27
oleic C18:1	42.7±3.42	43.4±3.47	43.2±3.46	43.1±3.44	42.9±3.43
linoleic C18:2	16.3±1.3	16.7±1.34	16.6±1.33	16.5±1.32	16.4±1.31
gamma-linolenic C18:3	0.3±0.02	0.3±0.02	0.3±0.02	0.3±0.02	0.3±0.02
alpha-linolenic C18:3	3.6±0.29	3.7±0.30	3.7±0.29	3.7±0.29	3.6±0.29
arachine C20:0	0.2±0.02	0.3±0.02	0.3±0.02	0.3±0.02	0.2±0.02
eicosene C20:1	3.6±0.29	3.6±0.29	3.6±0.29	3.6±0.29	3.6±0.29
eicosatriene C20:3 p-6	0.6±0.05	0.5±0.04	0.5±0.04	0.6±0.04	0.6±0.05
arachodonica C20:4	0.5±0.04	0.4±0.03	0.4±0.03	0.5±0.04	0.5±0.04
eicosatriene C20:3 p-3	0.3±0.02	0.3±0.02	0.3±0.02	0.3±0.02	0.3±0.02
behenaceae C22:0	0.2±0.02	0.2±0.02	0.2±0.02	0.2±0.02	0.2±0.02
erucic C22:1	0.5±0.04	0.4±0.03	0.4±0.03	0.5±0.04	0.5±0.04
eicosapentaenoic C20:5	1.5±0.12	1.6±0.13	1.6±0.13	1.6±0.12	1.5±0.12
nervonic C24:1	0.3±0.02	0.3±0.02	0.3±0.02	0.3±0.02	0.3±0.02
docosapentaenoic C22:5	0.7±0.06	0.8±0.06	0.8±0.06	0.8±0.06	0.7±0.06
docosahexaenoic C18:3	4.8±0.38	4.5±0.36	4.6±0.37	4.7±0.37	4.7±0.38

Minced meat obtained from trimming contains less myofibrillar proteins, more elastin and collagen fibers, and the total amount of proteins decreases. Table 3 shows the amino acid composition of the minced meat systems studied.

Table 3. Amino acid composition of proteins in minced meat.

Mass fraction of amino acid, %	Minced trout	Minced trout trimming	Minced meat 1	Minced meat 2	Minced meat 3
arginine,%	0.72±0.29	1.01±0.40	0.94±0.38	0.87±0.35	0.79±0.32
valine, %	1.12±0.45	0.75±0.30	0.84±0.34	0.94±0.38	1.03±0.41
histidine, %	0.65±0.33	0.49±0.25	0.53±0.27	0.57±0.29	0.61±0.31
glycine,%:	0.79±0.27	1.52±0.52	1.34±0.46	1.16±0.39	0.97±0.33
leucine and isoleucine (total), %	2.1±0.55	1.75±0.46	1.84±0.48	1.93±0.50	2.01±0.53
lysine, %	1.61±0.55	1.31±0.45	1.39±0.47	1.46±0.50	1.54±0.52
methionine,%	0.27±0.09	0.46±0.16	0.41±0.14	0.37±0.12	0.32±0.11
proline, %	0.7±0.18	0.83±0.22	0.80±0.21	0.77±0.20	0.73±0.19
serine, %	0.72±0.19	0.72±0.19	0.72±0.19	0.72±0.19	0.72±0.19
tyrosine,%	0.87±0.26	0.67±0.20	0.72±0.22	0.77±0.23	0.82±0.25
threonine,%	0.85±0.34	0.64±0.25	0.69±0.28	0.75±0.30	0.80±0.32
phenylalanine,%	0.7±0.21	0.62±0.19	0.64±0.19	0.66±0.2	0.68±0.2
Alanine, %	1.22±0.32	0.5±0.13	0.68±0.18	0.86±0.23	1.04±0.27
tryptophan, %	0.32±0.13	0.26±0.10	0.28±0.11	0.29±0.12	0.31±0.12
phenylalanine + tyrosine,%	1.57±0.55	1.29±0.45	1.36±0.48	1.43±0.50	1.50±0.53

In minced trout, the amount of protein decreases by 13.5%, while in a mixture of minced meat containing 25% minced trim, the amount of protein decreases by only 3.3%, in a mixture of minced meat containing 50% minced trim, the amount of protein decreases by 6.7 %, in a mixture of minced meat containing 75% trimmed minced meat, the amount of protein is reduced by 10.0%.

4 Discussion

Trimmed mince is a rich source of polyunsaturated fatty acids OMEGA-3 and OMEGA-6. Semi-finished fish products prepared from a mixture of minced trout and minced trout trimming can be recommended as products for gerontological nutrition, as they contain a high content of polyunsaturated fatty acids.

It can be seen that the content of OMEGA-3 and OMEGA-6 in mixtures of minced fish increases, with a slight decrease in proteins, but at the same time it becomes important to take into account the functional, technological and organoleptic characteristics of minced meat when choosing minced fish for semi-finished fish products. Accordingly, to improve the quality of semi-finished fish products containing trimmed minced meat, it is necessary to use additives that improve the nutritional and biological value of the product to increase protein in minced meat mixtures, as well as those that have high fat emulsification rates, stability during heat treatment, and high organoleptic characteristics.

5 Conclusion

The results of these studies showed that semi-finished fish products prepared from trout mince using trout trimming mince can increase the content of OMEGA-3 and OMEGA-6 by more than 50% with the addition of only 25% trout trimming mince. In semi-finished products containing 50% or 75% trimming minced meat, it increases the content of OMEGA-3 and OMEGA-6 by 2 - 2.5 times. The use of trout trimming minced meat allows you to reduce the cost by 22% when adding 25% trimming minced meat, and when adding 50% trimming minced meat by 44.7% in raw material costs. In semi-finished fish products containing 25% trimming, the total amount of protein is reduced by only 3.3%, which is a slight decrease in the biological value of the product.

In semi-finished fish products containing 50% trimming, the total amount of protein is reduced by only 6.7%; to improve the nutritional and biological value of such minced meat, the addition of protein ingredients may be recommended.

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