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SAFETY STUDY OF UZBEKISTAN FRESHWATER FISH AND THEIR CANNED FISH

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Methods for industrial processing of freshwater fish, ensuring the safety of canned fish, quantitative and qualitative determination of the chemical composition of the tested range of fish and canned food from them, including proteins with an essential amino acid composition, carbohydrates, fats, minerals, vitamins, enzymes, detection of hazardous components, including heavy metals and their salts, conversion products of pesticides, herbicides, antibiotics, the presence of radionuclides using gas-liquid chromatography methods, ways to eliminate them, finding ways to eliminate them, thereby ensuring the food safety requirements of a particular fish variety, or identifying a hazard, hidden in one or another canned fish, development of suitability criteria for canning fish of a particular variety, depending on the area where the fish is grown, the composition of groundwater and air of a given lake, river or artificial reservoir, as well as the method of preservation and the composition of auxiliary materials, such as sauce tomato, vegetable oil, used in canning fish, which is the scientific novelty and practical value of this research work, which ultimately allows you to create a map of the use of freshwater fish production in Uzbekistan, canning methods, compiling a list of ingredients for canned food for the production of canned fish, development of individual technology for production.

Keywords: presswater fish, roach, silver carp, carp, catfish, safety, proteins, fats, carbohydrates, vitamins, heavy metals.

ӨЗБЕКСТАН ТҰШЫ СУ БАЛЫҚТАРЫНЫҢ ЖӘНЕ ОНЫҢ КОНСЕРВЕРЛЕРІНІҢ ҚАУІПСІЗДІГІН ЗЕРТТЕУ

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Тұщы су балығын өнеркәсіптік өңдеу әдістері, балық консервілерінің қауіпсіздігін қамтамасыз ету, балық пен консервілердің сыналатын ассортиментінің химиялық құрамын, оның ішінде алмастырылмайтын аминқышқылдық құрамы бар ақуыздарды, көмірсуларды, майларды, минералды заттарды сандық және сапалық анықтау, дәрумендер, ферменттер, қауіпті компоненттерді, оның ішінде ауыр металдар мен олардың тұздарын, пестицидтердің, гербицидтердің, антибиотиктердің конверсиялық өнімдерін анықтау, газ-сұйықтық хроматография әдістерін қолдану арқылы радионуклидтердің болуы, оларды жою жолдары, оларды жою жолдарын табу, сол арқылы белгілі бір балық сортының азық-түлік қауіпсіздігіне қойылатын талаптар немесе сол немесе басқа балық консервілерінде жасырылған қауіпті анықтау, балық өсірілетін аумаққа, жер асты суларының және ауаның құрамына байланысты белгілі бір сортты балықты консервілеуге жарамдылық критерийлерін әзірлеу. берілген көлдің, өзеннің немесе жасанды су қоймасының, сондай-ақ балық консервілеуде қолданылатын тұздық қызанақ, өсімдік майы сияқты көмекші материалдардың сақтау әдісі мен құрамы, бұл ғылыми жаңалық және осы зерттеу жұмысының практикалық құндылығы; бұл сайып келгенде Өзбекстанда тұщы су балық өндірісін пайдалану картасын жасауға, консервілеу әдістеріне, балық консервілерін өндіруге арналған консервілер ингредиенттерінің тізімін құруға, өндірудің жеке технологиясын жасауға мүмкіндік береді.

Түйінді сөздер: пресс-су балықтары, балық, күміс тұқы, тұқы, табан балық, қауіпсіздік, белоктар, майлар, көмірсулар, витаминдер, ауыр металдар.

ИССЛЕДОВАНИЕ БЕЗОПАСНОСТИ ПРЕССНОВОДНЫХ РЫБ УЗБЕКИСТАНА И ИХ КОНСЕРВОВ

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Изложены способы промышленной переработки пресноводной рыбы, обеспечение безопасности рыбных консервов, количественное и качественное определение химического состава испытуемого ассортимента рыб и консервов из них, в том числе белков с незаменимым аминокислотным составом, углеводов, жиров, минеральных веществ, витаминов, ферментов, обнаружение опасных компонентов, в том числе тяжелых металлов и их солей, продуктов преобразования пестицидов, гербицидов, антибиотиков, наличие радионуклидов с помощью методов газожидкостной хроматографии, способы их устранения, изыскание путей их устранения, обеспечивая тем самым требования пищевой безопасности того или иного сорта рыбы, либо выявление опасности, таившейся в том или ином рыбном консерве, разработка критериев пригодности для консервирования рыбы того или иного сорта в зависимости от района выращивания рыбы, состава грунтовых вод и воздуха данного озера, реки или искусственного водоема, а также способа консервации и состава вспомогательных материалов, таких как соус томатный, масло растительное, применяемых при консервировании рыбы, что составляет научную новизну и практическую ценность данной научно-исследовательской работы, в конечном итоге позволяющей создать карту использования добычи пресноводной рыбы в Узбекистане, способы консервирования, составление списка ингредиентов для консервов для производства консервов из рыбы, разработка индивидуальной технологии для производства.

Ключевые слова: пресноводная рыба, вобла, толстолоб, сазан, сом, безопасность, белки, жиры, углеводы, витамины, тяжёлые металлы.

Introduction. The work is devoted to the preparation of fish feed from raw materials available in Uzbekistan and the processing of freshwater fish from lakes, rivers and artificial reservoirs for canned food. Studies show that feed produced from local raw materials contains protein in the range of 16-22%, and therefore the issue of bringing the amount of protein in feed to 32% is relevant. The production technology is complete

The conservation of presswater fish has its own specific problems. Fish in press water is contaminated with various toxic substances, depending on its habitat, as a result, the content of certain harmful substances in canned food often exceeds SanPIN and MPC standards, and there is no widespread practice of canning freshwater fish. In this regard, there is a need to identify the degree of harmfulness of freshwater fish, depending on the habitat.

The chemical compositions of fish from various reservoirs of the Republic of Uzbekistan, the chemical compositions of canned food made from them were studied. Such studies were carried out for the first time [1-3].

Materials and methods. The purpose of the work is to study the ways of industrial processing of presswater fish, ensuring the safety of canned fish products. To achieve this goal, it is necessary to solve the following tasks:

- study of the chemical composition of fish;
- study of the chemical composition of canned food;
- comparison of the components of fish and canned fish with the maximum allowable concentration of heavy metals;
- finding ways to reduce heavy metals in canned food.

An atomic absorption method was used for the determination of toxic elements: lead, cadmium, copper, zinc, and iron. The technique was developed by the Institute of Nutrition of the Russian Academy of Medical Sciences, introduced by the State Standard of Russia [4-10]. There is a detailed description and justification of the methodology used for the quantitative and qualitative determination of heavy metals);

The method of protein determination was also used. The methodology was developed by the Federal State Budgetary Scientific Institution ``All-Russian Research Institute of the Meat Industry named after V.M.Gorbatov (FGBNU VNIIMP named after V.M. Gorbatov) [11].

Results and Discussion. The chemical composition of fish meat is characterized mainly by the content of water, fat, nitrogenous and mineral substances, carbohydrates, enzymes, vitamins, etc.

The total amount of all protein substances in fish meat is, on average, about 16% (from 12 to 22%). This includes salt-soluble proteins such as globulins (myosin, actin, actomyosin, tropoliosin),

water-soluble proteins such as albumins (myogen, myoalbumin, globulin, myoprotein). Myostromins, as well as nucleoproteins (histones, deoxyribose, purine and pyrimidine bases) have been identified. Fish meat proteins are complete, they contain all the essential amino acids in a well-balanced ratio for consumption [12-13].

At the same time, the heterocyclic amino acid histidine, when fish is spoiled, turns into histamine, which has the properties of a synergistic toxin in high doses. The stromal protein collagen is defective, but when boiled in water, it turns into glue or glutin, which explains some stickiness (stickiness) of boiled fresh fish meat, as well as gelation of fish broths, which is important in the preparation of fish dishes. Non-protein nitrogenous extractive substances (nitrogenous bases, amino acids, acid amides, derivatives of guanidine, imidazole, purine, etc.), despite the small content in meat (from 0.3 to 0.6% in the meat of sharks and rays up to 2.2%) give the fish a specific taste, smell and affect the secretion of digestive juices in humans, stimulating appetite and promoting better absorption of food. In this regard, the ear is a more nutritious food product than the broth from the meat of warm-blooded animals.

The fresh meat of some sea and ocean fish contains a specific substance - trimethylamine oxide (TMAO), which has a pleasant smell (the smell of fresh cucumber). During storage, TMAO turns into trimethylamine, which has an unpleasant ammonia odor.

Fish oil has a lower melting point compared to the fat of warm-blooded animals, which has a positive effect on its digestibility by the human body. However, due to the significant amount of unsaturated fatty acids, fish oil is easily subjected to oxidative deterioration due to the contact of fat with atmospheric oxygen.

The fat content in fish meat is from 0.5 to 33% and depends on the type of fish, so they are conventionally divided into three groups: lean, in which the fat content in the body does not exceed 4% (cod, pike, pike), medium fat - from 4 to 8% fat (most carp fish, catfish, flounder) and fatty - the amount of fat in the body is more than 8% (sturgeon, salmon, herring, etc.).

Fat is deposited in different parts of the fish: in sturgeon - between muscle tissue, in cod - in the liver, in salmon - in the abdominal part, in herring - under the skin, etc.

Carbohydrates in fish tissues, mainly in the muscles of the trunk and liver, are mainly represented by glycogen (animal starch) and its hydrolysis products (glucose, pyruvic and lactic acids). Their content is from 0.03 to 0.8% and makes up the main part of nitrogen-free extractive substances.

Fish (especially in liver fat, caviar, internal fat) contain a significant amount of fat-soluble vitamins A, D and vitamin E.

Vitamins of group B (B_1, B_2, B_3, B_5, B_6, B_{12}) in fish meat are approximately the same as in the meat of warm-blooded animals.

Of the minerals, fish meat contains: potassium, sodium, magnesium, chlorine, sulfur, phosphorus, iron, and other elements (from 0.9 to 1.6% in total).

Particularly important is the content of the trace element iodine, which is very small in other foods. For example, cod meat contains 800-2440 times more iodine than beef.

Water in fish meat - 55-83%. The fatter the fish, the less water in its tissues. So, in the meat of eel it is about 55%, and in the meat of perch and cod - up to 80%.

Fish meat during heat treatment loses less water than the meat of slaughtered animals and birds, so it tastes juicier. However, water promotes the development of microorganisms, and also activates the processes of protein and fat hydrolysis.

For the production of canned food from freshwater fish, it is necessary to choose those fish whose habitat is not conducive to the accumulation of heavy metals in their bodies.

Vobla is a fairly well-known and popular type of fish from the carp family, despite its rather limited distribution. Canned vobla is no less valuable than condensed milk or stew. To this day, this representative of waterfowl is in demand.

Vobla grows up to 30 cm, but this is not the limit. There are representatives up to 40 cm. The average weight is from 600 to 700 g, the largest can weigh from 800 g to 1 kg. The body is flattened, but the sides remain wide. At the top of the back, there seems to be a small hump, and the back of the roach is even. The scales are smaller and fit tighter. It is dark on the top of the back, even sometimes it seems that it is black. Below is the transition to silver.

For experimental reproduction of the conservation of freshwater fish, in particular the roach of the Aidar-Arnasay system of lakes in the Jizzakh region, an analysis of the chemical composition of the fish was carried out, the results are entered in table 1.

Table 1. The chemical composition of fish meat of the roach of the Aidar-Arnasay system lakes of Jizzakh region

№	Name of indicator	Availability rate	Test results	Availability rate to metod
1	Mass fraction of protein, %	18,0	17,33	GOST 13496.4-2019
2	Mass fraction of fate, %	2,8	21,3	GOST 26829-6 п.2
3	Mass fraction of cation Mg^{2+}, %	2,5	2,93	SF XII
4	Mass fraction катиоан Na^{+} ,%	6,0	1,31	
5	Mass fraction of cation K^{+}, %	1,6	1,70	
6	Mass fraction of cation, Ca^{2+}, %	4,0	2,05	
7	Mass fraction Hg, ppm	0,3	Not detected	ГОСТ 26927
8	Mass fraction As, ppm no more	1,0	0,02	ГОСТ 26930
9	Mass fraction Pb, ppm no more	0,2	Not detected	ГОСТ 26932
10	Mass fraction Zn, ppm no more	40,0	0,005	ГОСТ 30178
11	Mass fraction Fe, ppm no more	0,8	0,006	
12	Mass fraction Ni, ppm no more	0,6	Not detected	ГОСТ 27236
13	Mass fraction vitamin group B:		-	SF XII
	$B_{1,}$ *мг*/100 g	-	-	
	B_{2}, *мг*/100 g	-	0,07	
	$B_{3,}$ *мг*/100 g	-	-	
	$B_{5,}$ *мг*/100 g	-	-	
	$B_{6,}$ *мг*/100 g	-	-	
	$B_{9,}$ *мг*/100 g	-	-	
	$B_{12,}$ *мг*/100 *g*	-	0,12	

As can be seen from Table 1, the proportion of hazardous minerals, such as arsenic, lead, mercury, zinc, nickel, in vobla meat is far from the norm or absent.

Table 2. The chemical composition of canned fish from roach of the Aidar-Arnasay system of lakes in the Jizzakh region

№	Наименование показателя	Availability rate	Test results	Availability rate to metod
1	Mass fraction of protein, %	18	14,4	GOST 7636-85
2	Mass fraction of fate, %	2,8	4,1	GOST 7636-85
3	Mass fraction of cation Mg^{2+},%	2,5	466	GOST EN 14084.2014
4	Mass fraction катиоан Na^{+} ,%	6,0	1826	
5	Mass fraction of cation K^{+}, %	1,6	2401,7	
6	Mass fraction of cation, Ca^{2+}, %	4,0	279,2	
7	Mass fraction Hg, ppm	0,3	Not detected	
8	Mass fraction As, ppm no more	1,0	Not detected	GOST ISO 8070/IDF119
9	Mass fraction Pb, ppm no more	0,2	Not detected	GOST EN 14084.2014
10	Mass fraction Zn, ppm no more	40,0	Not detected	GOST EN 14084.2014
11	Mass fraction Fe, ppm no more	0,8	Not detected	
12	Mass fraction Ni, ppm no more	0,6	Not detected	

Table 2 shows that the proportion of hazardous minerals such as arsenic, lead, mercury, zinc, nickel is much less than the standard, or absent altogether. Moreover, B vitamins appear: B_1=0.02; B_2=0.09; B6 0.01; B_{12} \u003d 0.08 mg / 100 g.

The conclusion is that it is possible to produce canned fish in oil and tomato sauce from the roach of the Aidar-Arnasay system of lakes in the Jizzakh region. The main safety criteria for canned fish from these fish have been verified, the MPCs of heavy metals in them comply with SanPIN standards

The chemical composition of fish meat from the Chinaz district of the Tashkent region is characterized by the content of water, fat, nitrogenous and mineral substances, enzymes, vitamins, etc. som and the results are entered in table 3.

Table 3. The chemical composition of fish meat in the Chinaz district of the Tashkent region

№	Name of indicator	Type of fish		
		Carp	Silver carp	Catfish
1	Mass fraction of protein, %	20,2	25,9	18,8
2	Mass fraction of fate, %	12,7	19,6	17,7
3	Mass fraction of cation Mg^{2+}, %	2,58	5,97	1,33
4	Mass fraction катиоан Na^{+} ,%	1,08	1,40	1,19
5	Mass fraction of cation K^{+}, %	1,40	1,23	1,70
6	Mass fraction of cation, Ca^{2+}, %	0,29	3,12	0,36
7	Mass fraction of vitamin group B:			
	$B_{1,}$ *мг*/100 *г*	0,11	0,08	0,17
	B_{2}, *мг*/100 *г*	0,09	0,14	0,11
	$B_{3,}$ *мг*/100 *г*	5,8	3,7	4,4
	$B_{5,}$ *мг*/100 *г*	-	-	-
	$B_{6,}$ *мг*/100 *г*	-	0,1	-
	$B_{9,}$ *мг*/100 *г*	-	-	-
	$B_{12,}$ *мг*/100 *г*	31,1	50,7	21,5

Studies have also been carried out to determine the amount of heavy metals and their salts, the presence of pesticides and herbicides, antibiotics and phytohormones used in agriculture, radioactive substances and radionuclides [14-15].

In addition to organoleptic indicators, we checked the presence of heavy metals in canned food, the source of which is the fish of the selected area, the results are included in table 4.

Table 4. The presence of heavy metals in canned freshwater fish of the Chinaz district of the Tashkent region

№	Name of indicator	Availability rate			MPC	Availability rate to metod
		Сазан	**Толстолоб**	**Сом**		
1	Mass fraction Hg, ppm	0,31	0,33	0,46	0,3	GOST 26927
2	Mass fraction As, ppm	0,02	0,05	0,04	1,0	GOST 26930
3	Mass fraction Pb, ppm	0,02	0,02	0,08	0,2	GOST 26932
4	Mass fraction Zn, ppm	2,07	1,78	2,47	40,0	GOST 30178
5	Mass fraction Fe, ppm	8,63	5,44	12,08	-	
6	Mass fraction Ni, ppm		Not detected		-	GOST 27236

Table 4 shows that in canned carp, silver carp and catfish grown in the Chinaz district of the Tashkent region, the mercury content exceeds the MPC, the worst reading in canned catfish. The conclusion is that catfish is not suitable for the production of canned food from them.

Studies have also been carried out to determine the amount of heavy metals and their salts, the presence of pesticides and herbicides, antibiotics and phytohormones used in agriculture, radioactive substances and radionuclides [16].

The total amount of all protein substances in vobla meat is, on average, about 18%. This includes salt-soluble proteins such as globulins (myosin, actin, actomyosin, tropoliosin), water-soluble proteins such as albumins (myogen, myoalbumin, globulin, myoprotein). Myostromins, as well as nucleoproteins (histones, deoxyribose, purine and pyrimidine bases) have been identified. Fish meat proteins are complete, they contain all the essential amino acids in a well-balanced ratio for consumption [14-16].

At the same time, the heterocyclic amino acid histidine, when fish is spoiled, turns into histamine, which has the properties of a synergistic toxin in high doses.

The stromal protein collagen is defective, but when

boiled in water, it turns into glue or glutin, which explains some stickiness (stickiness) of boiled fresh fish meat, as well as gelation of fish broths, which is important in the preparation of fish dishes.

Non-protein nitrogenous extractive substances (nitrogenous bases, amino acids, acid amides, derivatives of guanidine, imidazole, purine, etc.), despite the small content in meat (from 0.3 to 0.6% in the meat of sharks and rays up to 2.2%) give the fish a specific taste, smell and affect the secretion of digestive juices in humans, stimulating appetite and promoting better absorption of food. In this regard, the ear is a more nutritious food product than the broth from the meat of warm-blooded animals.

The fat content in fish meat is from 0.5 to 33% and depends on the type of fish, so they are conventionally divided into three groups: lean, in which the fat content in the body does not exceed 4% (cod, pike, pike), medium fat - from 4 to 8% fat (most carp fish, catfish, flounder) and fatty - the amount of fat in the body is more than 8% (sturgeon, salmon, herring, etc.).

Fish (especially in liver fat, caviar, internal fat) contain a significant amount of fat-soluble vitamins A, D and vitamin E.

There are about the same amount of B vitamins (B_1, B_2, B_3, B_5, B_6, B_{12}) in fish meat as in the meat of warm-blooded animals.

Of the minerals, fish meat contains: potassium, sodium, magnesium, chlorine, sulfur, phosphorus, iron, and other elements (from 0.9 to 1.6% in total).

Particularly important is the content of the trace element iodine, which is very small in other foods. For example, cod meat contains 800-2440 times more iodine than beef.

Water in fish meat - 55-83%. The fatter the fish, the less water in its tissues. So, in the meat of eel it is about 55%, and in the meat of perch and cod - up to 80%.

Fish meat during heat treatment loses less water than the meat of slaughtered animals and birds, so it tastes juicier. However, water promotes the development of microorganisms, and also activates the processes of protein and fat hydrolysis

Conclusions. Thus, the proportion of hazardous minerals, such as arsenic, lead, mercury, zinc, nickel, iron, in vobla meat is much lower than the permissible standard or they are absent [10-14]. This means that the roach living in the Aidar-Arnasay system of lakes in the Jizzakh region can be consumed both fresh and canned. Vitamins of group B appear in canned voble: B_1=0.02; B_2=0.09; B_6 =0.01; B_{12} \u003d 0.08 mg / 100 g.

Also, studies were carried out to determine the amount of heavy metals and their salts, the presence of pesticides and herbicides, antibiotics and phytohormones used in agriculture, radioactive substances and radionuclides in three types of fish in the Chinaz district of the Tashkent region: carp, silver carp, catfish. These results coincide with the studies previously carried out by the authors of the work I.Pulatov and K.Dodaev, which are carried out according to GOSTs [1].

In canned carp, silver carp and catfish grown in the Chinaz district of the Tashkent region, the mercury content exceeds the MPC, the worst reading in canned catfish. This is confirmed by the restrictions given in GOSTs [10-14]. The conclusion is that catfish is not suitable for the production of canned food from them.

Studies have also been carried out to determine the amount of heavy metals and their salts, the presence of pesticides and herbicides, antibiotics and phytohormones used in agriculture, radioactive substances and radionuclides in canned food of their selected three varieties of fish [2-3].

Fish from lakes, rivers and artificial reservoirs have been studied for the presence of heavy metals in their meat, such as arsenic, lead, mercury, zinc, nickel, and iron. Canned food was made from them, the presence of these metals and their compounds was investigated in them, and conclusions were drawn that it is possible to make canned food depending on the habitat and type of fish.

Freshwater fish habitats can be sources of radioactive substances, pesticides, herbicides, antibiotics, which is important when solving the problem of using or not using fish for canning.

These conclusions are substantiated by studies of the chemical composition of fish, canned food made from them, comparative analyzes of the components of fish and canned fish with the maximum allowable concentration of heavy metals, the use of certain methods that reduce the content of toxins in canned food to acceptable limits and below, thereby ensuring the safety of canned food.

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