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## СЕКЦИЯ «СОВРЕМЕННЫЕ ТЕХНОЛОГИИ ПИТАНИЯ ЖИВОТНЫХ И ПРОИЗВОДСТВА КОРМОВ»

УДК 639.3.043.2

### COMPARISON OF PLANT AND ANIMAL PROTEINS IN FISH NUTRITION

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**Abstract:** *Feed is one of the most important components of fish production in a closed breeding system, which accounts for 50% of the cost of production. According to the quality of protein used in fish nutrition, it is divided into vegetable and animal. In this article, we will look at the most important sources of animal and vegetable protein used in feeding various fish species, and the characteristics of each of them*

**Keywords:** *Protein, fish, fish powder, soy, wheat*

The development of domestic aquaculture is one of the main strategic objectives in the development of the entire agricultural and industrial complex of Russia, not only in recent years, but also in the future until 2025-2030. Modern industrial fish farming is based on the cultivation of fish in regulated conditions and urgently requires serious attention to the production process and the use of full-fledged and economically profitable feeds for all age groups of breeding and growing facilities [1, 2]. modern approaches to the effective use of the protein part of fish feeds completely coincide with the concepts of feeding farm animals and poultry: determining the optimal profile of essential amino acids in feeds for valuable fish species based on the concept of "ideal protein" for all phases of fish cultivation and subsequent calculations of feed recipes based on balancing the established profile of essential amino acids, using actual data on the nutritional value of feed components and finished forms of crystalline amino acids.

The main sources of dietary proteins are animals and plants, and there are important differences in the types of proteins they supply.

Differences include the molecular structure, amino acid profile, digestibility and technical functionality in food products, that is, the ability to turn into gel, emulsify, bind water, etc. (3)

Animal feed is the main source of high-grade protein and vitamins, characterized by high digestibility of amino acids included in the protein structure, rich in minerals. This group includes: products of the fishing industry (fish meal, crustacean flour, shellfish flour, particle fish);

- feed products of processing of farm animals (meat-bone, meat, blood, bone, feather, meat-feather flour);

- milk processing products (skimmed milk powder, buttermilk, whey, milk protein concentrate); processing products of various living organisms (silkworm pupae, etc.).

The main and most important among the concentrated sources of nutrients is fishmeal. Fishmeal is prepared from fish waste, contains a lot of proteins and essential amino acids, is rich in trace elements and vitamins of group B. The protein level, depending on the quality of fishmeal, is 48-70%, crude fat - 10-30%, ash - 15-18% [4].

Krill and squid flour contains 58-62% raw protein and, unlike fishmeal, is characterized by a large amount of carotenoids, which give the meat a pink color. It is a valuable source of unsaturated linolenic fatty acids, contains a lot of chitosan. Fish and krill meal protein has the most complete set of essential amino acids, it contains a lot of lysine, methionine, tryptophan arginine, valine.

Meat flour is a high-quality protein feed. It is produced from the entrails of animals and other meat waste. The proportion of bones should not exceed 10%. It contains 50-60% protein and no more than 12% fat. It is a yellowish-gray or brown powder. For feeding fish, meat and bone meal should be used only of the first grade, containing at least 50% protein and no more than 12% fat.

Recently, a group of scientists of the All-Russian Research Institute of Freshwater Fisheries [5] together with LLC "NPC Agreore-sursy", LLC "Triextra" have developed a recipe and technological regulations for the production of extruded protein-lipid feed RPK (belikor) based on fish processing waste and dry traditional standard components of animal, plant and microbial origin. By mixing fish waste and dry flour-like feeds, a feed mixture with a humidity of 20-30% is created and processed by extrusion at a temperature of 100-120 ° C under high pressure. In the extruded feed, the share of feed raw materials (grain, cake and meal, etc.) is more than 60-70%, and fish waste is 25-30%. According to the results of the analysis conducted by the staff of the All-Russian Scientific Research Technological Institute of Poultry Farming (VNIITIP), the resulting feed product contains (in% per absolutely dry substance): protein - 46-51, fat - 20-25, fiber - 2-4, nitrogen-free extractives (sugar, starch, pentosans, pectin substances, glucosides, inulin, chitin, etc.) - 12-19, lysine - 2-3,9, sulfur-containing amino acids (methionine + cystine) - 1,4- 1,8, metabolic energy - 13-14 MJ/kg [1].

Tests of the new feed product were carried out on different types of fish - carp, trout, catfish. It has been established that in the composition of standard compound feeds for growing carp in ponds, with the complete replacement of fish meal and other raw materials of animal origin for new feed, there is no decrease in fish-breeding and biological indicators of fish cultivation.

However, due to the fact that the use of a significant amount of protein contained in animal flours affects the energy metabolism of fish, which increases the load of water purification systems for nitrogen compounds, today feed manufacturers and fisheries specialists are doing a lot of work aimed at improving the composition of feed for growing commercial fish, replacing a significant proportion of animal protein and fat for proteins and fats of vegetable origin. In addition, the use of plant-based components reduces the cost and price of the feed produced, which allows both the consumer and the producer to benefit [6].

Components of plant origin are divided into low-protein (up to 20% protein) and high-protein (more than 20%). Low-protein feeds contain 8-20% protein, 2-6% fat (linoleic, oleic, linolenic acids), rich in starch, the content of which can reach 50-85%. Feed mixtures may include ground wheat, barley, rye, oats, corn or crushed products of their processing (flour dust), less often - grass, coniferous and algae flour. Whole grain flour without purification is the most nutritious. Less nutritious are white and gray flour dust (a mixture of fine flour and bran).

Wheat is one of the most nutritious cereals. The digestibility of its protein by carp reaches 80-85%, the availability of amino acids is 90% [30]. Wheat contains 13-16% protein, but little lysine. Fats are represented by unsaturated fatty acids - linoleic (56%), oleic (12%) and linolenic (4%). The sprouted grain also contains many enzymes and vitamins (A in the form of provitamins - carotenoids and sterols, E and group B). Barley is nutritionally close to wheat, but differs in the worst use for growth. It contains 11-12% protein, although it is poor in lysine and methionine. Fatty acids are mainly represented by unsaturated compounds (80-85%). The starch content is in the range of 50 to 60%. Barley is used as a wheat substitute in feed mixtures intended for carp and some other fish species. Corn is a valuable feed component, it contains a lot of starch, but it has little protein, lysine and tryptophan are in short supply. However, this grain is easily extruded and expanded, so it is indispensable in the manufacture of floating and slowly sinking extrudates. It is noted that feed with a high corn content is poorly stored and quickly moldy [7].

Triticale is a wheat-rye hybrid. It successfully replaces wheat, corn and barley as an energy source. Compared to them, it contains more protein and has a better amino acid composition. Triticale protein is more complete in terms of the content of essential amino acids and is better absorbed than wheat proteins [4]. Herbal flour is prepared by high-temperature drying from herbs harvested at the stage of budding of legumes and the beginning of earing of cereals.

High-protein vegetable feeds are legume seeds, meal and cake. Legume seeds (peas, beans, soybeans, lupine, lentils, vetch, chickpeas, chinas, etc.) are rich in protein (25-30%), its content is 2-3 times higher than in cereals. The use of legume seeds as fish feed limits the presence of digestive enzyme inhibitors in them, the effects of which are prevented by heat treatment of seeds before being added to the feed. Peas are a traditional high-protein component of compound feeds for fish. The protein content in peas is 22-26%, fat - 2-3% with a predominance of unsaturated fatty acids. The nutrients of peas are well digested by fish. Soy is a valuable protein crop. Soy seeds contain more than 30% protein, which has a high biological value,

the fat level reaches 15%. Lupin is relatively rarely used, vetch and lentils are limited. In addition, vetch contains toxic salts of prussic acid and is poorly eaten by fish. Cake and meal are waste products of oil extraction production, rich in proteins. Oilcakes are obtained by pressing oil on screw and hydraulic presses from pre-cleaned, ground and heat- and moisture-treated seeds of oilseeds. The meal is obtained by extracting oil with organic solvents (gasoline, dichloroethane). The protein content in the meal and cake ranges from 30-45%. Soy, sunflower, cotton cake and meal are the most rich in proteins. The meal contains up to 1.5% fat, which is 5-6 times less than in cakes. Fats are mainly represented by unsaturated fatty acids, so they are easily oxidized, which prevents long-term storage of feed. Cake and meal are rich in vitamins B and E, contain a significant amount of phosphorus, but little calcium. Sunflower meal and cake contain 40-44% protein and up to 15% fiber. Their lipids mainly consist of oleic and linoleic acids. They are well eaten by fish, are widely used in food for carp, rainbow trout and sturgeon. In mixed feeds for carp, their share can reach 30-40%. Soy meal and cake have a high biological value of proteins (43-45%) due to their high content of essential amino acids, in particular lysine. It is widely used as part of compound feeds for fish. Unlike sunflower meal, soy meal and cake contain a trypsin inhibitor, which reduces the digestibility of nutrients. This component restricts the introduction of soybean meal and cake into the feed. During the moisture-thermal treatment of feed (50 ° C for 60-90 minutes), this inhibitor loses its properties [4].

From the point of view of further improvement of compound feeds for trout and sturgeon, high-protein products of vegetable origin - corn and wheat gluten containing 60-70% protein are of interest. Since their digestibility exceeds 90%, they can partially replace fishmeal. At the same time, the content of essential amino acids in compound feeds should be taken into account to ensure the physiological needs of the fish body. It is promising to use in fish feeding inactivated full-fat soy, which has a higher energy value compared to soybean meal, as well as peas and the product of its processing - pea protein. Partial replacement of fish meal with pea protein does not reduce the indicators of fish cultivation. Moreover, its introduction into compound feeds for producers of sturgeon fish improves the quality of caviar for fish farming and food purposes - the size of the eggs increases and the strength of their shell increases. Rapeseed processing products are little used in fish feeds, although the proteins of this crop have a high biological value. The lysine level in them is lower than, for example, in soybean meal, by 8-10%, but the content of methionine and other sulfur-containing amino acids (cystine and cysteine) is almost 2 times higher. This valuable property of rapeseed makes it a desirable component of fish feed, since there is not enough methionine in the main types of vegetable raw materials.

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УДК 636.034

## **ПРИМЕНЕНИЕ РАЦИОНОВ С РАЗНЫМ УРОВНЕМ L-ИЗОЛЕЙЦИНА В КОРМЛЕНИИ ЦЫПЛЯТ БРОЙЛЕРОВ**

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***Аннотация:** Рассмотрена основная роль L-изолейцина как важной аминокислотой с разветвленной цепью в рационе цыплят бройлеров. Была собрана последняя информация об экспериментах в мире и РФ.*

***Ключевые слова:** аминокислоты с разветвленной цепью, изолейцин, бройлеры.*

Промышленное птицеводство – важнейшая отрасль животноводства, обеспечивающая население полноценными продуктами питания. Продуктивность и качество сельскохозяйственной птицы, соответственно, как и качество получаемых продуктов питания, во многом зависят от условий кормления и содержания. Поэтому одну из ключевых ролей играет грамотное составление рационов и производство необходимых кормов.

Неотъемлемой составляющей любого корма для продуктивных животных является протеин. Он играет крайне важную роль в метаболизме и структуре организмов. Зачастую, имеющих в сырье усвояемых аминокислот недостаточно или же они не содержатся вовсе, что мешает полноценному и