Lifetime correction of quality indicators of pork

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Abstract. For the first time, the composition of a feed additive from modern biologically active substances and natural components with a synergistic effect has been scientifically substantiated, which is capable of forming biologically complete, environmentally friendly products in animals at the final stage of growing (a month before slaughter). This additive consists of, %: 95.5 – micronized full fat soya (source of leucine – controller of adipopexis), 3.5 – betaine (osmoprotection moisture retention in muscle tissue), 0.3 – L-carnitine (an activator of energy metabolism), 0.7 – Lisofort (emulsifier of fats, improving its digestion). It was found that the use of a functional feed additive in the amount of 2.0% 30 days before slaughter of pigs increases its productivity by 9.3%, reduces feed costs for products by 8.4 %. In muscle tissue, fat content increased by 0.85 %, characterizing the improvement of “marbling” of meat. The moisture-binding ability increased by 8.0%, the color intensity by 5.0 units of extinction, and a protein-quality indicator of meat due to an increase of 4.68% in the content of essential amino acids. The economic efficiency of the use of functional feed additives for the final fattening of pigs was calculated.

1. Introduction

Providing the population with high-quality food in the required quantity and assortment is one of the priority directions of Russia's economic policy. An important role in solving this problem is played by one of the most effective industries – pig farming. Pork has a high content of complete proteins and is absorbed in the human body by 90-95 %. In terms of calories, it exceeds beef and mutton on average twice. Pork fat differs from beef and lamb lower melting point, better digestibility and a more complete composition of polyunsaturated fatty acids (oleic, linoleic, linolenic, arachidonic). These indicators put pork on one of the first places in the world production of meat.

The share of pork in total meat production in recent years in the world has grown up to 46 %, and in Russia reached 45 %. In our country, the pig industry is developing dynamically. Already, it meets the needs of the population in meat by 90 %, displaces import, in the coming years will fully cover the demand and will focus on exporting products abroad.

Pork, as is known, refers to high-calorie varieties of meat, differs from the meat of other species of animals’ superior fat content. Compared with beef, it is softer, juicier, well absorbed by the human body, has high culinary and taste qualities.

Modern requirements for the quality of pork are quite high. It should have as much protein in its composition as possible, differ in a relatively moderate fat content, to have high nutritional and taste qualities. Along with these characteristics, pork should be different by complete composition of proteins, i.e. to contain meat favorable ratio of essential and nonessential amino acids. It is now
generally accepted that the more essential amino acids in meat, the higher the nutritional value of protein, and therefore higher the quality of meat.

In addition to the biological value of proteins, meat quality is significantly influenced by a number of other indicators. The great importance, especially in the food industry, has such a property of meat as its ability to bind water, retain meat juice. This property of meat is very valuable in the manufacture of meat products, especially sausages. From the meat, which has a low ability to retain moisture, sausages are of poor quality, too watery.

Another important indicator in assessing the quality of pork is the intensity of meat coloring. Meat coloring is an externally well-defined feature, it is always given priority, both in trade and in the meat processing industry. This indicator plays a particularly important role in the export of pork. As we know, meat with poorly pronounced color and, especially, meat is light in color valued lower, sales of such pork difficult on the world market.

In assessing the quality of pork in its appearance has long been attached significant importance “marbling” of meat, which causes the accumulation of meat intramuscular fat.

The view that good quality pork should have a high “marbling” is so deeply rooted in practice that it has become traditional.

In the manufacture of products such as loin, brisket, roll, ham, etc., pork, as a rule, should have good qualities not only meat but also subcutaneous fat.

It is quite natural that the study of changes in the qualitative characteristics of pig fat under the influence of various factors, undoubtedly, deserves close attention.

The main indicators by which the quality of fat is judged are density, color and taste, among which the first indicator is usually given priority.

It is well known, for example, that soft fat, especially, fat smearing consistency has low nutritional and taste value. It is poorly stored, quickly rancid, becomes unsuitable for food purposes.

High quality fat should have a granular structure and be solid. This property largely depends on the chemical composition of fat, the quantitative content of saturated and unsaturated fatty acids.

The density of fat can be determined subjectively by pressing a finger, an objective method using a penetrometer device. Most accurately, the density of fat and its quality is established by chemical means, by a certain iodine number. The main influence on the quality of fat have a feed.

On the basis of practical experience and experimental data distinguish feed beneficial and unhealthy acting on the quality of fat.

A positive effect on the quality of fat have carbon-rich forages: barley, rye, wheat, root vegetables etc. The opposite view exists in respect of oil-cakes, oil seeds, fishmeal and other feeds containing high levels of unsaturated fatty acids. These foods contribute to gain of fat is less dense spotting consistency, with a high iodine number, as well as specific unpleasant flavor.

Thus, the quality of meat and fat is influenced by many factors. However, at different stages of development of pig breeding, their influence on quality of production was shown differently. In the recent past, pork production in our country was concentrated in state and cooperative (collective farms) enterprises, which used mainly meat-fat pigs with a strong constitution and high stress resistance. Feeding the animals was varied: concentrates, oil cakes, dairy waste, root crops, grass meal, green mass. Used free range system of keeping livestock (summer camp, backyard area). All this ensured the production of high-quality pork, which is in demand among the population.

Over the past twenty years, with the transition to a market economy, the pig industry has undergone fundamental changes. Intensive technology is being introduced everywhere in pig-breeding enterprises: keeping livestock with meat genetics in enclosed spaces, feeding with full-feed compound feeds. This allowed significantly increasing the production of meat pork, improving economic indicators, but created many problems with the quality of the products.

One-sided selection for meat reduced the adaptive capacity of the organism of pigs to the environment, to stress factors, worsened the quality of products [1]. As a result, at pig enterprises, animals with signs of PSE meat (pale, soft, exudative) were increasingly observed at slaughter. At the
same time, the content of intramuscular fat, which determines the “marbling” of meat, decreased to 1.0%, which worsens its tenderness, taste and aroma.

The quality of meat is influenced by many factors that can be controlled and produce products with the desired properties. This indicator can be improved by selection methods, using DNA markers for the H-FABP gene, which encodes the protein, binds fatty acids and influences the content of intramuscular fat in carcasses [2].

Actual in the solution of this problem is creation of system of functional food of pigs. Functional nutrition is the use in animal diets of products of natural or artificial origin, which in systematic daily use have a regulatory effect on physiological functions, biochemical reactions and behavior. It should be based on feeding diets consisting of compound feeds, its quality is determined by special complex functional additives that can provide not only the productivity of animals, but also the optimal composition of meat and its specific characteristics necessary for a full diet of different age and sex groups of people [3].

We have scientifically substantiated and developed the concept of creating such additives to improve the quality of pig products. The theoretical basis for this is the position that by modeling feed rations using functional additives, we can control the productive qualities of the animal, the fat content in the carcass, including intramuscular, change the structure of the fatty acid composition of meat (saturated and polyunsaturated fatty acids), enrich it with amino acids, vitamins, trace elements and other useful nutrients.

Another important condition is that in order to ensure maximum productivity and the formation of carcasses of the desired quality, the meat pig should receive optimal amounts of all nutrients, and be well protected from stress, especially in the final stages of cultivation [4]. Balancing the content of vitamins in the diet is the most important method in achieving this goal. Such biofortification has undeniable advantages in comparison with the technological enrichment of food products, as synthetic biologically active substances added to the feed in the animal’s body are transformed into natural ones [5].

Currently, a range of components that cause activation of genes that control adaptation to stress of different nature: carnitine, betaine, vitamins E and C, selenium. Ascorbic acid, selenium, vitamins B1 and B2 make it possible to maintain the activity of vitamin E under stress and provide effective antioxidant protection of the cell [6,7,8,9]. Osmogen betaine – trimethylene derivative of glycine, which is an important product in the reactions of transmethylation and acts as a “donor” of methyl groups. It helps to maintain osmotic balance in cells under stress, prevents disturbances caused by osmotic shock at high temperatures, reduces the negative effects of other adverse factors, such as mycotoxins or heavy metals [6,10].

The positive effect of betaine on animal productivity and product quality is noted in the works of many scientists. At the same time, its combined use with carnitine, vitamins E, C, selenium, lysine and methionine in animal feeding has a hepatoprotective effect, promotes the metabolism of mycotoxins and cleansing the body of harmful substances [10].

Complex functional feed additive is a product intended for use as part of feed, allowing to regulate the productive and reproductive functions of the animal, ensuring the production of products with desired properties.

The basis for the development of feed additives with defined functional properties for improving the quality of pork products laid down science-based components – a biologically active substance betaine (osmoprotection, the donor of methyl groups), carnitine and lisofort – regulators of energy and lipid metabolism, soya - a source of leucine. All selected components have a synergistic interaction and are designed when used in the final stages of fattening pigs to correct metabolism, immune status of animals, to ensure the withdrawal of various toxins from the body, to increase stress resistance, and ultimately the biological usefulness of pig products.

Based on the generalization of literature on the correction of pork quality defects by different methods, the concept of creating functional feed additives was developed.
The theoretical basis for the necessity of creating bio correction feed additives is the transfer of pork production to intensive technology: the use of animals unilaterally selected on the meat content, and a concentrate type of feeding, cattle keeping without physical exercise indoors. With this technology, the need for biologically active substances in animals increases significantly. When the substances are lacking, there is a failure in the metabolism, which negatively affects the quality of products.

The basic principles that we followed in the development of functional additives were as follows:
- functional additive must have certain properties that give it “functionality” - have a beneficial effect on one or more target functions in the animal body, in addition to favorable nutritional and productive effects;
- such an additive should include a set of basic components that can be easily and at a high speed absorbed and integrated into the main pathways of metabolism, providing the energy that the body needs and utilized from it without significant energy costs;
- the composition of the supplement should be based not only on thermodynamic and kinetic, but also on components in a given molecular form, providing a high physiological status of the body’s own digestive and microbial systems;
- the use of additives in feed should not lead to exceeding the permissible concentrations of its constituent biologically active substances;
- the additive should be harmless, direct and side harmful effects should be absent, allergic effects, the presence of anti-nutrients are not allowed;
- the additive must retain the functional properties of the components used in its composition.

Environmental degradation, contamination of plant and animal products with harmful substances, toxins, allergens, all sorts of microbes pose a serious threat to health, reduce the immune status of a person. For this reason, in our country, the highest mortality from cancer, morbidity of children with various types of allergies and diathesis. Therefore, programs are being created to produce organic products, technologies that ensure the welfare of animals, human health, as well as the quality of food.

Due to the use of functional feed additives with directed action at different stages of fattening, it is possible to optimize quality indicators of livestock products lifelong. The use of high doses of vitamin E, C, zinc, organic compounds of selenium, amino acids, betaine, carnitine, polyunsaturated fatty acids, enzymes and other biologically active substances at the final stage of fattening gives positive results [11-15,16-19]. Feeding in the diet of fattened pigs additionally 2% of the amino acid leucine improves the “marbling” of meat, increases the fat content in the longest muscle by 25-42 % [11].

It is known that the final formation of quality indicators of pig production occurs at the final stages of fattening. Summarizing numerous studies, we came to the conclusion that due to biologically active substances it is possible to change metabolism in a short period of time and significantly influence the formation of such qualitative indicators of meat as moisture binding capacity, color intensity and taste.

As for the “marbling” of meat, this sign requires a long exposure (at least 30 days), which requires a feed additive with a set of components of directed action.

The aim of our research is to develop a feed additive with functional properties to improve the quality of pig products.

For the first time scientifically substantiated the composition of the feed additive of the modern biologically active substances and natural components, having direct synergistic interaction and is able to form animals in the last stage (a month before slaughter) obtaining biologically high-grade, environmentally friendly pork products. This additive consists of, %: 95.5 – micronized full fat soya (source of leucine – controller of adipopexis), 3.5 – betaine (osmoprotection moisture retention in muscle tissue), 0.3 – L-carnitine (an activator of energy metabolism), 0.7 – Lisofort (emulsifier of fats, improving its digestion).

2. Materials and methods
The work was carried out within the framework of the state theme. To obtain a functional feed additive with high technological properties, the optimal modes of moisture-heat treatment of full-fat
soybeans, grinding and subsequent mixing of ingredients were determined. The most effective mode of micronization of soybeans in the experimental setup with dual heat system (infrared emitter on top, tan on bottom) and initial moisture of the beans – 18.0 %, heating it at a temperature of 130 °C for 60 sec. with subsequent tempering (exposure) at 90-92 °C for 15 minutes and conditioning to 15-18° C. With such treatment parameters, anti-nutrients are removed to a safe level determined by the activity of urease 0.2 ΔpH (Russian Standard 13979.-9-69).

The functional feed additive was tested by two groups (24 heads in each) of pigs of large white breed in collective farm-breeding plant V. I. Lenin of Tambov region. The control group received feed used in the farm, experienced-the same feed, but with the introduction of a functional feed additive in the amount of 2%, for 30 days before slaughter. The composition of feed included in %: barley seal at -70.0; wheat – 22.9; Protein-vitamin-mineral concentrates -5; chalk stern – 0.7; salt – 0.4; the premix is 1.0. 1 kg of feed contained 12.0 MJ of metabolic energy, 13.0 % of crude protein. The preparation of animal feed made at the feed mill equipment “Dоза” homogeneity of mixing 85-95%. The conditions of the experimental animals were the same, feeding with dry feed twice, drinking from the automatic drinking bowl. The average live weight at production of pigs on the experience amounted to 95.7-96.1 per kg when removing 114.1-116.2 kg.

During the experiment, microbiocenosis of intestinal flora, animal productivity, blood indicators and product quality were studied. At the end of the experiment, a control slaughter of 3 animals from each group was carried out, samples of the longest back muscle and fat were selected for analysis.

Moisture-binding capacity of muscle tissue was determined in the laboratory of the Institute “pressmethod”, the intensity of color spectral method, tasting evaluation of products was carried out on a 5-point scale. Amino acid, vitamin and mineral composition of meat from experimented pigs was determined in Federal state budgetary scientific institution “Federal scientific center of food systems named after V. M. Gorbatov” Russian Academy of Sciences.

All digital material that was obtained in the studies was processed using the Student t-criterion test. The differences were recognized as significant at p ≤ 0.05, at p > 0.1 tests were considered unreliable.

3. Results of the research

During the experiment, there were no significant differences in the consumption of feed, there were no cases of digestive disorders. The dominant position in the microbiocenosis of intestinal flora in all experimental animals was occupied by useful microorganisms-bifidobacteria and lactobacilli within 10^8-10^9 microbial cells in 1 g of feces.

When using a functional supplement, there was an improvement in the physiological state of animals, the metabolism proceeds more intensively. In the blood of pigs of the experimental group the content of γ-globulin increased by 8.4%, indicating a high immune status of the body. Glucose increased by 1.2 mmol/l and 0.5 mmol / l of urea, indicating greater mobilization of energy material and protein to build muscle and fat tissue. These data are consistent with the results of animal productivity. The average daily gain of live weight in pigs receiving the supplement was 670 g and was higher than the control by 9.3%, and feed costs for products decreased by 8.43%.

Control slaughter showed that the use of a functional additive in feed a month before slaughter, which was based on micronized soya and biologically active substances that can regulate energy and fat metabolism, increased the live and slaughter weight of pigs. Carcass yield in this group compared to the control was higher by 1.7 %, and slaughter yield by 1.8 %.

Evaluation of product quality was carried out on a set of indicators. It was found that in the muscle tissue of animals of the experimental group, the fat content increases by 0.85 %. This is evidence of the improvement of the “marbling” of meat. The most objective assessment of biological value of meat of pigs gives aminogram of protein content and the balance between essential and non-essential amino acids. The contents of these components in meat is influenced by many factors: breed, age, feeding and maintenance of animals. Consumer properties of meat were due to the content of biologically complete proteins, which are a source of essential amino acids. We have studied in detail
the amino acid composition of the meat of experimental pigs, the data for each group are presented in table 1.

For amino acids such as lysine, leucine, arginine, methionine and tryptophan, the difference between the experimental and control groups was highly reliable (p<0.01 - p<0.001). The total number of essential amino acids was 52.51 % and exceeded that of the control by 4.68 %. It is generally recognized that the more essential amino acids in protein, the higher the nutritional value of meat, and therefore higher and its quality.

The meat of the experimental group had more tryptophan and less oxyproline. As a result, the protein-quality index of meat of these animals was higher – 8.91 against 5.56 units in the control group. According to the existing scale, such meat can be attributed to the sort of high quality.

### Table 1. Amino acid composition of pork meat protein (g/100g).

| Amino acid     | Group         | control       | Experimental  |
|----------------|---------------|---------------|---------------|
|                | Essential     |               |               |
| Arginine       | 1.25±0.03     | 1.69±0.004*** |               |
| Valine         | 1.21±0.02     | 1.26±0.004    |               |
| Histidine      | 0.93±0.04     | 0.88±0.01     |               |
| Isoleucine     | 1.75±0.03     | 1.45±0.01     |               |
| Leucine        | 1.27±0.03     | 1.83±0.004*** |               |
| Lysine         | 1.45±0.02     | 1.82±0.004*** |               |
| Methionine     | 0.44±0.01     | 0.59±0.01***  |               |
| Threonine      | 1.13±0.02     | 1.14±0.01     |               |
| Tryptophan     | 0.40±0.01     | 0.52±0.02 **  |               |
| Phenylalanine  | 0.85±0.01     | 0.84±0.01     |               |
| Subtotal:      | 10.68         | 12.02         |               |
| Nonessential   |               |               |               |
| Alanine        | 1.27±0.02     | 1.62±0.02     |               |
| Asparagine     | 2.15±0.04     | 1.94±0.01     |               |
| Glycine        | 1.11±0.02     | 1.02±0.02     |               |
| Glutamine      | 3.77±0.07     | 2.93±0.01     |               |
| Proline        | 1.16±0.02     | 1.07±0.004    |               |
| Serine         | 1.13±0.03     | 1.26±0.004*   |               |
| Tyrosine       | 0.83±0.01     | 0.83±0.02     |               |
| Cystine        | 0.23±0.1      | 0.20±0.01     |               |
| Subtotal:      | 11.65         | 10.87         |               |
| Ratio          |               |               |               |
| Total number of amino acid | 22.33         | 22.89         |               |
| Among them, in %: |          |               |               |
| Essential      | 47.83         | 52.51         |               |
| Nonessential   | 52.17         | 47.49         |               |

*p<0.05; **p<0.01; ***p<0.001

Important indicators of meat quality - moisture binding capacity and color (table 2).
Table 2. Physical and chemical properties of the longest back muscle.

| Indicators                                      | Control          | Experimental     |
|------------------------------------------------|------------------|------------------|
| pH 24 hours after slaughter, units             | 5.58±0.06        | 5.59±0.06        |
| Moisture binding capacity, %                   | 56.4±1.76        | 64.4±0.78*       |
| The color intensity of the meat units of the extinction x 1000 | 73.0±0.9         | 78.0±0.4**       |

*p < 0.05,  ** p < 0.01

The table shows that the pH value of meat 24 hours after slaughter was in the range of 5.58-5.59 units. It is evidence of the normal process of maturation of meat and characterizes it high quality. This meat is well stored. Water binding capacity was at a fairly high level of 56.4-64.4%, while the color intensity in the range of 73.0-78.0 units of the extinction. At the same time, the meat of the experimental groups in both indicators significantly exceeded the control samples: the moisture binding capacity was higher by 8.0% (p<0.05), and the intensity of coloring by 5 units of extinction (p<0.01).

A tasting evaluation of the quality of meat and broth was carried out. The results of this assessment are often final and decisive in determining product quality. To assess the meat took indicators: consistency (tenderness, stiffness), juiciness, aroma and taste; for broth – appearance, richness, aroma and taste. Each indicator could receive a maximum score of 5 points.

The tasting evaluation revealed the advantages of meat from the animals of the experimental group, especially on such indicators as tenderness, juiciness of meat and richness of broth. Overall assessment on average for all indicators was 4.67 vs 4.24 points in the control variant. Apparently, the higher content of fat and other substances in the meat of animals of the experimental group provided higher food and taste indicators in assessing the quality of products according to the point system.

The presence in meat products of vital vitamins for humans complements the characteristics of its biological usefulness. We studied the vitamin composition of meat (table 3).

Table 3. Vitamins content in the meat.

| Group         | Content mg/100 g   | mcg/100g  |
|---------------|-------------------|-----------|
|               | B1    | B2    | B3    | B4    | B5    | B6    | B7    | B8    | B9    | B12   |
| Control       | 0.84±  | 0.27±  | 4.06±  | 0.79±  | 0.57±  | 3.31±  | 2.60±  | 0.73±  |
|               | 0.12   | 0.01   | 0.06   | 0.02   | 0.02   | 0.56   | 0.19   | 0.09   |
| Experimental  | 0.87±  | 0.32±  | 4.35±  | 0.82±  | 0.49±  | 5.64±  | 3.06±  | 0.66±  |
|               | 0.03   | 0.02   | 0.05±  | 0.02   | 0.01   | 0.91   | 0.04   | 0.03   |

*p<0.05

The data of the table show that in the meat of animals of the experimental group the content of choline was higher by 0.29 mg (p<0.05), the difference in the amount of biotin and folic acid approached the reliable value. Apparently, biologically active complex feed supplements, improving metabolism in the body of pigs, contributed to the absorption and deposition of vitamins in the tissues.

As for mineral substances, there were no significant differences in their concentration in the meat of experimental animals. The differences did not reach a reliable value and were within the statistical error of their determination.

It should be noted that in the meat samples of the experimental group, a decrease in lead of 3.5 μg or 30.2% was found. This can be regarded as a positive factor.

Significant differences in the chemical composition of fat of experimental animals were not found. It can only be noted that in the fat of pigs of the experimental group, receiving a functional feed additive, there was less protein by 0.38%, which is mainly in the connective tissue, and more fat itself by 0.37%. This is a positive indicator characterizing the quality of fat. All experimental animal fat was
solid consistency, white color, had a granular structure, which determines its high commercial and nutritional value.

Calculations have shown that the use of functional feed additives at the final stage of fattening pigs is economically justified, gives an additional income per animal 138.8 rubles. This functional additive can be used in industrial pig complexes and feed enterprises in the production of special feed intended to improve the quality of pig products.

4. Discussion of the obtained results
Lifetime formation of qualitative characteristics of meat raw materials, obtaining on its basis of products with predictable consumer and functional properties intended for healthy nutrition, is the main link among the technologies that provide the process of obtaining organic agricultural products [7].

Developed functional feed additive contains in its composition of full-fat soybeans and a complex of biologically active substances (carnitine, betaine, Lisofort) with a synergistic interaction of components aimed to regulate metabolism in the final stage of fattening pigs. There is no information in scientific literature about the joint application, but positive results were obtained when separate use in the practice of feeding pigs [9,12,14,15]. Full-fat soya is a rich source of leucine, which is a stimulant of intramuscular fat deposition in pigs [11]. Together with lisofort that improves the absorption of fat [12], and carnitine, which provides energy metabolism, the transport of fatty acids into the mitochondria [14] in animals bodies, improving lipid metabolism which contributed to the accumulation of fat in muscle tissue. This was further confirmed by a reliable increase in the content of leucine in the meat of experimental animals and an increase of 0.85% in the amount of fat, which contributed to the improvement of such an important indicator as the “marbling” of meat.

It is generally recognized that the more essential amino acids in a protein, the higher the nutritional value of meat, hence the higher its quality. The data obtained in our studies confirm this position. It was found that the content of amino acids lysine, leucine, arginine, methionine and tryptophan difference between the experimental and control groups was highly reliable (p<0.01 - p<0.001). The total number of essential amino acids was 52.51 % and exceeded that of the control group by 4.68 %. In the meat of animals from the experimental group, there was more tryptophan and less oxyproline. As a result, protein-qualitative indicator of meat from these animals was higher – of 8.91 vs 5.56 units in the controls. In our opinion, the improvement of these parameters was influenced by carnitine, which is an active stimulant of protein biosynthesis and lipid metabolism [8,14].

The important technological properties of meat are water binding capacity and color. The use of functional additives in the final stage of fattening pigs increased by 8.0% water binding capacity, and 5.0 units of the extinction intensity of the color of muscle tissue (p<0.01). An increase in the moisture-binding capacity of muscle tissue due to the use of betaine, which maintains water balance in the cells and tissues of the body, is reported in a number of studies [6,10,15]. Our findings are consistent with them.

The composition of meat vitamins complements the characteristics of its biological value. It was found that in the meat of animals from the experimental group, the content of choline was higher by 0.29 mg/100g (p<0.05), the difference in the amount of biotin and folic acid approached the reliable value. It is likely that the biologically active complex of components contained in the feed additive, improving metabolism in the body of pigs, contributed to the absorption and deposition of vitamins in the tissues. In the works of other researchers, a similar trend was revealed in the cultivation of young pigs using carnitine, which increased the content of vitamins in the liver of animals [20].

Summarizing the results of research, it can be noted that the concept of creating a functional feed additive of a new generation to improve the quality of pig products based on soya and a complex of biologically active substances was developed for the first time. The composition of the additive is scientifically substantiated, a prototype is obtained, which is tested in production conditions. The use of functional feed additives at the final stage of fattening pigs allows normalize metabolism and ensure
the production of pig products of the desired quality. There are no similar analogues in the country at present.

This development will be used mainly in pig-breeding complexes and will reduce economic losses from obtaining low-quality products.

It is advisable to continue working with functional feed additives in the direction of improving their composition and terms of use in relation to the genetics of meat-type pigs.

5. Conclusions

It was found that the use of functional feed additives at the final stage of fattening pigs 30 days before slaughter can improve: the technological quality of meat, moisture binding capacity, intensity of muscle tissue coloring, protein-quality index, “marbling”, and taste of products.

Due to this additive, we can adjust the vitamin composition of meat, increase its biological value, reduce the content of harmful elements such as lead.

The use of functional feed additive in combined feeds for 30 days before slaughter of pigs, which is based on soy and a complex of biologically active substances, increases the productivity of animals by 9.3 %, the content of intramuscular fat by 0.85 %, improves the consumer quality of meat.

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