

The effect of enzyme preparations and lecithin in feed on the biological value of broiler meat

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Abstract

The biological value of meat is determined by the level of essential amino acids in protein, as well as the amount of unsaturated and saturated fatty acids in lipids. These indicators may vary depending on the biologically active substances that enter the body of the bird with the feed. The article analyzes the results of studies on broiler chickens to study the effect of the enzyme preparations Sanzaym, Sanfayz 5000 and lecithin on the biological value of the resulting meat. The research was carried out in the State Unitary Enterprise Breeding Reproducer "Achkhoy-Martanovsky" of the Chechen Republic (Latitude: 43°11.3982 's. w. Longitude: 45°17.0238' w. d.) on broiler chickens of the ROSS-308 cross. The duration of the studies was 45 days. The experiment was conducted on 4 groups of day-old chickens: 1 control and 3 experimental. As the main diet, mixed feed is used, prepared from corn, barley, wheat, sunflower cake of local production with the addition of animal feed and a special premix. This diet was used in feeding the control group of birds. For the livestock of the 1 experimental group, the studied enzyme preparations were added to the main diet, at the rate of 100 g/t of feed. For the livestock of the 2 experimental group, the main diet was enriched with lecithin, at the rate of 10 g per 1 kg of mixed feed. For the livestock of the 3 experimental group, all 3 biologically active drugs were included in the diet, in the same amounts. It was found that the studied preparations improved the amino acid and fatty acid composition of broiler meat. Optimization of protein metabolism in the body of broilers of the experimental groups contributed to a significant increase in the concentration of the essential amino acid tryptophan in their meat from 353.3 to 366.5 mg/%. The improvement of lipid metabolism is confirmed by an increase in the content of mono - and polyunsaturated fatty acids of muscle tissue, which indicates a higher biological value of broiler meat of the experimental groups.

Keywords: enzymes; lecithin; broiler chickens; biological value

Introduction

The high productive qualities of modern highly productive poultry crosses are not fully manifested without the use of biologically active drugs, in particular enzymes that contribute to a more complete digestion and better assimilation of the nutrients of the diet. The use of multienzyme complexes, providing better digestion of non-starch polysaccharides and hard to digest proteins contained in the plant components of animal feed for poultry, improves quantitative and qualitative productive performance of broilers grown (Baeva et al., 2011; Zipkin & Kolobova, 2013; Ibragimov & Kaloev, 2018; Ibragimov & Kaloev, 2020; Kaloev & Khadaeva, 2011; Kaloev & Chertkoev, 2017; Kaloev & Ibragimov, 2017; Kaloev et al., 2017; Tmenov et al., 2014; Chernyshkov, 2019; Selle et al., 2010; Kaloev et al., 2019).

The authors note the dependence of the quality indicators of broiler chicken meat on the quality characteristics of muscle tissue fat. A positive effect on lipid metabolism is observed when phospholipids, in particular lecithin, are used in poultry feeding. At the same time, there is an improvement in productive indicators, which makes it possible to obtain better and safer livestock products (Aydinyan, 2015; Kairov et al., 2019; Kaloev & Ibragimov, 2020; Kaloev et al., 2020).

The purpose of the research was to study the possibility of increasing the biological value of broiler meat, as a result of the inclusion of enzyme preparations and lecithin in their diet.

Materials and Methods

Location of study

Objects and methods of research. Scientific work on studying of influence of enzyme preparations Sansim, Santis 5000 and lecithin, on the biological value of meat of broiler chickens held at GUP Breeding farm "Achkhoy - Martan" of the Chechen Republic (Latitude: 43°11.3982 's. w. Longitude: 45°17.0238' w. d.) and was a part of the scientific and economic experiment according to the scheme presented in figure 1.

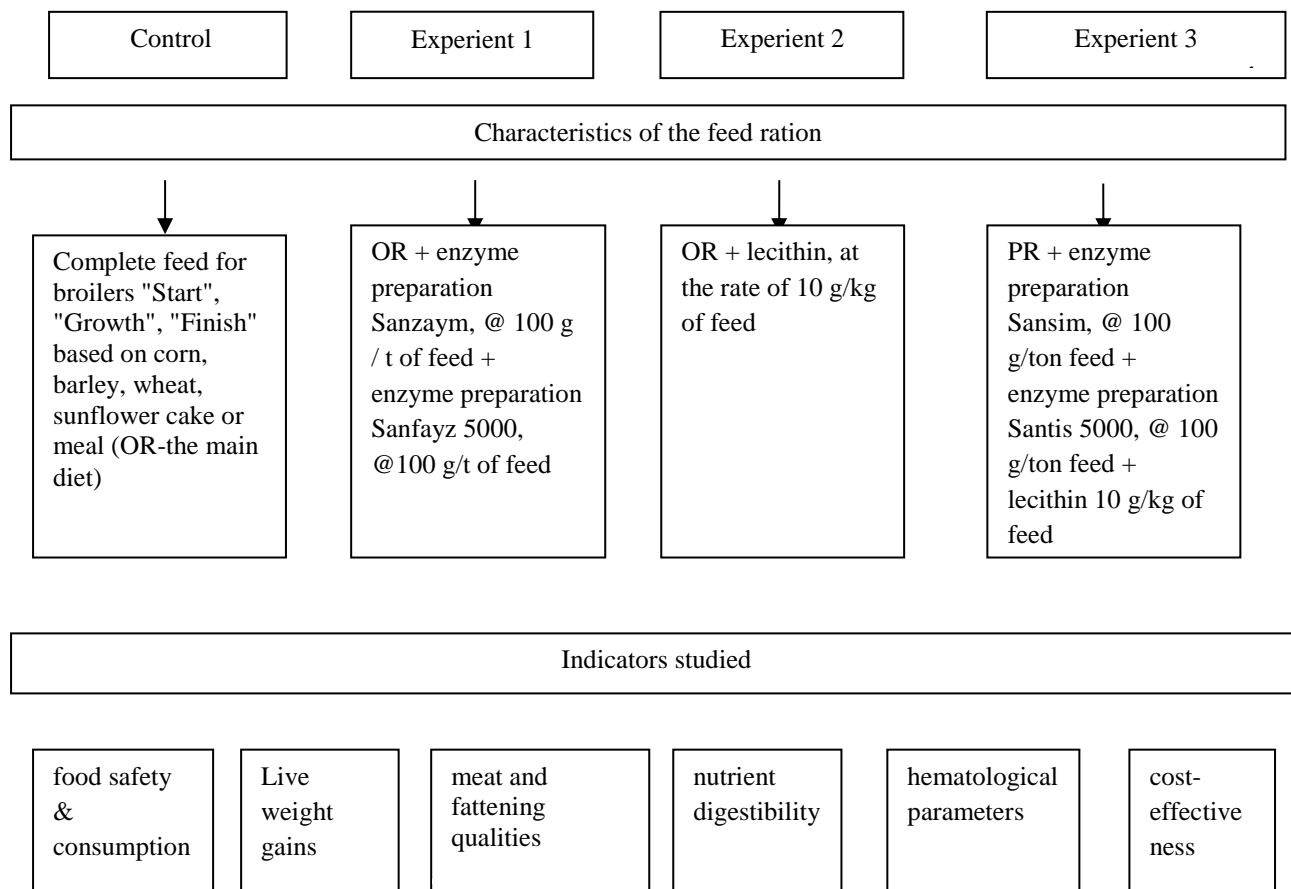


Fig 1. Scheme of scientific and economic experience

The studies were carried out on broiler chickens of the cross "ROSS-308, raised from a day to 45 days of age. In the course of the experiment, 4 groups of daily chickens were formed, each with 100 heads. As the main diet, full-fledged mixed feeds were used, prepared with the use of corn, barley, wheat, sunflower cake of local production.

Table 1. Composition and nutritional value of feed for broiler chickens

Components, %	Feed type and feeding period		
	«Start»	«Growth»	«Finish»
	1-14 days	15-28 days	29-45 days
Corn	40	44	47
Barley	8	8	8
Wheat	16	13	13
Sunflower/soy cake	20	19	17
Feed yeast	5,5	5,5	4,5
Fishmeal	6	5	4
Animal feed fat	2	3	4
Table salt	0,3	0,3	0,3
Tricalcium Phosphate	1,2	1,2	1,2
Premix	1,0 (P5-1-89)	1,0 (P5-1-89)	1 (P6-1-89)
Per 100 g of mixed feed contains:			
- metabolic energy, kCal	308,00	316,00	325,00
- crude protein, g	23,97	22,55	19,10
- crude fat, g	6,82	7,91	6,60
- crude fiber, g	4,80	4,78	4,40
- calcium, g	1,04	1,04	1,02
- phosphorus, g	0,74	0,70	0,70
- sodium, g	0,17	0,16	0,18
- lysine, g	1,33	1,24	1,09
- methionine + cystine, g	1,05	0,92	0,83

In addition to this compound feed, the studied preparations were introduced into the poultry diet of the experimental groups. Enzyme preparations Sanzaym and Sanfayz 5000 are developed by specialists of the Chinese firm "Wuhan Sunhy Biology Co., Ltd" and are made by LLC "Company Agros" Yekaterinburg. "Cansim" - a comprehensive tool for mixed rations, obtained by bacterial synthesis. The composition of "Sanzaym" includes four active enzymes: xylanase-at least 12,000 K-u/g, beta-glucanase-at least 4000 G-u/g, mannanase - at least 100 M-u/g, cellulase-at least 2000 C – u/g; filler-corn starch. "Santis 5000" a preparation on the basis of phytase (myo-Inositol-hexaphosphate phosphohydrolase), obtained by bacterial synthesis. The minimum activity of dry "Sunfayz" is 5 000 FE/g, the filler is corn starch.

Lecithin is a common name for a phospholipid-dominated lipid complex that meets the established requirements. Phospholipids are substances contained in the cells of all living organisms that perform vital functions related to the regulation of metabolic processes and the protection of cell membranes. Being a part of cell membranes, phospholipids provide their regeneration, influencing the biological activity of membrane proteins and receptors, play a crucial role in the activation of enzymes, regulate numerous metabolic processes, including the transformation of substances of a fatty nature, providing lipid metabolism.

In the course of the scientific and economic experience, all the main zootechnical indicators were carefully taken into account, including indicators that characterize the meat quality and biological value of meat in the laboratory of the Research Institute of Agricultural Ecology of the Gorsky State Agrarian University (NII AE). In particular, in the pectoral muscle, the biological value of the protein was determined by the ratio of the amount of the essential amino acid tryptophan to the substituted one-oxyproline (GOST 34132-2017. The method is based on acid hydrolysis of the protein until its complete breakdown into its constituent amino acids, followed by chromatographic determination of the mixture on an automatic liquid amino acid analyzer to identify the composition and determine the mass fraction of individual amino acids).

In view of the additives in the feed of the phospholipid preparation lecithin in the average samples of muscle tissue, according to GOST 7702-74, the fatty acid composition of lipids was determined.

The efficiency of growing broilers is determined not only by the use of complete feed in their feeding, but also by their cost, due to the use, if possible, of feed components of local production. The complete compound feeds used in the research and production experiment included corn, barley, wheat, and sunflower cake produced in the region, as well as animal feed and mineral fertilizing. In order to provide poultry with trace elements, vitamins and individual amino acids, a special premix was introduced into the feed, depending on the growing period. During the period of our research on broiler chickens, the farm used differentiated three-phase feeding with three different types of compound feed.

In each feeding phase, the experimental bird received a complex of nutritious, mineral and biologically active substances in accordance with the existing feeding standards, which is confirmed by the given formula of compound feeds.

At the same time, the presence of a significant amount of grain components indicates a high content of difficult-to-digest substances in the feed, for additional effects on which the studied enzyme preparations and lecithin were used.

Results

The biological value of poultry meat, first of all, is determined by the fullness of its proteins, that is, the content and ratio of essential amino acids in them. Tryptophan and threonine are considered the most deficient amino acids in the human diet, so their content is taken as a unit and all other amino acids are calculated based on them.

The study of the quality indicators of the obtained meat products was carried out by determining the biological usefulness of the pectoral muscles by calculating the protein-quality indicator.

Table 2. Biological usefulness of the pectoral muscles broiler chickens

Group	Tryptophan, mg/%	Oxyproline, mg/%	Relationship Tryptophan:hydroxyproline
Control	353,3±2,1	43,6±0,2	8,1
1 experimental	361,7±2,2 *	43,4±0,2**	8,3
2 experimental	361,3±1,9*	43,3±0,3**	8,3
3 experimental	366,5±2,1 **	43,1±0,2**	8,5

Note: * - $p \geq 0.95$, ** - $p \geq 0.99$, *** - $p \geq 0.999$.

It was found that due to the action of the studied drugs, there was a more intensive accumulation of tryptophan (361.7 - 366.5 mg/%) in the chest muscles of the broilers of the experimental groups, with a slight decrease in the content of oxyproline. The protein-quality index, determined by the ratio of tryptophan and oxyproline in the pectoral muscle, in the control group, was 8.1 units. In the experimental groups, it increased to 8.3 - 8.5, exceeding the control indicator by 0.2-0.4 units, which is a confirmation of the increase in the biological value of broiler meat that received the enzyme preparations Sanzaym, Sanfayz 5000 in combination with lecithin. However, the nutritional value of poultry meat is not only limited to its nutritional value and protein content, it is also determined by the amount of fat and the ratio of individual fatty acids.

For further study of the quality indicators of meat, it is interesting to study the qualitative characteristics of muscle tissue fat, for which the fatty acid composition of the dry matter of the muscle tissue of broiler chickens of the experimental groups was determined.

Unsaturated fatty acids, especially polyunsaturated ones, play a special role in the body of animals and poultry, as they are essential fatty acids, and are very active chemicals. These include linoleic, linolenic, arachidonic, and eicosapentaenoic fatty acids. Their significance is determined by the fact that linoleic and arachidonic fatty acids belong to the omega-6 family (ω -6), and linolenic and eicosapentaenoic acids belong to the omega - 3 family (ω -3). Their lack in the diet of fattened poultry can lead to a decrease in live weight gains and a deterioration in their meat qualities. From this point of view, a certain increase in the content of polyunsaturated fatty acids in products, in this case broiler meat, is desirable, since it leads to an increase in their ratio to saturated (replaceable) fatty acids. To characterize the fatty acid composition of muscle tissue, Table 3 shows the composition of lipids of the dry matter of the leg muscles of broilers of the experimental groups. It was found that in the samples of the leg muscles of the experimental groups, more polyunsaturated fatty acids were found, both in total and separately, compared to the control. At the same time, there is a decrease in the total amount of saturated fatty acids, and in particular, palmitic.

The greatest effect on the fatty acid composition of the dry matter of the leg muscle is noted in the experimental groups in which the broilers were fed with compound feed lecithin, which belongs to the group of phospholipids. Due to its effect on lipid metabolism, the ratio of unsaturated to saturated fatty acids in the muscle tissue of broilers of the 2 experimental group was 1.92, and in the 3 experimental group even 1.97, while in the control-only 1.62.

Table 3. Fatty acid composition of leg muscle dry matter lipids, %

Fatty acids	Group			
	Control	experiment 1	experiment 2	experiment 3
The amount of fatty acids	100,0	100	100	100
Saturated	38,16	37,41	34,23	33,72
including palmitic	36,02	35,04	32,16	31,57
Monounsaturated	39,73	40,06	42,89	42,71
including oleic acid	39,24	39,72	42,38	42,33
Polyunsaturated	22,11	22,53	23,39	23,57
including linoleic acid	20,42	20,66	21,06	21,14
Linolenic acid	0,38	0,46	0,59	0,62
Arachidonic acid	0,98	1,03	1,28	1,30
Eicosapentaenoic acid	0,33	0,38	0,46	0,51
The ratio of unsaturated to saturated	1,62	1,67	1,92	1,97
The ratio of palmitic and oleic acids	0,91	0,88	0,76	0,74

These indicators allow us to speak about a higher biological value of the pectoral muscles of the broilers of the experimental groups, in comparison with the control. Another indicator of the biological usefulness of muscles in terms of lipid composition can be the ratio of individual fatty acids, and in particular palmitic, as the main representative of saturated fatty acids, and oleic, as the main representative of monounsaturated fatty acids. This indicator is therefore, its decrease from 0.91 in the control group to 0.88-0.74 in the experimental groups confirms the positive effect of the studied drugs on the biological usefulness of leg muscle lipids.

The main content of the polyunsaturated fatty acid linoleic acid, lipids leg muscles of the experimental groups surpassed the control group 0.24-0.72 %, and the total content of polyunsaturated fatty acids – 0.42 -1.46 %.

Discussion

The calculation of the protein-quality index of broiler chicken meat, which characterizes its biological value, showed maximum effectiveness when the studied enzyme preparations Sanzaym and Sanfayz 5000 and lecithin were included in their feed diet, which is largely due to the optimization of carbohydrate and protein metabolism.

Comparison of the data on the fatty acid composition of broiler meat shows that the studied preparations generally have a positive effect on the accumulation of the most valuable, unsaturated fatty acids. However, it is noticeable that the effect of the enzyme preparations Sanzaym and Sanfayz 5000, was less significant, compared to the effect of the phospholipid lecithin. This is probably due to the fact that phospholipids (lecithin) regulate numerous metabolic processes, including the transformation of substances of a fatty nature, providing lipid metabolism (Baeva, 2011; Aidinyan, 2015; Kairov et al., 2019).

Conclusion

In general, it can be stated that when including in mixed feeds prepared on the basis of corn, barley, wheat, sunflower cake of local production, enzyme preparations Sanzaym and Sanfayz 5000, as well as lecithin, the biological usefulness of broiler meat improves, which is confirmed by an increase in the protein-quality index from 8.1 to 8.5 units and an improvement in the fatty acid composition of leg muscle lipids due to the accumulation of more unsaturated fatty acids. In this case, the best results on chickens-broilers obtained by the joint use of enzymes and lecithin in doses: Cansim - 100 g/t feed + Senpais 5000 - 100 g/ton of feed + lecithin 10 g/kg of feed.

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Conflict of interest Authors declare there are no conflicts of interests.

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