Amino acid composition of duck muscle tissue on using dietary supplements Activio

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Abstract

The optimal amount of protein is necessary for intensive growth. Protein malnutrition is one of the leading causes of poor growth and increased care of birds. However, excessive feeding of poultry with protein is impractical because the protein, in this case, is not fully used and harms the body, delaying its development. The lack and the excess of amino acids are harmful to a bird. Due to the imbalance of amino acids consumed with food, about 30 % of their amount is not used by the body for protein synthesis and is lost converted into energy. When normalizing the amino acid needs of poultry, it is necessary to consider the interaction of amino acids in the body with vitamins, micro-minerals, energy levels in feed. The article presents a study of the effect of the biologically active additive Activio, a selected combination of natural standardized active substances isolated from aromatic herbs and spices concentrated in one microencapsulated particle on the amino acid composition of Peking duck meat and cherry valley cross. It was found that the use of Activio supplement in the ducks feeding has a positive effect on the digestibility of amino acids.

Keywords: Activio, amino acids, meat and meat quality, Peking duck, cross-cherry valley.

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1. Introduction

Complete and adequate feeding of poultry, including ducks, is one of the essential components of improving poultry productivity and meat quality. Feed additives have been widely used in recent years, containing biologically active substances of plant origin. In particular, some studies have found that cinnamon essential oil is a taste stimulant and antioxidant, enhances the perception of smell and taste of food, reduces the effects of stress and disease; Rosemary essential oil is an antioxidant and anti-inflammatory agent, reduces oxidative and inflammatory reactions, regulates body temperature, reduces pain in inflammatory processes, chili pepper extract improves digestion by increasing the activity of digestive enzymes and secretion of gastric juice increasing feed conversion and taste, essential oil exhibits bactericidal and antioxidant properties by inhibiting the growth and development of pathogenic fungal and bacteria.

Modern intensive poultry farming places high demands on the quality of feeding. Today, the search and study of non-traditional feed additives reduce the cost of feed, increase the efficiency of nutrient absorption, increase the production of poultry products and reduce the effects of toxic compounds in feed.

Feed additives, as a rule, are characterized by a high content of nutrients, biologically active, and mineral substances and are used to enrich rations, compound feeds, and feed mixtures with missing nutrients to regulate the amount and ratio of nutrients and biologically active substances. Numerous experiments have shown that balancing feed rations through the use of appropriate additives can significantly increase the efficiency of feed nutrients and the level of productivity of poultry.

Most modern duck crosses need a balanced diet of nutrients and biologically active substances. The total value of

amino acid nutrition significantly impacts the productivity and nutritional and biological value of meat.

It is known that the bird is sensitive to protein deficiency. However, the protein's level and quality are essential for it. The latter is determined by the content of essential amino acids, which are not synthesized in the body of these animals or are synthesized in small quantities. These include lysine, methionine, tryptophan, leucine, isoleucine, threonine, phenylalanine, histidine, valine, and arginine. The lack of one of them in the diet has the same negative impact on the body as a deficiency in the diet of protein. It is estimated that if you completely balance the feed on amino acids, you can see increased productivity and egg production.

Proteins are components of poultry meat and eggs. The need for amino acids determines the need for protein. The content and ratio of essential amino acids (lysine, methionine, tryptophan, threonine, arginine, leucine, isoleucine, phenylalanine, cystine), which are not synthesized by poultry and therefore must come in large quantities, play a decisive role in protein synthesis in poultry. However, according to various authors, deficient or critical in modern diets are called tri-lysine, methionine, threonine or cystine, tryptophan, and arginine (Sychoy, 2014). It should be taken into account that animal feeds essential amino acids more than vegetables. Lack, absence, or imbalance of essential amino acids in poultry diets is accompanied by deterioration of protein use, metabolic disorders, and decreased productivity (Sychoy, 2014).

Poultry's need for specific amino acids is determined by the intensity of their use for biological functions of the body and the ability to be synthesized in the body or be replaced.

The rate of amino acid absorption depends on metabolic inhibitors, vitamin supplementation, age, health status, and intensity of intestinal peptide uptake.

All species of animals have their own set of essential amino acids, which cannot be synthesized from essential due to the physiological characteristics of the body. Methionine, cystine, lysine, threonine are considered indispensable for birds. In addition to these, some authors identify several other amino acids, which in most modern diets are in the optimal amount for birds, and the problem of their deficiency is less relevant (Lemesheva, 2003). Methionine and cystine are considered in the complex because the lack of cystine is partially covered by methionine.

Amino acids and minerals play a significant role in the metabolic processes of poultry. Amino acids are monomers of proteins that perform several essential functions in the body, from structural to specialized (catalysis, movement, transportation, etc.).

The deficiency of at least one of these essential amino acids harms the metabolism of poultry, which reduces productivity, resistance, and stress resistance. Note that lysine makes up about 7 % of the amino acids of broiler breast meat, and a lack of lysine in the diet, especially at the beginning of cultivation (start and growth periods), leads to lower meat yields.

It is necessary to control the number of essential amino acids in the diet and the amino acid ratio. This avoids the antagonism of individual amino acids and promotes their fuller assimilation.

When adding amino acids to the diet during feeding, productivity is noted. Thus, amino acids play an essential role in feeding birds, especially productive ones. It is necessary to carefully normalize the content of amino acids in the

diet, compensating for the lack and avoiding unwanted excess. With balanced feeding of all components, it is possible to maximize the genetic potential of broiler chickens and achieve significant gains in live weight and high feed conversion.

Our research aimed to study the effect of the biologically active additive Activio, a selected combination of natural standardized active substances isolated from aromatic herbs and spices concentrated in one microencapsulated particle on the amino acid composition of duck meat.

2. Materials and methods

Studies of the content of amino acids in the meat of Peking duck and cross-cherry valley were conducted at Wrocław State University.

The scientific and economic experiment material were ducks of the cherry valley and Pekinges breed aged 1–42 days. To determine the effect of Activio on the amino acid composition of duck muscle tissue, two groups of 50 birds were formed in each (the first – Pekinges breed and the second – cross cherry valley), taking into account age and live weight. The main period of the experiment lasted 42 days. At the end of the experiment, slaughter and tissue of the chest and thigh muscles were investigated.

The amino acid content was determined in the muscle tissue of ducks using an AAA 400 analyzer (INGOS, Czech Republic) according to generally accepted methods according to a standard protocol. The principle of operation of the analyzer is based on the separation of free amino acids by liquid ion-exchange chromatography with the subsequent formation of color complexes as a result of the reaction of the starting products with ninhydrin.

The analyzer was a stationary device. The housing houses a thermostatic analytical column, a pre-column, a ninhydrin reactor, a two-channel spectrophotometric sensor, peristaltic pumps, a buffer, and solenoid valves that control the flow of eluent, and a reagent. In the upper compartment of the analyzer, there are bottles with buffer solutions and a cooling tank with ninhydrin, a cassette for installation of samples. A computer-controlled analyzer. Analyzer programs provided full automation of analyzes.

The obtained digital material was processed mathematically using the program "Microsoft Excel." Standard statistical indicators were calculated: arithmetic means (M) its standard error (m). The statistical probability of the difference between the averages was determined using the confidence level (P) in the table, based on the calculated standard deviation (t -Student-Fisher test). The difference between the values of the mean values was considered statistically significant at * – $P < 0.05$; ** – $P < 0.01$; *** – $P < 0.001$.

3. Results and discussion

Proteins are an essential part of every organism and are high molecular weight organic compounds made up mainly of amino acids. Lysine and threonine are considered the essential amino acids in the feed base. Lysine provides growth of young individuals, promotes intensive consumption of food, the formation of the pigment melanin in the feathers. With the help of lysine, one can increase the growth of animals and birds by up to 30 %. Threonine is necessary for the normal functioning of the immune system, body growth, promotes the formation of collagen elastin,

participates in metabolism and assimilation, supports the gastrointestinal tract.

The need of birds for specific amino acids is determined by the need to use them in a particular biological function and be synthesized in the body. Therefore, in this regard, each amino acid is characterized by individual specific properties that depend on many factors.

In birds' diets, the primary source of essential amino acids is mainly animal feed. These are primarily meat and bone meal and fish meal. Such components are expensive, and therefore try to partially replace them by adding other non-traditional components or synthetic amino acids. Some researchers believe that protein feed of animal origin can be entirely replaced by the protein of plant feed and 20 % of protein feed of plant origin by adding synthetic amino acids without adversely affecting productivity.

Several other studies indicate that replacing animal feed with plant feed without synthetic amino acids leads to reduced productivity. Studies have shown that using plant biologically active feed additive Aktivio in the ducks' feeding has a positive effect on the digestibility of amino acids (Tables 1, 2).

Table 1

Amino acid composition of pectoral muscles, g/kg (n = 4)

Indicator	First group	Second group
Asp	66.52 ± 0.226	67.84 ± 1.026
Thr	32.59 ± 0.220	37.73 ± 0.211***
Ser	27.91 ± 0.182	28.62 ± 0.280
Glu	117.38 ± 2.726	126.09 ± 1.028*
Pro	26.70 ± 0.910	27.53 ± 1.096
Gly	33.45 ± 1.244	33.84 ± 0.447
Ala	42.59 ± 0.507	44.33 ± 0.398*
Val	34.8 ± 0.255	36.75 ± 0.224**
Ile	33.39 ± 0.284	34.38 ± 0.318
Leu	57.59 ± 0.422	59.12 ± 0.70
Tyr	24.61 ± 0.613	24.85 ± 0.602
Phe	29.97 ± 0.322	30.56 ± 0.928
His	25.91 ± 0.835	27.31 ± 0.380
Lys	62.04 ± 0.843	64.55 ± 1.058
Arg	47.06 ± 0.112	46.63 ± 0.858
Cys	7.6 ± 0.254	7.74 ± 0.194
Met	20.39 ± 0.124	21.02 ± 2.111
Try	6.14 ± 0.008	6.34 ± 0.039**

Notes: *P < 0.05; **P < 0.01; ***P < 0.001

As a result of the study, it was pointed out that the feeding of the second group of birds at all age periods of growing with complete feed with the addition of Aktivio in the feed in the amount of 100 g/t of feed helped to increase the content of essential amino acids in poultry meat by 2.6 %.

The increase in the number of essential amino acids in poultry meat of the second group was due to an increase of such amino acids as glutamic acid, leucine, lysine, alanine, valine, and tyrosine in the content.

In the meat of poultry of the second group, there was an increase in lysine content compared to the first, respectively, by 2.51. In particular, in the young ducks of the first group muscles, a decrease in glutamic acid by – 8.71, alanine – 1.74, valine – 1.95, isoleucine – 0.99, and phenylalanine – by 0.59 compared to birds of the second group was detected.

Studies have shown that the use of biologically active feed additive Aktivio in the amount of 100 g/t of a feed helps increase the number of amino acids in the pectoral

muscles of ducks and thus improves the biological value of meat and meat quality.

Table 2

Amino acid composition of thigh muscles, g/kg (n = 4)

Indicator	First group	Second group
Asp	58.72 ± 0.575	64.18 ± 1.306**
Thr	28.66 ± 0.210	31.77 ± 0.336***
Ser	25.44 ± 0.275	27.73 ± 0.166***
Glu	107.48 ± 3.263	120.4 ± 1.844*
Pro	26.54 ± 0.497	27.33 ± 0.827
Gly	34.58 ± 2.677	31.58 ± 1.322
Ala	38.80 ± 1.032	39.99 ± 0.864
Val	29.71 ± 0.748	33.03 ± 0.640
Ile	28.15 ± 0.091	32.81 ± 0.075***
Leu	49.61 ± 0.491	54.08 ± 0.850**
Tyr	20.63 ± 0.202	22.08 ± 0.222**
Phe	26.077 ± 0.446	27.41 ± 0.217*
His	20.61 ± 0.327	22.70 ± 0.630*
Lys	55.74 ± 0.350	60.0 ± 1.288*
Arg	42.46 ± 0.562	44.5 ± 0.957
Cys	7.94 ± 0.098	8.12 ± 0.147
Met	17.44 ± 0.316	17.92 ± 0.391
Try	6.16 ± 0.041	6.39 ± 0.081*

Notes: *P < 0.05; **P < 0.01; ***P < 0.001

The essential part of the research deals with the influence of amino acids on productivity, metabolic processes in poultry, and the interaction between these amino acids. The difference in the content of essential amino acids in the thigh muscles of ducks was established.

Our research shows that the increase of the number of essential amino acids in the thigh muscles of ducks of the second group is due to an increase of lysine by 4.26, arginine – 2.04, aspartic acid – 5.46, threonine – 3.11, serine – 2.29, glutamic acid – 12.92, leucine – 4.47, tyrosine – 1.45 and phenylalanine by 1.33 in its content. An increase in amino acids such as proline, glycine, valine, and methionine was observed in the second group, although no statistically significant difference was found between the two groups.

It was established that feeding ducks during the growth period with compound feed with the addition of the biologically active supplement Aktivio 100 g/t of a compound feed help increase the content of amino acids in the muscles of the thigh and sternum.

4. Conclusions

The study found that using the active supplement Aktivio during feeding of ducks helps intensify the growth, normalize and improve the amino acid composition of the chest and thigh muscles. When normalizing the amino acid needs of poultry, it is necessary to consider the interaction of amino acids in the body with vitamins, micro-minerals, energy levels in the feed. Thus, it was found that the additive Aktivio in the feed of ducks has a positive effect on the digestibility of amino acids.

Conflict of interest

The authors declare that there is no conflict of interest.

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