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**POULTRY GROWTH INTENSITY AND BREED DIFFERENCES IN
THE EXCHANGE OF PHOSPHORUS COMPOUNDS
ІНТЕНСИВНІСТЬ РОСТУ ПТИЦІ ТА ПОРОДНІ ВІДМІННОСТІ ОБМІНУ
ФОСФОРНИХ СПОЛУК**

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The article presents the results of studying the age-related dynamics of the content of phosphorus compounds in tissues. The age-related dynamics of adenine nucleotides in the liver of animals shows that in the liver of chickens of both breeds, the content of adenine dinucleotides increases with age, reaching the maximum level in the Plymouth breed up to three months, and in New Hampshire up to six months. In the first, the content of adenine nucleotides at the early stages of ontogenesis was significantly higher, but in the following age periods, the indicators by breed converged. The level of NF in the liver of Plymouth chickens at the early stages of ontogenesis was significantly higher than that of New Hampshire chickens. Until the age of two years, the content of NF in the liver of chickens of both breeds was determined at approximately the same level. The content of KrF increased with age to a greater extent in the tissues of fast-growing chickens. The exceptions, as before, were Plymouth chickens, in which, despite relatively slow growth, the content of KrF in muscles was determined at approximately the same level as in white Plymouth chickens, which had the most intensive growth. The total content of phosphorus compounds (FPK+ATP+ADP+CrF+NF) was the highest, as expected, in the muscles of intensively growing animals. The conducted studies showed that in most cases there is a direct relationship between the intensity of growth and the level of energy-rich phosphorus compounds in the tissues - intensive growth correlates with a high level of macroergy. These processes in body tissues are integrated and condition each other.

Key words: *phosphorus compounds, poultry, energy, synthesis, muscles, metabolic processes.*

He growth of the animal's body is primarily protein synthesis, which is possible only with a certain amount of energy. Synthesis reactions are impossible without energy entering the system. ATP is a universal donor of energy in tissues. Delivering energy to synthesis reactions, ATP in these reactions breaks down into ADP and H₃PO₄. It is known that the human body uses about 0.5 kg of ATP per day just to carry out the glycolysis reaction. And the more intensively the metabolic processes are carried out, the more active the protein synthesis is, the higher the expenditure of energy that provides these reactions, the faster the phosphorylation reactions that restore the used ATP should proceed.

As a result of hard work of breeders, wonderful breeds of farm animals have been created. Each breed has certain qualities that are beneficial to humans. Thus, dairy and meat breeds were created among cattle, numerous breeds of sheep differ in productivity, some breeds of chickens were improved in terms of early maturity and egg production, others developed meat qualities. Plymouth and New Hampshire



chickens differ significantly from each other. The first are early-ripening and egg-bearing, and the second are late-ripening, with well-defined meat qualities.

The age-related dynamics of the content of phosphorus compounds in tissues was monitored in the studied chickens of both breeds. Some and other animals were studied at the age of 1, 30, 60, 90, 180, 210 and 720 days. The content of FPK (phosphopyruvic acid), 3-FGA (3-phosphoglyceraldehyde), CrF (creatine phosphate), ATP+ADP (adenosine triphosphoric acid + adenosine diphosphoric acid) and NF (inorganic phosphate) was determined in the liver and thigh muscles of chickens. The age-related dynamics of adenine nucleotides in the liver of animals shows that in the liver of chickens of both breeds, the content of adenine dinucleotides increases with age, reaching the maximum level in the Plymouth breed before three months, and in New Hampshire up to six months. In the first, the content of adenine nucleotides in the early stages of ontogenesis was significantly higher, but in the following age periods, the indicators for breeds converged.

The level of NF in the liver of Plymouth chickens at the early stages of ontogenesis was significantly higher than that of New Hampshire chickens. Until the age of two years, the content of NF in the liver of chickens of both breeds was determined at approximately the same level [1, 4, 8].

According to the results of our research, it can be assumed that in the mitochondria of the liver of Plymouth chickens at the early stages of postnatal development, the processes of oxidative phosphorylation, and therefore ATP resynthesis, proceed more intensively than in later mature New Hampshire chickens [5, 10].

It is possible to draw conclusions about breed differences in the course of glycolysis reactions in the liver of animals based on the content of the metabolites of these reactions in the tissues - 3-FGA and FPK. Table 1 shows the results of research on the liver of chickens during the period of their most intensive growth.

Table 1 - Age-related dynamics of 3-FGA and FPK in the liver of chickens

Age in days	Plymouth	New Hampshire	Certainty differences	Plymouth	New Hampshire	Certainty differences
30	3,96±0,53	6,79±0,67	p 0,02	3,51±0,32	4,88±0,25	p 0,01
60	4,34±0,42	2,56±0,32	p 0,02	3,57±0,10	3,88±0,57	p 0,1
90	5,54±0,38	2,36±0,18	p 0,01	4,04±0,38	3,38±0,44	p 0,1

The difference in 3-FGA indicators is reliable. Changes of the FPK are of an unreliable nature. It is possible that in Plymouth chickens, FPK, which was formed in glycolytic reactions, was more intensively oxidized in the tricarboxylic acid cycle. In this case, even with the active formation of FPK, the level of this component in the tissues could remain relatively low.

With age, the content of CrF in the muscles of chickens of both breeds increased significantly, and in chickens of the Plymouth breed, the content of CrF rapidly increased, reaching the maximum level by the age of three months, and in New Hampshire this process occurred more slowly [2, 6, 9].



The content of adenine nucleotides in the muscles of Plymouth chickens grew much faster and reached its maximum level by the age of three months. The highest content of ATP+ADP in New Hampshires was noted only at 6-7 months of age.

In the muscles of Plymouth chickens, the content of adenine nucleotides and CrF during the period of intensive egg laying decreased to a level that is much lower than that of New Hampshire chickens. This is caused by the fact that in the hens of the first group, egg-laying occurs more intensively, and in connection with this, the energy resources of the tissues were depleted.

With different intensity of growth - different speed of reactions of glycolysis and oxidative phosphorylation. As already established, the intensity of these reactions can be judged by the level of metabolites - products of these reactions. It follows from this that by the level of macroergic compounds it is possible to have an idea of the state of synthesis reactions in the tissues being studied. The following data of our experiments can serve as confirmation of this position[3, 7].

Experiments were carried out on chickens with different intensity of growth. Unequal growth rate was ensured due to unequal diet. Plymouth, New Hampshire, Sussex and Plymouth chickens were under observation. Plymouth and New Hampshire chickens were raised under normal conditions and received a poor diet. White plymouths were grown both in conditions of inferior feeding and in broiler fattening on a complete high-calorie diet. Sussex was grown on the same diet.

During the experimental period, the weight of the animals and their general condition were taken into account. Upon reaching the age of 30-40 days, as well as before slaughter at the age of 80-90 days, part of the chickens from the general group were subjected to biochemical studies.

The weight of the chicks at 90 days of age, as expected, was not the same. Chickens of the Plymouth breed (experiment II) and Sussex with a full diet at the age of 3 months had a weight of 1400-1700 g, while the weight of chickens with poor feeding at this age did not exceed 700 g.

Table 2 - Change in the weight of chickens during the studied period

Breed	Weight (in g)	
	30 days	90 days
With a complete diet: Sussex	262	1410
Plymouth (experiment II)	241	1700
With an inferior diet: Plymouth (Experiment I)	195	520
New Hampshire	215	80

As expected, the level of phosphorus compounds depended on the nature of animal feeding. The highest level of FPK was observed in the liver and muscles of Plymouth breed chickens (experiment II), the weight of which, in comparison with animals of other groups, was the highest. And the lowest level of phosphoenolpyruvate was found in the tissues of New Hampshires, which at the age of 90 days had the lowest weight.



The dynamics of adenine nucleotides turned out to be no less interesting. Research has shown that the content of adenine nucleotides in the muscles of fast-growing chickens was higher than in the tissues of slow-growing chickens. Moreover, the difference was significant. A somewhat special position was occupied by Plymouth chickens. Despite the slow increase in weight, the level of ATP+ADP in their muscles turned out to be relatively high.

The content of adenine nucleotides in the liver of chickens, with the exception of slow-growing New Hampshires, was determined at approximately the same level. In general, the age-related changes of adenine nucleotides in the liver of chickens, with the exception of the Plymouth breed, were quite insignificant.

The content of KrF increased with age to a greater extent in the tissues of fast-growing chickens. The exceptions, as before, were Plymouth chickens, in which, despite relatively slow growth, the content of KrF in muscles was determined at approximately the same level as in white Plymouth chickens, which had the most intensive growth.

The total content of phosphorus compounds (FPK+ATP+ADP+CrF+NF) was the highest, as expected, in the muscles of intensively growing animals.

The conducted studies showed that in most cases there is a direct relationship between the intensity of growth and the level of energy-rich phosphorus compounds in the tissues - intensive growth correlates with a high level of macroergy. These processes in body tissues are integrated and condition each other.

With poor feeding, the animal grows slowly, the level of macroergic compounds in the tissues of such animals is relatively low. It is likely that in this case the synthesis of protein-enzymes is inhibited, the activity of which ultimately depends on the intensity of metabolic processes and resynthesis of ATP. Along with this, studies have shown that Plymouth chickens, even with a poor diet, have a high level of phosphorus compounds, which, one must think, is a rather valuable feature of chickens of this breed. using this example, you can once again make sure that the breed leaves its mark on the metabolism of phosphorus compounds in animal tissues.

Conclusions.

1. Thus, in Plymouth chickens at the early stages of postnatal development, the processes of ATP resynthesis, and accordingly, oxidative and substrate phosphorylation, proceed more intensively than in New Hampshire chickens. However, in the future, the level of macroergic compounds decreases significantly in egg-laying hens, and, on the contrary, increases in late-ripening New Hampshires.

2. For each breed group, a certain character of exchange processes is inherent, which was formed under the influence of the conditions of formation of this breed. The study of these features can be used in selection work for the qualitative characteristics of the obtained individuals.

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Анотація. В статті наведені результати вивчення вікової динаміки вмісту фосфорних сполук в тканинах. Вікова динаміка аденіннуклеотидів в печінці тварин свідчить, що в печінці курей обох порід вміст аденіндинуклеотидів з віком зростає, досягаючи максимального рівня у породі плімутрок до трьох, а в нью-гемпширів до шести місяців. В перших вміст аденіннуклеотидів на ранніх етапах онтогенезу був значно вищим, але в наступні вікові періоди показники за породами зблизились. Рівень НФ в печінці курей породи плімутрок на ранніх етапах онтогенезу був значно вищим, ніж у курей нью-гемпшир. До дворічного віку вміст НФ в печінці курей обох порід визначався приблизно на одному рівні. Вміст КрФ з віком в більшій мірі зростає в тканинах швидко ростучих курчат. Виключення, як і раніше, складала курчата породи плімутрок, у яких, не дивлячись на відносно повільний ріст, вміст КрФ в м'язах визначався приблизно на тому ж рівні, як і у курчат породи білий плімутрок, які мали найбільш інтенсивний ріст. Сумарний вміст фосфорних сполук (ФПК+АТФ+АДФ+КрФ+НФ) найбільш високим був, як і слідувало очікувати, в м'язах інтенсивно ростучих тварин. Проведені дослідження показали, що між інтенсивністю росту та рівнем в тканинах багатих енергією фосфорних сполук у більшості випадків проявляється пряма залежність – інтенсивний ріст корелює з високим рівнем макроергів. Ці процеси в тканинах організму інтегровані і обумовлюють один одного.

Ключові слова : фосфорні сполуки, птиця, енергія, синтез, м'язи, метаболічні процеси.