Age-related variability of indicators of protein metabolism in the blood of laying hens

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Abstract. Proteins are one of the most important indicators of blood. More than 150 individual whey proteins are currently known. However, an idea of the protein spectrum of blood can also be obtained on the basis of the concentration of total protein, albumin, globulins, the value of the protein coefficient, and the nature of their ratio gives an idea of the direction of protein metabolism (anabolic or catabolic), since the specificity of metabolic processes determines the productivity of layers. The concentration of total protein in the blood of chickens did not depend on the age of the bird, namely the period of the reproductive period, and hence the level of egg production. It fluctuated at the level of 37.2-42.0 g / l. Albumin concentration significantly increased during oviposition from 17.51 ± 1.71 to 21.36 ± 2.09 g / L. At the same time, the percentage of albumin in the total protein concentration increased from 47.07 ± 1.27 (26 weeks of age) to 53.93 ± 1.33% (p≤0.05) (80 weeks of age). The amount of globulins in the blood of hens did not depend on the age and duration of the reproductive period, but had a tendency to decrease, which was the result of a gradual decrease in the defenses of the bird's body. The resistance of the body of laying hens decreases to the greatest extent at the age of 80 weeks, which causes an increase in Alb / Gl - coefficient by 1.51 times (p≤0.05) compared to the beginning of oviposition. The concentration of urea in the body of hens steadily increased during oviposition from 2.76 ± 0.18 (26 weeks of age) to 4.03 ± 0.11 mmol / L (p≤0.05) (80 weeks of age). The uric acid content in the blood of laying hens did not depend on the age and duration of the reproductive period and varied in the range of 0.39 ± 0.007 - 0.43 ± 0.002 mmol / L.

1. Introduction
Ensuring uninterrupted and sustainable supply of the population with high-quality food of animal origin, including eggs, is the main problem of maintaining the health of the nation and food security of any country [1-6]. Increasing the production of high-quality products is one of the most important tasks for the development of animal husbandry, including poultry farming, which is becoming increasingly important due to the growth of the world's population and the satisfaction of humanity's needs for nutritious food [7-12]. In this regard, the development of poultry farming is given great national economic importance [12-19]. An increase in productivity is inseparably associated with an increase in
breeding work [19-30]. All over the world, chickens of the egg breed of the Loman-white cross are widely used to obtain edible eggs. In order to have high productivity indicators, it is necessary to adapt them to the conditions of industrial production. The problem of increasing the productivity of chickens and the quality of their chicken eggs will be solved on the basis of further intensification of the poultry industry, including the use of new highly productive crosses adapted to specific climatic and production conditions. In this regard, a comprehensive study of the quality of chicken eggs is one of the main ways to improve the quality of eggs and the efficiency of the industry, and also allows to control the technological conditions and quickly eliminate the causes that influenced the change in their properties [28-34]. Proteins are one of the most important indicators of blood. More than 150 individual whey proteins are currently known. However, an idea of the protein spectrum of blood can be obtained on the basis of the concentration of total protein, albumins, globulins, the value of the protein coefficient. The nature of their ratio gives an idea of the direction of protein metabolism (anabolic or catabolic), since the specificity of metabolic processes determines the productivity of laying hens [31-34].

The aim of the work is to study the dynamics of protein metabolism indicators of laying hens depending on the reproductive period.

2. Materials and method
The experimental part of the work was carried out by the industrial poultry farm for the production of edible eggs. The objects of research were laying hens of the same age industrial herd of the “Lohmann-White” cross during oviposition, which were kept in the main production buildings equipped with cage batteries. Three experimental groups were formed according to the principle of balanced groups (n = 10). The first group consisted of laying hens at 26 weeks of age (beginning of reproductive period), the second at 52 weeks of age (peak of oviposition), and the third - at 80 weeks of age (end of lay). In order to assess the quality of eggs, they were evenly selected from different tiers -20 pieces directly from the cages at 26, 52 and 80 weeks of age. The indicators taken into account were determined using generally accepted methods and techniques. Total protein - by the colorimetric method using the Klinitest-OB reagent kit; albumin - by the colorimetric method using a set of reagents "Klini Test - Albumin"; globulins and protein ratio or Alb / Gl; the activity of aminotransferases in blood serum was determined by the dinitrophenylhydrozone method (Reitman and Frenkel) using a standard set of reagents "Biola-Test"; urea by the colorimetric method using KliniT-test-Urea reagent kits; uric acid by the colorimetric method using the” KliniTest-Uric” acid reagent kits.

3. Results
An idea of the protein spectrum of blood can also be obtained on the basis of the concentration of total protein, albumin, globulins, the value of the protein coefficient. The nature of their ratio gives an idea of the direction of protein metabolism (anabolic or catabolic), since the specificity of metabolic processes determines the productivity of layers.

The concentration of total protein in the blood of chickens did not depend on the age of the bird, namely the period of the reproductive period, and hence the level of egg production, and fluctuated at the level of 37.2-42.0 g / l.

Albumin concentration significantly increased during oviposition from 17.51 ± 1.71 to 21.36 ± 2.09 g / L. At the same time, the percentage of albumin in the total protein concentration increased from 53.93 ± 1.33% (p<=0.05) (80 weeks of age) (figure 1).
The number of globulins in the blood of hens did not depend on the age and duration of the reproductive period, but had a tendency to decrease (figure 1), which was the result of a gradual decrease in the defenses of the bird's body.

The resistance of the body of laying hens decreases to the greatest extent at 80 weeks of age, which causes an increase in the Alb / Gl - coefficient by 1.51 times (p≤0.05) compared to the beginning of oviposition (figure 2).

The end products of protein metabolism are urea and uric acid. Urea is a product of the utilization of ammonia formed during the oxidative breakdown of amino acids, and therefore its level reflects the intensity of catabolic processes. The concentration of urea in the body of hens steadily increased during oviposition from 2.76 ± 0.18 (26 weeks of age) to 4.03 ± 0.11 mmol / L (p≤0.05) (80 weeks of age) (figure 3).
Figure 3. Nitrogenous substances in the blood of laying hens, mmol/l.

This indicates an increase in the intensity of the reactions of the breakdown of free amino acids to the final products, therefore, the level of urea was an indicator of the consumption of the protein fund of the body of layers.

The concentration ratio was calculated between globulins, albumin on the one hand, and urea, as the end product of amino acid metabolism, on the other hand (figure 4).

Figure 4. Indices of nitrogenous substances, conv. units.
The value level $\frac{\text{Alb}}{\text{uric acid}}$ at 26 weeks of age in chickens practically did not differ from the value at 52 weeks of age, but by the end of the reproductive period it decreased by 16.4%. The attitude level $\frac{\text{Glu}}{\text{uric acid}}$ gradually decreased during the laying, that is, with the age of the layers. Thus, compared with 26 weeks of age at peak and end of lay, the decrease was, respectively, 14.86 and 36.61%.

It was found that the uric acid content in the blood of hens did not depend on the age and duration of the reproductive period and varied in the range of $0.39 \pm 0.007$ - $0.43 \pm 0.002$ mmol / l (figure 3). In order to estimate the proportion of blood protein nitrogen excreted from the bird's body in the composition of uric acid, we calculated the following concentration ratios (figure 4):

- Between albumin and uric acid.
- Between globulins and uric acid.

The value of the ratio decreased as the birds grew and the laying period increased by 11.89%.

4. Discussion
The concentration of total protein in the blood of chickens did not depend on the age of the bird, namely the period of the reproductive period, and hence the level of egg production, and fluctuated at the level of 37.2-42.0 g / l.

Albumin concentration significantly increased during oviposition from $17.51 \pm 1.71$ to $21.36 \pm 2.09$ g / L. At the same time, the percentage of albumin in the total protein concentration increased from $47.07 \pm 1.27$ (26 weeks of age) to $53.93 \pm 1.33\%$ (p≤0.05) (80 weeks of age). The concentration of urea in the body of hens systematically increased during oviposition from $2.76 \pm 0.18$ (26 weeks of age) to $4.03 \pm 0.11$ mmol / L (p≤0.05) (80 weeks of age), which confirmed the intensity reactions of decomposition of free amino acids to final products. Similar data were obtained in the research results of Rani, MP, Ahmad, NN, Prasad, PE, Latha, CS, Rath, NC, Anthony, NB, Kannan, L., Huff, WE, Huff, GR, Chapman, HD, Erf, GF, Wakenell, P.

5. Conclusion
Based on the above, the concentration of albumin and urea increased by the end of the reproductive period, despite the fact that the concentration of total protein did not depend on the duration of the reproductive period. This demonstrates the intensity of the reactions of the breakdown of free amino acids to end products and an increase in the consumption of the protein fund of the body of layers.

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