Quality of poultry meat and eggs

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Abstract. The article reviews the quality issues of poultry products, in particular meat, liver and eggs. The smallest amount of total cholesterol was found in the liver of females (21.4 mmol/l), as well as in the liver of chickens of the brown cross (26.4 mmol/l) in comparison with the white cross. We noted the greatest amount of vitamin E in chickens of white and brown crosses (33.9 and 40.5 mg%). Broiler chickens' liver was poor in this vitamin (2.43-4.05 mg%). The smallest amount of total cholesterol was found in white poultry meat of the studied crosses (3.6-6.3 mmol/l). Brown eggshell eggs contained less cholesterol and more vitamin E compared to white eggshell eggs. The smallest amount of fat was found in the pectoral muscles of both males and females of the Ross 308 cross. The thigh muscles of the Ross 308 cross chicks contained less fat, but were poor in protein compared to the Iza Flex cross. The nutritional value of broiler meat from the Iza Flex cross is higher compared to the Ross 308 cross. Thus, from a nutritional point of view, it is better to include white poultry meat in the diet, since it contains the least amount of fat and cholesterol compared to dark meat, as well as eggs with brown shells, because they have a reduced total cholesterol content and contain 1.4 times more vitamin E compared to eggs with white shells.

1. Introduction
Currently, there is an acute problem of cholesterol content in poultry products. In many countries of the world, high cholesterol content in eggs, liver and meat limits the consumption of these valuable protein foods [1].

The main role of cholesterol in a multicellular organism is to transport fatty acids in the blood that enter the body with food. It is the main substrate for energy and plastic material for the formation of cell membranes [2].

The amount of cholesterol in the blood is directly related to its content in food.

It is known that excess cholesterol in the blood of a person is dangerous to his health. This is due to the fact that, oxidizing in the blood, cholesterol is deposited on the walls of the arteries, leading to the development of atherosclerotic processes in the human body and coronary heart disease [3].

At the same time, cholesterol is useful, as it is important in metabolism and necessary for normal life, since it serves as a material for the synthesis of hormones and bile acids [4].

On the other hand, the results of numerous studies clearly indicate that cholesterol is not the cause of arteriosclerosis, and its oxidized forms (oxidized sterols) are the cause of many diseases [5].

The recommended norms for the consumption of cholesterol per day for a person are about 300 mg, provided that its content in the blood is 3.0-6.2 mmol/l [6].
2. Materials and methods
We investigated the quality of the pectoral and thigh muscles, eggs and liver of laying hens of the Hisex white and Hisex brown crosses at the age of 15 months, as well as the quality of the pectoral and thigh muscles, the liver of broiler chickens (males and females) of the Iza Flex and Ross 308 crosses at slaughter age (33 days).

To carry out our research, we used the following indicators and methods for their determination:

- Total cholesterol (research material - liver, pectoral and thigh muscles, eggs) - Bloor's method on a SPEKOL spectrophotometer (wavelength 656 nm);
- Vitamin E (research material - liver, eggs) - on a SPEKOL spectrophotometer (wavelength 520 nm);
- Moisture (research material - chest and thigh muscles) - drying at 105 °C using a drying cabinet;
- Protein (research material - pectoral and femoral muscles) - according to Kjeldahl, modified by V.V. Efremova;
- Fat (research material - pectoral and femoral muscles) - according to the method of S.V. Rushkovsky in a Soxhlet apparatus by extracting dried poultry meat with ether;
- Ash (research material - pectoral and femoral muscles) - dry ashing method;
- Tryptophan (research material - pectoral and femoral muscles) - according to the Spize and Chambers method as modified by Höller;
- Hydroxyproline (research material - pectoral and femoral muscles) - according to Newman and Logan by the method of acid hydrolysis according to Verbitsky;
- PQI (protein-quality indicator) - the division of an essential amino acid (tryptophan) by a nonessential amino acid (hydroxyproline) [7].

3. Results and discussion
Data on the content of total cholesterol and vitamin E in poultry liver are shown in the table 1.

|                | Hisex white | Hisex brown | Isa Flex | Ross 308 |
|----------------|-------------|-------------|----------|----------|
| **Total cholesterol, mmol/l** | 30.3±0.67   | 26.4±0.52   | 27.2±0.68 | 24.9±0.55   |
| **Vitamin E, mg%**           | 33.9±0.5    | 40.5±0.6    | 3.60±0.05 | 4.05±0.07  |

Thus, the smallest amount of total cholesterol was noted in the liver of broiler chickens (females) and amounted to 21.4 mmol/l.

If we compare the content of this indicator in the liver of poultry by belonging to crosses, then it was least found in the liver of chickens of the brown cross (26.4 mmol/l) compared with the white cross and in the liver of hens of the Ross 308 cross (21.4 mmol/l) in comparison with the cross Iza Flex.

It is also possible to highlight an advantage in the content of total cholesterol in the liver of females, since it was less in comparison with males, respectively, by 3.5 mmol/l in both breeds.

As for the content of vitamin E in the liver, we noted its greatest amount in chickens of white and brown crosses, respectively 33.9 and 40.5 mg%.

As for the liver of broiler chickens, it was poor in this vitamin, its content ranged from 2.43 to 4.05 mg%.

The data on the content of total cholesterol in poultry meat are shown in table 2.


Table 2. Total cholesterol content in poultry meat, mmol/l.

|                         | Hisex white ♀ | Hisex brown ♂ | Isa Flex ♂ | Isa Flex ♀ | Ross 308 ♂ | Ross 308 ♀ |
|-------------------------|--------------|---------------|------------|------------|------------|------------|
| Chest muscles (white meat) | 3.6±0.05     | 3.9±0.08      | 5.0±0.10   | 4.5±0.13   | 6.2±0.16   | 6.3±0.16   |
| Thigh muscles (dark meat) | 4.9±0.09     | 5.3±0.13      | 6.6±0.16   | 6.5±0.16   | 9.1±0.18   | 9.0±0.18   |

From the data in table 2, it was established that the amount of total cholesterol contained in the white meat of poultry of the studied crosses was 3.6-6.3 mmol/l.

Interestingly, the pectoral muscles, i.e. white meat, cockerels were characterized by a lower cholesterol content compared to chickens.

Thus, from a nutritional point of view, it is better to include white poultry meat in the diet, since it contains the least amount of cholesterol compared to dark meat. Also, the bird of white cross and cross Iza Flex contained the least total cholesterol, both in white and dark meat.

In dark meat, the lowest amount of total cholesterol was found in white (4.9 mmol/l) and brown (5.3 mmol/l) chickens.

It can be noted that the femoral muscles of broiler chickens of the Ross 308 cross have a higher cholesterol content (9.0-9.1 mmol/l).

Table 3 shows the content of cholesterol in the egg yolk of chickens. As a result of this study, we found that eggs with brown shells had less total cholesterol (3.7 mmol/l) compared to eggs with white shells.

Table 3. The content of total cholesterol and vitamin E in poultry eggs.

|                         | Hisex white ♂ | Hisex brown ♂ |
|-------------------------|--------------|---------------|
| Total cholesterol, mmol/l | 50.3±1.0    | 46.6±0.93     |
| Vitamin E, mg%           | 3.0±0.08    | 4.2±0.08      |

When comparing the level of vitamin E in the yolks of eggs, it was found that it is higher in the yolks of eggs with brown shells by 1.2 mg% compared to eggs with white shells.

Thus, it is advisable to use eggs with brown shells in food, since they have a reduced total cholesterol content and contain 1.4 times more vitamin E compared to eggs with white shells.

Analysis of the chemical composition of broiler breast muscles (table 4) showed that there were no significant differences in the content of moisture, dry matter, protein and ash according to gender and belonging to the cross.

Fluctuations in fat content were found. Thus, the smallest amount of fat was found in the pectoral muscles of both males and females of the Ross 308 cross (1.96 and 1.69%, respectively), which was 1.4 and 1.7 times less than in the parallel studied cross.

Table 4. The chemical composition of the breast muscles of broiler chickens, %.

|                         | Isa Flex ♂     | Isa Flex ♀     | Ross 308 ♂ | Ross 308 ♀ |
|-------------------------|---------------|---------------|------------|------------|
| Moisture                | 75.11±0.23    | 74.76±0.21    | 75.13±0.67 | 75.82±0.75 |
| Dry matter              | 24.89±0.22    | 25.24±0.21    | 24.87±0.25 | 24.18±0.22 |
| Protein                 | 20.99±0.15    | 21.28±0.15    | 21.67±0.22 | 21.34±0.21 |
| Fat                     | 2.77±0.03     | 2.94±0.04     | 1.96±0.02  | 1.69±0.02  |
| Ash                     | 1.13±0.01     | 1.02±0.009    | 1.24±0.01  | 1.15±0.02  |
The data in table 5 show that the thigh muscles of Ross 308 broilers had an advantage in moisture content, while the Isa Flex was superior in terms of dry matter, protein, fat and ash.

Table 5. Chemical composition of the thigh muscles of broiler chickens, %.

|                | Isa Flex | Ross 308 | Isa Flex | Ross 308 |
|----------------|----------|----------|----------|----------|
| Moisture       | 71.62±0.26 | 70.57±0.25 | 74.82±0.72 | 73.90±0.74 |
| Dry matter     | 28.38±0.27 | 29.43±0.26 | 25.18±0.27 | 26.10±0.29 |
| Protein        | 18.85±0.15 | 19.98±0.12 | 17.81±0.20 | 17.23±0.17 |
| Fat            | 8.47±0.10  | 8.29±0.11  | 6.38±0.06  | 7.99±0.09  |
| Ash            | 1.06±0.02  | 1.16±0.02  | 0.99±0.01  | 0.88±0.009 |

It can be noted that the femoral muscles of chickens of the Ross 308 cross contained less fat (6.38-7.99%), but were poor in protein (17.23-17.81%) in comparison with the Isa Flex cross (8.29-8.47% and 18.85-19.98%).

According to studies to determine the protein-quality indicator (the ratio of tryptophan to hydroxyproline), the muscles of broilers of the Iza Flex cross had its value higher than that of the Ross 308 cross (table 6).

Table 6. PQI (protein-quality indicator) of the muscles of broiler chickens.

|                | Isa Flex | Ross 308 | Isa Flex | Ross 308 |
|----------------|----------|----------|----------|----------|
| Chest muscles (white meat) | 9.48±0.16 | 9.92±0.19 | 4.19±0.07 | 3.88±0.06 |
| Thigh muscles (dark meat)   | 2.56±0.05 | 3.75±0.08 | 2.04±0.04 | 2.10±0.04 |

The PQI of the pectoral muscles of both males and females was 1.8-3.7 times higher compared to the femoral muscles. There was also an advantage of the Iza Flex cross in this indicator of the nutritional value of meat.

4. Conclusion

The results of studies assessing the quality of poultry meat and eggs showed that the lowest amount of total cholesterol was noted in the liver of broiler chickens, and the highest amount of vitamin E was found in white and brown crosses.

The least amount of total cholesterol was found in white poultry meat of the studied crosses. Brown eggs were lower in cholesterol and higher in vitamin E compared to white eggs.

The smallest amount of fat was found in the pectoral muscles of both males and females of the Ross 308 cross (1.96 and 1.69%, respectively), which was 1.4 and 1.7 times less compared with the parallel studied cross.

The thigh muscles of chickens of the Ross 308 cross contained less fat (6.38-7.99%), but were poor in protein (17.23-17.81%) in comparison with the Isa Flex cross (8.29-8.47%, respectively). and 18.85-19.98%).

The nutritional value of broiler meat from the Iza Flex cross is higher compared to the Ross 308 cross.

According to our research, the following recommendations can be made to producers of poultry meat and eggs:

- generate demand for eggs with brown shells;
- sort meat chickens by sex at one day of age for separate rearing, since there are sex differences in meat and liver in chemical composition, nutritional value, cholesterol, fat and vitamin E content, which can affect the pricing of carcasses;
- use the labeling of packaging materials for poultry meat and eggs, indicating the amount of total cholesterol in 100 g of the product.
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