Quality of broiler chicken meat when applying supplement Mintreks

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Abstract. The development of the poultry industry involves the use of feed supplements and biologically active substances. They have various effects on the body of birds: growth and development stimulants, macro- and microelements, enterosorberts, pro- and prebiotics, etc. A greater economic effect is achieved by using complex supplements. However, when using them, their effect on the veterinary and sanitary characteristics of meat is not taken into account. The issue of manufacturability of the resulting product is crucial. Poultry meat, especially white meat, is considered to be rather dry. Therefore, feed supplements retain moisture in meat. The work deals with quality of broiler chicken meat when applying the Mintrex supplement. Mintrex consists of mineral components translated into an easily digestible form. The main ones are Zn – 50 mg/kg, Cu – 10 mg/kg, Mn – 50 mg/kg feed). Mintrex is used to increase meat productivity and fatness of birds. The studies have proved that Mintrex does not change sensory, biochemical parameters, seeding, maturation, and meat preservation during storage, but increases the energy value of meat and its water-holding ability.

1. Introduction
Domestic poultry farming is based on the use of the latest achievements in feeding and poultry keeping, modern crosses characterized by high productivity. Scientists have developed poultry farming innovative feeding diets containing vitamins, single or complex macro- and microelements, energy and protein. Biologically active feed additives are being developed [1].

It is relevant to develop feed formulations with the addition of new natural biological supplements improving broiler meat productivity [2–5]. In many European countries, the poultry industry began to use natural trace elements that have a growth-promoting effect. Zinc, copper, manganese are used as feed supplements in a chelated form.

Zinc is required for many processes, including the synthesis of keratin and collagen. It is also very important for the immune system of birds. A lack of zinc can decrease the tissue strength, cause bone abnormalities, and decrease the immune function, which adversely affects broiler life expectancy. Copper is also an essential component in tissue development. Copper maintains a healthy state of skin, bones, tendons and intestines. A lack of copper weakens bones and increases the likelihood of their destruction. Manganese is essential for the bone growth. It is involved in the formation of a proteoglycan matrix in which collagen and elastin are embedded in the bone. The formation of this matrix is required for further development of the skeletal system. Three of these minerals, individually or in combination, will fulfill an important function in maintaining the integrity of tissues. Since these
three trace elements are key in the development of tissues, it is important to use high quality minerals in bird diets. Diets with chelated trace elements provide birds with these components.

The Novus Company produces chelated trace elements Mintrex, which increase broiler productivity due to a high degree of bioavailability, but there is no information on the effect of this drug on qualitative characteristics of meat. The aim of this research is to assess broiler chicken meat when using feed additives. The research objectives are as follows:
1. Conduct a veterinary and sanitary examination of broiler chicken meat when using Mintrex.
2. To analyze the chemical composition of broiler meat when using Mintrex.
3. To identify changes in broiler chicken meat during its maturation and storage.

2. Materials and research methods
The experiment was conducted at the Nagaybak poultry enterprise producing poultry products with a closed production cycle. An egg is obtained from the breeding bird of the parent herd, from which chickens are obtained in the incubation workshop, after growing hens and broilers replenishing the industrial herd. The parent flock is also replenished with birds from breeding reproducers.

The object of research was chickens "KOB-500": experimental and control groups. The groups were formed on the basis of analogues:, only clinically healthy birds were used, a slight difference in live weight was observed within the group. The experimental group was fed with Mintrex according to the scheme shown in Table 1. Feeding and keeping conditions, as well as all other zootechnical parameters, were identical for all groups. The slaughter was performed at the age of 40 days, with a live weight of 1.4–1.6 kg. Broilers were characterized by well-developed muscles, a rounded chest shape and a small amount of subcutaneous fat.

Table 1. The feeding scheme for experimental chickens

| Groups    | Feeding scheme                                         |
|-----------|--------------------------------------------------------|
| Control   | Main diet                                              |
| Experimental | Main diet + feed supplement Mintrex (Zn – 50 mg/kg, Cu-10 mg/kg, Mn – 50 mg/kg feed) |

At the same time, samples of carcasses were taken to control the quality of meat and other slaughter products during different storage periods.

The carcasses and internal organs of broiler chickens were subjected to veterinary and sanitary examination for compliance with GOST 31470-2012 [7]. White and red types of meat were examined separately. The percentage of water, fat, protein, ash and ash elements was determined. During the physical and chemical study, the pH of red and white meat, peroxidase, content of primary protein (reaction with copper sulfate), content of ammonia and ammonium salts (with Nessler’s reagent), the amount of volatile fatty acids and the acid number of fat – a day after slaughtering poultry were determined using the known methods [6]; a water-binding (water-holding) ability of white and red meat was determined in accordance with GOST 7836-85 [8].

The storage stability of meat was determined in accordance with GOST 52702-2006, according to which chilled carcasses should be stored in cold stores at 0–2 °C for 5 days without changes in quality characteristics. Broiler carcasses were taken by bacterioscopy of smears from the surface and depth before and 5 days after the storage. The microbial contamination of muscles was carried out according to GOST R 50396.1-92 [9]. Bacterioscopy of fingerprints. The data were processed biometrically using the generally accepted methods of variation statistics.

3. Results
To prevent the sale of unsafe products, it is necessary to monitor the quality of broiler chicken meat fed with a feed additive in order to establish its compliance with all sanitary and epidemiological requirements and current state standards to determine the possibility of using a feed additive for breeding chickens. Organoleptic characteristics of meat were of interest.

The results of organoleptic studies of samples are presented in Table 2.
When examining the appearance, there were no significant differences between the carcasses from the experimental group and the control group. The surface was dry, without mold and mucus, and clean, whitish-yellow with a pink tint. The muscles were elastic, dense, fairly moist, pale pink; the adipose tissue was white with a yellowish tint (Table 2).

The serous membrane of the abdominal cavity was moist, shiny, without mucus and mold.

When studying the organoleptic characteristics, extraneous odors of adipose and muscle tissues were not identified.

When cooking, the broth was transparent and aromatic in both groups. The appearance and smell were pleasant, there were no extraneous odors, clouding or flakes.

Thus, according to the results of organoleptic research, we can conclude that the poultry meat of the experimental and control groups had indicators characteristic of fresh meat of healthy chickens, which indicates the absence of the negative effect of Mintrex on the sensory characteristics of poultry meat.

**Table 2.** Organoleptic characteristics of broiler chicken meat

| Parameter                               | Control                                   | Experimental                             |
|-----------------------------------------|-------------------------------------------|------------------------------------------|
| Appearance and color:                   |                                           |                                          |
| carcass surfaces                        | Whitish yellow with a pinkish tint        |                                          |
| subcutaneous and internal adipose tissue| Whitish yellow                            |                                          |
| subcutaneous and internal adipose tissue|                                           |                                          |
| serous membrane of the abdominal cavity | Wet, shiny, without mucus and mildew.     |                                          |
| Sectional muscle condition              | Slightly wet, do not leave wet spots on filter paper; pale pink | The muscles are dense, elastic, when pressed with a finger, the resulting fossa is quickly leveled |
| Consistency                             | The muscles are dense, elastic, when pressed with a finger, the resulting fossa is quickly leveled. |                                           |
| Odor                                    | Specific to Fresh Poultry                 | Transparent, fragrant                    |
| Transparency and broth aroma            |                                           |                                          |
|                                        |                                           |                                          |

Adding biologically active substances to the main feed of birds can lead to changes in the chemical composition of meat. We have conducted studies to determine the percentage of protein, moisture, fat and ash, which characterize the chemical composition of meat. Studies of red and white meat were carried out separately.

**Table 3.** Chemical composition of broiler chicken meat (X±Sx; n = 10)

| Parameter     | Control                  | Experimental                  |
|---------------|--------------------------|------------------------------|
|               | pectoral muscles         |                             |
| Moisture, %   | 72.75±0.11               | 72.26±0.11                   |
| Protein, %    | 23.45±0.09               | 23.51±0.08                   |
| Fat, %        | 2.11±0.01                | 2.40±0.01                    |
| Ash, %        | 1.51±0.01                | 1.62±0.01                    |
| thigh muscles |                          |                             |
| Moisture, %   | 74.36±0.15               | 71.40±0.14                   |
| Protein, %    | 20.69±0.10               | 20.80±0.10                   |
| Fat, %        | 3.10±0.02                | 6.22±0.02                    |
| Ash, %        | 1.63±0.01                | 1.58±0.01                    |
The research results shown in Table 3 indicate the presence of discrepancies in some values of the control and experimental groups.

According to the indicators presented in Table 3, it is evident that the data on white meat of the experimental and control group are different.

In white meat of chickens of the experimental group, there were more fat, ash and protein, and less moisture.

The chemical compositions of femoral muscles (red meat) were different. Thus, the amount of fat in red meat of experimental chickens was higher by 3.12 %, and moisture and ash contents were lower.

In addition, there was an increase in the energy value of red meat of the experimental group to 599 kJ, which is 117 kJ more than in the control group.

Thus, the addition of Mintrex does not adversely affect the chemical composition of poultry meat.

After slaughter in poultry meat, a series of autolytic changes occur under the influence of enzymes. As a result, meat becomes mature, acquires certain qualitative characteristics. To assess the degree of maturation, its quality, laboratory research methods are used (determination of physico-chemical indicators). The results are shown in Table 4.

Table 4. Veterinary and sanitary indicators of broiler meat after maturation (X±S; n = 10)

| Parameter                          | Control         | Experimental     |
|------------------------------------|-----------------|------------------|
| pH                                 | 5.91±0.01       | 5.79±0.02        |
| Acidity/oxidation coefficient      | 0.43±0.01       | 0.41±0.01        |
| Amino-ammonia nitrogen, mg%        | 0.69±0.01       | 0.62±0.01        |
| Fat acid value, mgKOH/g            | 0.84±0.01       | 0.82±0.01        |
| Water retention capacity, %        | 56.32±8.12      | 58.16±7.76       |
| Degree of bleeding                 | good            | good             |
| VFA, mg KOH/g                      | 0.93±0.02       | 0.63±0.01        |
| Reaction with CuSO₄                | negative        | negative         |

The concentration of hydrogen ions (table 4) in the meat of the experimental group was lower by 1.3. This indicator characterizes the resistance of poultry meat to the effects of microflora and the shelf life. In addition, the water-holding ability is interconnected with this indicator. The ability to bind water is of great importance for the technological characteristics of meat. According to the results of our studies, in the muscle tissue of broilers of the experimental group, it is 1.8 % higher than in the muscle tissue of control chickens.

All enzymatic changes that occur during meat maturation lead to proteolytic changes in protein. This affects the characteristics of meat – it becomes more tender, juicy, ready for further processing. However, when meat is overmature, protein breakdown products accumulate in meat. To control these substances, a reaction with copper sulfate is carried out in broth. A negative reaction (the absence of a flocculent precipitate) indicates that the maturation processes occurred without deviations. The meat of chickens from both groups was fresh and mature.

During the breakdown of proteins, ammonia and amino acids accumulate. They are determined by the reaction to amino-ammonia nitrogen. This reaction determines the presence of ammonia and allows you to calculate its amount. The amount of amino-ammonia nitrogen in the meat of broiler chickens from the experimental group corresponded to fresh meat. The acidity-oxidability index was similar for both groups. The degree of exsanguination of carcasses was good, which confirms the results of organoleptic research.

With meat maturation, enzymatic changes affect the adipose tissue of carcasses. Its condition characterizes freshness of meat. The main characteristic indicator is the acid number of fat, which
changes during the hydrolysis. As can be seen from Table 4, the acid number of carcasses of broilers of the experimental group was slightly less.

Another indicator of meat freshness is its volatile fatty acid content. According to the table, in the experimental group this indicator was slightly lower.

In order to determine the effect of the feed supplement on the shelf life of meat; smears were examined – prints from the surface of carcasses and deep muscles were stained according to Gram and the presence of decomposed muscle fibers, the number of microorganisms and the type of microflora were taken into account. Bacterioscopy results had no significant differences in both groups. Mostly coccal microflora was found in smears; 7–10 microbial bodies in one field of vision and no decomposed muscle fibers were found. According to the smears from the depth, 15–20 coccal microorganisms were detected, there were no decayed fibers. Thus, the addition of Mintrex does not affect the percentage of meat that has been seeded, and therefore the shelf life.

4. Conclusion
The use of Mintrex for feeding broilers (Mintrex Zn – 50 mg/kg, Cu – 10 mg/kg, Mn – 50 mg/kg feed) does not cause sensory changes in meat, but it changes content of fat, protein, moisture, which increases the energy value of red meat by 117 kJ. The use of Mintrex throughout the entire feeding period does not negatively affect the biochemical composition of meat, does not change the natural maturation process, shelf life, but improves technological properties of a water-holding ability. Organoleptic, biochemical indicators, indicators of autolysis of both the control and experimental groups corresponded to fresh meat of healthy chickens, which indicates the absence of a negative effect of the supplement on the veterinary-sanitary characteristics of chicken meat.

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