Effectiveness of using enriched feed supplements in the floor growing of broiler chickens

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Abstract. The article describes the experiment allowing to assess the expedience of using the anti-stress feed supplement Super Pre-starter in floor growing of chickens in the first week of life. The analysis of complete feeds and their comparison with the feed supplement was performed. Throughout the growing period, live weight gain was recorded; after slaughter, an analysis of anatomical indices and meat indices was carried out. The work carried out allows to conclude that the feed supplement does not lead to an increase in economic characteristics, and therefore does not have the desired economic effect.

1. Introduction
At present, the industrial poultry is a rapidly and dynamically developing branch of modern livestock farming. Moreover, its importance is constantly growing in the world agriculture. It is worth noting that finding the most optimal conditions for growing and feeding broiler chickens contributes to the manifestation of their genetic potential in meat productivity and to the increase in growth energy. Intensification of the growth and development of broilers can significantly reduce the poultry growing time. However, it is necessary to pay close attention to the finished product quality.

Undoubtedly, the feed base is the very tool that allows to regulate the poultry growth and to form a healthy livestock due to the maximum correspondence of feed to micro- and macronutrients to physiological needs. Achieving a balance in the content of the main components will reduce the stress load and get a greater commercial yield [1, 2]. For this reason, new feed supplements for growing agricultural poultry have attracted the attention of researchers and practitioners.

In order to make this livestock industry competitive, it is necessary to comply with all parameters of keeping and feeding the meat poultry. Until recently, planning of feeding broilers seemed like an easy task. However, now there are numerous feeding programs that differ from each other in the feed supplements composition, the chickens age, the poultry growth stages, growing methods and many other factors [3]. For this reason, the selection of feeding parameters should be based on scientific research that confirms or disproves one or another approach [4].

In recent years, the period for growing broiler chickens to a weight of 2 kg has been halved – from 63 to 37 days. In the first 24–48 hours of life, chickens are stressed due to lack of nutrition and transportation to the house. Their mortality is about 2–5%, and many survivors show slow growth. For
this reason, it is advisable to introduce balanced feed supplements in the first days of the chickens life, which can reduce the stress on the body, increase disease resistance and the final yield of finished products [5–10]. The research on the effectiveness of balanced feed supplements in the early days of broiler chickens is of practical interest.

2. The experimental part
The experimental part of the research was carried out on a poultry site in the village of Bozhonka (Novgorod region, Russia). The object of research were floor-grown broiler chickens of the cross-breed Ross-508. The feed supplement Super Pre-starter was fed to the bird in the first 7 days of life. All experiments were carried out in accordance with all the rules of animal husbandry.

Broiler chickens were selected in analog groups at the age of 1 day. Their weight and origin were registered. All chickens should have been clinically healthy. Regular veterinary control confirmed the satisfactory condition of the chickens. It is worth noting that the conditions for all chickens fully met the zoohygienic and veterinary-sanitary requirements. All feeds given to the birds had the necessary certificates and underwent a complete zootechnical analysis.

For the experiment, 2 groups (control and experimental) were formed, 4150 birds each. Floor-grown broiler chickens were kept on a deep litter (sawdust was used as flooring) for 39 days. The halls were equipped with container feeders and drip drinkers with a button. The meat chickens had free access to food and water.

The peculiarity of poultry feeding consisted in the sequential introduction of complete feeds BR1, BR2 and BR3. Granular mixed feeds were balanced in composition, calorific value and content of micro- and macronutrients in accordance with the manufacturer's recommendations. The complete feed was changed three times for the entire growing period. This corresponds to the program for the development of broiler production at the enterprise. As for feeding the chickens in the experimental group, during the first week of life they were fed the anti-stress feed supplement Super Pre-starter.

The conditions for broiler chickens were also in accordance with the manufacturer's recommendation. The humidity was in the range of 60-70% (instruction), the average temperature in the halls varied depending on the birds age and amounted to 30°C at the brooder for chickens of daily age. When they reached the age of 27 days, the temperature dropped to 24°C. The illumination also varied (from 25 to 3 Lux), which depended on the birds age. The number of poultry stocks depended on the live weight and amounted to 17 m² at a weight of 2 kg and 19 m² at 1.8 kg.

During the experiment, the chickens were weighed weekly, starting from the moment of settling in the daily age and every 7 days. The absolute average daily gain in live weight was calculated according to the standard methodology of the All-Russian Research and Technological Institute of Poultry. In addition, a morphological analysis of broiler chickens was performed.

The main studies were carried out in the veterinary laboratory of the poultry site and in the laboratories of Yaroslav-the-Wise Novgorod State University. The anatomical analysis of meat chickens required cutting the poultry with fixing of individual products from each broiler on the technological scales, the calculation was carried out according to the methods of T.M. Polivanov and the Technological Institute of Poultry.

The obtained data were statistically processed using the methodological guidelines for biometry (of N. Plokhinsky) and the Excel program.

Feeding of chickens was carried out in accordance with the recommendations of the complete feed manufacturers. In the initial period of life (age 1–10 days), BR 1 was fed, in the main (age 11–24 days) – BR2, in the final (more than 25 days and till killing) – BR3.

3. Results and discussion
When growing broiler chickens, it is important to achieve early active eating of food by hatched chickens, because this directly affects the formation of the body's protective systems and brings significant financial profit. Starvation of young animals leads to metabolic disorders, namely, slowing down the yolk absorption, which is a strong stress for birds. The residual yolk provides the chicken with
antibodies and nutrients for three days. Decreased activation of the body’s growth processes leads to a
decrease in body weight and insufficient growth of the pectoral and femoral muscles, which are the main
useful economic signs. For this reason, it is important to achieve a higher feed intake by daily chickens
[11–13].

The BR1 compound feed given in the poultry industry is balanced in terms of various nutritional
indicators. These are: digestible protein, digestible and indigestible carbohydrates, the essential amino
acids [14], minerals and vitamins. All the ingredients are in the right ratio to the metabolic energy. The
feed is developed on the basis of wheat, whose proportion is 48.96% [15–20]. Barley grain is added in
the amount of 15%, fish meal containing organic salts of calcium and phosphorus – 7.38%, as well as
fodder yeast – 2%, premix 1%, limestone and salt 0.38 and 0.07%, respectively. The addition of
sunflower meal (5.76%) and soybean meal (16%) improves the absorption of micro and macro elements
in the intestine and, consequently, leads to an increase in the absorption of nutrients. The calorie content
of the feed is 301 Kcal, the crude protein content is in the range of 22–24%, and fiber is about 4%.

The addition of natural ingredients enriches the feed with microelements – iodine and selenium,
which are necessary both for the growth and development of broiler chickens, and for strengthening
immunity. The formation of the body's resistance to environmental influences leads to a reduction in the
death rate of young animals. The composition of the feed was compiled in such a way as to maximize
the adaptation of the young organism to external conditions, which will positively affect the production
results.

The need to feed, between start and finish, has a physiological basis. By the age of 11 days, the
plumage changes, the size of the bird increases significantly, the growth and accumulation of useful
economic attributes is activated. Therefore, the feed of this feeding period is still called “growing”. It is
important to ensure a smooth transition from the crumbles and the mini-granular form of feed to granular
feed, gradually changing the starting feed to the intermediate one [21].

Compound feed BR2 has a slightly lower energy value (299 Kcal), the proportion of wheat is
reduced, of barley – increased.

| Table 1. Composition of the compound feed BR2. |
|-----------------------------------------------|
| Indicator                  | Mass fraction, % |
| Wheat                      | 32.19            |
| Barley                     | 30               |
| Soybean meal               | 11               |
| Sunflower meal             | 12.15            |
| Fish meal                  | 3.96             |
| Meat and bone meal         | 3.5              |
| Premix                     | 1                |
| Animal fat                 | 1.48             |
| Limestone                  | 0.21             |
| Salt                       | 0.20             |

An increase of barley in the feed composition leads to an increase in the content of indigestible
dietary fiber, the balance of micronutrients is achieved through the introduction of meat and fish meal.
The feed is designed to provide good feed conversion and, ultimately, improved carcass quality.

Activation of growth processes during this period is possible with the optimal ratio of vitamins and
minerals, that is why the amount of crude protein in the feed composition is increased to 52% and feed
yeast – to 3%. Vitamins of group B, which are part of the yeast, are cofactors of protein metabolism,
therefore, with this ratio, the absorption of amino acids is at the maximum level.

As for the ratio of calcium and available phosphorus, necessary not only for the formation of bone
tissue, but also for muscle contraction and nerve impulse, in this type of feed it is 1.75 against 1.85 in
the starting compound feed. This provides structural strength to the bones and greatly enhances the
immunity.
The finishing feed BR3, fed to chickens from the age of 25 days, represents the bulk of the broiler feed and is designed to ensure active bird growth. At this age, the digestive system of broiler chickens becomes able to digest all the nutrients of the feed. At the same time, the amount of its consumption increases. Note that in the final feed the size of the granules is increased (up to 3.5 mm) and the nutrients ratio is significantly changed.

Table 2. Composition of the compound feed BR3.

| Indicator                      | Mass fraction, % |
|--------------------------------|------------------|
| Wheat                          | 21.1             |
| Barley                         | 40               |
| Crude protein                  | 21               |
| Meat and bone meal             | 5                |
| Animal fat                     | 1.27             |
| Soybean meal                   | 12               |
| Sunflower oil                  | 1.88             |
| Limestone                      | 0.02             |
| Salt                           | 0.21             |
| Fodder yeast                   | 5                |
| Sunflower meal                 | 9.3              |

Note that the final feed should be less calorific, so that its use did not lead to an increase of the fat content in the chicken carcass.

Thus, we can conclude that all of these feeds correspond to the physiological period of life of broiler chickens and are aimed at providing the body with the necessary micro and macro elements. The activation of the poultry genetic potential will increase the production profitability.

As for the chickens of the experimental group, in the first week of life they received the anti-stress feed supplement Super Pre-starter. 1 kg of this contains about 50 g of lipids, 35 g of dietary fiber, 65 g of ash substances. The supplement also contains the essential amino acids and micro- and macronutrients [11, 14]. It should be noted that this additive is enriched with enzymes that catalyze the hydrolysis of peptides and free amino acids [17, 22]. These changes are aimed at providing chickens with a large amount of protein in the first days of life.

The comparison of the nutritional value and composition of the feeds is given in table 3.

Table 3. Comparative analysis of the nutritional value of complete feeds and anti-stress supplement.

| Indicator                      | Unit of measuremen | BR1  | BR2  | BR3  | Super Pre-starter |
|--------------------------------|--------------------|------|------|------|------------------|
| Crude protein                  | %                  | 22–24| 21–23| 19–21| 22               |
| Metabolic energy               | Kcal/kg            | 301  | 299  | 306  | 305              |
|                                | MJ                 | 1.18 | 1.24 | 1.27 | 1.27             |
| Arginine                       | %                  | 1.53 | 1.47 | 1.27 | 1.54             |
| Lysine                         | %                  | 1.38 | 1.3  | 0.984| 1.35             |
| Methionine                     | %                  | 0.48 | 0.49 | 0.446| 0.68             |
| Methionine + cysteine          | %                  | 0.92 | 0.82 | 0.766| 0.95             |
| Threonine                      | %                  | 0.85 | 0.67 | 0.612| 0.94             |
| Tryptophan                     | %                  | 0.24 | 0.165| 0.145| 0.30             |
| Calcium                        | %                  | 0.9-1.0| 0.85-0.95| 0.8-0.9 | 1.0            |
| Available phosphorus           | %                  | 0.48-0.54| 0.45-0.54| 0.4-0.45 | 0.7           |
| Magnesium                      | mg                 | 78.7 | 78.7 | 78.7 | 79.0             |
The anti-stress supplement contains more metabolic energy and crude protein, 305 Kcal and 22%, respectively, than the starting BR1 feed. A 2-fold increase in free phosphorus is noted, the concentration of other trace elements is at the level of complete feed. It seems that the feed additive is more balanced in composition, but there was no significant live weight increase throughout the entire period of growing the experimental group chickens. Perhaps this is due to the fact that too high calorie feed for the chickens did not allow the residual yolk to be completely absorbed, and this, in turn, affected the activation of the genetic potential of the bird (table 4). The producers of the cross recommend monitoring the drinking regime, because a lack of water will lead to digestion problems and low uniformity of the flock, which ultimately leads to a decrease in the average dressed weight.

Table 4. Average daily gain (absolute values) of live mass in broiler chickens using feed supplement «Super Pre-starter », g.

| Broilers group | Age, days |
|---------------|-----------|
|               | 7 | 14 | 21 | 28 | 35 | 39 |
| Control       | 16.3 | 34.7 | 51.4 | 48.6 | 64.3 | 10.8 |
| Experimental  | 19.3 | 27.1 | 59.5 | 48.8 | 66.0 | 19.0 |

In addition, the meat productivity of broiler chickens was determined, as well as its quality indicators. These include live weight and meat quality of poultry (mass of carcass, pectoral and femoral muscles, internal organs) at a slaughter age. The breast was also measured; in chickens of the control group, it was 13.8 ± 0.5 cm versus 13.2 ± 0.6 cm in the experimental group birds. At the same time, the pectoral muscles weight was also higher in the chickens of the control group, namely 273.4 ± 23.4 g, versus 258.0 ± 32.9 g in broilers who consumed the anti-stress feed supplement in the first days of life, and femurs 347.4 ± 25.6 g and 345.9 ± 29.9 g, respectively. Indicators of the carcass and internal organs weight are shown in table 5.
Table 5. The effect of anti-stress feed additives on broiler slaughter rates, M ± m, г.

| Broiler group | Half-gutted carcass | Gutted carcass | Liver | Heart | Gizzard (without cuticle) |
|---------------|---------------------|----------------|-------|-------|--------------------------|
| Control       | 1510.0±35.7         | 1355.0±39.3    | 41.7±2.1 | 10.2±0.3 | 32.9±0.1 |
| Experimental  | 1596.7±28.5         | 1360.0±23.0    | 43.2±1.4 | 7.8±1.4¹ | 36.7±3.2¹ |

Note ¹Ρ<0,05

Against the background of a slight increase in the weight of the gutted carcass in the experimental group, the mass of the most valuable parts of the carcass, pectoral and femoral muscles, on the contrary, decreases. Note that in broiler chickens of the control group, the ratio of the masses of the femoral muscles and pectoral muscles is 1.27, and when the feed supplement was added to the rations during the first week of life, the ratio is 1.34. At the same time, there was a slight difference in the mass of the liver, heart and gizzard.

The weight data were used for the anatomical indices calculation, which serves as an expression of the broiler chickens constitution and characterizes the bird’s health. Therefore, such an assessment of meat chickens is necessary to know their biological and economic characteristics, especially when feeding a supplement. To assess the carcass meat, the indices proposed by B.K Gindze. In the industrial broiler meat production, the following indices are used (%):

- carcass fleshing = (muscle mass of the legs and breast/ carcass weight) x 100%;
- leg fleshing = (leg muscle mass / carcass weight) x 100%;
- breast fleshing = (mass of the muscles of the breast / mass of the carcass) x 100%.

During the experiment, it was found that the following indicators are characteristic of the control group broiler chickens:

- breast fleshing index – 20.2%;
- legs fleshing index – 25.6%.

The data obtained can be explained by the large mass of the pectoral and femoral muscles. The liv weight of the broiler chickens was average. The overall anatomical index was 45.8%.

In the experimental group, when feeding the anti-stress supplement, we recorded lower indices. Breast fleshing index was 19.0%, leg fleshing index was 25.4% and carcass fleshing index was 44.4%. The reason for the decrease in the indices was the growth of both muscle and bone tissue.

4. Conclusion
The analysis of experimental data showed the effectiveness of using the anti-stress supplement Super Pre-starter. Due to the high content of readily available amino acids and nutritional value (which is especially important for meat chickens in the first days of life) compared to the complete compound feeds BR1, BR2, and BR3, its use contributed to the maintenance of body functions. However, the use of the anti-stress supplement did not significantly affect the meat product yield, although there was an increase in live weight. The data obtained as a result of the studies should be taken into account when drawing up the diets for meat chickens and the advisability of introducing various supplements.

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