Biologically active feed additive in cattle feeding

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Abstract. The aim of the research was to study the feeding of grain with triticale instead of barley in the amount of 10 and 15% of the Valentin-90 variety with the introduction of the Allzyme PT enzyme preparation in mixed feed for broiler chickens. An increase in the live weight of young poultry was established by 3.6-5.4%, a decrease in feed costs per unit of production by 4.5-5.6%, an increase in the safety of livestock by 1.0-8.0%, an output of gutted carcasses by 0.5-0.6 abs. %, gutted by 2.9 abs. %, muscle output by 2.7-3.7 abs. %. Thus, the studied feeding schemes for broiler chickens can be recommended for production.

1. Introduction

2020 began with shocks: the coronavirus pandemic, the collapse of OPEC and a sharp drop in oil prices, a collapse in global stock markets, stagnation of the largest economies and a number of negative events on a smaller scale. In such a situation, the availability of food for the population, the absence of shortages and a sharp rise in prices are extremely important. Moreover, in the conditions of closed borders, limited cargo transportation, fluctuations in national currencies, and a decrease in production in the world, the country's ability to provide itself with food is of great importance. It is obvious that agriculture plays a leading role in the country's food security. But, despite state support, positive changes in the industry are taking place slowly, and a number of systemic problems remain. In particular, modern feed is needed for efficient livestock management. For their manufacture, components are used that are not produced in Russia: more than 90% of the additives used remain dependent on imports. Therefore, any external changes lead to price fluctuations and the availability of imported components.

The Russian feed market includes three basic segments. The first group is feed intended for feeding animals, birds and fish, both industrially and produced directly on the farm. The second segment is functional components and feed additives, which include vitamins, minerals, amino acids, probiotics and prebiotics, organic acids and enzymes, yeast cultures and bacteria, antioxidants and other components, as well as complexes of several components that solve a particular problem.
group includes premixes - mixtures for balancing feed rations. They can contain various functional components, in most cases vitamins and minerals are present in the composition, but complex premixes also include amino acids, enzymes (enzymes) and other components [1].

In recent years, a comprehensive optimization of the feeding strategy and feed composition has been recommended [2, 3]. Adequacy of nutrition and maintenance of poultry should correspond to its genetic potential [4].

One of the ways to improve the efficiency and profitability of livestock production is the use of new feed and feed additives, allowing obtaining a significant increase in live weight and reducing feed costs [5].

Triticale is a promising herbal ingredient as a source of protein and carbohydrates, recommended for the preparation of feed [6].

Wheat as the main source of grain is widely used in poultry feed because of the relatively high concentration of nutrients compared to other ingredients such as barley, rye, triticale and sorghum [7].

The effect of triticale as a substitute for wheat or corn in feed mixtures for broiler chickens or as the only grain source on poultry productivity, slaughter results, as well as physicochemical and organoleptic characteristics of meat has been studied. The use of triticale in broiler diets reduced their live weight by 4.0% when used as a replacement for wheat and by 8.0% when used instead of corn or as the only grain component and reduced feed costs per 1 kg of live weight gain by 8.0 and 14.0%, respectively. Grain type did not significantly affect carcass meat yield. Chickens fed the diets containing triticale had the same palatability as the control chickens, but the combined feeding of triticale and wheat had an adverse effect on the taste of the meat. Feeding triticale alone or in combination with wheat significantly (p≤0.05) improved the fatty acid content in pectoral muscle lipids [8].

Triticale grain contains a large amount of non-starchy polysaccharides (NSP): such as cellulose, hemicellulose, lignin. The arabinoxylans and xyloglucans contained in NPK have gel-forming properties, which predetermines the formation of a viscous chyme in the digestive tract of poultry. The addition of enzyme preparations has a reducing effect on the viscosity of the chyme, while increasing the digestibility of nutrients and increasing the productivity of poultry [9].

The main mechanism for this is that enzyme supplementation improves nutrient availability by reducing the viscosity of intestinal digestion by degrading non-starch polysaccharides. For example, they can hydrolyze arabinoxylan polymers, thereby increasing the ability of endogenous enzymes to gain access to nutrients present in triticale [10, 11].

For cereals, the most suitable degradation enzymes are arabinofuranosidases, α-glucuronidases and esterases. Enzyme compositions, in addition to simple base mixtures of xylanases, cellulases and glucanases, can take advantage of the synergistic benefits provided by this class of enzymes. A wide range of enzymatic activity in feed mixtures can more effectively affect the elastic structure of cereal grain fiber in diets for poultry [12, 13].

The aim of the research was to study the feeding of grain with triticale instead of barley in the amount of 10 and 15% of the Valentin-90 variety with the introduction of the Allzyme PT enzyme preparation in mixed feed for broiler chickens.

In the course of the research, the following tasks were set and solved:

- Determine the influence of the studied factor on changes in live weight of poultry and growth rates;
- To study the effect of feeding grain with triticale instead of barley in the amount of 10 and 15% of the Valentin-90 variety with the introduction of the Allzyme PT enzyme preparation in compound feed for broiler chickens on the safety of the livestock and feed costs per unit of production;
- Analyze the influence of the studied ingredients on the meat productivity of poultry.
2. Methodology
The experiments were carried out on broiler chickens of the cross "SK-Rus-4" at the age from one day old until the chickens reach the age of 42 days at the poultry farm "Teuchezhskaya" in the Teuchezhsky district of the Republic of Adygea. All experimental work was carried out in accordance with the recommendations of VNITIP on the methodology for conducting scientific and industrial research on feeding poultry (Sergiev Posad, 2005). The groups were formed by the method of random sampling according to the principle of paired analogs for live weight. The studies were carried out according to the following scheme, presented in table 1.

Table 1. Scheme of studies of the first batch in broiler chickens.

| Group | Feeding characteristics                                                                 |
|-------|-----------------------------------------------------------------------------------------|
| 1     | General diet (GD)                                                                        |
| 2     | GD with the replacement of 10% barley for triticale grain + 0.50 kg / t of feed "Allzyme PT" |
| 3     | GD with the replacement of 15% barley for triticale grain + 0.50 kg / t of feed "Allzyme PT" |

Allzyme PT Alltech, Belgium, Great Britain is a formulation designed to increase the digestibility of nutrients in poultry feed mixtures with a high content of grains, including triticale and sorghum. Allzyme PT contains an enzymatic extract with a xylanase activity of at least 600 units / g, produced on the basis of the culture of Trichoderma longibrachiaium, as well as a filler - calcium carbonate. The Allzyme PT enzyme does not contain genetically modified organisms. Anti-nutritional components are not higher than the values adopted in Russia. Allzyme PT is presented in the form of a grayish-white powder, not hygroscopic. It is allowed to store in the package up to 1 year.

Xylanase included in Allzyme PT destroys non-starch polysaccharides from xylans in feed mixtures with increased levels of these non-starch polysaccharides. Allzyme PT has been shown to increase the absorption of many nutrients, the availability of amino acids and energy in animal diets high in wheat, rye and triticale.

The composition of complete feed for young meat chickens is presented in table 2.

Table 2. Component composition of broiler chicken feed, %.

| Components         | 1     | 2     | 3     | 1     | 2     | 3     | 1     | 2     |
|--------------------|-------|-------|-------|-------|-------|-------|-------|-------|
| Rub the corn       | 31.80 | 21.30 | 31.80 | 21.30 | 31.80 | 21.30 |       |       |
| Wheat grating      | 15.07 | 13.65 | 15.07 | 13.65 | 15.07 | 13.65 |       |       |
| Gash shelled barley| 20.00 | 30.00 | 10.00 | 20.00 | 5.00  | 15.00 |       |       |
| Rub triticale      |       | 10.00 | 10.00 | 15.00 | 15.00 |       |       |       |
| Sunflower meal     | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 |       |       |
| Soybean meal       | 10.00 | 13.00 | 13.00 | 10.00 | 13.00 | 10.00 |       |       |
| Fish flour         | 8.50  | 5.30  | 8.50  | 5.30  | 8.50  | 5.30  |       |       |
| Sunflower oil      | 2.40  | 3.00  | 2.40  | 3.00  | 2.40  | 3.00  |       |       |
| Limestone          | 0.60  | 0.45  | 0.60  | 0.45  | 0.60  | 0.45  |       |       |
| Monocalcium Phosphate | 0.13 | 0.30  | 0.13  | 0.30  | 0.13  | 0.30  |       |       |
| Ipomoea           | 0.10  | 0.40  | 0.10  | 0.40  | 0.10  | 0.40  |       |       |
| Shell rock         | 0.40  | 1.60  | 0.40  | 1.60  | 0.40  | 1.60  |       |       |
| Premix             | 1.00  | 1.00  | 1.00  | 1.00  | 1.00  | 1.00  |       |       |
| In total           | 100.00| 100.00| 100.00| 100.00| 100.00| 100.00|       |       |
The broiler rearing period was divided into two stages: start - 1-14 days, growth - 15-28 days and finish 29-42 days. The feed mixtures used were optimally balanced. The composition of the nutrient and biologically active substances contained in them in the second group is identical to the diet of the chickens of the first group.

The live weight of the bird was determined by individual weighing at one day of age, then weekly until the end of the experiment. The calculation of feed costs was carried out by determining the amount of consumed feed mixture and the calculated increase in live weight of chickens for a certain period of the experiment. The safety of the young stock was determined by daily identification of dead birds, the cause of death was identified, and an autopsy was carried out.

The control slaughter was carried out when the youngsters reached the finish of fattening - at 42 days in accordance with GOST R 52837-2007 "Agricultural poultry for slaughter", 6 heads were selected from each group - 3 males and 3 females, with an average live weight in the group ... According to the requirements of GOST R 52702-2006 "Meat of chickens", during slaughter, morphological deboning of carcasses was carried out, while the mass of an unpeeled carcass, a gutted carcass, internal organs, muscles (pectoralis, drumsticks and thighs) was measured, a linear measurement of the total length of the intestine and its blind processes.

The data obtained during the reproduction of the experiments were processed using a personal computer and a Microsoft Excel spreadsheet using the method of variation statistics according to N.P. Plokinsky (1970). Differences were considered statistically significant at: * - p≤0.05; ** - p≤0.01; *** - p≤0.001.

3. Results and discussion

The dynamics of changes in the live weight of broiler chickens by growth periods in the experiment is shown in table 3.

Table 3. Dynamics of live weight of broiler chickens in the second experiment, g, n=100.

| Age, days | Groups 1 | Groups 2 | Groups 3 |
|-----------|----------|----------|----------|
| at one day of age | 40.00±0.31 | 40.03±0.33 | 40.04±0.29 |
| 14 | 337.00±5.70 | 340.09±5.30 | 339.5±4.80 |
| % to control | 100.0 | 100.9 | 100.7 |
| 28 | 1090.20±13.10 | 1160.30±17.00** | 1123.10±11.30* |
| % to control | 100.0 | 106.4 | 103.0 |
| 42 | 2030.30±30.58 | 2140.20±29.15* | 2104.00±33.00* |
| % to control | 100.0 | 105.4 | 103.6 |

When setting up for fattening, the live weight of young meat chickens was the same in all groups and amounted to approximately 40.0 g, respectively, in groups. At 14 days of age, the growth rate slightly exceeded the control in the experimental groups.

At 28 days of age, the live weight of young animals in the experimental groups was greater, in comparison with the control in the second group, by 6.4% (p<0.01), in the third - by 3.0% (p<0.05). For the entire stage of feeding, the live weight of broiler chickens in the control group was 2030.3 g, and in the second group it was 5.4% higher than the control indicator (p<0.05), in the third, where 15.0% triticale was fed with with a multi-enzyme composition, the live weight of the bird was 3.6% higher than the control value (p<0.05). The average daily gain in live weight for the stage of fattening 0-14 days was almost the same, in the period 15-28 days this indicator corresponded to 53.8 g in the control group, in the second group - 58.6 g, or more than the control indicator by 8.9%, in the third group - 56.0 g, which is 4.1% more than in the control group.

For the period of 29-42 days, the average daily gain in live weight of chickens was higher than the control in the second group by 4.2%, and in the third experimental group by 4.2%, compared to the control, but without a significant difference. The average daily gain in live weight for the entire
experiment was 47, 50 and 49 g, respectively, in groups and was higher than the control criterion in the second group by 5.49%, and in the third group - by 3.59%. The addition of triticale grain instead of barley, despite the presence of a multienzyme composition, contributed to a slight decrease in the appetite of broiler chickens: the average daily intake of feed mixture by birds of the first group was 84.50 g per head over the entire period of the experiment, in the second group - 83.80 g, which is lower than the control indicator by 0.8%, in the third - 83.7 g, or below the control by 0.9%. However, there was a decrease in feed costs per 1 kg of live weight gain. In the first group, this indicator was 1.78 kg, in the second - 1.68 kg, or 5.6% lower, in the third - 1.70 kg, or 4.5% lower.

The safety of the young stock of experimental poultry is shown in Table 4.

| Age period         | Groups 1 | Groups 2 | Groups 3 |
|--------------------|----------|----------|----------|
| The first: 1-14 days| 97.0     | 100.0    | 97.0     |
| The second: 15-28 days | 97.8    | 100.0    | 97.8     |
| The third: 29-42 days | 96.8    | 100.0    | 97.9     |
| Average for the fattening period: 1-42 days | 92.0 | 100.0 | 93.0    |

The introduction of triticale instead of barley into the feed mixture for young poultry had a positive effect on its survival.

During the period of bird growth of 1-14 days, the safety was in groups: 97.0, 100.0 and 97.0%, in the period 15-28, days - 97.8, 100.0 and 97.8%. At the final stage, in the first group, this indicator corresponded to 96.8%, in the second group, no bird deaths were detected during the third stage of the experiment, and the safety was 100.0%, which is higher than the control value by 3.20%, and in the third group - 97.9%, or 1.10% higher than the control.

For all stages of the experiment, the safety was higher in the second group of fattening young animals - by 8.0%, in the third - by 1.0%, in comparison with the control.

The weight of unseed carcasses was 1614.09 ± 8.00 g in the control group, 1712.16 ± 11.00 g in the second experimental group, (p≤0.001) in the third - 1685.30 ± 10.00 g (p≤0.001) ... Weight of gutted carcasses: 1409.02 ± 8.30 g, 1547.36 ± 9.00 g (p≤0.001) and 1521.19 ± 11.36 g (p≤0.001), respectively, by groups.

The poultry of the experimental groups prevailed over the control in terms of the value of the yield of gutted carcasses by 0.50-0.60 abs. %, and gutted - by 2.90 abs. % in both groups.

At the same time, in the control group, the yield of gutted carcasses was 79.5%, in the second experimental group - 80.0%, in the third - 80.1%, and the yield of gutted carcasses was 69.4, 72.3 and 72.3%, respectively. ...

The addition of triticale grain to the experimental feed mixtures instead of barley when using the Allzyme PT enzyme preparation had a positive effect on the formation of meat productivity, the development of individual muscle groups and internal organs of broiler chickens (Table 4).

Relative to the mass of gutted carcasses, the muscle yield was higher, compared with the control, in the second group by 2.66 abs. %, in the third - by 3.73 abs. %.

The mass of the pectoral muscles in the experimental groups had a significant advantage over the control: in the second group by 2.35 abs. % (p≤0.01) and in the third group - by 4.35 abs. % (p≤0.001), respectively. The mass of the thigh muscles of broiler chickens in the second experimental group was higher, compared with the control, by 0.25 abs. % (p≤0.01) and in the third - by 0.30 abs. % (p≤0.01). Consequently, the addition of a multi-enzyme composition promotes more intensive formation of the muscles of the thigh and lower leg.

In terms of the weight of the leg and other muscles (muscles of the back, wings, neck), there was no significant difference between the groups of birds (p> 0.05) (Table 5).
Table 5. Development of individual muscle groups (relative to gutted carcass weight) and internal organs of broiler chickens (relative to the weight of the carcass without gutting), n=6.

| Muscles         | Groups | 1     | 2     | 3     |
|-----------------|--------|-------|-------|-------|
|                 |        | g     | %     | g     | %     | g     | %     |
| Gutted carcass  |        |       |       |       |       |       |       |
| weight, g       | 1409.02±8.30 | 1547.36±9.00*** | 1521.19±11.36*** |
| Pectoral        | 305.1±2.8 | 21.65 | 370.9±24.3** | 24.00 | 395.0±12.5** | 26.00 |
| Femoral         | 138.0±3.2 | 9.79  | 155.4±3.2 **| 10.04 | 153.5±2.6** | 10.09 |
| Shins           | 102.3±1.1 | 7.26  | 110.3±5.1  | 7.13  | 97.3±3.9   | 6.40  |
| Rest            | 650.6   | 46.17 | 755.6 | 48.83 | 759.1 | 49.90 |
| Total           | 1614.09±8.00 | 1712.16±11.00*** | 1685.30±10.00*** |
| Carcass without |        |       |       |       |       |       |       |
| gutting, g      |        |       |       |       |       |       |       |
| Organ mass:     |        |       |       |       |       |       |       |
| Heart           | 7.7±0.54 | 0.48  | 7.2±0.5  | 0.42  | 7.3±0.2   | 0.43  |
| Liver           | 42.0±1.1 | 2.60  | 43.0±1.6 | 2.51  | 44.0±1.4  | 2.61  |
| Glandular       | 6.7±0.2 | 0.42  | 7.0±1.1 | 0.41  | 7.3±0.2*  | 0.43  |
| stomach         | 41.0±2.2 | 2.54  | 37.7±2.8 | 2.20  | 43.0±1.5  | 2.56  |
| Intestines      | 78.7±1.8 | 4.88  | 78.0±2.3 | 4.56  | 79.0±3.9  | 4.69  |

Note: *- p≤0.05; **- p≤0.01; ***- p≤0.001.

The weight of the heart, liver, glandular and muscular stomach in the experimental groups varied within the control value. To a certain extent, relative to the weight of the unpeeled carcass, the average intestinal weight in the second group turned out to be lower, compared with the control, by 0.32 abs. %, in the third group - by 0.19 abs. %, which can be explained by a decrease in the load on it due to the introduction of an enzyme preparation and a faster movement of the chyme along the digestive tract of the bird.

4. Conclusions

Thus, a positive effect of replacing 10 and 15% of barley in feed for broiler chickens with triticale grain was established when the Allzyme PT enzyme preparation was introduced.

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