Results of hypoporosis prevention in farm birds

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Abstract. Various feed additives are used to increase productivity in poultry farming. The purpose of our research was to study the effectiveness of the developed and patented mineral feed additive “Cu-Active” for the prevention of hypocuporosis, increasing the performance and meat quality of broiler chickens. The research work was carried out in the laboratories of the Vitebsk State Academy of Veterinary Medicine and at the enterprise of OAO “Poultry Farm “Rassvet”. It has been established that the patented mineral feed additive “Cu-Active” is not toxic for the protozoa Tetrahymena pyriformis and has an adsorption activity against sanitary-indicatory microorganisms (the number of mesophilic aerobic and facultative anaerobic microorganisms) at a level of 10.8 mg/g. The experimental poultry meat is of good quality according to organoleptic indices. The resulting carcasses meet the requirements of Grade I. Carcass yield – 71.0%. Saturation of the body with copper contributed to an increase in the natural resistance of the experimental poultry, a decrease in endogenous intoxication and the intensity of natural blood serum fluorescence, and, consequently, the normalization of the liver tissue functional activity. The introduction of a patented additive to compound feed for broiler chickens on the poultry farm contributes to an increase in average daily gains – by 1.9%, ensuring the poultry safety by at least 96.6% and reducing feed consumption by 4.1%. The level of profitability of poultry meat production increases by 0.51%. We recommend introducing the patented additive “Cu-Active” into compound feed for poultry in order to prevent microelementoses, hypocuporosis in particular, at a dose of 0.005%.

1 Introduction

At present in the Republic of Belarus poultry farming occupies the first place in gross meat production. Ensuring the country’s food security made it possible not only to supply fully the population with complete protein but also to enter the boundless Russian market with the products sale [1, 2]. In the early 70s of the last century, noted the positive effect of the copper use, copper sulfate in particular, in the poultry feeding to stimulate live weight [3]. It has been established that copper ions, in comparison with ions of other metals, interact more actively introducing the patented additive “Cu-Active” into compound feed for poultry in order to prevent microelementoses, hypocuporosis in particular, at a dose of 0.005%.
Almost all copper in poultry’s body is part of the proteins that play a regulatory role in the redox reactions of tissue respiration. Caeruloplasmin, as a depot of copper, having enzymatic activity, can participate in the synthesis of hemoglobin (iron oxidation). Copper ions are involved in the protective mechanisms of the cell, in preventing the toxic effects of oxygen derivatives, normalize the exchange of calcium (Ca) and phosphorus (P), helps strengthen bone tissue (due to the production of collagen in the bones), keratinization of poultry feather, the full development of embryos. Copper enhances the production of iron (Fe) and its transfer to the bone marrow, which increases the content of vitamin В₁₂ and ascorbic acid in the liver.

In the conditions of industrial poultry farms, various technological, feeding, veterinary and other stress factors, as well as various endemic diseases, can occur, which negatively affect the economic efficiency of broiler meat production. One of these diseases is hypocuporosis, which is accompanied by an imbalance of hematopoiesis, anemia, functional and morphological abnormalities in the central nervous system and bone tissue, digestive organs, kidneys, liver, decreased tissue respiration, and a decrease in the activity of a number of enzymes.

Previously, it was found that silicon dioxide is a micronized sorbent that has good sorption against antigens, tissue decay products, various toxins, allergens, microorganisms, etc. It is used for poisoning, intestinal infections, allergic reactions, gastrointestinal disorder, removes uric acid. Silicon dioxide is not broken down in the body, is not absorbed by the intestines and is excreted unchanged without damaging the gastric mucosa. It removes toxins, and is an antidote for poisoning animals with phosphorus. Silicon dioxide belongs to the new IV generation.

Various mineral mycotoxins adsorbents are used in compound feed for poultry, which help to reduce the toxic load on the body when raising poultry. It is proved that silicon dioxide in colloidal solutions, not only in the initial concentration, but also in dilutions of 1:10, has antibacterial activity against gram-positive and gram-negative microorganisms.

Our created and patented the mineral feed additive “Cu Active” is a fundamentally new substance for use in feed additives for farm animals, including poultry. Restored copper obtained as a monolayer on the surface of mineral sorbent nanoparticles provides the biological activity of the substance. “Cu Active” is used to prevent hypocuporosis in poultry.

Previously, a method for obtaining a sorbent based on silicon dioxide with zinc oxide and sodium oxide was known. However, zinc is a micronutrient and needs precision dosing. When high doses of zinc enter the body with compound feed, the mucous membranes of the stomach and intestines can be affected; after absorption, zinc accumulates in the bones, liver, and other organs. Sodium overdoses are the problem of industrial poultry farming.

Prevention of hypocuporosis, in fast-growing broiler chickens in particular, is an urgent problem. In poultry farming the prevention is carried out by using the mineral mycotoxin adsorbent “Cu Active”, which contains the micronutrient restored copper, copper sulfate and silicon oxide. The biological activity of the adsorbent is provided by restored copper obtained as a monolayer on the surface of mineral sorbent nanoparticles using the technology of mechanochemical activation.

In connection with the stated above, we consider that our research work has scientific novelty and practical significance. The solution of this problem has a significant impact on the economic efficiency of broiler poultry farming.
2 Materials and methods

The purpose of our research is to determine the efficiency of the copper-containing mycotoxins adsorbent “Cu-Active” for the prevention of hypocuporoses, increase the productivity and quality of broiler chickens meat.

The patented mineral feed additive “Cu-Active” is a homogeneous free-flowing powder from light gray to light yellow in color, dark inclusions may be present. It is a water-dispersed mineral powder with a persistent antidiarrheal and growth-stimulating effect.

The copper-containing mineral sorbent is contained in the optimal rate of input into compound feed and does not reduce the nutritional value of the poultry diet.

“Cu-Active” is able to suppress pathogenic intestinal microflora, stimulates the growth and regeneration of intestinal villi, does not antagonize with other minerals and vitamins, has stimulating and antibacterial properties, and increases the productivity of farm animals (poultry).

Feed mineral additive “Cu-Active” does not contain antibiotics, hormonal preparations and GMOs. Adverse effects and complications at additive application are not revealed, and contraindications are not established.

Products obtained from poultry can be used without restrictions.

The stated goal was achieved in three stages: I - test “Cu-Active” in vitro; II - test “Cu-Active” in vivo in a scientific and laboratory experiment; III - test “Cu-Active” in vivo in scientific and production experiment.

When conducting research work, we used classical and the latest techniques and methods for applying scientific research in animal husbandry.

The study of the “Cu-Active” toxicological properties was carried out by a group of chemical and toxicological research in the feed quality control laboratory of the research expertise department of the Scientific Research Institute of Applied Veterinary Medicine and Biotechnology of the VSAVM.

The determination of general toxicity was carried out according to GOST 31674-2012 “Feed, compound feed, compound feed raw materials. Methods for determining general toxicity” using the protozoa Tetrahymena pyriformis.

Before the evaluation, a study of farm animals compound feed for the presence of toxicity was conducted. After the results (the survival rate of ciliates is more than 90%), an additive was introduced into the compound feed according to the product instruction.

The compound feed containing the feed mineral additive “Cu-Active” was subjected to the toxicological assessment, which was re-conducted for the broiler chickens compound feed.

Table 1.

<table>
<thead>
<tr>
<th>Group number</th>
<th>Name of the work performed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (control)</td>
<td>Basic diet (BD)</td>
</tr>
<tr>
<td>2 (experimental)</td>
<td>BD + «Cu-Active» 0,001% compound feed</td>
</tr>
<tr>
<td>3 (experimental)</td>
<td>BD + «Cu-Active» 0,005% compound feed</td>
</tr>
<tr>
<td>4 (experimental)</td>
<td>BD + «Cu-Active» 0,01% compound feed</td>
</tr>
</tbody>
</table>

Scientific and production experiment

1 (control) | Basic diet (BD) |
2 (experimental) | BD + «Cu-Active» 0,05% compound feed |
We monitored feed consumption by daily group accounting of given feeds and residues removal at the end of accounting periods. As the main diet for experimental animals, standard complete compound feeds (according to age) were used. Observations of poultry safety and health were carried out by daily recording of poultry and analysis of the causes of poultry mortality. The clinical and physiological poultry state was determined by daily examination, paying attention to behavior, appetite, water intake, mobility, etc.

The flashing category was established according to GOST 18292-2012 “Poultry for slaughter. Specifications” and STB 1945-2010 “Poultry meat. General technical conditions”.

The calculation of the economic efficiency of our own research results was carried out based on obtained empirical data. Biometric processing of digital material obtained in experimental studies conducted using the Microsoft Excel software package under the control of the Windows operating system according to the P. F. Rokitsky method.

### 3 Results

At the first stage of the in vitro research work, we compared the general toxicity of broiler chickens compound feed that does not contain feed additives, as well as experimental compound feed for broiler chickens with the introduction of the mineral feed additive “Cu-Active”. The experimental sample "Cu-Active" was introduced into the compound feed at an increased input rate, at the rate of 1 g/kg (0.1% per 1 ton of compound feed). To determine the toxicity by the express method, our created and patented additive was used as a test object of the protozoan *Tetrahymena pyriformis*. The results obtained are presented in Table 2.

<table>
<thead>
<tr>
<th>Sample name</th>
<th>60 minutes exposure</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compound feed for broiler chickens without feed additive</td>
<td>Survival rate of protozoa at the level not less than 90%</td>
<td>Non toxic</td>
</tr>
<tr>
<td>Compound feed for broiler chickens containing “Cu-Active” additive</td>
<td>Survival rate of protozoa at the level not less than 90%</td>
<td>Non toxic</td>
</tr>
</tbody>
</table>

From the presented data, we can see that the “Cu-Active” mineral feed additive is not toxic. During the observation period, the protozoa *Tetrahymena pyriformis* did not show any changes in shape, the nature of their movement, or mass death.

The evaluation of the total adsorption activity was performed by the adsorption of a methylene blue solution with a concentration of 3 mg/cm³.

The results of the total adsorption activity assessment of our created feed mineral additive “Cu-Active”, by determining the number of mesophilic aerobic and facultative anaerobic microorganisms, according to GOST 10444.15-94 are presented in Table 3.

<table>
<thead>
<tr>
<th>Name</th>
<th>Actual adsorption result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mineral feed additive “Cu-Active”</td>
<td>10.8</td>
</tr>
</tbody>
</table>

From the presented data we can see that the patented additive “Cu-Active” for hypocuporosis prevention has adsorption activity against sanitary-indicatory microorganisms. It allows us to recommend the additive “Cu-Active” for further use in farm animals, including poultry.
The obtained positive data on the study of the copper-containing feed additive “Cu-Active” properties in vitro made it possible to proceed to in vivo tests.

The second stage of the research work in vivo was carried out in the clinic of the Department of Parasitology and Invasive Animal Diseases of the Educational Establishment “Vitebsk the Badge of Honor State Academy of Veterinary Medicine (VSAVM), according to the experiment scheme (see Table 1). To carry out the second stage, we purchased day-old broiler chickens and compound feed for their raising at JSC “Vitebsk Broiler Poultry Factory”.

Day-old broiler chickens of the cross “Ross-308” (80 chickens (40 ♂ + 40 ♀) and an average live weight of 39.0 ± 0.10 g), bred in the poultry factory incubator, were delivered to the clinic of the academy for scientific and laboratory experiments. The duration of the scientific and laboratory experiment was 42 days.

Broiler chickens of the control group consumed only registered compound feed used in poultry factory, and broiler chickens of the experimental groups used compound feed and the patented additive “Cu-Active” in various dosages, according to the experimental scheme. No other feed additives, antibiotics or vaccines were added. Each group included 20 broilers (10 ♂ + 10 ♀).

The results of the scientific and laboratory experiment, at the end of the technological period of experimental poultry growing, are presented in Table 4.

**Table 4.** Results of the experimental broiler chickens productivity, (M±m)

<table>
<thead>
<tr>
<th>Indices</th>
<th>Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1-st control</td>
</tr>
<tr>
<td>Live weight at slaughter age, g/head</td>
<td></td>
</tr>
<tr>
<td>2009.70 ± 42.43</td>
<td></td>
</tr>
<tr>
<td>2261.80 ± 24.85***</td>
<td></td>
</tr>
<tr>
<td>2396.85 ± 20.68***</td>
<td></td>
</tr>
<tr>
<td>2293.40 ± 18.26***</td>
<td></td>
</tr>
<tr>
<td>Average daily gain, g</td>
<td>46.92</td>
</tr>
<tr>
<td>Stock safety, %</td>
<td>90</td>
</tr>
<tr>
<td>Feed consumption per 1 kg of live weight gain, kg</td>
<td>1.74</td>
</tr>
<tr>
<td>Feed consumption for the entire growing period, kg</td>
<td>3496.88 ± 0.03</td>
</tr>
</tbody>
</table>

*Note:*** - P ≤ 0.001

As we can see from the results of the cross “Ross-308” broilers fattening presented in Table 4, the chickens of the experimental groups, where the additive “Cu/Active” was given in various doses, had the highest live weight. The maximum gain in live weight was observed in broilers from the 3-rd and 4-th groups.

The difference between the 1-st and 2-nd groups was reliable and was 12.5% (P ≤0.001) in favor of the 2-nd group broilers (+ 252.1 g). The live weight of the 3-rd group broilers significantly differed from the indices of the control group by 19.3% (P ≤ 0.001). The indices of the 4-th group significantly exceeded analogues in live weight by 14.1% (P ≤ 0.001).

The difference between the indices of the 2-nd and 3-rd experimental groups was 5.9% in favor of the indices of the 3-rd group (P ≤0.001). The difference between the performance broiler indices of the 3-rd and 4-th groups was not reliable. Thus, we can conclude that the optimal input rate of the feed additive “Cu/Active” is 0.005% of the compound feed.
The results of broilers average daily gain from the 2nd experimental group exceeded the broilers control group by 12.8% (+6 g). The achieved rate of 4th group broilers average daily gain exceeded the results of control group by 14.4% (+6.8 g). The stock safety, while ensuring optimal microclimate parameters during research work, in the experimental groups was 100%. In the 1st control group, during the experiment, two broiler chickens died. One broiler died on the 3rd day of the experiment and one broiler, suffering from diarrheal syndrome and hepatotrophy, died on the 10-11th day.

It should be noted that in the experimental groups where broiler chickens were kept, the litter was always dry, without a sharp and putrid odor. The litter mass was formed, with a slight white coating, without blood impurities and the primary signs of diarrhea.

It has been established that for the entire growing period, in average, 3.5 to 3.9 kg of compound feed was spent per one broiler in groups. In the experimental groups, the average feed consumption during the fattening period was higher, however, its costs paid off by obtaining an additional increase in the broilers live weight and selling it on meat.

The indices of feed consumption per 1 kg of broilers live weight gain on average in the control was 1.74 kg. In the 2nd and 4th experimental groups, the feed consumption was 1.67 kg, which was 4.1% less and was 0.070 g/kg of compound feed. In the 3rd experimental group, the feed consumption was 1.66 kg, which was 4.6% less, which amounted to 0.080 g/kg of compound feed.

At the end of clinical trials, after 24 hours of fasting, broilers at 42 days of age were slaughtered to determine zootechnical, hematological, and veterinary and sanitary indices. To study the effect of the patented additive “Cu Active” use on the quality of broiler chickens meat, we conducted a set of organoleptic and laboratory studies of 40 carcasses (10 control and 30 experimental).

In the organoleptic study according to GOST 18292-2012, we determined the appearance and color of the beak, the oral cavity mucous membrane, the eyeball, the carcass surface, the subcutaneous and internal adipose tissue, the serous membrane of the abdominal cavity. In addition, we defined the condition of muscles in the section, their consistency, smell, and the transparency and broth aroma with the sample cooking. Based on organoleptic studies, it was found that all samples have a glossy beak; the eyeball is convex, the cornea is shiny, subcutaneous and internal fat of a pale yellow color. In all samples the carcasses surface is dry, whitish-yellow in color with a pink tint; the mucous membrane of the oral cavity is shiny, pale pink in color, slightly moistened; the serous membrane of the abdominal cavity is moist, shiny; the muscles on the cut are slightly moist, pale pink in color, elastic in texture. All samples have specific smell, characteristic of fresh poultry meat.

When testing by boiling, it was found that the broth in all cases was transparent, fragrant. No foreign smell and taste were detected. From the data of the organoleptic assessment, we can see that there were no significant differences in all indices of the carcasses of the control and experimental groups. The additional introduction of the additive “Cu Active” for hypocuporosis prevention did not worsen the organoleptic indices of broiler chicken meat.

According to STB 1945-2010, all carcasses obtained from experimental broiler chickens were classified as grade I, which had a positive effect on the economic efficiency of the experimental work. We studied the effect of the patented additive “Cu Active” on some biochemical indices of blood serum obtained from experimental broiler chickens. Biometrical material is presented in Table 5.
The patented additive “Cu-Active” into the compound feed for broiler chickens of the cross “Ross308”. In poultry house No. 15 (control), broiler chickens were grown according to generally accepted technology on a poultry farm. Broilers grown in poultry house No. 14 were additionally given the mineral feed additive “Cu-Active” with compound feed at the rate of 0.005%, according to the experimental scheme (see Table 5).

All of the foregoing suggests that the use of the patented feed mineral additive “Cu-Active” for the hypocuporosis prevention is an effective catalyst for restoring metabolic processes, saturates the broilers body with copper, increases the redox reactions of tissue, and optimizes the liver functions.

Table 5.

<table>
<thead>
<tr>
<th>Indices</th>
<th>1-st control</th>
<th>2-nd experimental</th>
<th>3-d experimental</th>
<th>4-th experimental</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alanine aminotransferase</td>
<td>△</td>
<td>△</td>
<td>△</td>
<td>△</td>
</tr>
<tr>
<td>Triglycerides</td>
<td>△</td>
<td>△</td>
<td>△</td>
<td>△</td>
</tr>
<tr>
<td>Glucose</td>
<td>△</td>
<td>△</td>
<td>△</td>
<td>△</td>
</tr>
<tr>
<td>Total cholesterol</td>
<td>△</td>
<td>△</td>
<td>△</td>
<td>△</td>
</tr>
<tr>
<td>Cholesterol</td>
<td>△</td>
<td>△</td>
<td>△</td>
<td>△</td>
</tr>
<tr>
<td>Aspartate aminotransferase</td>
<td>△</td>
<td>△</td>
<td>△</td>
<td>△</td>
</tr>
<tr>
<td>Alanine aminotransferase</td>
<td>△</td>
<td>△</td>
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<tr>
<td>Cholesterol</td>
<td>△</td>
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<td>Glucose</td>
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<tr>
<td>Total cholesterol</td>
<td>△</td>
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<tr>
<td>Cholesterol</td>
<td>△</td>
<td>△</td>
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</table>

Active” stimulated aspartate aminotransferase activity in the broilers of the experimental groups with the use of the additive “Cu-Active” helps to reduce endogenous intoxication, which is a typical process for broilers with intensive growing technology.
Table 6. Indices for closed broiler chickens groups

<table>
<thead>
<tr>
<th>Name</th>
<th>Poultry houses</th>
<th>№ 15 - control</th>
<th>№ 14 – experiment («Cu-Active»)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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</tbody>
</table>

As we can see from the table, the number of broiler chickens for growing in poultry houses were the same. When assessing the veterinary and physiological poultry state, it was noted that in poultry house No. 15 during the growing period 1035 broilers died and were culled for objective reasons, which amounted to 96.2%. In poultry house No. 14 («Cu-Active»), 923 broilers (96.6%) died and were culled.

As the veterinary service noted, the additional introduction of the patented additive “Cu-Active” with the compound feed made it possible to increase the immune status and natural resistance of the broiler chickens body, prevent hypocuprosis and increase the poultry safety — by 0.4%. In the gross poultry meat production, this allowed us to obtain a high economic result, which affected the profitability level.

The average weight of one broiler grown according to the traditional feeding scheme (poultry house No. 15) was 2524 g/pcs, and young broilers in poultry house No. 14 («Cu-Active») — 2628 g/pcs. Additional growth increased by 104 g/pcs, which amounted to 4.1%.

Accordingly, the average daily gain of broiler chickens was 57.5 g in the control poultry house No. 15, and 58.6 g in the experimental poultry house No. 14. Thus, the additional introduction of the mineral feed additive “Cu-Active” into the diets of poultry for preventive purposes increased the average daily indices of broilers by 1.1 g, which is cost-effective.

Feed consumption per 1 kg of live weight gain is also an economic index of the poultry meat production efficiency. Feed consumption in poultry house No. 15 (control) was 1.90 kg, and in the experimental poultry house — 1.87 kg, which was 1.6% better. The savings in feed consumption amounted to 0.03 g/kg of compound feed.

The additional introduction of the additive “Cu-Active” with the compound feed contributed to the normalization of mineral metabolism in the poultry body and the increase in the absorption of feed nutrients. From broilers grown in an experimental poultry house, according to STB 1945-2010, the yield of full-fledged carcasses of grade I increased by 0.7%, which corresponded to 2458.4 kg of meat sold at maximum prices. Obtaining additional products made it possible to recoup the costs of the additive “Cu Active”.

The poultry farm calculates the European Performance Index (EPI) for meat production. On average, this index should be within 300 units. As we can see from the results obtained, in the control poultry house No. 15, the meat production efficiency was 297.2 units, and in the experimental poultry house No. 14 — 4.0% (+12.0 units) more — 309.2 units.
Based on the obtained data on experimental broiler chickens performance, it was found that the level of profitability of poultry meat production in poultry house No. 15 (control) was 5.13%, and in poultry house No. 14 (“Cu’Active”) 5.64%, which was higher by 0.51 percentage points and was cost-effective.

4 Discussion

In recent years, on the poultry farms of the Republic of Belarus, hypomicroelementoses, hypocuporosis in particular, have been an urgent problem. For prevention, for the increasing the performance and meat quality of broiler chickens, we have developed and patented the feed mineral additive “Cu’Active”. Based on a series of in vitro and in vivo tests, we established that “Cu’Active” contributes to the metabolism activation, redox reactions and enzymatic metabolism in tissues.

Assessing the effect of the feed additive on the indices of the basic metabolism, we can argue that the chickens in the experimental groups showed a positive effect on carbohydrate-fat metabolism. Thus, the saturation of the poultry organism in the experimental group with copper contributed to the strengthening of the antioxidant blood system and the normalization of the general metabolism.

We realized that in the animal clinic it is quite easy to provide ideal conditions for keeping poultry and get maximum performance results, but they can still be an indicator for planning the poultry performance raised in the conditions of intensive poultry farming.

We should note that in ОАО “Poultry Farm “Rassvet” the veterinary and preventive measures scheme, approved by the chief veterinarian of the district, is implemented strictly and timely. In this regard, unlike laboratory tests, vaccinations, antibacterial preparations and other measures were carried out in each poultry house, according to the approved veterinary and preventive measures scheme. However, in the experimental poultry house, an additional poultry meat and excess profit was obtained, which reliably confirms the use of “Cu’Active” for hypocuporosis prevention.

We also conducted studies on other types of poultry (laying hens, turkeys), where positive results were also obtained, which indicates the effectiveness of “Cu’Active” use.

Mixing of mineral feed additive “Cu’Active” was carried out in “Big Dutchman” feeding tankers for broiler chickens. As a result, it was found that the feed mineral additive “Cu’Active” does not hang in the dosing equipment tanker. It is dosed stably in accordance with technological standards. Equipment corrosion was not detected. All of the above confirms the technological properties of “Cu’Active” and allows using it in an unlimited amount at feed mills and poultry feed preparation shops for introduction into compound feed for farm animals, including poultry.

Based on the foregoing, we can state with confidence about effectiveness of the use of the developed and patented feed mineral additive “Cu’Active” for the prevention of hypocuporosis in poultry.

5 Conclusion

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3. Feeding broiler chickens with compound feed “Cu Active” in the clinic of the academy contributed to the increase of the average live weight of broilers in the experimental groups – by 12.5–19.3%, the average daily gain in live weight by 6.0–9.2 g. It also reduced the cost of compound feed per 1 kg of live weight gain by 0.07–0.08 kg (4.1–4.6%), prevented poultry diseases and achieved livestock safety – 100%.

4. The broiler chickens meat of the delivered samples, in the diet of which the feed additive “Cu Active” was introduced, is not inferior to the meat of the control group in organoleptic indices, and is of good quality.

5. Aspartate aminotransferase activity in broilers of the experimental groups was 23.2–43.0% higher, and alanine transaminase activity was 12.8–21.8% higher than in the blood serum of broilers in the control group. The level of copper in the whole blood of experimental broilers increased by 49–63%. Saturation of the body with copper contributed to the decrease in the intensity of natural fluorescence of blood serum (decrease in the degree of endogenous intoxication), normalization of the functional activity of the liver tissue.

The introduction of the feed mineral additive “Cu Active” into the diets contributes to the increase in the average daily gain of broiler chickens of the cross “Ross 308” – by 4.1%, ensuring the poultry safety – at least 96.6% and reducing feed consumption per production unit – by 1.6%. The profitability of broiler meat production was 5.64% and increased by 0.51%.

Thus, based on the foregoing, we consider that the use of the mineral feed additive “Cu Active” is relevant, has practical significance and economic efficiency. We recommend the patented additive “Cu Active” (manufactured by ООО “Bionorm”, Vitebsk, Republic of Belarus) for further use in order to prevent microelementoses, in particular hypocuporosis, in diets for farm animals, including poultry at a dose of 0.005%.

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