Active Coal Feed Additive, An Effective Means of Preventing Chronic Mycotoxicosis and Increasing Egg Production by Laying Hens

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INTRODUCTION

Fowl mycotoxicosis is one of the most economically important problems in modern poultry industry. High-yielding breeds of fowl are extremely sensitive to mycotoxins. The disease is not necessarily to be manifested by obvious clinical symptoms, but productivity decrease is inevitable [1, 2]. Over three hundred mycotoxins are known, and most of them have toxic effects on animals and birds [3]. Most studied are the properties of most widespread mycotoxins - aflatoxin, ochratoxin, fumonisin, some mycotoxins from trichothecenes group, zearalenone [4,5].

The mycotoxins introduced in chemically pure form exhibit toxic properties in a much lesser degree than the same quantity but produced in vivo [6]. This is because microscopic fungi during their life activity produce various toxins that can number up to several dozens, and these toxins exhibit combined toxic effect. Laboratories can identify only a small part of the known mycotoxins. Synergetic effect of mycotoxins has not been yet studied well enough. The difficulty lies in the uniqueness and unpredictability of qualitative and quantitative composition of mycotoxins synthesized by various kinds of fungi [7].

Mycotoxins have one thing in common, namely, they are biocides. By physical and chemical properties mycotoxins vary considerably, making it impossible to devise a single effective method of controlling them [8,9]. The mycotoxins problem today remains unsolved [10].

Methods:

Experimental studies were made on 24 laying hens 16 months of age from the "Avantgarde" poultry in the Ruzaevka municipal district of Mordovia with evident signs of mycotoxicosis poisoning.

To perform experiments on the principle of analogues four experimental groups of 6 hens each were formed. Active coal feed additive made by Khiminvest STC [11] was added to the daily ration of hens in the following doses: 1st test group - 200 g, 2nd group - 400 g, 3rd group - 800 g per ton of feed. Hens in group 4 did not receive the additive.

Laying hens in all groups were kept in the same conditions and received the feed from the farm.
In order to evaluate the clinical status of the hens, their general condition, coordination of movement, feathering, skin and visible mucous membranes were examined. From whole blood, hemoglobin level, concentration of erythrocytes and leukocytes were examined and leucograms were made. Blood color index and content of hemoglobin in erythrocytes was calculated for hens.

Biochemical study of blood plasma of chickens was made using Humalyzer 2000 semi-automatic biochemical analyzer with the use of Human proprietary techniques. The following biochemical indicators were defined: levels of alanine aminotransferase (ALAT) and serum glutamate-oxaloacetate-transaminase (AAT), albumin, glucose, total protein, phosphorus, magnesium, potassium, calcium. De Ritis coefficient and calcium-phosphorus ratio were calculated.

The feed was examined for the presence of mycotoxins at the Federal Center on toxicological, radiological and biological safety (Kazan). In course of mycological examination it was found that the feed is most contaminated with the following types of microscopic fungi: A. fumigatus - 30%, A. niger (25%), Mucor sp. - 20%. HT-2 toxin was detected in combined feed.

The main part:

With the entire livestock of laying hens we found the following clinical signs mycotoxicosis disease: depression and drowsiness, mucous membranes of the mouth, tongue, pharynx, and at the base of the beak has foci of necrosis, faeces are watery with traces of blood, lurching walk, motor dysfunction, ruffled, dim, dirty feathers, sometimes alopecia areas, lack or loss of egg production, eggs are of low weight with thin shell.

It was found out that on the 15th day after administering the active coal feed additive in groups where the dose was 200, 400 and 800 g per ton of feed, hens’ clinical condition improved significantly. Laying hens became more active, movements became coordinated, feed eatability was noticed, especially in the second group, where the dose of active coal feed additive was 400 g per ton of ready feed.

On the 30th day of the experiment, general condition of laying hens that received active coal feed additive in doses of 200, 400 and 800g per ton of ready feed finally returned to normal. We noted recovery of appetite, no abnormalities in motor coordination, apathy in hens' behavior completely disappeared.

In the group treated with active coal feed additive in dosage of 200 g per ton of feed, egg production increased by 8%, in dosage of 400 g per ton of feed - by 30%; in dosage of 800 g per m - by 5%. Average weight of eggs in the experimental group was, respectively, 54 g, 67 g, and 58 g. The change in average eggs weight was mainly due to the increase in the white. We patented the method of using the active coal feed additive in order to increase laying hens productivity [12].

The studies also revealed that use of the additive with laying hens in dosages of 200, 400 and 800 g per ton of feed does not affect the hematological status, however, changes blood indicators like hemoglobin content, erythrocytes content, leukocytes and lymphocytes content within the physiological standard.

In the blood of experimental hens, band forms were found, which are normally absent in healthy animals. Presence of band forms, i.e., neutrocytosis, is the evidence of organism intoxication. On the 30th day of the experiment, in the blood of laying hens that received active coal feed additive in dosages of 400 and 800 g per ton of feed, only single stab forms were found.

Data on changes in mineral metabolism indicators in laying hens that received active coal feed additive was statistically processed and presented in a table.

Table 1: Indicators of mineral metabolism in laying hens that received active coal feed additive.

<table>
<thead>
<tr>
<th>Examination periods, days</th>
<th>Group</th>
<th>Phosphorus, millimoles per liter</th>
<th>Magnesium, millimoles per liter</th>
<th>Calcium, millimoles per liter</th>
<th>Potassium, millimoles per liter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before the experiment</td>
<td>1</td>
<td>2.5±0.2</td>
<td>1.7±0.09</td>
<td>6.6±0.5</td>
<td>9.1±1.07</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>3.2±0.2*</td>
<td>2.0±0.1*</td>
<td>9.3±0.6*</td>
<td>14.3±1.9*</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>3.0±0.1*</td>
<td>1.7±0.1*</td>
<td>6.8±1.0</td>
<td>18.8±2.3*</td>
</tr>
<tr>
<td></td>
<td>Reference</td>
<td>3.5±0.5</td>
<td>1.8±0.1</td>
<td>7.2±1.0</td>
<td>16.5±1.7</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>1.6±0.06*Δ</td>
<td>1.2±0.05*</td>
<td>4.6±0.5*</td>
<td>5.5±0.5*Δ</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>1.6±0.01*Δ</td>
<td>1.3±0.02*</td>
<td>5.6±0.2</td>
<td>6.2±1.0*</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>1.6±0.05*Δ</td>
<td>1.1±0.04*</td>
<td>6.4±0.5*Δ</td>
<td>5.2±0.05*Δ</td>
</tr>
<tr>
<td></td>
<td>Reference</td>
<td>1.2±0.07</td>
<td>1.1±0.06*</td>
<td>4.2±0.6</td>
<td>4.3±0.07</td>
</tr>
</tbody>
</table>

Note: in the table marked with * are cases of considerable differences (p<0.05) of indicators with experimental laying hens, as compared to the data obtained before the test, and with Δ - cases of significant differences of indicators with experimental laying hens as compared to the reference.

From the data shown in the table, it is clear that content of phosphorus in blood plasma of experimental hens in Group 1 changed as follows: before use of the preparation, this indicator was apocryphally above the norm. On the 15th day of treatment with the preparation in dosage of 200 g per ton of feed, phosphorus level was credibly higher compared to the data obtained before using the preparation, and above normal level, and on
the 30th day of experiment, it was credibly reduced. Compared to reference hens, phosphorus level in group 1 on day 15 and day 30 was credibly higher. Therefore, use of active coal feed additive in doses of 200 g per ton of feed resulted in marked increase in phosphorus content in blood plasma of experimental hens.

Phosphorus content in laying hens' blood plasma in case of using preparation dosage of 400 g per ton of feed was credibly higher than the reference level, and on day 30 it decreased but remained within the normal range. The data indicate changes in the amount of phosphorus in blood plasma when the dosage of 400 g per ton of feed was used.

Changes in phosphorus content in the blood of laying hens when the dosage of 800 g per ton of feed was used, had the following pattern: on the 15th day of the experiment it was not significantly different from that in reference hens, and on the 30th day it was credibly higher than that in reference hens, while remaining within the normal range.

Therefore, use of active coal additive in various dosages for experimental hens resulted in a marked increase in phosphorus level in blood plasma, which was particularly manifested in birds receiving the preparation in dosages of 200 and 400 g per ton of feed.

Changes in the level of magnesium in laying hens that received active coal feed additive were stable, and were not considerably different from that in reference hens. The highest values of this indicator were observed in hens treated with active coal feed additive in dosages of 200 and 400 g per ton of feed. Therefore, use of active coal feed additive does not reduce content of this macronutrient in laying hens.

When analyzing changes of calcium content in blood plasma of experimental hens, the following was found: the content level in all hens was above the normal range.

Use of the preparation resulted in a credible increase in potassium concentration on the 15th day of the experiment, which was especially marked in case of preparation dosage of 800 g per ton of feed, which is significantly above the reference level. The lowest potassium concentration was observed in laying hens in the reference group on the 30th day of experiment. Therefore, use of active coal additive does not lead to potassium removal from laying hens, its use stabilizes potassium exchange on the 30th day.

Thus, inference may be drawn that use of active coal feed additive in dosages of 200 and 400 g per ton of feed leads to stabilization of calcium and phosphorus, magnesium and potassium exchange in laying hens.

On the 15th day of the experiment, ALAT indicator in the group of hens treated with the preparation in the dosage of 400 g per ton of feed was higher than that in other experimental groups and the reference group. Its low content in blood indicates hepatic cirrhosis.

On the 30th day of the experiment, in groups of laying hens treated with dosages of 200, 400 and 800 g per ton of feed, AAT level was credibly higher than the data obtained before the experiment, i.e., use of the preparation in dosages of 200, 400 and 800 g per ton of feed increases AAT level in laying hens' blood.

The de Ritis rate in experimental hens before the experiment was 0.8 ±0.1 units/l, indicating hens' liver disease. On the 15th day of the experiment, the de Ritis rate in blood of hens treated with active coal feed additive in dosages of 200 and 400 g per t of feed was normalized, and was 1.3 ± 0.2 and 1.2 ± 0.2 units/l, respectively. In the experimental reference group, this indicator remained at the bottom limit of 0.9 ± 0.2 units/l. On the 30th day, the de Ritis rate in hens in experimental groups remained normal.

Therefore, active coal feed additive in dosages of 200 and 400 g per ton of feed encourages increasing the de Ritis rate in blood and possible prevention of liver diseases in laying hens.

**Conclusion:**

Thus, use of active coal feed additive for laying hens helps the following: positive influence on the overall clinical status of experimental hens; increase in egg production and eggs quality, normalization of band forms levels in laying hens' blood; stabilization of calcium-and-phosphorus, magnesium and potassium exchange [13], which is most likely due to ash residue in the additive; normalization of AAT and ALAT levels, increase in the de Ritis rate in hens' blood and possible prevention of liver diseases in laying hens [14].

1. Laying hens fed that received feed contaminated with mycotoxins had clinical signs of mycotoxicosis: depression and drowsiness, mucous membranes of the mouth, tongue, pharynx, and at the base of the beak has foci of necrosis, faeces were watery with traces of blood, lurching walk, motor dysfunction, ruffled, dim, dirty feathers, sometimes alopecia areas.

2. It was found that use of active coal feed additive in dosages of 200 g per ton of feed increases egg production by 8%, in dosage of 400 g per ton of feed - by 30%; in dosage of 800 g per m - by 5%. Average weight of eggs in the experimental group was, respectively, 54 g, 67 g, and 58 g. The change in average eggs weight was mainly due to the increase in the white.

3. Use of active coal feed additive in dosages of 200 and 400 g per ton of feed leads to stabilization of calcium and phosphorus, magnesium and potassium exchange and encourages increase in the de Ritis rate in laying hens.

4. The data obtained made it possible to develop a method of using active coal feed additive in order to increase productivity of laying hens.
REFERENCES