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# Influence of natural organic matter on chemical composition of broiler chicken carcass

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**Abstract**. Intensively developing poultry industry requires a constant search for new methodological approaches to increase not only quantity, but also quality of finished products. Due to the ban on the use of feed antibiotics, more and more research has been carried out aimed at the use of various growth stimulants of plant origin. In our research, a systematic analysis of the effect of vanillin at concentrations of 0.25 mg/kg of the main diet (group 1), 0.50 mg/kg (group 2) and 0.75 mg/kg (group 3) was carried out. The degree of influence was assessed by means of weekly weighing (live weight), determination of chemical composition, macro- and essential elements. The experimental data obtained showed that of all the concentrations of vanillin used, the most pronounced positive dynamics was observed after the use of 0.25 mg/kg of feed, since at the final stage average indicators of the final body weight in this group exceeded the control values by 22.16% ($p < 0.05$). Indicators of chemical composition indicated the maximum level of protein and ash residue against the background of the minimum values of water and fat in the studied biological samples. The studied indicators of the elemental status also indicated a positive effect of this concentration on percentage of accumulation with the maximum values of calcium, sodium and zinc. Therefore, vanillin at a dose of 0.25 mg/kg of the main diet can be recommended as an effective feed additive.

**Keywords:** vanillin, Arbor Acres cross, essential elements, live weight, meat quality

**Author Contributions**. All authors contributed equally to this manuscript. All authors read and approved the final manuscript.

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## Introduction

The early use of antibiotics to promote growth in poultry and manage gut microbiota was the norm. However, due to concerns about the potential for fatal effects on food animals and indirectly on humans, their use as feed additives is banned or regulated in several jurisdictions [1].

With introduction of new regulations on the control of quality of products received, various stimulants are used less and less on poultry farms, and there is a need to replace them with safer ones with similar effects [2]. Currently, poultry farming is the leading sector of animal husbandry consuming feed additives, ahead of pigs, ruminants and representatives of aquaculture. Along with the balancing components traditionally used in poultry feeding, various organic acids, essential oils [3], plant metabolites [4], medicinal herbs, indigestible fibers [5] and biologically active compounds of phytogenetics [6] are used.

Phytochemicals provide four major stimulation mechanisms such as improving feed composition, palatability, having antimicrobial activity and enhancing anabolic activity [7].

Many phenolic compounds found in foods and medicinal plants have shown interesting therapeutic potential and have attracted the attention of the pharmaceutical industry as promising pharmacologically active compounds for health promotion and disease prevention [8]. Vanillin is a phenolic aldehyde and is the second most popular flavoring agent after saffron, which is widely used in various industries: as a food additive in foods and beverages, a masking agent in pharmaceuticals, etc. [9]. Vanillin is obtained by natural extraction [10], chemical synthesis or tissue culture technology, and microbial synthesis [11, 12]. Vanillin has several beneficial properties for human and animal health, such as antioxidant activity, anti-inflammatory, antimutagenic, antimetastatic and antidepressant properties [13].

Vanillin is currently being actively studied as phytochemical with pronounced biological effects. In particular, it was established that vanillin enhances liver regeneration in a model of liver injury induced by thioacetamide [14], has a potent vasodilatory effect [15], reduces death of hippocampal neurons in rat models of global cerebral ischemia and improves motor function in mice after ischemia and reperfusion [16], has a neuroprotective effect in multiple neurological disorders and neuropathophysiological conditions [13, 17], has analgesic and anti-inflammatory effect in a wide range of inflammation models in mice, and its mechanisms of action include antioxidant effects and nuclear transcription factor-associated inhibition of proinflammatory cytokine production [18], significantly increases expression of aryl hydrocarbon receptor (AhR), and inhibition of AhR by its agonist can reverse protective effect of vanillin on cadmium-induced lung injury [19].

The modern literature presents data indicating the high potential of using vanillin as an inhibitor of pathogenic and opportunistic microorganisms. For example, vanillin and its derivative (4-((E)-(4-hydroxy-2-methylphenylimino)methyl)-2-methoxyphenol (MMF)) demonstrated clear inhibition of violacein and pyocyanin at subinhibitory concentrations, which indicates the presence of an anti-Quorum sensing (QS) effect in both compounds. MMF was able to inhibit formation of *Pseudomonas aeruginosa* biofilm at 125 μg/ml ($p < 0.05$), while vanillin did so at 250 μg/ml ($p < 0.05$), which indicates the activity of these compounds in relation to biofilm formation [20]. Also, anti-QS activity of vanillin in relation to *Staphylococcus epidermidis* was experimentally established, which reduced biofilm formation by 80% [21].

In poultry farming, vanillin is used as a feed additive (phytobiotic agent) both in pure form and as part of combined compounds. It was established that this additive stimulates key immune cells, making them more functionally effective, acts as an immunomodulator to enhance the ineffective and underdeveloped immune system of young chickens [2], reduces inflammation, improves the expression of tight junction proteins and intestinal barrier function and, thus, increases feed efficiency [22].

**The aim of the study** was to evaluate influence of various concentrations of vanillin used as feed additive to the starter and grower diet on assimilation of physiologically significant elements in broiler chickens.

## Materials and methods

100 seven-day-old broiler chickens (cross Arbor Acres), divided into 4 groups with $n = 25$ each were studied (Table 1). Feeding and watering of the birds was carried out by group method according to the recommendations of Russian Research and Technological Institute of Poultry Farming.

*Table 1*

**Experimental design**

| Group of broiler chickens | Basic diet | Vanillin in concentration, mg/kg | | |
|---|---|---|---|---|
| | | 0.25 | 0.50 | 0.75 |
| Control | + | | | |
| I group | + | + | | |
| II group | + | | + | |
| III group | + | | | + |
| Research methods | | | | |
| Determination of body weight dynamics | Body weight was monitored weekly by individual weighing in the morning before feeding (±1 g) during the control period (35 days) | | | |
| Determination of chemical composition (meat and meat products) | The chemical composition of meat and meat products was analyzed using standardized methods at the independent accredited Testing Center of the Federal Scientific Center of Biomedical Engineering of the Russian Academy of Sciences (GOST 51479—99. Method for determining the mass fraction of moisture, GOST 23042—86. Methods for determining fat, GOST 25011—81. Methods for determining protein, GOST R 53642—2009. Method for determining the mass fraction of ash | | | |

*Ending of table 1*

| Research methods | |
|---|---|
| Determination of elemental composition (feed, broiler chicken meat, offal) | The atomic emission and mass spectrometry method (ICP-AES and ICP-MS) was used on Elan 9000 (Perkin Elmer, USA) and Optima 2000 V (Perkin Elmer, USA) equipment |
| Animal care and experimental studies were performed in accordance with the instructions and recommendations of Russian regulations and the Guide for the Care and Use of Laboratory Animals (National Academy Press, Washington, D.C., 1996). During the studies, measures were taken to ensure minimum animal suffering and to reduce the number of experimental samples studied | |

**Statistical processing.** The results obtained in the studies were processed using Statistica 12.0 software package (Stat Soft Inc., USA). For statistical analysis, the parametric Student t-test was used.

## Results and discussion

In the experimental studies, we carried out a comprehensive assessment of the effect of different vanillin concentrations on mineralization. To achieve this goal, we determined chemical composition of carcasses (Fig. 1), growth dynamics (Fig. 2), and the content of macro (Table 2) and essential elements (Table 3) in tissues.

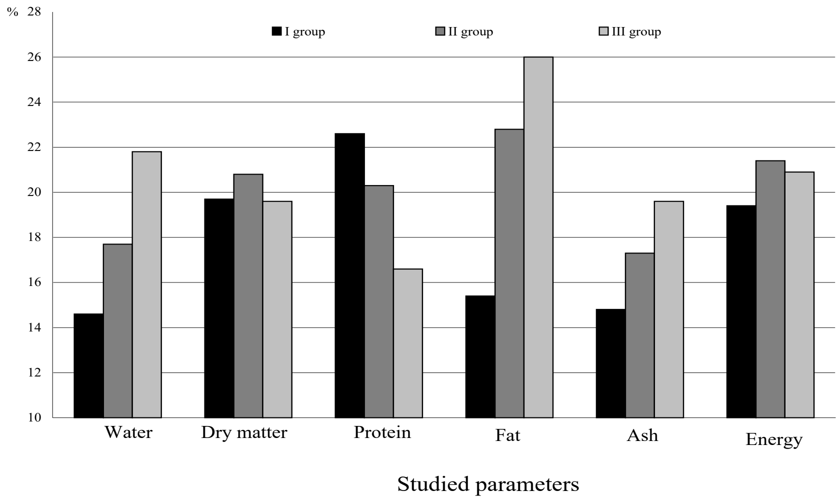


**Fig. 1.** Changes in chemical composition of broiler chicken carcasses compared to the control
*Source*: created by G.K. Duskaev , O.V. Kvan , Y.A. Sizentsov , M.Y. Kurilkina , B.S. Nurzhanov using Excel program

The obtained data (see Fig. 1) indicate a significant effect of the tested vanillin concentrations on chemical composition of broiler chicken carcasses, since all the studied parameters significantly exceeded the similar values of the intact group. It should be noted that content of water, fat and ash directly depends on the concentration of vanillin introduced into the diet ($p \leq 0.05$ in groups 1 and 3), while an inverse relationship was established with protein, due to a decrease in this indicator after increase in concentration of vanillin in the diet. The maximum dry matter and energy values were established in the group with the addition of vanillin at concentration of 0.50 mg/kg of feed and exceeded the control values by 20.8% ($p \leq 0.05$) and 21.4% ($p \leq 0.05$), respectively. Vanillin at a concentration of 0.75 mg/kg of the main diet significantly reduces protein level compared to other experimental groups and exceeds control values by 16.6% ($p \leq 0.05$), against 22.6% ($p \leq 0.05$) and 20.3% ($p \leq 0.05$) in the first and second experimental groups, respectively. Opposite data were obtained by foreign scientists in studies on feeding a mixture of essential oils (thymol and vanillin), which led to decrease in the content of intramuscular fat in chickens and an overall improvement in the fatty acid profile. Moreover, food additives with essential oils reduced lipid oxidation in cooked meat, while minor changes in color and lipid stability, microbial load in raw meat were observed [23].

The study of dynamic growth indices of broiler chickens (Fig. 2) indicates a pronounced effect of all tested concentrations on growth intensity compared to the similar indices of the intact group.

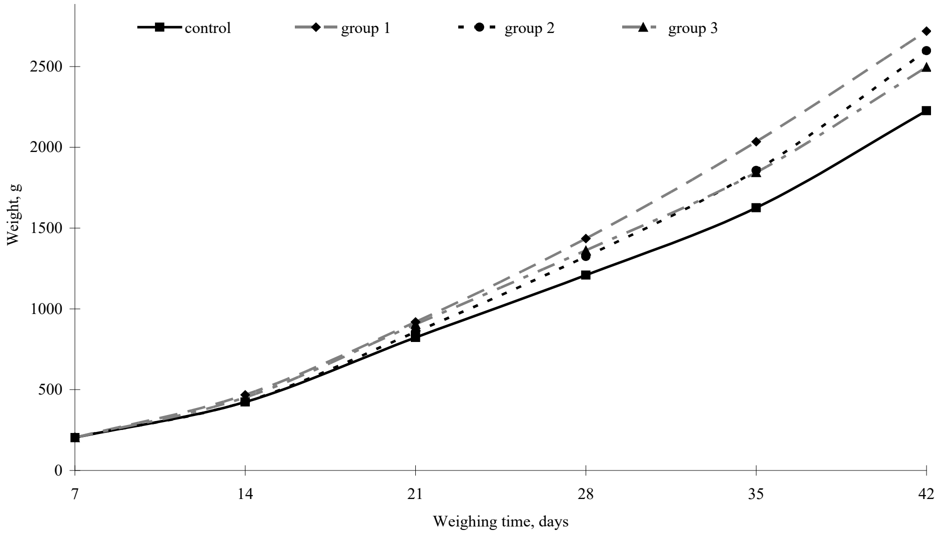


**Fig. 2.** Growth dynamics of broiler chickens

*Source*: created by G.K. Duskaev , O.V. Kvan , Y.A. Sizentsov , M.Y. Kurilkina , B.S. Nurzhanov using Excel program

The data presented in the graph (see Fig. 2) indicate that the maximum growth rates were recorded in the group using 0.25 mg vanillin/kg of the main diet feed starting from the 28th day of the experiment, with positive growth dynamics until the end of the experiment ($p \leq 0.05$) compared to the intact group. At the final stage, the average final body weight values exceeded the control values by 22.16% ($p \leq 0.05$) in the first, 16.71% ($p \leq 0.05$) in the second, and 12.14% in the third experimental groups. Summarizing the obtained data with the results shown in Fig. 1, it can be stated that introduction of vanillin at a dose of

0.25 mg/kg stimulates an increase in muscle mass. Similar data were obtained by Krauze M. et al., so chickens that received cinnamon oil in the amount of 0.25 ml/L had better growth rates, which was associated with beneficial effect of the drug on microbiome of small intestine, metabolism [24]. Our results are also consistent with the study, which found that when feeding a diet with vanillic acid (group I and II), an increase in live weight was observed throughout the experiment and a significant increase at the end of the experiment (by 8.2 … 8.5%; $p \leq 0.05$) compared to the control group [25].

Analysis of the effect of vanillin on the elemental composition included the determination of key macroelements (calcium, potassium, magnesium, sodium) (Table 2). The obtained data indicate a high degree of calcium absorption in the first and second experimental groups in all the studied samples, with the maximum level of accumulation after the use of additive — 0.25 mg vanillin/kg of feed: by 13.48% in pectoral muscle ($p \leq 0.05$), 16.94% in femoral muscle ($p \leq 0.05$) and 10.50% in liver ($p \leq 0.05$) compared to the control values.

*Table 2*

**Comparative analysis of the effect of different vanillin concentrations on macroelements content in tissues of experimental poultry and balance of absorption from feed**

| Objects of research | Elements | | | |
|---|---|---|---|---|
| | Ca | K | Mg | Na |
| Control group | | | | |
| Pectoral muscle | 0.178 ± 0.0041 | 10.965 ± 0.2554 | 0.894 ± 0.0208 | 1.371 ± 0.0319 |
| Femur muscle | 0.183 ± 0.0017 | 10.144 ± 0.0926 | 0.775 ± 0.0071 | 1.994 ± 0.0182 |
| Liver | 0.200 ± 0.0018 | 0.200 ± 0.0018 | 0.620 ± 0.0057 | 2.604 ± 0.0238 |
| Feed | 8.682 ± 0.0424 | 5.647 ± 0.027 | 1.530 ± 0.0075 | 2.661 ± 0.0130 |
| Litter | 30.563 ± 0.1491 | 19.128 ± 0.0933 | 6.160 ± 0.0301 | 4.338 ± 0.0212 |
| Intake balance | 0.462 ± 0.0279 | 0.669 ± 0.0404 | −0.298 ± 0.0180 | 2.606 ± 0.1574 |
| I experimental group (vanillin 0.25 mg/kg of feed) | | | | |
| Pectoral muscle | 0.202 ± 0.0030* | 12.686 ± 0.1867* | 0.982 ± 0.0145* | 1.912 ± 0.0281* |
| Femur muscle | 0.214 ± 0.0031* | 9.404 ± 0.1384* | 0.715 ± 0.0105* | 2.167 ± 0.0319* |
| Liver | 0.221 ± 0.0032* | 0.221 ± 0.0032* | 0.773 ± 0.0114* | 3.131 ± 0.0461* |
| Feed | 8.682 ± 0.0808 | 5.647 ± 0.0526 | 1.530 ± 0.0142 | 2.661 ± 0.0248 |
| Litter | 24.508 ± 0.2282* | 19.873 ± 0.1850* | 5.951 ± 0.0554* | 6.908 ± 0.0643* |
| Intake balance | 3.436 ± 0.1059* | 0.176 ± 0.0054* | −0.250 ± 0.0077* | 1.370 ± 0.0422* |
| II experimental group (vanillin 0.50 mg/kg of feed) | | | | |
| Pectoral muscle | 0.195 ± 0.0033* | 13.381 ± 0.2252* | 1.075 ± 0.0181* | 1.627 ± 0.0274* |
| Femur muscle | 0.207 ± 0.0035* | 9.496 ± 0.1598* | 0.750 ± 0.0126 | 1.738 ± 0.0293* |
| Liver | 0.210 ± 0.0035* | 0.210 ± 0.0035* | 0.718 ± 0.0121* | 2.975 ± 0.0501* |
| Feed | 8.682 ± 0.0781 | 5.647 ± 0.0508 | 1.530 ± 0.0138 | 2.661 ± 0.0239 |
| Litter | 24.228 ± 0.2180* | 20.488 ± 0.1843* | 6.433 ± 0.0579* | 6.431 ± 0.0579* |
| Intake balance | 6.798 ± 0.3347* | 2.203 ± 0.1085* | 0.182 ± 0.0090* | 2.552 ± 0.1256 |
| III experimental group (vanillin 0.75 mg/kg of feed) | | | | |
| Pectoral muscle | 0.169 ± 0.0022 | 12.105 ± 0.1563* | 0.958 ± 0.0124* | 1.572 ± 0.0203* |
| Femur muscle | 0.187 ± 0.0024 | 8.354 ± 0.1079* | 0.630 ± 0.0081* | 1.706 ± 0.0220* |
| Liver | 0.219 ± 0.0028* | 0.219 ± 0.0028* | 0.668 ± 0.0086* | 3.495 ± 0.0451* |
| Feed | 8.682 ± 0.0599 | 5.647 ± 0.0390 | 1.530 ± 0.0106 | 2.661 ± 0.0184 |
| Litter | 21.112 ± 0.1457* | 19.108 ± 0.1319 | 6.148 ± 0.0424 | 6.585 ± 0.0454* |
| Intake balance | 6.716 ± 0.5520* | 1.938 ± 0.1593* | 0.086 ± 0.0071* | 2.008 ± 0.1651* |

*Note.* * — $p \leq 0.05$.

Concentration of potassium in liver and pectoral muscles increased compared to the control by 15.70% in the first ($p \leq 0.05$), 22.03% in the second ($p \leq 0.05$) and 10.40% in the third ($p \leq 0.05$) experimental groups, however, it should be noted that the negative level of potassium accumulation in femoral muscle in the experimental groups was 7.30 % (p ≤ 0.05), 6.39% ($p \leq 0.05$) and 17.65% ($p \leq 0.05$).

The level of magnesium distribution in the studied samples has a dependence similar to potassium, due to higher accumulation rates in pectoral muscle in the experimental groups by 9.84% ($p \leq 0.05$), 20.25% ($p \leq 0.05$) and 7.16% ($p \leq 0.05$) due to decrease in this element in femoral muscle by 7.74% ($p \leq 0.05$), 3.23 and 18.71% ($p \leq 0.05$), respectively.

Sodium distribution in tissues has a common trend with calcium and had maximum accumulation level in the first experimental group by 39.46% in pectoral ($p \leq 0.05$) and 8.68% in femoral muscles ($p \leq 0.05$). In the second and third groups, the sodium content demonstrated increase in the pectoral muscle by 18.67% ($p \leq 0.05$) and 14.66% ($p \leq 0.05$), along with decrease in femoral muscle by 12.84% ($p \leq 0.05$) and 14.44% ($p \leq 0.05$) compared to the indicators of the intact group, respectively.

Summarizing the results of the effect of different concentrations of vanillin used as a feed additive on the level of macroelements in biological samples, it should be noted that the highest accumulation rates of two of the four elements were recorded in the group using 0.25 mg vanillin/kg of feed. Even though the concentration of potassium and magnesium in this group was lower than the indicators of the second group, it still exceeded the total values in the intact group by 4.70 and 7.91%, respectively.

Analysis of the distribution of essential elements (iron, copper, zinc, manganese (Table 3) indicates a significant effect of vanillin on their absorption. Similar results were previously reported, according to which inclusion of 1% basil in the diet contributed to an increase in zinc in meat by 13.48%, and in samples with thyme and sage — by 7.81 and 7.59% compared to the control. In the thigh part of broilers, a slight increase in iron concentration was also noted [26].

*Table 3*

**Comparative analysis of the influence of different vanillin concentrations on content of essential elements in tissues of experimental poultry and balance of absorption from feed**

| Objects of research | Elements | | | |
|---|---|---|---|---|
| | Fe | Cu | Zn | Mn |
| Control group | | | | |
| Pectoral muscle | 0.292 ± 0.0068 | 1.187 ± 0.0276 | 15.371 ± 0.3579 | 0.735 ± 0.0171 |
| Femur muscle | 0.319 ± 0.0029 | 1.709 ± 0.0156 | 35.004 ± 0.3195 | 1.594 ± 0.0146 |
| Liver | 1.033 ± 0.0094 | 11.428 ± 0.1043 | 90.057 ± 0.8221 | 9.663 ± 0.0882 |
| Feed | 6.043 ± 0.0295 | 19.416 ± 0.0947 | 71.066 ± 0.3468 | 112.066 ± 0.5468 |
| Litter | 11.834 ± 0.0577 | 67.716 ± 0.3304 | 448.610 ± 2.1890 | 484.266 ± 2.3630 |
| Intake balance | 4.946 ± 0.2987 | 1.345 ± 0.0812 | −93.423 ± 5.6420 | −38.004 ± 2.2952 |

*End of the table 3*

| Objects of research | Elements | | | |
|---|---|---|---|---|
| | Fe | Cu | Zn | Mn |
| **I experimental group (vanillin 0.25 mg/kg of feed)** | | | | |
| Pectoral muscle | 0.260 ± 0.0038* | 1.487 ± 0.0219* | 18.941 ± 0.2788* | 0.734 ± 0.0108 |
| Femur muscle | 0.196 ± 0.0029* | 1.592 ± 0.0234* | 48.676 ± 0.7165* | 0.799 ± 0.0118* |
| Liver | 1.187 ± 0.0175* | 12.226 ± 0.1800* | 88.370 ± 1.3008 | 11.505 ± 0.1693* |
| Feed | 6.043 ± 0.0563 | 19.416 ± 0.1808 | 71.066 ± 0.6616 | 112.066 ± 1.0433 |
| Litter | 9.234 ± 0.0860* | 70.908 ± 0.6601* | 798.243 ± 7.4312* | 488.975 ± 4.5521 |
| Intake balance | 6.490 ± 0.1999* | −0.745 ± 0.0230* | −284.835 ± 8.776* | −46.043 ± 1.4187* |
| **II experimental group (vanillin 0.50 mg/kg of feed)** | | | | |
| Pectoral muscle | 0.475 ± 0.0080* | 1.401 ± 0.0236* | 15.488 ± 0.2607 | 0.922 ± 0.0155* |
| Femur muscle | 0.224 ± 0.0038* | 1.862 ± 0.0313* | 39.135 ± 0.6587* | 1.012 ± 0.0170* |
| Liver | 1.382 ± 0.0233* | 10.447 ± 0.1758* | 85.232 ± 1.4347* | 9.968 ± 0.1678 |
| Feed | 6.043 ± 0.0544 | 19.416 ± 0.1747 | 71.066 ± 0.6394 | 112.066 ± 1.0083 |
| Litter | 12.883 ± 0.1159* | 80.522 ± 0.7245* | 478.905 ± 4.3089* | 538.816 ± 4.8479* |
| Intake balance | 6.601 ± 0.3250* | 2.842 ± 0.1399* | −76.046 ± 3.7437* | −18.358 ± 0.9037* |
| **III experimental group (vanillin 0.75 mg/kg of feed)** | | | | |
| Pectoral muscle | 0.381 ± 0.0049* | 2.167 ± 0.0280* | 16.485 ± 0.2128* | 0.966 ± 0.0125* |
| Femur muscle | 0.306 ± 0.0040* | 1.804 ± 0.0233* | 36.919 ± 0.4766* | 1.055 ± 0.0136* |
| Liver | 0.944 ± 0.0122* | 11.057 ± 0.1427 | 78.573 ± 1.0144* | 9.938 ± 0.1283 |
| Feed | 6.043 ± 0.0417 | 19.416 ± 0.1340 | 71.066 ± 0.4904 | 112.066 ± 0.7733 |
| Litter | 12.366 ± 0.0853* | 75.316 ± 0.5197* | 518.861 ± 3.5805* | 500.293 ± 3.4523* |
| Intake balance | 5.729 ± 0.4709 | 2.314 ± 0.1905* | −101.497 ± 8.3418 | −16.300 ± 1.3407* |

*Note*. *— $p \leq 0.05$.

It should be noted that the maximum concentrations of all the elements studied were recorded in liver tissues, several times exceeding accumulation level in pectoral and femoral muscles.

Iron distribution in the studied samples indicates an ambiguous effect of different vanillin concentrations on accumulation level of this element. In all tested groups, decrease in Fe in femoral muscle was recorded: by 38.56% in the first ($p \leq 0.05$), 29.78% in the second ($p \leq 0.05$) and 4.08% in the third ($p \leq 0.05$) groups compared to the control. The fixation level of this element in pectoral muscle had negative accumulation values at vanillin concentration of 0.25 mg/kg of feed by 32.88% ($p \leq 0.05$) compared to the intact chickens. With increase in vanillin dose to 0.50 mg/kg, iron concentration in pectoral muscle had maximum values and exceeded the control by 62.67% ($p \leq 0.05$).

Copper content in the studied samples also indicates a significant effect of vanillin at concentration of 0.50 mg/kg and 0.75 mg/kg of feed on accumulation of this element in tissues, so the maximum level of Cu in pectoral muscle was recorded in the third experimental group and amounted to an average of 2.167 mg/kg, which was 82.56% higher than the intact group.

The maximum zinc content in the studied samples was recorded in the first experimental group with increase in concentration by 23.23% in pectoral ($p \leq 0.05$) and 39.06% in femoral ($p \leq 0.05$) muscles, compared to the control. Vanillin concentrations of 0.50 mg/kg and 0.75 mg/kg of feed also have positive effect on zinc accumulation in pectoral and femoral muscles, exceeding the control values by 0.76 and 11.80% ($p \leq 0.05$) in the second and 7.25% ($p \leq 0.05$) and 5.47% ($p \leq 0.05$) in the third groups, respectively.

Analysis of manganese content in the studied samples of all tested groups indicates the effect of vanillin in concentrations of 0.50 and 0.75 mg/kg of feed on accumulation of this element in pectoral muscle by 25.44% ($p \leq 0.05$) and 31.43% ($p \leq 0.05$) in comparison to the control values, in the first experimental group this indicator was almost identical to the values of the intact group. In femoral muscle, manganese content had negative values compared to the control by 49.88% in the first ($p \leq 0.05$), 36.51% in the second ($p \leq 0.05$) and 33.81 % in the third ($p \leq 0.05$) groups. Previous studies have shown that the combined inclusion of probiotic *Bacillus cereus* and coumarin in the diet of birds contributed to increase in greater number of chemical elements in the liver (Ca, K, Mg, Mn, Si and Zn) and breast muscles (Ca, Na, Co, Cu, Fe, Mn, Ni and Zn) [27], which may also be associated with the ability of phytochemicals to exhibit synergism [28, 29].

Summarizing the results of the effect of vanillin on accumulation of essential elements in the body of broiler chickens, it should be noted that there was a pronounced stimulation of zinc biosorption mechanisms in all experimental groups with a maximum level against the background of 0.25 mg of vanillin per kg of feed. The distribution of the remaining elements does not have a general tendency to increase or decrease in all the studied tissues, however, the minimum concentration of vanillin has a negative effect on manganese accumulation, as evidenced not only by a decrease in the level of this element in muscle tissue, but also by the maximum values of the negative balance of Mn intake into the body.

## Conclusions

The conducted analysis of efficiency of using vanillin as a feed additive indicates a high potential for its use as phytogenic growth stimulator. The vanillin concentrations studied during the experiment had a pronounced effect on both growth indices and chemical composition. The maximum dynamic growth indices and qualitative characteristics of the chemical composition were established against the background of using 0.25 mg of vanillin per kg of the main diet. Thus, the pre-slaughter body weight in this group had maximum values among the experimental groups and exceeded the control values by 22.16% ($p \leq 0.05$), against 16.71% ($p \leq 0.05$) in the second and 12.14% in the third groups. Analysis of chemical composition also indicates a beneficial effect of the minimum tested dose of vanillin on the body of broiler chickens. Thus, against the background of minimal indicators of water and fat in the carcass, maximum concentrations of protein and ash residue were recorded.

The study of the level of accumulation of macro and essential elements also shows that the minimum concentration of vanillin has the most beneficial effect on accumulation of most of the studied elements with the maximum level of calcium, sodium and zinc in muscle tissue.

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# Оценка влияния природного органического вещества на химический состав тушки цыплят-бройлеров

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**Аннотация.** Интенсивно развивающаяся отрасль птицеводства требует постоянного поиска новых методических подходов для увеличения не только количества, но и качества готовой продукции. На фоне запрета использования кормовых антибиотиков проводится все больше исследований, направленных на использование различных стимуляторов роста растительного происхождения. Проведен системный анализ влияния введения в корм ванилина в концентрациях 0,25 мг/кг основного рациона (I опытная группа), 0,50 мг/кг (II опытная группа) и 0,75 мг/кг (III опытная группа). Степень влияния оценивали посредством еженедельного взвешивания (живая масса), определения химического состава, а также макро- и эссенциальных элементов. Совокупность полученных экспериментальных данных показала, что наиболее выраженная положительная динамика наблюдается на фоне применения концентрации ванилина 0,25 мг/кг корма, так как на заключительном этапе средние показатели конечной массы тела в соответствующей группе превышали контрольные значения на 22,16 % ($p \leq 0{,}05$). Показатели химического состава свидетельствуют о максимальном уровне протеина и зольного остатка на фоне минимальных значений воды и жира в исследуемых биологических образцах. Исследуемые показатели элементного статуса также свидетельствуют о положительном влиянии данной концентрации на процент накопления с максимальными значениями содержания кальция, натрия и цинка. Результаты исследования позволяют с высокой долей уверенности рекомендовать ванилин в дозе 0,25 мг/кг основного рациона в качестве эффективной кормовой добавки.

**Ключевые слова:** ванилин, кросс Арбор Айкрес, эссенциальные элементы, живая масса, качество мяса

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