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# MORPHOLOGY OF YOUTH AND BROILER CHICKENS THAT RECEIVED VILOMIX AND SUVAR FODDER ADDITIVES

***Abstract:*** *This article presents data taken from young hens and laying hens of the Highsex White and Highsex Brown egg-laying breeds. For the study, three experimental groups of 60 birds were formed, with the first two being experimental groups and the third being a control group. In the context of the active development of the poultry industry in agriculture, feeding is one of the most important factors in High productivity and product quality in poultry flocks largely depend on effective management practices. In intensive poultry production, nutrition and feed supplementation are critical determinants of productive and reproductive performance. However, stress-related factors can adversely impact birds, leading to declines in egg yield and live weight gain. One of the most significant contributors to reduced productivity and compromised product quality is the presence of mycotoxins in feed.The results of the conducted studies showed that the feed additives «Vilomiks» and «Suvar» increase the hemoglobin content and lysozyme activity in the bird's blood, within the physiological norm, compared to the control group of chickens, which indicates an increase in the nonspecific resistance of the young and laying hens in industrial poultry farming. By the age of six months, the hemoglobin level increased and reached a value of 103.13±1.46** g/l in the first experimental group, 96.50±1.12** g/l (P<0.01) in the second compared with the control, and lysozyme activity in the blood serum of chickens varied depending on the age of the bird in 6 months, respectively 5.3±0.03***% (P<0.001) and 5.19±0.02**% (P<0.01).*

*Key words: feed additives, poultry nutrition, hematological parameters, hemoglobin concentration, lysozyme activity, nonspecific resistance, laying hens.*

## Introduction

Adequate nutrition is one of the fundamental prerequisites for the normal growth, development, and productive performance of farm animals and poultry. The physiological development of birds largely depends on the quality and availability of feed, which are among the key factors influencing management practices, health status, and productivity [1,3]. Under current economic conditions in the Russian Federation and the Republic of Kazakhstan, particular attention is being paid to factors that may adversely affect the efficiency of agricultural production [1,2]. Therefore, the development of innovative approaches aimed at improving the profitability of livestock and poultry farming through cost-effective production methods remains highly relevant. This study focuses on evaluating the effectiveness of the feed additives «Vilomik» and «Suvar» when included in the diets of laying hens under different feeding regimens, with the objective of prolonging the productive lifespan of the birds. At present, understanding the mechanisms by which premixes exert their biological effects remains a major area of research worldwide. Previous studies have shown that trace elements and enzymes contained in feed additives can exert systemic effects on the organism by enhancing nonspecific resistance, thereby increasing the resistance of both young and adult birds to infectious diseases [4,8,10]. Given the limited information available regarding the physiological and pathological responses of pullets and laying hens to the dietary supplementation. In view of the important role of nutrition in regulating physiological responses and the potential benefits associated with the feed additives «Vilomik» and «Suvar,» the present study was designed to examine hematological and serum biochemical characteristics in young and laying hens fed diets supplemented with these additives. With the rapid development of the poultry industry, feeding is one of the main factors affecting the productivity of poultry.

In modern intensive poultry production systems, properly balanced nutrition is a key factor in maintaining high productive performance and ensuring optimal reproductive characteristics of poultry [5,6,11]. Exposure to various stressors can negatively affect birds, resulting in reduced egg production and lower body weight gain. Among these stress factors, the consumption of feed contaminated with

mycotoxins is  presence of mycotoxins in feed is considered a significant cause of production losses and quality deterioration. Moreover, exposure to environmental toxicants can lead to the bioaccumulation of harmful substances in animal tissues, thereby impairing health and productive efficiency. Therefore, considerable attention is being directed toward the development of strategies that enhance the adaptive capacity and resistance of animals to unfavorable environmental and management-related factors [14,15].

Relevance and purpose of the study. Despite the existence of a significant number of studies devoted to the use of feed additives, the issues of their influence on immunobiochemical blood parameters in laying hens remain insufficiently studied [8,9]. Of particular interest is the study of lysozyme activity as one of the key factors of the body's non-specific resistance [10,12].

The purpose of the study is to investigate the effect of feed additives «Vilomiks» and «Suvar» on the morphological and immunobiochemical parameters of the blood of laying hens. Lysozyme is one of the key components is recognized as an important element of the innate immune system, participating in the early defense against infectious agents and other foreign substances. the protection of animals and poultry against infectious agents. Owing to its hydrolytic, bacteriostatic, and bactericidal properties, as well as its capacity to stimulate phagocytic activity, promote the proliferation of T- and B-lymphocytes and fibroblasts, and enhance antibody production, lysozyme contributes significantly to the maintenance of immune homeostasis. Therefore, the assessment of lysozyme activity serves as a valuable indicator for evaluating the effectiveness of defense mechanisms and the immune status of animals and poultry.

**Research materials and methods.**

The study was conducted through scientific and production experiments involving clinically healthy young and laying hens of the Hysex White and Hysex Brown egg-laying breeds. Three groups, each consisting of 60 birds, were established: two experimental groups and one control group. Prior to the initiation of the main experiment, the general health and production status of the poultry farm were evaluated, and samples were collected for histological and histochemical analyses. Birds in the first experimental group received the feed additive «Vilomix» in addition to the The first experimental group was fed the standard ration supplemented with «Vilomik,» whereas the second experimental group received the standard ration supplemented with «Suvar.» Birds in the control group were maintained on the basal diet without the inclusion of feed additives. For each experimental period, ten birds were randomly selected from the 1-, 2-, 3-, 5-, and 6-month age groups for blood sampling. To assess the physiological and immune status of the birds, blood samples were collected for the determination of hemoglobin concentration and serum lysozyme activity. The level of natural resistance in young and laying hens was characterized using these indicators, with hemoglobin reflecting hematological status and serum lysozyme activity representing a key component of the innate, nonspecific defense system. being measured by the nephelometric method. Before the main experimental phase, the baseline status of natural resistance in chickens aged 1, 2, 3, 4, 5, and 6 months reared under industrial production conditions was assessed. For this purpose, hematological and histological examinations were performed. Hematological parameters were considered the primary indicators of physiological reactivity and nonspecific resistance in the birds.

The following parameters were evaluated:

1. Hemoglobin concentration (g/L);
2. Serum lysozyme activity (%).

**Results**

The hemoglobin concentrations observed during the study are presented in Table 1. As shown in the table, only minor differences in hemoglobin levels were detected between the first and second experimental groups at 1 and 2 months of age. However, by 3 months of age, the values became more comparable between the groups. In the first experimental group, hemoglobin concentration increased with age from 86.25±0.52** g/L to 96.00±0.73** g/L (P<0.01). Similarly, in the second experimental group, the corresponding values increased from 83.38±0.40** g/L to 92.25±0.39** g/L (P<0.01). A further increase in hemoglobin concentration was recorded as the birds matured. By six months of age, hemoglobin levels reached 103.13±1.46** g/L Compared with the control group, both experimental groups demonstrated significantly higher hemoglobin concentrations, reaching 95.33 ± 0.89 g/L in the first group and 96.50 ± 1.12 g/L in the second group (P < 0.01). The findings demonstrated a progressive increase in blood hemoglobin concentration as the birds matured, indicating an age-dependent trend during growth and development. An exception was noted at four months of age, when hemoglobin levels did not follow the general pattern of increase (Figure 1).

Table 1 – Hemoglobin content in poultry blood, M±m

| Age, months | Group, g/L | | |
|---|---|---|---|
| | I | II | control |
| 1 | 85,75±0,52* | 82,68±0,40* | 81,83±0,59 |
| 2 | 86,83±1,12* | 86,75±0,66* | 82,63±0,60 |
| 3 | 95,80±0,73* | 91,85±0,39* | 82,68±0,49 |
| 4 | 92,73±1,58* | 90,75±0,80* | 86,60±0,49 |
| 5 | 98,38±1,34* | 95,88±0,53* | 86,88±0,43 |
| 6 | 104,13±1,46* | 95,60±1,12* | 88,75±1,03* |

Note: * – p<0.05; ** – p<0.01; *** – p<0.001 in comparison with the control.

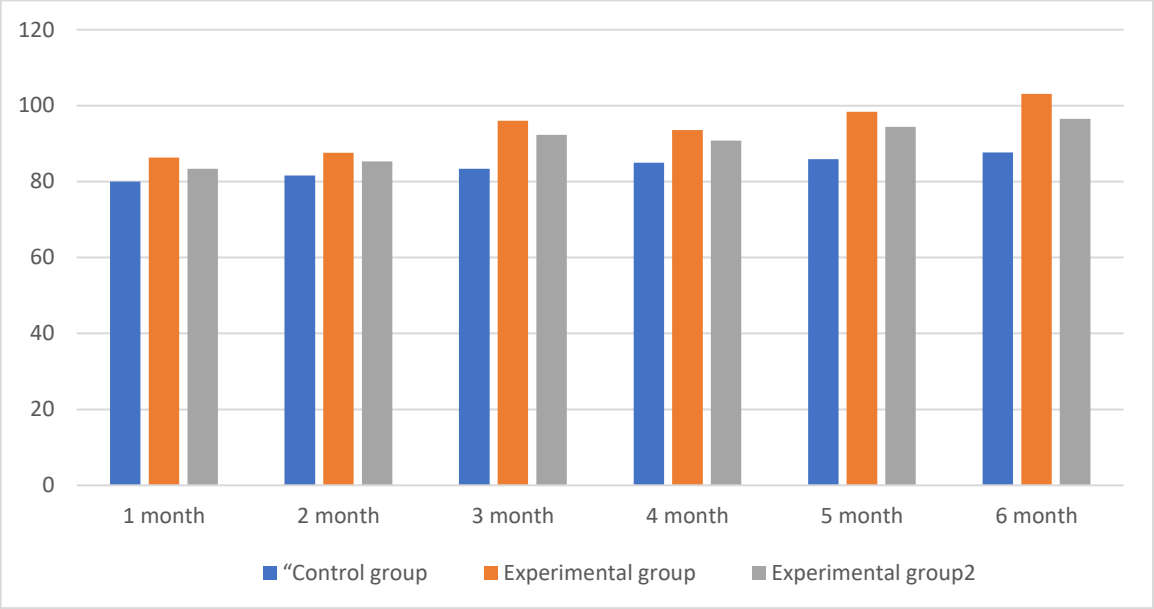


Figure 1 – Changes in blood hemoglobin concentration of poultry receiving the feed additives «Vilomix» and «Suvar» relative to the control group

Analysis of the data presented in Table 2 indicates that serum lysozyme activity in chickens varied according to the age of the birds. Age-related changes were observed throughout the study period, suggesting that lysozyme activity is influenced by the physiological development of the chickens. Thus, at the age of three months, it was 6.56±0.03** % (P<0.01) in the first experimental group compared to the control, and 6.45±0.09 % in the second experimental group; by the age of four months, it decreased by 1.24% Compared with the reference value, the increase amounted to 0.87% in the first experimental group and 1.19% in the second experimental group. At five months, the lysozyme activity of the birds was 5.01±0.03***% (P<0.001), compared to the control, and 4.95±0.02**% (P<0.01) in the second experimental group; at six months, it was 5.3±0.03***% (P<0.001) and 5.19±0.02**% (P<0.01), respectively (Figure 2)

Table 2 – Lysocyme activity in poultry blood, M±m

| Age, months | Group, g/L | | |
|---|---|---|---|
| | I | II | control |
| 1 | 5,28±0,07 | 5,03±0,09 | 4,88±0,21 |
| 2 | 5,66±0,13 | 5,76±0,09 | 5,49±0,08 |
| 3 | 6,52±0,03** | 6,55±0,09 | 6,55±0,04 |
| 4 | 5,31±0,03 | 5,26±0,03 | 5,29±0,02 |
| 5 | 5,11±0,03*** | 4,95±0,02** | 4,89±0,02 |
| 6 | 5,3±0,03*** | 5,19±0,02** | 5,09±0,02 |

Note: * – p<0.05; ** – p<0.01; *** – p<0.001 in comparison with the control.

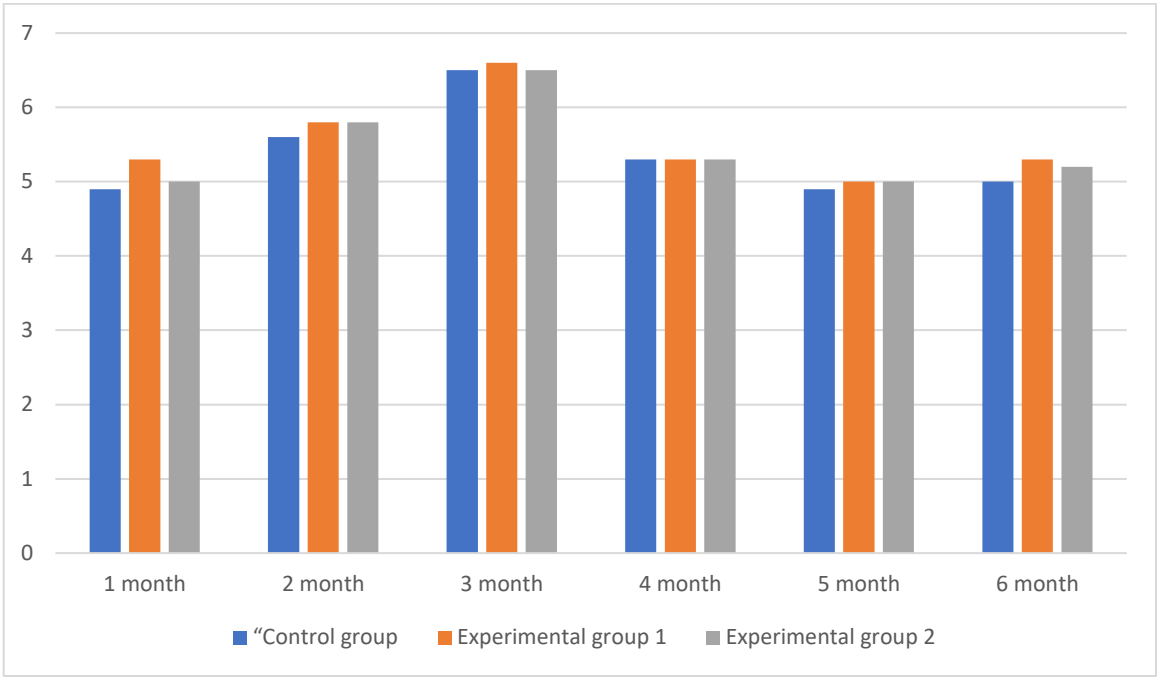


Figure 2 – Dynamics of lysozyme activity increase (%) in experimental and control poultry.

The evaluation of hematological parameters is considered one of the most informative diagnostic approaches for assessing the functional status of hematopoietic organs and the physiological response of birds to various environmental and nutritional factors [7,9]. The hematological indicators assessed in this study remained within the established physiological reference ranges for both young and laying hens, indicating that no significant pathological abnormalities were detected. At the same time, notable differences were identified between the experimental and control groups, suggesting that supplementation with the feed additives influenced metabolic activity and immune function in the birds. These findings indicate a positive effect of the tested feed additives on the physiological condition and nonspecific resistance of poultry [8,10,11]. The analysis of lysozyme activity showed an increase by the end of the experiment, especially in the group that received the feed additive «Vilomiks» [12,13]. This indicates an increase in the factors of non-specific resistance and a more pronounced activation of the body's defense mechanisms compared to the «Suvar» group and the control group.

**Discussion**

The obtained results indicate a positive effect of feed additives on the morphological and immunobiochemical parameters of poultry blood [8]. An increase in the level of hemoglobin indicates an improvement in the oxygen transport function of blood and an intensification of metabolic processes, which is especially important in industrial farming. An increase in lysozyme activity reflects an enhancement of innate immunity factors and an increase in the body's nonspecific resistance. A more pronounced effect when using the Vilomix feed additive may be due to the optimal ratio of biologically active components that stimulate the immune system and metabolism, which is consistent with the findings of modern research.

The results indicate that the inclusion of «Vilomiks» and «Suvar» in the diet positively influenced the physiological condition of young and laying hens, promoting higher hemoglobin levels and greater lysozyme activity without exceeding physiological reference limits. This indicates an increase in metabolic processes and non-specific resistance of the organism. The most pronounced effect was observed when using the «Vilomiks» additive, which allows it to be recommended for increasing the stability and productivity of poultry in industrial poultry farming.

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Vilomix және Suvar азықтық қоспаларын қабылдаған жас және бройлер тауықтарының морфологиясы

*Бұл мақалада жұмыртқа бағытындағы Хайсекс-уайт және Хайсекс-браун тұқымдарының жас және жұмыртқа салатын тауықтарынан алынған мәліметтер келтірілген. Зерттеу жүргізу үшін әрқайсысында 60 құстан тұратын үш топ құрылды: алғашқы екі топ тәжірибелік, ал үшінші топ бақылау тобы ретінде пайдаланылды. Құс шаруашылығының ауыл шаруашылығындағы қарқынды дамуы жағдайында азықтандыру құстардың жоғары өнімділігі мен сапалы мал басын қалыптастырудың негізгі факторларының бірі болып табылады. Өнеркәсіптік құс өсіру жүйесінде теңгерімді азықтандыру рационы мен жемшөп қоспаларын қолдану құстардың өнімділік көрсеткіштерін арттыруда және олардың репродуктивтік қасиеттерін жақсартуда маңызды рөл атқарады. Құстардағы стресс факторлары жұмыртқа өндірісінің төмендеуіне және тірі массаның өсуіне әкеледі. Атап айтқанда, микотоксиндермен ластанған жемді пайдалану өнімнің жетіспеуінің және оның сапасының нашарлауының негізгі себептерінің бірі болып саналады. Жүргізілген зерттеулердің нәтижелері көрсеткендей, «Виломикс» және «Сувар» жемшөп қоспалары бақылау тобындағы тауықтармен салыстырғанда құс қанындағы гемоглобин мен лизоцимдік белсенділіктің физиологиялық норма шегінде жоғарылайды, бұл өнеркәсіптік құс шаруашылығындағы жас және жұмыртқа салатын тауықтардың ерекше емес төзімділігінің жоғарылауын көрсетеді. Құстың алты айлық жасына қарай гемоглобин деңгейі жоғарылап, бірінші тәжірибелік топта 103,13±1,46** г/л мөлшеріне жетті, бақылаумен салыстырғанда екіншісінде 96,50±1,12** г/л (P<0,01), сондай-ақ тауықтардың қан сарысуындағы лизоцимдік белсенділік құстың жасына байланысты 6-да өзгерді ай сәйкесінше 5,3±0,03***% (P<0,001) және 5,19±0,02**% (P<0,01).*

***Түйін сөздер:*** *жемшөп қоспалары, гематология, гемоглобин, лизоцим белсенділігі, жұмыртқа салатын тауықтар*

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**Морфология молодняка и бройлерных цыплят, получавших кормовые** добавки Vilomix и Suvar

*Исследования проводились на молодняке и курах-несушках яичного направления кроссов Хайсекс Уайт и Хайсекс Браун. В эксперимент были включены три группы птицы по 60 голов: две опытные и одна контрольная. В современных условиях интенсивного развития птицеводческой отрасли полноценное кормление имеет решающее значение для реализации генетического потенциала птицы, повышения её продуктивности и сохранения высокого качества поголовья. Существенное влияние на продуктивные и репродуктивные показатели птицы оказывают рацион кормления и применение кормовых добавок. Воздействие различных стрессовых факторов негативно отражается на продуктивности птицы, приводя к снижению яйценоскости и замедлению прироста живой массы. Одним из существенных факторов, ограничивающих эффективность производства, является использование кормов, загрязнённых микотоксинами, что способствует сокращению объёмов получаемой продукции и ухудшению её качественных показателей.*

*Применение кормовых добавок «Виломикс» и «Сувар» оказало благоприятное влияние на гематологические и иммунобиологические показатели птицы. По сравнению с контрольной группой у молодняка и кур-несушек опытных групп отмечено увеличение уровня гемоглобина и лизоцимной активности крови, не выходящее за пределы физиологической нормы, что свидетельствует об усилении неспецифической резистентности организма. К шестимесячному возрасту содержание гемоглобина достигло 103,13±1,46 г/л в первой опытной группе и 96,50±1,12 г/л во второй опытной группе (P<0,01). Лизоцимная активность сыворотки крови также возрастала с возрастом птицы и к шести месяцам составляла 5,3±0,03 % (P<0,001) и 5,19±0,02** % (P<0,01). Полученные данные свидетельствуют о положительном влиянии исследуемых кормовых добавок на гематологические показатели и естественную резистентность птицы.*

***Ключевые слова:*** *кормовые добавки, гематологические показатели, гемоглобин, лизоцимная активность, куры-несушки, неспецифическая резистентность, птицеводство.*

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## ENVIRONMENTALLY SAFE APPROACHES TO THE CONTROL OF VARROATOSIS IN HONEY BEE COLONIES

***Abstract:*** *Varroatosis caused by the ectoparasitic mite Varroa destructor remains one of the most important biological threats to managed honey bee colonies. The aim of this review was to summarize environmentally safe approaches to Varroa destructor control and to evaluate them according to acaricidal efficacy, ecological safety, colony productivity, practical applicability, and suitability for integrated pest management. Publications from 2021 to 2025 were analyzed, with priority given to peer-reviewed studies on chemical acaricides, organic acids, thermal treatment, biotechnical methods, acaricide resistance, and breeding for Varroa-tolerant honey bees. The reviewed evidence shows that amitraz-based chemical preparations can provide rapid mite reduction, but their sustainability is limited by residue risks and the development of acaricide resistance. Oxalic acid and thermal treatment showed the most balanced profile because they combine substantial mite reduction with low contamination risk and preservation of colony productivity. Biotechnical measures, including drone brood removal and brood interruption, are environmentally safe but are more effective as preventive or supportive components of a broader control program. The review concludes that sustainable varroatosis control should be based not on a single treatment but on integrated pest management that combines regular monitoring, threshold-based decision-making, ecologically safer treatments, resistance management, and selection of honey bee stocks with improved hygienic and grooming behavior.*

*Key words: Apis mellifera; Varroa destructor; varroatosis; oxalic acid; thermal treatment; integrated pest management; acaricide resistance; hygienic behavior.*

### Introduction

Honey bees (Apis mellifera) play an essential role in agricultural production, ecosystem stability, and food security because of their contribution to pollination and the production of honey, wax, propolis,