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ТҮЙІН

Мақалада қойлардың сальмонеллезді абарты бактерияларының эпизоотиялық өсінді изоляттарының биологиялық (культуралды, тинкториалды, морфологиялық, биохимиялық, антигендік) қасиеттері қоректік орталарға, Эндо, висмут-сульфитті агар дифференциалды-диагностикалық орталарға себу арқылы зерттеу нәтижелері берілген.

Сынама алу Алматы облысының 2 ауданының қой шаруашылықтарында жүргізілді, онда бұрын қойларда түсік тастау байқалған. Бактериологиялық әдіспен сальмонелла өсінділері бөлініп алынды - *Salmonella abortus-ovis* №1, №4 и *Salmonella abortus-ovis* (A), содан кейін колонияларды сатылы іріктеу әдісімен перспективалы эпизоотиялық сальмонелла штамдары таңдалынып алынды. Биологиялық қасиеттерін зерттеу үшін бактериялық массаны жинақтауды МПА-ның тығыз қоректік ортасында *Salmonella abortus-ovis* №1 және *Salmonella abortus-ovis* (A) себу жолымен жүргізілді.

Сальмонеллалардың *Salmonella abortus-ovis* № 1 және *Salmonella abortus-ovis* (A) эпизоотиялық өсінділері *Salmonella* тектес бактерияларға тән биологиялық қасиеттерге ие болды. Биохимиялық қасиеттері бойынша өсінділер *Salmonella abortus-ovis* 372 вирулентті бақылау штаммымен бірдей болды: күкіртті сутек құрады, индол түзбеді және желатинді сұйылтпады, лактоза, сахароза ферменттемеді.

Salmonella abortus-ovis № 1 және *Salmonella abortus-ovis* (A) эпизоотиялық өсінділерінің антигендік белсенділігін зерттеу жүргізілді. Сальмонелланың тәуліктік агар өсінділері О-ХІІ поливалентті сальмонеллездік сарысумен және О-IV, Н- с (1 фаза), 1,6 (2 фаза) сальмонеллездік сарысулармен агглютинацияланды. Агглютинация реакциясының (РА) нәтижелері бойынша қойдың биоматериалынан бөлініп алынған *Salmonella abortus-ovis* № 1 мен абортталған түсіктен бөлініп алынған *Salmonella abortus-ovis* (A) эпизоотиялық өсінділерінің антигендік қасиеттері *Salmonella abortus-ovis* 372 бақылау вируленттік штаммымен бірдей болды.

Культуралды-морфологиялық, биохимиялық қасиеттерін, антигендік құрылымын зерттеу нәтижелері бойынша сальмонеллалардың бөлініп алынған эпизоотиялық 2 өсінділері (*Salmonella abortus-ovis* № 1 және *Salmonella abortus-ovis* (A)) *Salmonella abortus-ovis* В серологиялық тобына жатқызылған.

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BIOCHEMICAL BLOOD PARAMETERS OF BROILER CHICKENS WHEN USING A SILICEOUS ROCK ADDITIVE - OPOKA IN FEEDING

ANNOTATION

Understanding the digestive system and metabolic processes of broiler chickens is essential for optimizing productivity in poultry farming. Adequate energy and nutrient intake are necessary for maintaining life and enhancing productivity. Monitoring basic blood parameters can provide valuable insights into the overall health and immune function of the birds, as changes in protein composition are indicative of growth and development processes. The research was conducted on Ross-308 cross broiler chickens following a scientific and economic experiment design. Three groups were established: one control group and two experimental groups, each consisting of 50 birds. The experimental groups were comprised of day-old broiler chickens fed according to the cross's dietary recommendations. Our findings indicate that supplementing the main diet of broiler chickens with a mineral additive - opoka, while maintaining the nutritional value of protein and amino acids, positively impacted the blood protein profile, leading to increased total protein levels and its fractions. There were no significant differences in the biochemical parameters of blood serum between the experimental and control groups, demonstrating the safety and effectiveness of incorporating the mineral feed additive siliceous rock - opoka in broiler chicken diets.

Key words: *poultry farming, broiler chickens, opoka, blood, serum, protein, albumins, globulins, hemoglobin, erythrocytes, leukocytes*

Introduction. For enterprises engaged in poultry farming, enhancing the living conditions of poultry to boost production metrics and cut expenses is crucial. Consequently, a primary objective of veterinary science involves creating new strategies to prevent avian diseases. Utilizing different adaptogenic medications to bolster the birds' immune defenses serves as a potent strategy to diminish disease rates and augment productivity [1,2].

The blood biochemical indicators in broiler chickens serve as a gauge of their adaptive and protective capacities while their productive capabilities are being actualized. Analyzing these blood parameters enables the forecasting of productivity levels in poultry farming, the management of feed quality, and the prevention of potential metabolic imbalances. Notably, this research underscores that variations in metabolic activities are most prominently revealed by alterations in the blood's composition, which constitutes the body's internal milieu. [10,11].

Analyzing blood is a crucial method for diagnosis. Blood-forming organs respond acutely to a variety of physiological and, notably, pathological influences, making the blood profile a mirror of these effects. The blood's composition and characteristics vary based on the organism's physiological condition, as well as factors such as age, gender, diet, living conditions, microclimate, and the manner in which the bird is utilized. This information is instrumental in evaluating the organism's metabolic activity and health. The adoption of automated blood analysis techniques has been on the rise, offering more detailed insights into the organism's condition. The integration of these automated systems into clinical practice has significantly reduced errors and brought uniformity to blood examinations.

Mineral supplementation is crucial in animal husbandry. Disproportionate levels of these nutrients can lead to significant issues, including stunted growth in livestock, diminished productivity and fertility, disease onset, higher death rates, and compromised product quality. Ensuring that animals receive the right quantities and ratios of minerals, primarily through their diet, is essential for their well-being. The purpose of this research was to investigate the impact of adding diatomite, a type of sedimentary rock rich in silica, to broiler chicken feed on their blood's hematological and biochemical indicators.

Materials and methods. Numerous research findings indicate that the morphological and biochemical elements in blood can vary based on factors such as diet, habitat conditions, the animals' age, the time of year, and other environmental influences. Evaluating hematological parameters is vital for understanding the metabolic activities occurring within broiler chickens [6, 7]. Analyzing blood and biochemical markers enables the swift and precise identification of initial indicators of detrimental shifts in poultry health that may arise from incorporating novel mineral supplements into their feed, which have not been extensively researched.

The research was carried out within the university's premises using Ross-308 broiler chickens. Three distinct groups were formed, consisting of one control group and two groups for experimentation. The chicks were housed on the floor with free access to food and water. The environmental conditions, including lighting, temperature, and other microclimate factors, adhered to the prescribed norms. The broilers were nurtured until they attained 40 days of age.

Continuous surveillance was maintained over the chicks' health, encompassing assessments of their conduct, feeding patterns, plumage state, among other signs. The chicks were all in good clinical health, accommodated in floor-based cages, and provided with a well-rounded diet. Initially, the chicks weighed an average of 42 grams at the age of one day. In the experiment, the first group of broilers was given a conventional diet. The second group was fed a regular diet augmented with a 2.0% inclusion of a mineral additive derived from siliceous rock — diatomite. Meanwhile, the third group of chicks received a standard diet enhanced with diatomite at a 3.0% level, over a period of 40 days. Prior to initiating the experiment, a comprehensive blood analysis was conducted on all broiler groups to evaluate various hematological and biochemical markers. This analysis encompassed the quantification of hemoglobin levels, erythrocyte counts, leukogram compilation, and the measurement of total protein, in addition to the blood concentrations of macroelements and vitamins. Following the application of medical treatments, blood samples were collected from the avian wing vein for further examination. A hematological analyzer was employed to analyze the blood serum's biochemical parameters, adhering to the protocols specified by the "ZooDoctor" veterinary clinic. The blood serum analysis entailed evaluating the total protein and its fractions, levels of urea nitrogen and creatinine, and the concentrations of calcium and phosphorus.

Results and discussion. During the initial week of life, the variation in the broiler chicks' live weight and growth rate was minimal, with their weights spanning from **148.7 to 163.3 grams**, showcasing their uniformity. However, from the 14th day onward, the third experimental group's chicks began to exhibit a notably higher live weight, achieving **398.4 grams**. This pattern of increased weight gain in the chicks from the experimental groups, as opposed to the control group, persisted for the duration of their growth phase. By day 40, the broilers from the experimental groups outperformed the control group chicks in terms of live weight, surpassing them by **29.6 and 45.9 grams**, which translates to a growth enhancement of **1.3% and 2.1%**, respectively.

In the cultivation of broiler chickens, the live weight progression serves as a concrete measure of growth. To maximize the inherent potential of the "Ross-308" broiler breed, it's crucial to ensure a strong start, as the birds are genetically predisposed to a metabolic dominance during their development. This predisposition indicates a heightened demand within the tissues for nutrient and oxygen intake, coupled with an increased need for the elimination of metabolic byproducts. The circulatory and respiratory systems are the primary physiological networks activated to fulfill this dominant role established within the organism. The outcomes of the individual weigh-ins for the chicks across each group are compiled in Table 1.

The composition of blood is characterized by distinctive physicochemical attributes, encompassing both nutrients and metabolic byproducts. The levels of these substances can fluctuate based on a range of determinants, including the bird's physiological condition, its developmental stage, and the environmental parameters of nutrition and accommodation.

At the end of the experimental period, the analysis of blood and its serum did not reveal significant differences in the main indicators. The level of leukocytes in the chicks of all test groups corresponded to the norm, which is equal to $20-40 \times 10^9/L$: in the first control group, it was $21.2 \times 10^9/L$, in the second — $20.7 \times 10^9/L$, and in the third — $21.1 \times 10^9/L$. As for erythrocytes, their number in the chicks of the control group was $0.58 \times 10^{12}/L$ less than the norm ($2.42 \times 10^{12}/L$), in

the chicks of the second group — $0.92 \times 10^{12}/L$ less than the norm ($2.08 \times 10^{12}/L$), and in the chicks of the third group — $0.71 \times 10^{12}/L$ less than the norm ($22.29 \times 10^{12}/L$).

Table 1 – Changes in live weight of broiler chickens depending on age, g

Age, days	Experimental groups		
	Control I	Control II	Control III
1	42,4	43,9	44,6
7	148,7	162,5	163,3
14	379,8	392,7	398,4
21	742,3	757,8	762,9
28	1284,8	1302,5	1308,4
35	1836,6	1559,3	1868,9
40	2251,9	22,81,6	2297,9

The examination of protein metabolism revealed that incorporating a mineral additive like diatomaceous earth into the diet from the onset of the chicks' lives through to the conclusion of the growth period, while maintaining the levels of crude protein and amino acids, has a beneficial impact on the concentration of total protein and its subfractions in the broilers' serum. The highest concentration of total protein reached 26 g/L in the third experimental group's chicks, with the first and second groups' chicks showing 24 g/L and 25 g/L, respectively, as detailed in Table 2. The presence of albumin in the blood serum is a dependable measure of protein reserves. Consistent albumin levels were noted across all experimental groups. An elevation in albumin levels in the broiler chicks' serum could signify an enhancement in protein synthesis by the liver and an overall improvement in metabolic activities, given albumin's role in substance transport within the organism.

The investigation into hematological parameters of blood indicated that the hemoglobin concentration in the third group surpassed the standard benchmarks by over 20%, while the count of erythrocytes and other cellular blood components remained within expected limits. Creatinine, synthesized in avian bodies from creatine, is derived from the amino acids arginine, glycine, and methionine. The creatinine concentration in the bloodstream is contingent upon the balance of its production and elimination, with its synthesis being intimately linked to the extent of muscular mass. An increase in blood creatinine levels can be symptomatic of conditions such as renal insufficiency, widespread kidney ailments, blockages in the urinary system, periods of fasting, or muscular dystrophy. Conversely, a reduction in creatinine concentration is typically devoid of clinical relevance. In this particular study, the creatinine levels were found to be below the norm across all examined groups.



Figure 1 – Taking blood from the axillary vein from the control I group

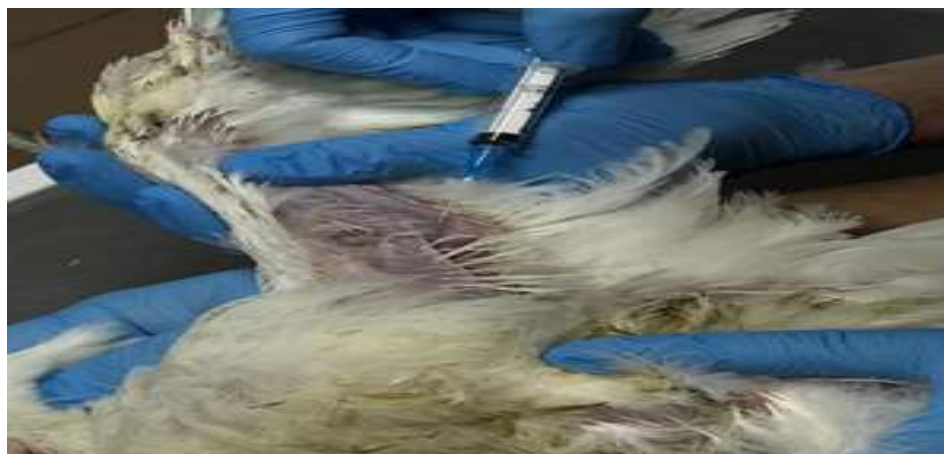


Figure 2 – Taking blood from the axillary vein from the control II group



Figure 3 – Taking blood from the axillary vein from the control III group

Table 1 – Hematological characteristics of broiler chicks' blood after the introduction of diatomaceous earth into the diet

Indicators	Unit	Experimental groups, % input		
		Control I	Control II	Control III
WBC (leukocytes)	$\times 10^9/L$	21,2	20,7	21,1
RBC (red blood cell concentration)	$\times 10^{12}/L$	2,42	2,08	2,29
HGB (hemoglobin)	g/L	117	105	126
HCT (hematocrit)	L	32,2	27,8	32,4
MCV (average erythrocyte volume)	g	133,3	134,0	141,8
MCH (average hemoglobin content in an erythrocyte)	g/L	48,3	50,4	55
MCHC (average hemoglobin concentration in erythrocyte)	g/L	36,3	37,7	38,8
RDW (erythrocyte distribution index)	L	8,0	7,8	8,4
PLT (platelets)	$\times 10^9/\mu$	17	25	20
Albumen	g/L	7	7	7
Urea nitrogen	mmol/l	0,35	0,32	0,29
Creatinine	mmol/l	13	17	10
Total protein	g/L	24	25	26
Glutamyltransferase	U/l	29	52	33
Alanine aminotransferase	U/l	4	6	5

The translation from Russian to English is: "On the hematological analyzer, the main hematological parameters were studied: WBC, $\times 10^9/L$ – white blood cell count, RBC, $\times 10^{12}/L$ – red blood cell count, HGB, g/L – hemoglobin, HCT % – hematocrit, MCV, fL – mean corpuscular volume, PLT, $\times 10^9/L$ – platelet count. Additional hematological parameters: MCH pg – mean cell hemoglobin, MCHC g/L – mean corpuscular hemoglobin concentration, RDW % – red cell distribution width.

Phosphorus, along with its compounds, is crucial for the formation of bones, teeth, nucleotides, and nucleic acids. It is also essential for the prosthetic groups in phosphoproteins and contributes to the development of the body's buffering systems. The metabolic processes of phosphorus are intricately linked with those of calcium. In both the experimental and control groups, phosphorus levels were consistent, with the exception of the third experimental group, which exhibited a 3.7% higher phosphorus content compared to the control values.

The total calcium concentration in the bloodstream consists of ionized calcium, protein-bound calcium, and complexed calcium anions. Serum calcium levels generally remain constant but may fluctuate based on dietary intake and the health status of animals and birds. Hypocalcemia, characterized by a diminished blood calcium level, can result from dietary calcium deficiency or impaired absorption due to insufficient vitamin D, proteins, carbohydrates, or an overabundance of phosphorus and zinc. Hypercalcemia, which refers to increased blood calcium levels, is rarer and can be linked to excessive iodine intake, acute bone dystrophy, or an overdose of vitamin D. In the research conducted, the serum's highest calcium concentration was observed in the third experimental group's chicks, measuring 2.72 mmol/L, compared to 2.51 mmol/L in the first group's chicks, and 2.67 mmol/L in the second experimental group's chicks.

Таблица 3 – Biochemical parameters of blood serum in broiler chickens after the introduction of the opoka

Indicators	Unit	Experimental groups, % input		
		Control I	Control II	Control III
Phosphorus	mmol/l	2.44	2.85	3.02
Calcium	mmol/l	2.51	2.67	2.72
Sodium	mmol/l	146	130	137
Potassium	mmol/l	5.8	5.3	5.4
Chloride	mmol/l	104	87	93
Na/K	mmol/l	25.2	24.5	25.4

Conclusion. One of the important indicators in the cultivation of broiler chickens is their survivability, which has significant importance for the economic efficiency of meat production. Research has revealed that the survivability of broilers throughout the entire growing period (from the 1st to the 40th day) was high and met the standards of the "Ross-308" breed. Throughout the experiment, the survivability in all groups was 100%. Thus, the use of a mineral supplement in the form of diatomaceous earth positively affects the increase in live weight and survivability of broilers.

The examination of blood biochemical indicators in broiler chickens revealed that the experimental groups' readings aligned with recognized physiological standards. The study demonstrated that incorporating diatomaceous earth as a mineral feed additive does not diminish the levels of crude protein and digestible amino acids in the diet, and it actually enhances the blood protein profile. This enhancement is evidenced by the elevated total protein levels and its components when compared to the control group. Evaluating the calcium and phosphorus content in the blood of the chicks involved in the study, the group receiving the mineral additive showed reduced levels relative to the control group, suggesting a more dynamic turnover of these minerals in chicks on the supplement. The findings suggest that adding diatomaceous earth to the regular diet is beneficial and does not adversely affect the metabolic functions in broiler chickens.

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ТҮЙІН

Құстардың ас қорыту аппараттарының ерекшеліктерін және бройлер тауықтарының метаболизмін білу оның өнімділік қасиеттерін арттыруда, саланы өнеркәсіптік негізде жүргізуде аса маңызға ие. Өміршеңдікті, өнімділікті сақтау және арттыру үшін құс жеткілікті энергия мен қоректік заттарды алуы қажет. Қанның негізгі көрсеткіштері ағзаның жалпы күйін және оның қорғаныс мүмкіндіктерін бағалауға мүмкіндік береді, өйткені өсу мен дамуға байланысты процестер әрқашан қанның ақуыздық құрамында көрінеді. Зерттеу жұмысы Росс-308 кросс бройлер тауықтарында жүргізілді. Ғылыми-шаруашылық тәжірибе схемасы бойынша әр топта бір күндік 50 бройлер балапандарынан 3 топ құрылды: бір бақылау тобы және 2 тәжірибелік топ. Бройлер балапандарын азықтандыру кросттың ұсыныстарына сәйкес келді. Жүргізілген зерттеулер шикі протеин мен сіңімді аминқышқылдары бойынша қоректік заттардың төмендеуінсіз бройлер тауықтарының негізгі азығына қосымша опока минералды азық қоспасын енгізу қанның ақуыз спектріне оң әсер етіп, жалпы ақуыз мен оның фракцияларының деңгейін арттыруға ықпал ететінін көрсетті. Тәжірибелі топтардың бройлер тауықтарының қан сарысуындағы биохимиялық көрсеткіштердің құрамындағы статистикалық сенімді айырмашылықтар бақылау тобымен салыстырғанда табылған жоқ, бұл бройлер тауықтарының рационында опока кремний тұқымының минералды жемшөп қоспасын қолдану қауіпсіздігінің дәлелі болып табылады.

РЕЗЮМЕ

Для улучшения производительности бройлерных цыплят в промышленном птицеводстве крайне важно изучение особенностей пищеварения и метаболизма. Это знание необходимо для поддержания и повышения их жизнеспособности и продуктивности путем обеспечения достаточного поступления энергии и питательных веществ. Основные биохимические показатели крови отражают общее состояние здоровья и функционирование иммунной системы организма. Изменения, связанные с физиологическими процессами роста и развития птиц, напрямую влияют на состав белков в крови. Исследование было выполнено на бройлерах породы Росс-308. В рамках научного эксперимента были созданы три группы бройлеров: контрольная и две экспериментальные, каждая из которых насчитывала по 50 особей. Группы для опыта были сформированы из цыплят, взятых в возрасте одних суток. Цыплятам было предоставлено кормление в соответствии с рекомендованными нормами для данного кросса. Наши исследования показали, что добавление минеральной подкормки в виде опоки к основному корму для бройлеров не только не снижает содержание сырого белка и необходимых аминокислот, но также благоприятно влияет на состав белков крови. Это приводит к увеличению содержания общего белка и его составляющих. При статистическом анализе не было обнаружено значимых различий в биохимических параметрах сыворотки крови между экспериментальными и контрольными группами цыплят. Это показывает, что использование минеральной добавки в виде опоки в кормах для бройлеров является безопасным.

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