профилактика и лечение дерматомикоза верблюдов (трихофитии и микроспории), является необходимым условием профилактики и лечения этого заболевания и совершенствования существующих вакцинных препаратов, а также развития малых и крупных фермерских хозяйств. страна. Профилактика, лечение и ликвидация дерматомикозов животных включены в перечень наиболее опасных заболеваний, которые осуществляются за счет бюджетных средств (приложение 5 согласно Приказу Министра сельского хозяйства Республики Казахстан №7- 1/559 от 30 октября 2014 г.).

В настоящее время нами разработана технология приготовления современной поливалентной инактивированной вакцины против дерматомикозов сельскохозяйственных животных. Это позволяет решить задачи профилактики (лечения) заболевания, которое может повлиять и предотвратить улучшение эпизоотологической ситуации по дерматомикозам в Республике Казахстан, и в конечном итоге позволит получить безопасную продукцию животноводства высокого санитарного качества (шубат, верблюжье мясо, кожевенное сырье и шерсть).

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MORPHOBIOCHEMICAL INDICATORS OF BLOOD AS A TOOL FOR EVALUATING THE EFFICIENCY OF ANIMAL PROTEIN IN GOOSE NUTRITION

ANNOTATION

The article presents the results of a study of the effect of animal protein in the diet on the morpho-biochemical parameters of geese blood. The purpose of this study is to study the morpho-biochemical parameters of geese blood as indicators of the body's physiological response to the inclusion of animal protein in the diet. In the experiment, fish meal was used as an additional protein source for the experimental group, while the control group received a standard diet without animal protein. A comparative analysis of the control and experimental groups was carried out, significant changes in the levels of the main hematological (hemoglobin, erythrocytes, leukocytes) and biochemical (total protein, albumins, globulins) parameters were revealed. The results showed that the introduction of animal protein improves metabolic processes, as evidenced by significant changes in blood parameters. It has been established that morpho-biochemical parameters can be used as reliable indicators of adaptation and the general physiological state of a bird when changing its feeding strategy. The data obtained are of practical importance in the development of diets to increase productivity and resistance of geese to external factors.

Additionally, it was found that the use of fishmeal has a positive effect on protein metabolism and potentially improves body weight gains. The results can be applied in the industrial poultry farming system to optimize the feeding of waterfowl.

Key words: *geese, feeding, animal protein, morpho-biochemical parameters, fish meal, metabolism, physiology, feeding ration, productivity.*

Introduction. Feeding animals is an important factor affecting their productivity, health, and physiological condition. One of the key aspects of feeding waterfowl is the choice of protein sources, which plays a significant role in metabolism and the formation of physiological processes in the body. Protein of animal origin, especially in the form of fish meal, is a valuable component of the diet, contributing to improved growth, increased immune resistance and overall adaptation to the environment.

Geese, as one of the most common species of waterfowl in agriculture, require a balanced diet for optimal productivity. Morphobiochemical blood parameters such as levels of total protein, albumins, hemoglobin and enzyme activity are important indicators of the physiological state of poultry and can be used to assess the effectiveness of feeding.

The purpose of this study is to analyze the effect of animal protein, in particular fish meal, on the morpho-biochemical parameters of geese blood. The paper will examine how changes in the feed composition affect the metabolism and physiological state of birds, which makes it possible to optimize diets and increase the efficiency of fattening [1].

The use of animal-derived protein in the feeding of waterfowl, such as geese, is an important aspect for improving productivity and health. In particular, animal proteins, including fishmeal, play a key role in ensuring proper metabolism in birds. One of the most important indicators used to assess the condition of birds is the morpho-biochemical parameters of blood [2-4]. These parameters can serve as indicators of diet effectiveness, as well as the physiological state of the animals. Research shows that the addition of animal protein to the diet can affect plasma protein levels, lipids, as well as enzyme activity, reflecting both feed assimilation and bird health [5].

Morphobiochemical blood parameters in birds include total protein levels, albumin, transaminases, hemoglobin levels, and other indicators. These parameters are important indicators of metabolic processes in the bird's body [6,7]. For example, total blood protein and its fractions (albumin and globulin) are key indicators of protein metabolism, while the activity of liver enzymes reflects liver health, which is directly related to feed quality [8].

There is an opinion that the addition of fishmeal to the birds' diet may increase the blood protein levels, improve overall metabolism, and support liver health. Fishmeal contains amino acids such as methionine and lysine, which are essential for normal growth and metabolism in birds [9-11]. Studies show that the inclusion of animal protein in the diet of waterfowl contributes to improved growth and overall productivity. In particular, the addition of fishmeal to geese feed increases blood protein levels, improves gastrointestinal tract function, and enhances immune status [12-16].

It is important to note that the concentrations of certain biochemical parameters may vary depending on the dosage and duration of animal protein use [18,19]. On the other hand, some studies show that excessive amounts of fishmeal can lead to metabolic imbalances, manifesting as increased ammonia and urea levels in the blood, which indicates a disruption in protein metabolism. Therefore, it is essential to carefully control the dosage and composition of feeds to achieve optimal results. Fishmeal is not only a source of protein but also omega-3 fatty acids, which play an important role in strengthening the immune system and improving meat quality [20].

However, despite the obvious benefits, it is important to remember that not all animal-derived proteins are equally effective, and their impact on the bird's body depends on the quality and composition of the feed.

Research materials and methodology. The research was carried out within the framework of grant funding AP19579335 for fundamental and applied scientific research on scientific and (or) scientific and technical projects for 2023-2025 on the project «Technological justification for intensifying the production of meat of waterfowl in the West Kazakhstan region».

A scientific and economic experiment was conducted in the conditions of the West Kazakhstan Agrarian and Technical University named after Zhangir Khan, aimed at studying the effect of animal protein in the diet on the morphobiochemical parameters of blood in young goslings of the Linda breed. The research included an analysis of the nutritional value of feed, the development of optimal diets using local feed resources and an assessment of their impact on the morphobiochemical parameters of poultry.

To achieve these goals, a comprehensive assessment of the composition of feed and feed additives selected from available local sources was carried out. Based on the data obtained, compound feed recipes were compiled for each sex and age group of goslings, taking into account the physiological needs of the bird during different growth periods.

The analyzed feeds included the main grain crops (barley, wheat, millet), legumes (soybeans, peas), as well as by-products of processing (wheat bran, sunflower cake). Feed shells and fish meal were added to the diet to ensure a complete amino acid composition. The nutritional value of the feed was determined in the zootechnical laboratory of the Zhangir Khan ZKATU Testing Center.

According to the adopted breeding technology, the young goslings were kept in cell batteries for the first 14 days, providing optimal microclimate conditions and ease of care. From the 14th to the 63rd day, cultivation was carried out on deep bedding, which contributed to the development of the bird's natural behavior and the strengthening of the musculoskeletal system.

To conduct the research, we formed a control (I) and 2 experimental (II, III) groups (experimental scheme – 1) of 50 males and females each, the birds were selected using the method of analog groups in terms of live weight and overall development (Table 1).

The division into groups was carried out taking into account the homogeneity of the composition of the bird, which is an important factor for the accuracy of subsequent calculations and data analysis. This approach made it possible to assess as accurately as possible the effect of experimental feed mixtures on growth, development and metabolic processes in goslings under the conditions of this study.

Table 1 – Scheme of experience

Age, day	Group	Total number, n	Feeding pattern
1 – 63	Control I	50/50	The main recipe of the feed mixture
	Experimental II	50/50	The main recipe of the feed mixture + Fish meal 3 %
	Experimental III	50/50	The main recipe of the feed mixture + Fish meal 6 %

The same conditions of detention were created in all groups, which made it possible to exclude the influence of external factors on the results of the study. The poultry of the control group (I) received a standard diet without additional components. The diet of goslings from the second experimental group (II) included 3% fishmeal, while in the third experimental group (III) the proportion of fishmeal was 6%.

This approach allowed us to evaluate the effect of different levels of this protein supplement on the morphobiochemical parameters of blood in young animals. The inclusion of fishmeal in feed mixes is aimed at increasing the biological value of the diet due to the additional intake of easily digestible proteins, essential amino acids and minerals.

Clinical examination of goslings was carried out at all stages of the experiment to assess their general condition, identify possible pathologies, and control the effect of experimental diets on physiological parameters. The examination was carried out daily, and a detailed examination was carried out once a week. The clinical examination took into account the appearance, activity, behavior, condition of the plumage, eyes, beak, paws and skin.

To analyze the morpho-biochemical parameters of blood in each of the groups, blood sampling was performed at the beginning of the experiment (at the start of the study) and at the end (at the end of 8 weeks). Blood was taken from 20 randomly selected individuals from each group using a standard venipuncture technique.

Blood was taken in the morning on an empty stomach to exclude the effect of food on the test results. Sterile tubes with anticoagulants were used to prevent hemolysis and other blood disorders.

The obtained results were subjected to statistical processing using methods of variational statistics. The mean values (X), standard deviation (σ), and coefficient of variation (CV) were calculated in MS Excel and Statistica 10.0. The reliability of differences between groups was assessed using the t-Student criterion at a significance level of $p < 0.05$.

This comprehensive approach made it possible to objectively assess the effect of different levels of fish meal in the diet on the blood counts of goslings. The results will be used to optimize feeding and increase the productivity of waterfowl in the conditions of the West Kazakhstan region.

Research results. As part of the research conducted in the West Kazakhstan region, the feeding system of goslings was studied, as well as a detailed analysis of the chemical composition of the feed and feed additives used. Based on the experimental data obtained, an optimized formulation of feed additives was developed, which makes it possible to create a balanced diet for various sex and age groups of goslings kept in the farm under study.

The analysis of the chemical composition and nutritional value of the feeds, presented in Table 2, allowed us to determine their energy and biological value. Based on these data, recipes for feed mixtures were formulated, adapted to the physiological needs of poultry, taking into account the period of their growth and productivity. All the studies were conducted on the basis of the West Kazakhstan Agrarian and Technical University named after Zhangir Khan, which ensured control over the quality of feeding and its impact on the morphobiochemical parameters of goslings.

Table 2 – Chemical composition of farm feed in the West Kazakhstan region

Feeds	Types of feed												
	Sudan (grain)	Crushed corn	Millet	Rye	Sorghum	Barley	Crushed wheat	Soybeans	Sunflower meal	Soybean meal	Wheat bran	Sunflower meal	Fish meal
Metabolizable energy, MJ	9,2	10,1	9,5	9,7	9,8	10,9	11,2	11,5	10,7	11,6	7,3	10,8	11,1
Dry matter, g	850	847,3	846,2	860,7	848,7	886,8	837,5	843,8	908	893,8	839,7	890	880,9
Crude Protein, g	108	96,5	105,7	109	101,2	150,8	118,6	218,6	356,4	387,6	149,6	361,5	616,9
Digestible Protein, g	81,6	65,4	67	72,6	69,2	107,8	78,9	138,3	213,7	231,7	83,6	208,4	413,7
Lysine, g	3,6	2,9	2,1	3,8	2,6	5	3,1	41,7	12,6	22,5	3,4	12,1	44,6
Methionine + Cystine, g	3,2	2,6	4,5	3,3	2,3	2,3	4,6	7,6	14,3	11,3	3,8	9,8	20,7
Tryptophan, g	1,1	0,9	1,6	0,9	0,6	0,8	1,2	2,7	4,7	2,3	0,6	4,6	6,1
Crude fat, g	16,1	33,6	32	17	26,9	25,4	23,9	36,8	56,3	24,4	28,4	32,3	87
Crude fiber, g	37	28,2	37	19,7	29,8	27,4	17,6	37,9	98,2	59,4	79,1	106,7	0
NFE, g	573	663	562	664,4	649	870,4	672	0	224,5	308,4	511	201,3	46
Sugar, g	15	22	13	12	39	12,4	18,6	0	56,4	86,4	33	51,4	0
Calcium, g	1,5	0,4	0,8	0,6	0,9	0,8	0,5	3,9	6,3	1,9	1,1	2,7	30,1
Phosphorus, g	3,4	3,8	5,3	2,3	3,2	2,8	3,2	6,8	15,1	9,8	9,8	10,8	22,4
Magnesium, g	1,2	2,8	0,8	0,6	0,8	1,9	1,6	2,1	3,7	2,7	3,3	2,60	3,4
Potassium, g	5,4	4,2	3,6	4,3	2,7	4,7	5	19,7	8,4	16,9	7,8	5,6	12,5
Sulfur, g	1,4	1,1	0,2	0,2	0,2	0	0,1	0,1	4,7	2,5	1,1	1,9	3,8
Iron, mg	31,8	7,6	33,7	62,5	45,1	1,1	43,9	112	118	203,4	131	282,5	81,5
Copper, mg	4,9	6	13,4	6,2	8,6	7,5	6,2	13,1	15,1	14,1	8,5	21,5	11,1
Zinc, mg	22,5	24,2	27,8	18,9	11,6	28,7	22,6	26	46,6	37,4	53	37,4	76,4
Manganese, mg	20,5	10,7	15,7	29,6	14,5	36,8	47,6	18,6	40,1	31	101,2	16,8	8,6
Cobalt, mg	0,07	0,4	0,01	0,05	0,1	0,4	0,3	0,02	0,14	0,09	0,3	0,21	0,3
Carotene, mg	1,3	2,1	1,2	0,3	0,9	0	2,4	1,1	2,4	0,08	1,7	0	0

Analysis of the obtained results showed that the level of metabolizable energy in the feeds ranged from 7.3 to 11.6 MJ. The highest values were recorded in soybean meal (11.6 MJ) and soybeans (11.7 MJ), indicating the high energy value of these components. Furthermore, the highest crude protein content per 1 kg of dry matter was found in feeds related to by-products, including sunflower meal and fishmeal, where this indicator ranged from 118.6 to 616.9 g.

Based on the studied data on the chemical composition of feeds used in farms in the Western Kazakhstan region, optimal feed mixtures were developed. These mixtures have high nutritional value and a balanced composition, which contributes to the maximum realization of the bird's productive potential.

Table 3 – Feeding ration of young geese in experimental groups for the period of 1-14 days

Indicators		% of input		
		Experimental groups		
		Control I	Experimental II	Experimental III
Sudan grain		16	13	10
Crushed corn		5	5	5
Millet		2	2	2
Rye		2	2	2
Sorghum		2	2	2
Barley		10	10	10
Crushed wheat		20	20	20
Soybean		7	7	7
Sunflower expeller		10	10	10
Soybean meal		9	9	9
Whaet bran		5	5	5
Sunflower meal		10	10	10
Fish meal		-	3	6
Seashell		2	2	2
Feed mixture recipe includes:				
Metabolizable energy	MJ	1,03	1,03	1,03
	Kcal	243,62	246,01	248,40
Dry matter, g		84,70	84,79	84,88
Crude Protein, g		19,67	21,19	22,72
Digestible Protein, g		12,40	13,39	14,39
Lysine, g		0,96	1,08	1,21
Methionine + Cystine, g		0,61	0,67	0,72
Tryptophan, g		0,20	0,21	0,23
Crude fat, g		2,81	3,03	3,24
Crude fiber, g		4,78	4,67	4,55
NFE, g		47,97	46,39	44,80
Sugar, g		2,99	2,95	2,90
Phosphorus, g		0,63	0,69	0,74
Magnesium, g		0,29	0,29	0,30
Potassium, g		0,74	0,77	0,79
Sulfur, g		0,13	0,13	0,14
Iron, mg		8,99	9,14	9,29
Copper, mg		0,99	1,01	1,03
Zinc, mg		2,96	3,12	3,28
Manganese, mg		3,31	3,27	3,23
Cobalt, mg		0,02	0,02	0,02
Carotene, mg		0,13	0,12	0,12

The developed recipe of the feed mixture provides an optimal ratio of nutritional components, contributing to the easy assimilation of feed by young goslings in the first days of life. The composition

of the feed mixture for the control group includes 13 components, while the diet of the experimental group contains 14 ingredients.

A significant difference lies in the amount of Sudan grain: in the feed mixture for the experimental group, its content is reduced by 3-6% compared with the control group. However, this disadvantage is offset by the introduction of fishmeal into the diet, which increases the overall nutritional value of the feed and provides the goslings with the necessary amino acids for full growth and development. This approach allows not only to improve the digestibility of the diet, but also to increase its biological effectiveness, contributing to the health of young animals and the formation of stable immunity.

Table 4 – Feeding ration of young geese in experimental groups for the period of 14-63 days

Indicators		% of input		
		Experimental groups		
		Control I	Experimental II	Experimental III
Sudan grain		11	8	5
Crushed corn		19	19	19
Millet		2	2	2
Rye		2	2	2
Sorghum		2	2	2
Barley		10	10	10
Crushed wheat		20	20	20
Soybean		6	6	6
Sunflower expeller		5	5	5
Soybean meal		5	5	5
Whaet bran		5	5	5
Sunflower meal		10	10	10
Fish meal		-	3	6
Seashell		3	3	3
Feed mixture recipe includes:				
Metabolizable energy	MJ	1,00	1,01	1,02
	Kcal	238,85	241,23	243,62
Dry matter, g		83,35	83,44	83,53
Crude Protein, g		16,93	18,45	19,98
Digestible Protein, g		10,77	11,77	12,77
Lysine, g		0,79	0,91	1,03
Methionine + Cystine, g		0,51	0,56	0,62
Tryptophan, g		0,17	0,18	0,20
Crude fat, g		2,79	3,00	3,21
Crude fiber, g		4,22	4,11	4,00
NFE, g		52,03	50,45	48,87
Sugar, g		2,60	2,56	2,51
Phosphorus, g		1,34	1,43	1,52
Magnesium, g		0,55	0,60	0,66
Potassium, g		0,33	0,34	0,34
Sulfur, g		0,65	0,67	0,69
Iron, mg		0,10	0,11	0,12
Copper, mg		7,42	7,57	7,72
Zinc, mg		0,91	0,92	0,94
Manganese, mg		2,78	2,94	3,10
Cobalt, mg		3,01	2,97	2,94
Carotene, mg		0,02	0,02	0,02

In the second growing period, the developed diet provided a level of metabolic energy in the range of 1.00–1.02 MJ, and the crude protein content ranged from 16.93% to 19.67%. In the feed mixture

intended for the experimental group, the crude protein content was higher by 8.24–15.27% compared to the control group, which contributes to a more intensive growth of young animals.

In addition, the analysis of the mineral composition showed that the feed for goslings of the experimental group contained more micro- and macronutrients compared with the control diet. In particular, the phosphorus level was higher by 6.29–11.84%, and the magnesium content exceeded the control group by 8.33–16.67%.

Table 5 – Morphobiochemical parameters of male goslings of experimental groups at the beginning and at the end of experiments, ($\bar{x}$±Sx, n=20)

Indicators	Experimental groups		
	I control	II experimental	III experimental
	♂		
Erythrocytes, 10^{12}/l	2,38±0,06	2,42±0,03	2,34±0,04
	2,21±0,05	2,48±0,05	2,41±0,05
Hemoglobin, g/l	112,2±2,24	113,5±2,60	112,7±2,25
	104,7±1,20	111,4±2,26	119,6±2,38
Leukocytes, 10^{9}/l	20,45±0,39	20,87±0,45	21,12±0,42
	20,5±0,45	21,6±0,50	22,4±0,50
Color indicator, units	1,49±0,05	1,42±0,03	1,44±0,04
	1,52±0,06	1,46±0,04	1,43±0,03
Alkaline reserve, mg%	726,5±5,29	748,1±5,04	748,4±6,41
	718,9±5,26	739,4±4,29	740,9±5,32
Total nitrogen, mg%	848,5±10,15	879,4±11,25	908,3±13,47
	783,5±8,90	919,6±12,34	987,2±16,75
Total protein, g/l	54,8±2,41	58,3±1,68	63,8±1,67
	55,7±2,59	59,4±1,71	66,3±1,73
Albumins, %	31,6±0,96	32,4±1,02	32,6±0,84
	33,5±1,37	34,6±1,14	37,8±1,13
α-globulins	15,03±0,67	14,78±0,64	15,41±0,68
	13,76±0,64	14,24±0,57	15,62±0,70
β- globulins	9,32±0,48	9,73±0,51	9,58±0,43
	8,15±0,38	9,11±0,41	9,73±0,47
γ-globulins	47,02±0,68	44,75±0,61	41,12±0,62
	43,18±0,49	44,02±0,48	45,23±0,65
A/G ratio	0,54±0,04	0,53±0,03	0,48±0,02
	0,49±0,03	0,48±0,02	0,42±0,02
Calcium, mmol/l	2,98±0,21	2,71±0,21	2,58±0,20
	2,83±0,25	2,64±0,20	2,41±0,18
Phosphorus, mmol/l	2,14±0,13	2,16±0,14	2,10±0,19
	1,32±0,09	1,21±0,13	1,18±0,13

An analysis of the morphobiochemical parameters of the blood of male geese of the experimental groups presented in the table makes it possible to trace the dynamics of changes that occurred during the experiment under the influence of animal protein in the diet.

The number of leukocytes, as an indicator of immune activity, increased in all groups. This indicates the positive effect of animal protein on the immune system of birds.Total blood nitrogen, reflecting protein metabolism, decreased by 7.7% in the control group, while it increased by 4.6% in the first experimental group and by 8.7% in the second. This confirms a more active assimilation and use of proteins in the diet of birds receiving animal protein supplements.

The level of total protein also showed positive dynamics: it increased by 1.6% in the control group, by 1.9% in the first experimental group, and by 3.9% in the second. This indicates the activation of synthetic liver function and improved metabolism.

There was an increase in albumins in all groups: in the control group — by 6.0%, in the first experimental group — by 6.8%, in the second — by 16.0%. This is especially pronounced in the group with the addition of fishmeal, which indicates the high biological value of this component..

The ratio of albumins to globulins (A/G coefficient) decreased in all groups, especially in the second experimental group — from 0.48 to 0.42, which indicates a shift in the protein profile towards globulins involved in immune defense.

The calcium content in the blood decreased in all groups, which may be due to the intensive growth of bone tissue in young animals. However, the decrease was more pronounced in the experimental groups (by an average of 5-6%).

Phosphorus also showed a decrease: by 38.3% in the control group, by 44.0% in the first experimental group and by 43.8% in the second. This indicates a high intensity of phosphorus metabolism and, possibly, the need for additional phosphorus intake with feed during the period of active growth.

In general, the analysis of the data obtained shows that the addition of animal protein, especially in the form of fish meal, improves the morphological and biochemical parameters of the blood in goslings, which positively affects their general condition, metabolism and immune system.

Table 6 – Morphobiochemical parameters of female goslings in the experimental groups at the beginning and end of the trials, ($\bar{x}$±Sx, n=20)

Indicators	Experimental groups		
	I control	II experimental	III experimental
	♀		
Erythrocytes, 10^{12}/l	2,24±0,01	2,33±0,02	2,48±0,05
	2,33±0,02	2,46±0,03	2,51±0,08
Hemoglobin, g/l	110,7±2,241	111,8±2,08	114,5±2,00
	06,8±1,57	109,2±1,95	121,7±2,11
Leukocytes, 10^{9}/l	20,38±0,55	20,38±0,58	21,47±0,62
	20,2±0,53	21,3±0,67	23,1±0,71
Color indicator, units	1,44±0,04	1,45±0,03	1,42±0,03
	1,42±0,02	1,44±0,03	1,48±0,05
Alkaline reserve, mg%	752,7±5,44	749,8±10,35	731,6±5,33
	733,2±5,17	731,8±9,45	756,7±5,38
Total nitrogen, mg%	869,7±10,52	851,7±12,60	901,7±12,55
	843,9±10,12	910,1±13,45	1047,4±24,91
Total protein, g/l	55,2±1,86	57,5±1,76	61,9±1,59
	56,4±1,83	58,8±2,04	64,7±1,60
Albumins, %	32,0±0,97	31,9±0,88	38,4±1,00
	32,7±1,32	35,1±1,16	32,7±0,87
α-globulins	15,37±0,65	15,2±0,65	15,36±0,63
	14,12±0,55	15,49±0,54	15,53±0,68
β- globulins	9,61±0,54	9,54±0,46	10,11±0,51
	8,47±0,36	9,23±0,40	9,64±0,46
γ-globulins	42,31±0,60	48,56±0,63	46,24±0,56
	41,24±0,39	45,27±0,58	44,38±0,50
A/G ratio	0,46±0,03	0,52±0,03	0,49±0,02
	0,44±0,02	0,45±0,02	0,41±0,01
Calcium, mmol/l	2,85±0,19	2,70±0,21	2,56±0,20
	2,87±0,23	2,68±0,19	2,43±0,18
Phosphorus, mmol/l	2,25±0,17	2,20±0,17	2,17±0,22
	1,27±0,12	1,16±0,12	1,12±0,15

By the end of the experiment, female goslings in all groups showed positive dynamics of morphobiochemical parameters. Especially in the III experimental group, a significant increase in the level of hemoglobin (by 6.3%), leukocytes (by 7.6%), total protein (by 4.5%) and β-globulins was recorded, indicating activation of metabolic and immune processes in the body.These changes indicate a beneficial effect of the animal protein diet on the physiological state of the bird. At the same time, a decrease in the content of calcium and phosphorus was noted, which requires adjustments to the mineral part of the diet.

Conclusions. The results obtained convincingly demonstrate that the use of specially developed feeding diets allows not only to maintain normal physiological parameters in goslings, but also helps optimize metabolic processes. The most pronounced positive effect was observed in the second experimental group, where the maximum values of hemoglobin and the most stable indicators of mineral metabolism were recorded. These data are of great practical importance for improving the feeding system of young geese and can be used in the development of new feed formulations.

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ТҮЙІН

Мақалада қаздардың қанындағы морфо-биохимиялық көрсеткіштерге жануар текті ақуыздың рационға қосылуының әсері жөніндегі зерттеу нәтижелері ұсынылған. Бұл зерттеудің мақсаты – рационға жануар текті ақуыз енгізілген жағдайда организмнің физиологиялық жауабын индикатор ретінде бағалау үшін қаздардың морфо-биохимиялық көрсеткіштерін зерттеу болып табылады. Ғылыми – зерттеу жұмысында тәжірибелік топтары үшін қосымша ақуыз көзі ретінде балық ұны қолданылды, ал бақылау тобы жануар текті ақуызсыз стандартты рационмен қоректендірілді. Бақылау және тәжірибелік топтарының салыстырмалы талдауы жүргізіліп, негізгі гематологиялық (гемоглобин, эритроциттер, лейкоциттер) және биохимиялық (жалпы ақуыз, альбуминдер, глобулиндер) көрсеткіштерде сенімді өзгерістер анықталды. Нәтижелер жануар текті ақуыздың енгізілуі алмасу үдерістерін жақсартатынын көрсетті, бұл қан көрсеткіштерінің сенімді өзгерістерімен дәлелденеді. Морфо-биохимиялық көрсеткіштер құстың жаңа қоректік стратегияға бейімделуі мен жалпы физиологиялық жағдайының сенімді индикаторлары ретінде пайдаланылуы мүмкін екені анықталды. Алынған деректер қаздардың өнімділігін және сыртқы факторларға төзімділігін арттыру мақсатында рациондар әзірлеуде практикалық маңызға ие.

Қосымша түрде, балық ұнының қолданылуы ақуыз алмасуына оң әсер етіп, тірілей салмақтың өсімін арттыруға ықпал ететіні анықталды. Зерттеу нәтижелері өнеркәсіптік құс шаруашылығы жүйесінде су құстарын азықтандыруды оңтайландыруға мүмкіндік береді.

РЕЗЮМЕ

В статье представлены результаты исследования влияния животного белка в рационе на морфо-биохимические показатели крови гусей. Целью данного исследования является изучение морфо-биохимических показателей крови гусей как индикаторов физиологической реакции организма на включение белка животного происхождения в рацион. В эксперименте использовалась рыбная мука в качестве дополнительного источника протеина для опытной группы, тогда как контрольная группа получала стандартный рацион без животного белка. Проведён сравнительный анализ контрольной и опытной групп, выявлены достоверные изменения в уровнях основных гематологическим (гемоглобин, эритроциты, лейкоциты) и

биохимическим (общий белок, альбумины, глобулины) параметрах. Результаты показали, что введение животного белка способствует улучшению обменных процессов, о чём свидетельствуют достоверные изменения показателей крови. Установлено, что морфо-биохимические параметры могут использоваться как надёжные индикаторы адаптации и общего физиологического состояния птицы при изменении кормовой стратегии. Полученные данные имеют практическую значимость при разработке рационов для повышения продуктивности и устойчивости гусей к внешним факторам.

Дополнительно было выявлено, что использование рыбной муки положительно влияет на белковый обмен и потенциально способствует улучшению приростов живой массы. Результаты могут быть применены в системе промышленного птицеводства для оптимизации кормления водоплавающей птицы.