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PHYSIOLOGICAL CHANGES IN GOAT ORGANISMS UNDER FAVORABLE AND ADVERSE ENVIRONMENTAL FACTORS

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Abstract

This study examines the influence of favorable and adverse environmental factors on the physiological and metabolic processes in goats raised under varying ecological conditions. The research emphasizes the importance of hematological and biochemical analyses in assessing the functional state of the organism. Morphological parameters of blood, including erythrocyte and leukocyte counts and hemoglobin levels, were measured alongside serum protein concentrations and their fractions, such as albumins and globulins. The findings highlight how environmental stressors, including technogenic pressures, heavy metal exposure, and variations in water, soil, and plant quality, affect metabolic regulation and overall health in goats. The results provide valuable insights for optimizing animal husbandry practices and improving resilience to ecological challenges.

Keywords

environmental factors, favorable and adverse conditions, technogenic pressure, heavy metals, water quality, soil composition, plant nutrition, hematological parameters, biochemical parameters, erythrocytes, leukocytes, hemoglobin, blood serum, total protein, albumins, globulins

The rapid adaptation of organisms to adverse environmental factors occurs as a functional response aimed at counteracting the harmful effects of new environmental conditions. In recent years, the commissioning of numerous industrial enterprises has transformed the surrounding environment into a technologically altered state. Waste products from industrial facilities lead to changes in the chemical composition and physicochemical properties of water, soil, and plants, which constitute the ecosystem. Notably, emissions from metallurgical plants, oil refining industries, and thermal power stations contribute significantly to the contamination of nearly all ecosystem substrates with heavy metals.

Many damaging factors in the external environment, even at doses minimally affecting vital processes, can induce disturbances in the organism. However, these disruptions can often be compensated through chemical adaptation reactions that support recovery. Nonetheless, artificially created environments may not align with the biological characteristics of the organism. In such cases, adaptation occurs through quantitative and qualitative changes in physiological functions. Monitoring these critical signals involves analyzing tissue structure, hematological responses in blood-forming systems, and alterations in metabolic processes, providing valuable insight into the organism's adaptive capacity.

Objectives and tasks of the study. The main aim of this study was to evaluate the impact of different technogenic pollution zones on the hematological and immunological parameters of goats. To achieve this, the research focused on determining the morphological and biochemical characteristics of goat blood under varying levels of technological pressure and assessing the resilience and adaptive capacity of animals raised in different ecological conditions.

Materials and methods. The study was carried out throughout the year on two groups of goats maintained and grazed under distinct ecological settings. To assess the effects of diets with varying compositions on the blood profile, a series of hematological and biochemical analyses were conducted. Hematological examinations included measurements of erythrocyte and

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leukocyte counts as well as hemoglobin concentration, while biochemical analyses evaluated the total protein content in blood serum and its fractions using refractometric and colorimetric methods. The collected data were subsequently processed following the methodology proposed by E.K. Merkyureva.

Results and discussion. Metabolism, being the sum of chemical, physical, and biochemical changes that occur in an animal's body and ensure its vital activity, plays a crucial role in assessing the key metabolic links of small ruminants raised under different ecological conditions. Studying these links allows the identification of disruptions in metabolic processes, while simultaneously providing an opportunity to implement timely measures to maintain animal health and ensure environmental balance. Blood serves not only as a connector between tissues and organs reflecting the health status of the organism, but also as an indicator of its adaptability to changing environmental conditions. For this reason, investigating the morphological composition of goat blood in different ecological zones was of particular interest.

Table 1. Morphological Composition of Goat Blood in Different Ecological Zones

№	Parameter	Ecological Condition	Relative to Control (%)
		Favorable	Unfavorable
1	Erythrocytes (million)	8.49 ± 0.61	6.96 ± 0.46
2	Leukocytes (thousand)	7.60 ± 0.38	7.01 ± 0.24
3	Hemoglobin (g/%)	93.84 ± 1.51	73.9 ± 1.39

According to the obtained data, goats raised in ecologically favorable zones exhibited an 18.1% higher erythrocyte count, an 8.6% higher leukocyte count, and a 21.3% higher hemoglobin concentration compared to their counterparts in unfavorable zones. These findings indicate that animals in favorable conditions have more efficient oxygen supply, maintain balanced oxidation and recovery reactions, and utilize nutrients in feed more effectively.

To validate these findings, we examined the total protein content in blood serum and its fractions under different ecological conditions. Protein metabolism is one of the essential links of metabolism, as serum proteins are in dynamic equilibrium with tissue and organ proteins and perform regulatory, catalytic, transport, and protective functions while influencing protein, lipid, carbohydrate, and mineral metabolism. Therefore, studying serum protein levels and their fractions allows us to reveal patterns of physiological changes in animals raised under different environmental conditions.

Table 2. Total Protein and Its Fractions in Goat Serum under Different Ecological Conditions

№	Parameter	Ecological Condition	Relative to Control (%)
		Control	Experimental

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1	Total protein (g/L)	70.83 ± 0.28	61.90 ± 0.23
2	Albumins (%)	34.52 ± 1.12	33.10 ± 0.14
3	Globulins (%)	36.23 ± 1.28	37.80 ± 0.19
4	Protein index A/G	0.9/1.0	0.87/1.0

As seen from the table, goats raised in ecologically favorable conditions had 12.02% higher total serum protein levels than those in unfavorable conditions, indicating that animals in less favorable environments utilize dietary protein less efficiently. Furthermore, the albumin fraction decreased by 6.8% in goats under unfavorable conditions compared to those in favorable conditions, while the globulin fraction increased by 4.33%. This reflects the mobilization of adaptive and recovery mechanisms to maintain the stability of metabolic processes under adverse factors, as the globulin fraction plays a primary role in the protective function of the organism.

Conclusion. When raising sheep and goats-the main livestock of pasture farming-in different ecological zones, it is essential to study the impact of environmental factors on metabolic processes in the organism. To prevent various metabolic disturbances, periodic morphological and biochemical analyses of blood and serum are necessary.

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