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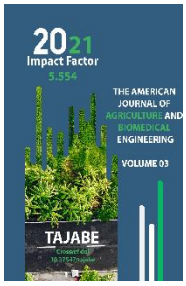

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The Influence of Laser Beams up to 10 w/cm2 on the Immune System of Animals

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ABSTRACT

The article discusses the impact of low-intensity laser radiation on the safety indicators of the animal's natural resilience, productivity and viability of young animals, the creation of environmentally friendly, energy-saving technology for breeding cattle.

KEYWORDS

Laser Radiation, Biophysical Method, Exposure, Low Intensity, Functional, Tissue, Platelet, Leukocyte, Immune System, Cardiovascular, Endurance, Pastoralism.

INTRODUCTION

In recent years, the development and introduction of intensive technologies for the production of safe, environmentally friendly, biologically competitive livestock products in all developed countries of the world has had a positive impact on the transformation of animal husbandry into an efficient industry.

Various biological methods, including biophysical and biochemical, are widely used in the world's leading scientific centres in order to maintain the viability of small horned animals bred in environmentally unfavourable conditions, increase the volume of products and reduce their cost, along with the targeted use of genetic potential.

For the more sustainable development of pastoral livestock in our country, special attention is paid to the creation and

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organization of normal feeding conditions for existing sheep and goats, using new biotechnological methods to increase meat, milk productivity and viability. The Action Strategy for the further development of the Republic of Uzbekistan sets the tasks "... to further strengthen the country's food security, expand the production of environmentally friendly products" [1].

Based on these tasks, farms specializing in the care of small ruminants in the region will increase productivity, improve the quality and production of meat by maintaining the viability, population, dry matter content and digestion of the offspring obtained through the use of biophysical, biochemical methods. The introduction of the output is of great practical importance.

President of the Republic of Uzbekistan No. PP-4243 of March 18, 2019 "On measures to support the further development of the livestock sector", No. PP-4406 of July 29, 2019 "On measures for deep processing of agricultural products and further development of the food industry" "On additional measures" and "On additional measures of state support of the livestock sector" dated January 29, 2020, No PP-4576, as well as the implementation of the tasks set out in other regulations related to this activity. To perform these tasks, we conducted an experiment on small horned animals grazing in the fields of the mountainside on the farm "Gulamdon ona" Kushrabot district of the Samarkand region.

MATERIALS AND METHODS

As a method of non-invasive biostimulation of the body, low-intensity laser radiation has recently been widely used due to the following properties:

High monochromatic (displacement Δl = 0.01 nm);

Sufficiently large power, 73 W in this case;

- The thinness of the beam-beam;
- Extreme coherence;
- It has a high energy density;
- High stability of laser beams in stationary mode;
- Hence it is increasingly used.

This helps to stabilize metabolic processes in the body and thereby increase the rate of growth and development of animals, as well as to prevent and reduce the incidence of various diseases in young animals. According to our study on the benefits of using lasers to prevent disease, exposure to laser light 5-7 days before and 10 days after birth in cows 'mammary glands is known to increase the safety of newborn calves by 24.87% [14]. Innovative ways to enhance the colostral immunocompetent properties of colostrum for cows and calves from first-calf heifers biophysical methods [2].

The effects of laser radiation are associated with protective-compensatory mechanisms, general biological and adaptive effects at the cellular, tissue and organ level, and contribute to the activation of self-regulation [6,12].

Laser radiation has a positive effect on the physiological functions of the respiratory system - thermoregulation and the formation of the centre of cardiovascular activity. In the neonatal phase, the stabilization of physiological parameters is observed to increase threefold after exposure to laser

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radiation [11]. Activation of biosynthetic processes may be one of the important factors determining the effect of low-intensity laser radiation on the most important functions of cells and tissues, vital activity and renewal [3].

After exposure to laser radiation, the energy capacity of the cells increases, which helps to increase their adaptogenic compensatory abilities. In addition, summarizing the results obtained, it can be concluded that low-intensity laser radiation serves as a factor with immunocorrective and reparative effects [5,6].

RESULTS

Under conditions of favourable order and exposure dose, positive changes in metabolic processes are observed when there are different mechanisms of reception and conversion of the energy of low-intensity laser radiation by living systems. Hypoxia in tissues decreases, their recovery potential increases, and ultimately the survival of the organism, its resistance to adverse environmental factors increases, and the limits of its ability to adapt expand [8].

The effect of laser radiation on the functional activity of the cell - increases the activity of enzymes that provide important information about the basic biochemical mechanisms. Along with the enzymes of the tricarboxylic acid cycle, the activity of enzymes acting on compounds of protein and carbohydrate metabolism increases, when exposed to low-energy laser radiation doses, which in turn stimulates redox processes. When irradiated with a low-intensity laser, hypoxia of "soft" tissues occurs, and it is believed that one of the specific mechanisms of laser exposure is its effect on the oxygen-transport function of the blood, leading to their non-specific activation. When a living organism is exposed to laser light, there is an increase in the biosynthesis of nucleic acids, as well as an increase in mitochondria and ribosomes, which results in the activation of the cell's nuclear apparatus. Activation of bioenergetic processes under the influence of low-intensity laser radiation enhances the production of universal adenosine triphosphoric acid (ATP) energy source in mitochondria, accelerates its formation, enhances cellular metabolic activity, and increases respiratory efficiency. The chain reduces the amount of oxygen consumed and causes remodelling in the membrane structures of the mitochondria [4].

Morphometric studies show an increase in mitochondrial volume under the influence of lasers. Laser radiation has an anti-mutagenic effect, activates DNA synthesis, and accelerates the recovery processes in cells exposed to neutron flux or gamma radiation. Low-intensity laser radiation not only destroys the cell organelles of tissue components but also activates their regeneration.

In addition, the ability of cells to form new organelles is increased, microcirculation is improved, and most importantly, the recovery of somatic cell chromatin is enhanced. Blood, in general, is considered by the hematopoietic system to be particularly sensitive to laser radiation. Under the influence of low-intensity laser radiation in the blood serum, the total intensity of protein increases, which reflects the fact that the infrared spectral effects of low-intensity pulsed lasers are directed to the regenerative function of substances. Found that low-intensity radiation was associated

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with improved blood microcirculation. The enhancing effect of low-power laser radiation on the lymph microcirculatory system has been studied [9,13].

CONCLUSION

Low-energy lasers provide a corrective effect of light on the blood coagulation system. Laser light causes a decrease in the functional activity of platelets, which is characterized by a decrease in their viscosity and ability to bind. The effect of laser radiation on animals shows a significant increase in the number of leukocytes in the peripheral blood. Moderate leukocytosis is accompanied by significant fluctuations in the composition of individual leukocyte forms. The therapeutic effect of laser therapy depends on immune reactions and immunocytes are one of the main sensitive targets in the body. Interactions between populations improve the state of the overall immune system, which ultimately leads to an improvement in the functioning of other protective and regulatory systems in the body. However, the mechanism of action of low-intensity laser radiation on immunocompetent cells has not been fully elucidated. The immune system, as the body's control system, is indeed sensitive to the effects of the laser, and the nature of this interaction remains unexplored. Experimental studies to study the immunomorphological aspects of the problem are rare [7].

The development and outcome of common pathological processes (inflammation, regeneration, proliferation, metaplasia, and sclerosis) are mainly due to the role of immune mechanisms, the involvement of immunocompetent cells (T and V-lymphocytes, macrophages), humoral immune factors (immunoglobulin, lymphocytes, monokines, and regulatory peptides) determined. The immune system promotes the idea that changes in climatic conditions can be achieved by increasing the concentration of T and V lymphocytes, immunoglobulins - IgA, IgM, IgG and catecholamines in the sympathoadrenal system. Stabilization of these indicators usually takes about 14 days. However, with the help of laser exposure (supravascular effect on the blood), the manifestation of stress in the adaptation process is reduced, the adaptation period is significantly shortened (from 5 to 6 days). The reflective properties of laser light can be used to accelerate and soften adaptation processes, which has been confirmed by the results of these studies [10].

They tried to study the effects of low-intensity laser radiation on lymphoid cells. The authors analyzed the effect of Ne-Ne laser (240 mW/cm2), exposure time 30 minutes, and immunological parameters isolated from individual fractions of blood leukocytes and lymphocytes (in vitro). In their study, the authors confirmed that the effect of all leukocyte populations in this order did not deprive lymphocytes of the ability to produce in the presence of antigen, a factor that reduces cell adhesion is a previously discovered leukocyte suppression reaction.

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