

# The importance of stimulation of metabolism processes in the body of *Ovis aries* L. by biophysical methods

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**Abstract.** In this article, for the first time in the extreme conditions of Uzbekistan, in order to reduce farm costs from born male lambs, data on the use of low-frequency laser radiation as one of the biophysical methods is presented and summarized, which, as studies have shown, ensures the normal course of physiological processes in the body of male lambs that fall into a state of stress after separation from their mothers and the cessation of breastfeeding. The work presents reliable data on the positive effect of this method, which also improved the quality indicators of the resulting livestock products.

## 1 Introduction

In order to increase the efficiency of the Karakul breeding network by selective methods, the most important conditions are practical developments and their technological improvement, which can ensure the productivity of animals and contribute to the reduction of materials used in animal husbandry. In the production of various products, it is important to fully utilize the biological potential of meat products. At present, for the population of the country, the biological nature of the body of farm animals, their ability to adapt to the influence of various environmental factors, as well as the comprehensive use of biochemical, biophysical and physiological methods in various sectors of agriculture are of great importance. The deterioration of the ecological situation, insufficient precipitation and snow, the emergence of drought symptoms, the reduction of natural pastures, the increasing dominance of poisonous plants instead of edible ones, have had a significant negative impact on the development of pasture livestock farming in Uzbekistan in recent years. In addition, there is a practice of annual selection of 50x50% of ram lambs and ewe lambs from karakul ewes. The exception is ram lambs, which are left for breeding until they become independent (not counting lambs with brown, white skin color and other defects). Previously, all karakul farms organized centralized slaughterhouses for removing ram skins, and thus the farms were protected from excessive losses and costs.

Undoubtedly, research and development aimed at increasing the productivity and natural resistance of the organism of Karakul sheep rams (males) through the use of biophysical

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methods will become the object of new innovative research not only in Karakul breeding, but also in relation to small cattle in general. That is, this method can be used in technological processes for the care of young males obtained in farms in large quantities. The relevance and necessity of this research work is due to the lack of research in this area, as well as the lack of data on the environmental and chemical negative impact of the biophysical methods used on the resulting products, the efficiency of animal husbandry [1, 2].

In recent years, in scientific centers of many foreign countries, physical factors, including the effect of low-frequency laser radiation, which has a stimulating effect on growing animals under moderate feeding and care conditions, are considered as the most effective and convenient biological factors for increasing the productivity of growing animals [3, 4].

However, in the available literature and scientific articles it is noted that an increase in animal productivity and the body's resistance to the effects of various unfavorable factors occurs, first of all, due to the stabilization and activation of anabolic processes in the animal body [5]. In developed countries, it has been shown that the use of laser technologies at different stages of animal life is very effective in achieving genetically high and high-quality productivity from cattle raised on an industrial basis. The advantage of biophysical methods, especially low-intensity laser radiation, compared to other biological methods is that the resulting effect has a multifaceted positive effect on the animal's body, including the ability to fight diseases and increase productivity. Recently, much attention has been paid to increasing the production of lamb and improving its quality in the field of karakul breeding. Therefore, the problem of ensuring the viability of weaned lambs, strengthening their health, increasing productivity, growing environmentally safe, chemically clean, high-quality sheep products is one of the main priorities [6]. In this regard, the main attention should be paid to the restoration of functional reserves of important adaptive systems of the body under the influence of various biochemical and biophysical factors. One of them is low-frequency laser radiation - a method that allows stimulating the productivity of farm animals and increasing the natural resistance of their body. Traditionally, at the age of 5-6 months, in all livestock farms, lambs are weaned from their mothers' milk, separated from them, and herds are formed by sex. At this time, all lambs of both sexes are exposed to the same stress conditions. But in male lambs, stress is different in that the process of excitation of their higher nervous activity is somewhat active: they ram each other, push each other, chase each other, and as a result, due to dehydration and lack of nutrition, 45-50% of male lambs under 1 year old go to waste, and this not only does not compensate for the farm's costs, but also increases the amount of costs by 2 times. As a result, the economic efficiency of farms specializing in the production of livestock products decreases, and leads to an increase in the cost of manufactured products [7, 8].

It is known from literary sources that in recent years, large scientific centers of developed countries, including scientific institutions of the Stavropol Territory of Russia, have presented processed data on the use of low-frequency laser beams for 1.5-2.0 minutes (twice) on the day of birth of lambs in the thymus gland or thymus (for 1 day). The thymus is known to produce hormones thymosin and thymopoietin, which stimulate the production of antibodies, releases leukocytes - T-lymphocytes into the circulating blood, which destroy abnormal cells storing foreign antigens. Another function of the thymus gland is to prevent pathological growth of body cells. It also ensures moderate growth and development of body cells, their metabolism within the physiological norm under the stimulating effect of the digestive glands of the gastrointestinal tract, increases the appetite of animals due to the secretion of digestive juices, and also helps to increase productivity by increasing the consumption of food without dividing it into one type or another [9].

The positive changes observed in lambs after their separation from their mothers up to 10-12 months of age have attracted attention, since they have been well studied and the results obtained are data worthy of implementation in production [10]. However, in the conditions

of Uzbekistan, the nutrition of lambs, digestion and assimilation of food ingredients, under the influence of unfavorable food and climatic factors in the body of weaned lambs as a result of a number of stresses, as well as research on the influence of biophysical methods on such processes as consumption of pasture feed, were not carried out. Therefore, the problem of increasing the productivity of lambs given for breeding, while maintaining their health and viability, enriching the market with environmentally friendly, high-quality, competitive lamb meat, has become one of the most priority areas in the modern market economy.

## 2 Methods

The analysis of quantitative and qualitative characteristics was carried out using statistical and mathematical methods, which ensured the objectivity (reliability) of the results obtained.

Two groups (control and experimental) of 15 lambs each were formed. In the first group, the lambs were exposed to low-intensity laser light, while in the second group, they were not. Unlike the control group, the lambs of the experimental group, at the age of 15-20 days, were exposed to low-intensity laser radiation on the area of the thymus gland for an average of 1.5-2.0 minutes for 2 days. All other experiments were technically carried out similarly.

In the experiment, the lambs were exposed to a laser device MSL-FN-639-50 mWBI90389 with a power of 0.5 J/cm<sup>2</sup> and an exposure time of 1.5-2 minutes and a laser beam wavelength of  $\lambda=632.8$  nm (in infrared color) with low intensity, using a helium-neon laser with a power of E=1 mW.

Research using biophysical methods was conducted at the “Tulganoi Ona” state farm in the Kusrabad district.

The results directly depend on the intensity of the impact. In veterinary medicine, laser radiation is mainly used in three different ways. The use of such methods is selected depending on the size or pathological type of the object.

1. The interaction method (contact) - the illuminator touches the object or presses lightly on the skin (so that the light penetrates deeper and is reflected and scattered less). This method can achieve a flow of energy of maximum intensity through small surfaces.

2. Stable method – for this method, the illuminator is firmly fixed in the impact zone in a stationary state and the object is irradiated for at least one minute.

3. With an unstable (unstable) method, the emitter moves along the sphere of influence.

The authors used the contact method, which was more consistent with the stated goals and objectives than others.

It should be noted that the lambs in both groups were identical in time of birth, live weight, color, sex, and the feeding and care processes were carried out properly [11].

In the evening, after returning from the pasture, each lamb in both groups was fed an average of 200 g of barley groats and 400 g of boiled alfalfa, dried to a moisture content of 45-55% (the state of haylage when stored in the shade for 2 days). If the barley groats were completely eaten during feeding, then the average amount of hay from various grasses in the control group was 80-95 grams, and in the experimental group this figure was 43-50 grams, this shows that 50% more hay was consumed in the experimental group. During the reporting period, the nutritional balance experiments were continued on 5 lambs of the compared groups, while the digestion of substances, microbiological and biochemical processes in the rumen were analyzed. To do this, food samples were taken from the rumen of lambs using a probe [12] and the number of cellulolytic bacteria and ciliates, which play a predominantly important role in the assimilation of food by animals, were determined, improving the appetite of animals, creating a moderate and active environment in the rumen, activating the digestion of nutrients, and their ratio to each other was determined.

During the analytical work, the acid activity of gastric juice was determined on the LPU-01 potentiometer, the total amount of volatile fatty acids (VFA) was determined on the Markgamma apparatus, fatty acid fractions (acetic, propionic and fatty) were determined by gas-liquid chromatography, total and protein nitrogen was determined by Keldahl, and the amount of non-protein nitrogen was determined by subtracting protein nitrogen from total nitrogen. The results obtained were processed statistically and their reliability level was determined.

### 3 Result and Discussion

Before the start of the experiment, the selected lambs were examined by veterinarians and after receiving a conclusion about their health, experimental studies were carried out with the lambs.

After the introduction of supplementary feeding, the lambs did not eat pasture food at all, only water. Therefore, during the experiment, only the dry matter of the food consumed during supplementary feeding and its nutrients were taken into account (Table 1).

**Table 1.** Digestibility of consumed dry matter in the body of compared lambs in the experiment (M±m, n=5)

Indicators	Groups	
	Control	Experience
Dry matter consumption, kg	0,430	0,472
Energy food protein, g	0,36	0,39
Exchange energy, mJ	4,21	4,24
Digestible protein, g	34,4	37,2
Calcium, g	3,0	3,4
Phosphorus, g	1,40	1,52
Table salt, g	Licking	Licking
Carotene, mg	5,7	6,4
Digestibility, %	50,6	56,5

During the experiments, dung bags were attached to the lambs, they were fed with the herd on the pasture during the day, and in the evening they were separated from the herd, fed with additional feed, and in the morning they were driven out to pasture with the herd again. Before driving them out to pasture, the amount of droppings in the dung bag was determined, a 10-15% sample was taken for chemical analysis, and the cleaned dung bag was tied back in place and the manure excreted during the day was collected again.

Furthermore, during the 7-day experiment with equal feed amounts for both groups, it was found that the amount of feed consumed by the lambs in the control group was 0.430 kg compared to 0.472 kg for the lambs in the experimental group. This showed that they consumed 9.77% more feed than the control group.

The dry matter digestibility coefficient of the food consumed daily by the lambs of the compared groups, consisting of pasture feed supplemented with mixed grass silage and barley groats, was 50.4% in the control group and 5.8% higher in the experimental group, amounting to 56.2%. This is due to the fact that in the process of chewing and grinding the fibrous structures of food, which serve as the main food product for bacteria, the scope of action of microorganisms on the food mass expands and, as a result, their digestibility increases.

In lambs, chewing of the cud usually began 30-36 minutes after the end of the evening feeding, 4-6 cuds were observed during the night, each of which lasted on average 22-25 minutes. After a rest period lasting 35-65 minutes, the chewing process began again.

According to the results of the experiments, it was established that the process of chewing food lasts 8-12% longer in animals of the experimental group than in animals of the control group. Rumination was recorded 6-8 times for 5 minutes in the rumen of lambs of both compared groups.

It has been established that the concentration of hydrogen ions in the rumen fluid has a certain effect on the appetite of animals, that is, on food consumption [13].

According to the data obtained, it was assumed that as a result of the application of biophysical methods, there is an increase in the process of chewing food, which leads to an increase in the secretion of saliva and an improvement in the digestion process in the rumen. Consequently, in both groups, these processes were close to each other, and that these conditions were favorable for the activity of microorganisms in the rumen (Table 2).

**Table 2.** Acidity of rumen fluid of lambs (pH), volatile fatty acids (VFA) and their percentage (M±m, n=5)

Indicators	Groups	
	Control	Experience
pH	6,51	6,78
Volatile fatty acids (VFA), mmol/ml	9,82±0,18	11,07±0,21
Acetic acid, %	64,5	67,8
Propionic acid, %	23,6	29,9
Butyric acid %	11,7	7,77

A diet consisting only of roughage increases the pH level in the rumen and simultaneously increases the secretion of saliva. This, in turn, provides additional buffer protection for the rumen. This acidity level is created by the precipitation of bicarbonates and sodium phosphate. As a result of the evacuation of acids from the rumen, they are transferred with the chyme to the intestine and are carried into the blood, which is ensured by the buffering properties of the rumen fluid. In addition, when the rumen fluid environment is close to neutral (pH 6.4-6.8), very favorable conditions are created for the development of microflora.

In the lambs of the experimental group, the amount of VFA formed in the rumen and the percentage of acetic acid were 12.73% and 1.18 mmol/ml higher compared to the control group. In the control group, it was observed that the VFA fractions were at a normal level, but in the lambs of the experimental group, in our opinion, the increase in the proportion of propionic acid occurred due to a decrease in the proportion of fatty acids, which allowed us to conclude that the decrease in the proportion of fatty acids is associated with the deposition of fats located in tissues and providing an increase in the live weight of animals.

**Table 3.** Cellulolytic activity of microorganisms (CAM) in rumen fluid, percentage content of bacteria and ciliates in it; (M±m, n=5).

Indicators	Groups	
	Control	Experience
CAM %	13,71±0,59	14,37±0,77
bacteria, mg/ml	2,49±0,20	3,29±0,39
ciliates, mg/ml	2,73±0,56	2,62±0,29

According to the data presented in Table 3, the cellulolytic activity of microorganisms reflects primarily the breakdown and assimilation of fibrous structures of food products by bacteria. When studying the percentage of bacteria and ciliates in the rumen fluid, it was found that the percentage of bacteria in the rumen fluid of the lambs in the experimental

group was 32.13% (0.8 mg/ml) higher than in the control group. And the percentage of ciliates prevails in the lambs of the control group by 0.96% or 4.1 mg/ml.

The quantitative proportions of bacteria and ciliates in the rumen fluid reflect the nitrogen metabolism in the rumen fluid and were recorded in a number of laboratory analyses on the physiology of nutrition. According to the data presented in Tables 3 and 4, the percentage of bacteria in the rumen fluid of the lambs of the experimental group was higher, and the concentration of total nitrogen was 19.90% higher than in the control group. This is the result of the positive effect of low-frequency laser radiation on the activity of the secretory glands in the walls of the initial section of the stomach and intestinal system, when the motility of the walls involved in the digestion process is activated, the secretion of juices is accelerated, the appetite of lambs is ensured, as a result of which the consumption of food and the digestion of nutrients contained in it leads to an increase in rumen fluid. Improvement of digestive processes indicates that favorable conditions have been created for improving the activity of microorganisms acting in the rumen. As a result, this led to an increase in the amount of consumed and digested nutrients, acceleration of bacterial activity, which was reflected in the results obtained on the daily dynamics of growth and development of lambs. The proportion of ciliates in the rumen fluid of the lambs in the control group was 97.5% higher than in the lambs in the experimental group, which ensured a higher percentage of protein-free nitrogen in the rumen fluid (Table 4).

**Table 4.** Percentage of total, protein and non-protein nitrogen in large abdominal fluid ( $M \pm m$ ,  $n=5$ )

Indicators	Groups	
	Control	Experience
Total nitrogen, mg%	114,4±3,5	137,2±4,2
Protein nitrogen, mg%	94,7±4,2	127,9±6,3
Protein-free nitrogen, mg%	19,7±4,4	9,21±2,1
Ammonia nitrogen, mg%	13,7±0,6	14,37±0,8

Due to gases (CO<sub>2</sub>, hydrogen peroxide, NH<sub>3</sub>) produced by microflora during fermentation, the nitrogen contained in ammonia is converted into the body's own protein of bacteria and infusoria, and a large amount of rennet enzymes enters the rumen fluid. In the rumen, the microflora and body proteins killed by hydrochloric acid are used as a source of protein-free nitrogen.

The fact that the concentration of ammonia formed in the rumen fluid of the compared groups in the experiment is almost the same allows us to conclude that this was due to the homogeneity of the food consumed. We believe that the increase in the duration of the process of chewing the feed by lambs had a positive effect on the neutralization of acidosis with the help of buffer components contained in the silage.

Available literature presents the species composition of microorganisms, their activity, production and transport of ammonia, organic acids, performance of the functions of movement of the large and small stomach, primarily depending on the level of the environment (pH). In turn, the reaction of the environment ensures the composition, quality of food, and active life of the rumen microflora.

In addition, a positive result is that feeding lambs with natural pasture feed and hay from different grasses allowed them to re-chew food, ensure the processes of separation of a large number of macrota and promote gastrointestinal motility, while in the experimental lambs the number of ciliates in the rumen fluid was at a higher level compared to the control group.

A large number of ciliates in the rumen indicates a moderate flow of enzymatic processes there. Ciliates are very sensitive to changes in the environment in the rumen; if conditions there are unfavorable, this is primarily manifested by their disappearance (death). It has been

established that 67.0% of the number of ciliates in the large rumen of lambs belongs to the class of small ciliates.

The results of natural resistance in the blood and serum of experimental lambs show that the phagocytic activity of neutrophils in the blood of lambs treated with low-intensity laser radiation significantly exceeds that of lambs in the control group (Table 5).

**Table 5.** Natural resistance indices in the blood and serum of experimental lambs, % (M±m,n=5)

Indicators	Groups	
	Control	Experience
Phagocytic activity of neutrophils	41,9±0,9	52,9±1,1
Bactericidal activity of blood serum	43,1±0,8	51,7±1,0
Serum lysozyme activity	44,1±1,4	54,8±0,9

The table shows that the phagocytic activity of neutrophils in the blood of the lambs of the experimental group treated with low-intensity laser radiation was 26.3% higher than that of the lambs of the control group. This, in turn, indicates the activation of the bactericidal and lysozyme activity of the blood serum.

## 4 Conclusion

In recent years, the food and climate conditions of Uzbekistan have become distinctly continental. An animal adapted to such conditions and possessing high natural resistance of the organism can be viable and productive.

Based on the above, it can be concluded that low-intensity laser radiation can be used as one of the biophysical methods for stimulating lamb metabolism and improving digestion processes and increasing the coefficient of nutrient digestibility in extreme conditions, when consuming roughage on pasture. The paper presents reliable data on the positive effect of this method, which also improved the quality indicators of the resulting livestock products.

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