

# Morphological changes in sheep blood when using the associated vaccine against salmonellosis and pasteurellosis

*K.B. Makhmudov\**, and *I. Sattori*

Institute of problems of biological safety and biotechnology TAAS, 734067, Dushanbe, Republic of Tajikistan

**Abstract.** The article presents the results of studies on the use of an associated vaccine against salmonellosis and pasteurellosis. It was found that the number of erythrocytes and leukocytes in the blood of vaccinated animals increases, as well as the levels of hemoglobin, total protein and its fraction, which indicate a positive effect of the associated vaccine on hematological parameters and the content of total protein in the blood of animals.

## 1 Introduction

Sheep breeding is the main livestock industry in Tajikistan and plays a predominant role in the welfare of the population. This is due to the fact that the republic has natural mountain pastures on an area of more than 3.8 million hectares and is more effectively used by farms (state, farmers and the population) that raise small cattle.

Currently, there are more than 6 million heads of small cattle in the republic, and with the development of economic reforms, about 92% of animals are in the private sector (farms, dehkan farms and private households of the population) and only 8% of animals are kept in state farms.

Resolution of the Government of the Republic of Tajikistan No. 160 dated March 27, 2018 approved the "Comprehensive program for the development of the livestock industry in the Republic of Tajikistan for 2018-2022". The main goal of the Program is to increase the production of meat, milk, eggs, honey, fish using modern technologies, the creation of new livestock farms to increase the productivity and productivity of animals, birds, fish, bees in all forms of ownership, providing the population with environmentally friendly food, increasing the yield of pastures by 15-20 quintals, creating a stock of genetic species and semen of pedigreed animals, the creation of new jobs and, in general, the production of import-substituting products and ensuring food security.

This Decree of the Government of the Republic also obliges scientists of specialized institutes of the TAAS to more actively introduce their achievements and the results of

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\* Corresponding author: [mkamoljon@mail.ru](mailto:mkamoljon@mail.ru)

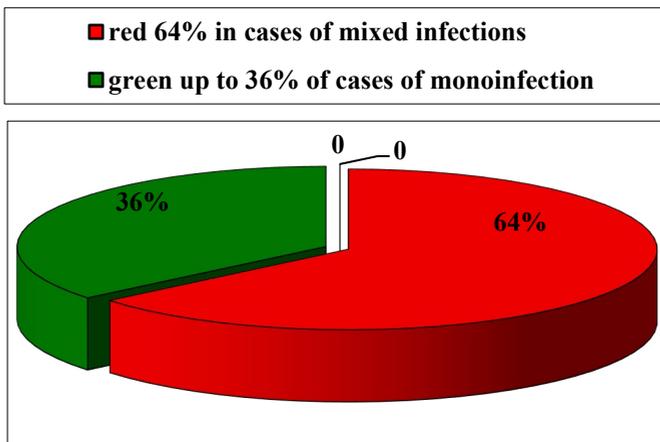
scientific work into production in order to solve the problems that have arisen in animal husbandry and prevent infectious animal diseases.

Sheep and goats are in summer and winter pastures all year round, and a system of mountain and valley sheep breeding has been established in the republic. Animals from May to October are in (summer) mountain pastures and from November to April in valley (winter) pastures.

Taking into account the natural and climatic conditions, the annual lambing campaign begins in February and there are more than 2 months left before the flight to the summer pastures. During this short period, the veterinary service plans to carry out a set of preventive measures to prevent infectious and invasive diseases. Depending on the epizootic situation on the ground, animals are vaccinated against 5-6 of the most common infectious diseases before driving away.

Based on this, the urgent need to immunize animals with complex and associated vaccines is obvious.

The development of sheep breeding is largely hindered by infectious diseases. Current infectious diseases of young farm animals are colibacteriosis, salmonellosis, pasteurellosis, diplococcal septicemia, streptococcosis and staphylococcosis. According to our research, various mixed bacterial infections in sick young farm animals in farms of Districts of republican subordination of the Republic of Tajikistan (DRS RT) occur up to 64% [7]. (Figure 1).



**Fig. 1.** Mixed bacterial infections in sick young farm animals in the farms of Districts of republican subordination of the Republic of Tajikistan.

Analysis of the literature shows that mixed bacterial infections of sheep are common in the CIS countries and the world [1].

It was found that when animals were vaccinated simultaneously against pasteurellosis, salmonellosis and trichophytia, an increase in the number of leukocytes and total serum protein was noted, and intense immunity to all three infections lasting more than 4-5 months was also formed [2].

In the case of mountain sheep breeding, the fight against infectious diseases of animals, especially when animals are infected with several pathogenic pathogens at the same time, is a problem for livestock breeders [3].

An associated vaccine against infectious pathology - chlamydia, salmonellosis, leptospirosis and campylobacteriosis has been created for sheep. The test showed that the

use of such a vaccine increases the yield of lambs with a significant reduction in vaccination costs [3].

Predisposing factors of animal infection in the republic are cattle-driving tracks of flocks from winter to summer pastures with a length of 500-600 km. The risk of infection of animals lies in the fact that up to 700 or more flocks with a population of 700-1000 heads each are driven along the same route. At the same time, sick animals and bacterial carriers with feces and excretions spread pathogens into the external environment and infection of healthy animals occurs.

Due to the reform of state farms and the emergence of farms and dehqan farms, cattle runs are so narrowed that animals can hardly move and there is no way to properly feed the animals. This often leads to a decrease in the natural resistance of the body and infection of animals.

Based on the above, the relevance of creating associated vaccines and conducting timely comprehensive vaccination of animals before the removal of small cattle to flight pastures is obvious [2, 3, 9, 10].

Long-term scientific research conducted in sheep farms of the republic has shown that various gray groups of salmonella and pasteurilla play an important role in the infection of sheep. Many imported monovaccines against salmonellosis and pasteurellosis from different strains of pathogens do not have the corresponding effect. Based on this, in order to increase the preventive activity of the vaccine, we studied more than 485 samples of pathological material of patients and sheep who died from salmonellosis and pasteurellosis. As a result of studying the bacteriological and immunogenic properties, as well as the pathogenicity of 120 isolates of salmonella and pasteurilla, 5 strains of these pathogens were selected for the manufacture of the associated vaccine.

The study of the properties of the experimental series of this associated vaccine showed that it is sterile, harmless to laboratory animals and sheep, weakly lactogenic and has high immunogenic activity [4, 6].

During the production testing of the associated vaccine against salmonellosis and pasteurellosis, sheep develop a fairly intense immunity [6].

The results of our experiments are confirmed by studies conducted by a number of scientists [2, 3].

## **2 Materials and methods**

The research was carried out in the Laboratory of monitoring of Infectious diseases of small cattle and the department of biotechnology of the Institute of problems of biological safety and biotechnology of the Republic of Tajikistan (IPBSB) and in the Center of animal biotechnology of the Institute of animal husbandry and pastures of the Tajik academy of agricultural sciences.

For immunization, an associated vaccine against salmonellosis and pasteurellosis, manufactured in IPBSB, was used. The experimental animals were immunized according to the instructions for the use of the associated vaccine.

30 sheep heads were selected for the study and three experimental groups of animals of 10 heads were organized. The first group of animals consisted of 6 month old lambs, the second group consisted of 3 year old sheep, the third control group consisted of 5 heads of sheep and 5 heads of 6 month old lambs. The experimental animals were kept in separate pens. They were fed according to the diet we developed the same way.

For hematological studies, blood samples were taken from experimental animals (before vaccination, 14 days after vaccination), treated with a heparin solution. Hematological studies were carried out on the mindray VS-5150 hematological analyzer at the Istiklol

medical institution. The obtained blood samples were delivered to the named institution within the same day after taking the blood, in a special thermochem. In these studies, the content of hemoglobin, leukocytes and erythrocytes was determined.

Also, the blood serum of the second experimental group and control animals (5 sheep) was examined before vaccination, 14 and 30 days after vaccination for the content of total protein and its fractions. The analyses were performed by the biuretic method.

The results were processed using statistical analysis for Microsoft Excel. The reliability of the results was evaluated using the Student's t-test.

### 3 Research results

The results of the studies showed that the associated vaccine against salmonellosis and pasteurellosis has a weakly lactogenic property for small cattle, which is expressed in an increase in body temperature by 0.4-0.8°C and a slight local reaction in the form of a small swelling at the site of subcutaneous administration of the associated vaccine, which disappeared for 5-7 days. At the same time, no changes in the general clinical condition of the experimental animals were observed, the experimental animals were active and ate food well, lameness in these animals was absent.

As a result of the conducted studies, it was found that in vaccinated animals, an increase in the number of red blood cells was noted during the study on the 14th day after vaccination. So, in the first and second experimental groups, these indicators were 1.02 and 1.01 times higher than those of the control group. An increase in hemoglobin levels was noted. Thus, in experimental animals of the first experimental group, hemoglobin increased by 0.82, in sheep of the second experimental group - by 1.02 times in relation to the indicators of the control group.

There was an increase in the number of leukocytes to  $11,63 \pm 0,534 \cdot 10^9/l$  in animals of the first experimental group; to  $14,15 \pm 0,674 \cdot 10^9/l$  in animals of the second experimental group, however, in the control group of animals, the number of leukocytes was within the indicator before vaccination.

The content of total protein and its fraction in the blood serum of sheep of the second experimental and control (5 heads of sheep) groups before vaccination averaged  $64,3 \pm 0,03 g/l$ , alpha-globulins ( $\alpha_1$ ) -  $4,1 \pm 0,08 g/\%$ , alpha-globulins ( $\alpha_2$ ) -  $8,9 \pm 0,03 g/\%$ ; beta-globulins -  $13,8 \pm 0,01 g/\%$ , gamma-globulins -  $25,2 \pm 0,06 g/\%$  and the obtained indicators of sheep of the second experimental and control (5 heads of sheep) groups differed slightly.

The increase in the level of total protein and its fraction in the serum of experimental sheep on the 14th day after vaccination averaged up to  $69,8 \pm 0,08 g/l$ ,  $\alpha_1$  -  $5,6 \pm 0,08 g/\%$ ,  $\alpha_2$  -  $9,9 \pm 0,03 g/\%$ , beta-globulins -  $14,6 \pm 0,01 g/\%$ , gamma-globulins -  $27,4 \pm 0,06 g/\%$ .

On the 30th day, the indicators of total protein and its fraction averaged up to  $68,2 \pm 0,05 g/l$ , alpha-globulins ( $\alpha_1$ ) up to  $4,7 \pm 0,02 g/\%$ , alpha-globulins ( $\alpha_2$ ) up to  $9,1 \pm 0,03 g/\%$ , beta-globulins - up to  $15,4 \pm 0,07 g/\%$ , gamma globulins - up to  $28,4 \pm 0,04 g/\%$  and the obtained indicators were lower than the obtained indicators (on the 14th day of the study), but remained even higher than the indicators of the control group of animals.

In the control group of sheep (5 heads) these indicators remained  $64,4 \pm 0,06 g/l$ , respectively; alpha-globulins ( $\alpha_1$ ) -  $4,3 \pm 0,08 g/\%$ , alpha-globulins ( $\alpha_2$ )  $9,1 \pm 0,03 g/\%$ ; beta-globulins -  $13,8 \pm 0,04 g/\%$ , gamma-globulins -  $25,3 \pm 0,03 g/\%$ .

The obtained indicators indicate the intensification of immunological and metabolic processes in experimental animals after the introduction of the associated vaccine against salmonellosis and pasteurellosis.

## 4 Conclusions

According to the results of studies on the 14th day after the introduction of the associated vaccine against salmonellosis and pasteurellosis, an increase in the number of leukocytes, erythrocytes and an increase in hemoglobin levels was noted in experimental animals. Also on the 14th and 30th days, there was a significant increase in the indicators of total protein and its fraction, which remained at this level until the end of observations (30 days).

The results obtained indicate an increase in the processes and activation of the immune system of experimental animals.

Thus, the results obtained during the experiments indicate a positive effect of the associated vaccine against salmonellosis and pasteurellosis on hematological parameters and the content of total protein and its fractions in the blood of animals.

## References

1. A.M. Ablov, Dissertation for the degree of candidate of veterinary sciences, (2015)
2. D.D. Butyanov, G.V. Stepanov, The tension of immunity during simultaneous vaccination of calves against pasteurellosis, salmonellosis and trichophytia, 113 (Sb. Problems of veterinary immunology, M., 1985)
3. R.A. Kadimov, Yu.B. Safarov, Associated and complex vaccination of animals, 5-8 (M., Kolos, 1974)
4. P.A. Krasochko, I.A. Krasochko, S.L. Gaisenok, E.L. Gaisenok, V.V. Ovchinnikova, Actual problems of intensive development of animal husbandry (2019)
5. A.I. Laishevtsev, *Clinical and epizootological justification of vaccination prevention and development of a vaccine against manheimiosis of cattle and small cattle* Dissertation for the degree of candidate of biological sciences, Moscow (2018)
6. K.B. Makhmudov, I. Sattori, L.M. Akhmedzhanova, Patent of the Republic of Tajikistan, No. TJ677, 7 (2015)
7. K.B. Makhmudov, I. Sattori, Study of epizootology of infectious diseases of young farm animals in farms of Districts of republican subordination of the Republic of Tajikistan. "Reports of TAAS", Dushanbe, 44-47 (2017)
8. M. A. Ponaskov, Dairy and economic bulletin, **3 (35)**, 40-44 (2019)
9. N.V. Pimenov, A.I. Laishevtsev, RJOAS, **12 (60)**, 247-254 (2016) DOI. <https://doi.org/10.18551/rjoas.2016-12.31>.
10. A.Ya. Samuylenko, Thematic collection: Veterinary Medicine, **82**, 734-736 (2003)