Vaccine prophylaxis of lumpy skin disease

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Abstract. Bovine lumpy skin disease is a viral disease that causes significant economic damage to dairy and beef cattle breeding. Its prevention is based on the vaccination of animals. The use of vaccines, on the one hand, allows to control the spread of the disease, on the other hand, to cause various complications in animals in the form of embryonic mortality and abortions. The use of immunostimulants is recommended to increase the effectiveness of vaccination of animals. One of which may be a specific transfer factor. Transfer factor is a complex of simple and complex proteins that are able to sensitize the cells of the animal's immune system to the antigen, accelerate the immunological response and prolong the effect of the vaccine, according to some data, up to one year. Its effect in vaccinating animals against lumpy skin disease has not been studied. The aim of the work was to assess the impact of a specific transfer factor on some indicators of the clinical status of animals during their vaccination against lumpy skin disease. During the study, it was found that vaccination of animals does not lead to an increase in body temperature above the physiological norm, viral antigens are not secreted through the genital tract of females. Vaccination of animals leads to liver dysfunction. This is manifested by an increase in the activity of alkaline phosphatase by 6%, the content of bilirubin by 39.3%, cholesterol by 19.9%. The use of transfer factor and the preparation Isidivit simultaneously with vaccinations, which has a hepatoprotective effect due to the content of vitamin E, allows to reduce the toxic effect of the vaccine on the liver. At the same time, the activity of alkaline phosphatase in comparison with the initial value decreases by 15.1%, the content of bilirubin increased only by 8.4%, and the content of cholesterol decreased by 5.5%.

1. Introduction

Bovine lumpy skin disease is a viral contagious disease. The causative agent is a virus of the genus Capripoxvirus of the Poxviridae family. Lumpy skin disease is a cross-border infection and occurs in many countries around the world: in Africa, the Middle East, Central Asia, Europe and the Russian Federation.

Clinical signs of the disease are observed in both wild and domestic animals and are manifested in the form of fever, nodules on the skin and mucous membranes, damage to the respiratory tract and gastrointestinal tract, enlargement of superficial lymph nodes [1-4]. Blood-sucking insects are of great importance in the spread of the disease [5].

The disease has significant economic consequences for cattle breeding, as milk production decreases, abortions and infertility occur in cows, and the industrial value of animal skins decreases. In producers,
the virus can be in the seed for a long time and thus be transmitted to other animals during mating and during artificial insemination through infected sperm [6-8]. In some cases, the death of animals may be observed due to secondary bacterial infections.

Numerous studies have established that the lumpy skin disease virus, when multiplying in the body, has an adverse effect on the homeostasis indicators of animals, which is manifested by inflammatory phenomena in organs and tissues, especially in the liver. To prevent this disease, the biological industry offers a number of vaccines: Lumpivax, vaccine against smallpox of sheep and goats. The use of vaccines gives only 60-70% of the protection of the livestock. The use of preparations stimulates not only the formation of immunity, but also numerous complications in animals in the form of rashes and ulcers on the skin, abortion, and embryonic mortality. This is especially clearly manifested in the vaccination of animals with a latent course of the disease and in highly productive animals. According to some researchers, in some cases, the vaccine strain can cause not only adverse reactions, but also reacquire virulence. Therefore, in the Russian Federation, live vaccines from an attenuated homologous virus are prohibited, and the vaccine against sheep and goat pox is used to prevent the disease [9-12].

It is known that the main share of immunity in lumpy skin disease falls on the cellular link. Therefore, its stimulation during vaccination of animals makes it possible to achieve better results from the use of vaccines, to reduce the number of complications and side effects. In this regard, the aim of the work was to assess the effect of the specific transfer factor on some indicators of the clinical status of animals during their vaccination against lumpy skin disease. Transfer factor is a complex of simple and complex proteins that are able to sensitize the cells of the animal's immune system to the antigen, accelerate the immunological response and prolong the effect of the vaccine, according to some data, up to one year. Its effect in vaccinating animals against LSD has not been studied.

2. Condition, materials and methods
The experiments were carried out in compliance with the requirements set out in the EU directives (86/609 / EEC) and the Helsinki Declaration. Studies to determine the effectiveness of the use of the transfer factor in the vaccination of animals were carried out on the basis of LLC "Agrofirma" "Magnezit in the Satkinsky district of the Chelyabinsk region. At the enterprise, according to the principle of analogous pairs, 3 groups of black-and-white heifers were formed, 5 heads each. Before applying the vaccine, blood samples were taken from animals for biochemical research; blood sampling was repeated 28 days after the start of the experiment. Before the start, 7 and 14 days after the start of the experiment, vaginal flushes were taken from the animals to detect the viral vaccine antigen. Since the vaccine against smallpox of sheep and goats was used for immunization of animals, a set of reagents "PCR-OSPA-FACTOR" was used for PCR diagnostics to detect the DNA of sheep and goat pox virus in biological material by RT-PCR. All animals were vaccinated against lumpy skin disease with a virus vaccine against sheep pox and infectious nodular dermatitis of cattle cultured dry ShipPox-LSD vac. The animals of the second experimental group simultaneously with the vaccine received preparation "Interferon-B" at a dose of 1 ml per 10 kg of live weight subcutaneously, animals of the third group on the first and second days received the transfer factor at a dose of 1.5 ml per head subcutaneously. Also, the animals of the second and third groups received preparation "Isidivit" in a dose of 5 ml per head intramuscularly. After vaccination, all animals were monitored clinically, including twice daily temperature measurements for 3 days. In the blood of animals, biochemical parameters characterizing the state of the liver were determined: cholesterol, total bilirubin, alkaline phosphatase activity. Cholesterol was determined according to Ilk using the "BIO-LA-TEST" kit. Cholesterol in the presence of acetic and sulfuric acids gives an emerald green color, the intensity of which is directly proportional to the concentration. Determination of bilirubin in blood serum is based on the following reaction: under the action of hydrochloric acid, the tetrapyrole bond of bilirubin is broken and two dipyroles are formed, which are diazotized by diazobenzosulfonic acid to form pink-violet azobilirubin. Serum alkaline phosphatase activity was determined by measuring the rate of hydrolysis of the phosphoric acid ester - p-nitrophenyl phosphate. The rate of substrate hydrolysis is directly proportional to the enzyme activity.
in the sample and is measured spectrophotometrically. Statistical data processing was performed using a Microsoft Excel - 2003 spreadsheet processor and a Biometrics application package.

3. Analysis and results

3.1. Study of the clinical state of animals

No clinical signs of vaccine reactogenicity were found on clinical examination of all vaccinated animals. The animals did not show oppression, refusal of food and water. The position of the body in space is natural, the reaction to external stimuli is adequate. The visible mucous membranes of the nose, conjunctiva, reproductive system is moderately moist, pale pink in color. In one heifer of the second experimental group, slight depression and swelling at the injection site of the vaccine was observed. It disappeared on the third day after vaccination (figure 1).

![Figure 1. The third day after vaccination.](image1)

The results of measuring the temperature of the animals of the experimental groups are shown in figure 2.

![Figure 2. The results of measuring the temperature of animals.](image2)

Measurements have shown that vaccination did not cause an increase in body temperature in animals. On the contrary, over the course of six measurements, the body temperature of the heifers decreased by 0.6-0.9 degrees. It should be noted that the greatest difference in temperature was observed in the group of animals that received Interferon-B together with the vaccine.
Since the sheep and goat pox virus is epitheliotropic, its isolation through the genital tract of females after vaccination is possible, which in some cases may cause complications after vaccination in the form of abortions and embryonic mortality [9-12]. At the same time, according to our observations, abortions have pathological signs similar to lumpy skin disease (figure 3).

![Figure 3. Abortion of the fetus. Nodules on the skin.](image)

The results of studying the possibility of isolating the virus through the mucous membranes of the genital tract are shown in table 1.

**Table 1.** Study of the isolation of sheep and goat pox virus through the mucous membranes of the genital tract of heifers.

| Control period       | 1 experimental group | 2 experimental group | 3 experimental group |
|----------------------|----------------------|----------------------|----------------------|
| Before vaccination   | Sheep and goat pox   | Sheep and goat pox   | Sheep and goat pox   |
|                      | virus was not detected| virus was not detected| virus was not detected|
| 7 day after vaccination | Sheep and goat pox     | Sheep and goat pox     | Sheep and goat pox     |
|                      | virus was not detected| virus was not detected| virus was not detected|
| 14 Day after         | Sheep and goat pox   | Sheep and goat pox   | Sheep and goat pox   |
| vaccination          | virus was not detected| virus was not detected| virus was not detected|

The data in table 1 indicate the absence of vaccine antigens in the body of animals before vaccination and their isolation through the genital tract of animals.

The contact of the animal organism with the vaccine, the purpose of which is to develop immunity, is accompanied not only by immunological reactions, but also by profound changes in the homeostasis of the internal environment. At the same time, metabolic products are produced that can have a negative effect on the animal's body, sometimes even more than the vaccine antigens themselves. Disinfection of a significant amount of toxic substances occurs in the liver. Table 2 shows data on the effect of
vaccination against lumpy skin disease on some biochemical parameters of blood serum, characterizing the state of the liver of animals.

**Table 2.** The effect of vaccination of animals on some biochemical parameters of blood serum.

| Indicator                      | 1 experimental group | 2 experimental group | 3 experimental group |
|--------------------------------|----------------------|----------------------|----------------------|
|                                | before vaccination   | after vaccination    | before vaccination   | after vaccination    | before vaccination   | after vaccination    |
| Alkaline phosphatase activity, U / l | 122.9±13.6           | 130.3±8.9            | 125.3±7.8            | 103.9±11.1           | 101.3±13.2           | 86.0±16.1            |
| Bilirubin, μmol / l            | 3.3±1.1              | 4.6±0.6              | 2.7±0.6              | 5.4±                 | 4.1±0.8              | 4.4±0.2              |
| Cholesterol, mmol / l          | 1.86±0.09            | 2.22±0.03            | 2.22±0.13            | 2.25±0.09            | 1.83±0.14            | 1.73±0.24            |

* - p<0.01.

Research data indicate that vaccination of animals against lumpy skin disease without the use of immunostimulants causes liver damage in animals. Thus, in comparison with the initial observations, the activity of alkaline phosphatase in animals increased by 6%, the content of bilirubin by 39.3%, cholesterol by 19.9% (p<0.01). In the second experimental group, the activity of alkaline phosphatase decreased by 17.1%, the bilirubin content increased by 96%, and the cholesterol content increased by 1.4%. In the third experimental group, the activity of alkaline phosphatase compared with the initial indicator decreased by 15.1%, the content of bilirubin increased only by 8.4%, and the content of cholesterol decreased by 5.5%.

4. Conclusion
Vaccination of animals against lumpy skin disease is the basis for the creation of welfare for this disease among susceptible livestock. When studying the effect of vaccines on the body, it is important important to determine the clinical state of animals after vaccination. When studying the possible pyrogenic effect of the vaccine, it was found that the biological product does not cause an increase in the temperature of the animal above the physiological norm. The body temperature in animals that received Interferon-B simultaneously with the vaccine was the highest among the other groups, since this is a feature of the side effects of interferon on the body, as well as the reaction of the body of animals to the introduction of a foreign protein. While studying, the possibility of isolating vaccine antigens through the genital tract of females after vaccination has not been confirmed. Our research has established that vaccination of animals leads to impaired liver function, which is manifested in an increase in the level of bilirubin, cholesterol and alkaline phosphatase activity in the blood serum. The use of preparation Isidivit which has a hepatoprotective effect due to the content of vitamin E, simultaneously with vaccinations, can reduce the toxic effect of the biological product on the liver. An additional effect is provided by the transfer factor, which, by stimulating the cellular link of immunity, allows for more complete absorption of destroyed cells and the removal of their metabolic products from the body.

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