Vaccinal prevention of nodular dermatitis in Hereford cattle (clinical and immunological implications)

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Abstract. Animal vaccination is the principal method of preventing nodular dermatitis in cattle. Objective: to analyze the impact of using a specific transfer factor in vaccination of Hereford cattle against nodular dermatitis on the development of immunity and indices of animal homeostasis. Application of the transfer factor and the vitamin preparation Asidivit in the vaccination of animals against nodular dermatitis has reduced the reactogenicity of the vaccine in the form of a lower temperature reaction to the medicinal preparation of biological origin. The combined application of the immunoamplifier and Asidivit decreased the negative impact of vaccination on the liver of animals. The greatest quantitative decrease in bilirubin in the blood serum by 14% was observed. It made it possible to achieve a significant increase in antibodies in the blood serum by 72.4% compared to the initial analysis and an increase in the number of antibody-positive animals up to 80%.

1 Introduction

Modern breeds of cattle are marked by high productivity, improved quality of products like milk and meat as well as wide range of opportunities for genetic progress of the breed. Together with the increase in economic indices of production, animals have developed an increased sensitivity to diseases. That is why a high percentage of pathologies is taken up by infections.

Since its discovery, animal vaccination has played a key role in the prevention of infectious diseases. Current vaccines are characterized by high preventive effectiveness and specificity. They are elaborate drugs that have provided safety in animals for a large number of infectious diseases. However, it should be taken into account that vaccination provides stable immunity in about 70% of the vaccinated livestock.

Yet, in practice, there are often events of violation of post-vaccination immunity formation. It is possible because of a number of reasons: abnormal feeding, housing, adverse environmental factors, and anthropogenic factors. Lately, according to numerous

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reports, the violation of immunological reactivity has been identified as one of the major reasons for the low formation of post-vaccination immunity in animals.

In order to prevent immune deficiency, a great number of immunoamplifiers of plant and animal origin have been developed and are being used. An effective immunoamplifier is a drug with an antigen-directed effect. These drugs contain Lawrence factor or transfer factor.

The transfer factor has the following features: water soluble, undergoes dialysis, has a relative molecular mass of less than 10,000. It also includes polypeptides and oligonucleotides. Transfer factor is thermolabile. It is not an antigen. It transfers the ability to respond to cellular immunity. As for practical purposes, the transfer factor is mostly used for immunocorrection of cellular immunity [1-3].

The last feature of the transfer factor may be used to improve the effectiveness of vaccine prevention of nodular dermatitis in cattle.

Nodular dermatitis in cattle is a viral contagious disease. The pathogen is a virus of the genus Capripoxvirus of the family Poxviridae. Clinical evidence is characterized by fever, nodulation on the skin and mucous membranes, corrosion of the respiratory and gastrointestinal tract, and enlargement of the superficial lymph nodes [4-7]. The vector-borne way of transmission of the pathogen is proved [8].

The economic loss from the disease is made up of a decrease in milk productivity, abortions and infertility in cows, and a decrease in the quality of animal skins. In servicing bulls, the virus may cause short-term sterility, and may be transmitted via frozen sperm during artificial insemination. In some cases, animals may die due to bacterial secondary infections [9-11].

During vaccination of animals, complications in the form of diseases flare, abortions and fetal mortality are possible. This is particularly true when using medicinal preparations of biological origin containing a homologous pathogen or using a vaccine for animals that have a asymptomatic infection course.

To this end, the purpose of the research was to analyze the effectiveness of a specific transfer factor application in vaccination of Hereford cattle against nodular dermatitis on the formation of immunity and indices of animal homeostasis.

2 Materials and methods

The experiments were conducted in compliance with the requirements specified in the EU directives (86/609/EEC) and the Helsinki Declaration. Research to identify the effectiveness of the transfer factor in animal vaccination was performed on the basis of “Agrofirma “Kalininskaya” OOO of the Bredinsky district in the Chelyabinsk region. 3 groups of heifers of the Hereford breed with 5 items each were formed at the enterprise on the basis of pairs of analogs. The animals were 12-14 months old. Blood sampling was performed in animals before the use of the vaccine for a biochemical study as well as for determining the antibody titer. Blood sampling was repeated 28 days after the start of the experiment. Before, 7 and 14 days after the start of the experiment, vaginal swabs were taken from the animals to detect the viral vaccine antigen. As the sheep and goat smallpox vaccine was applied for animal immunization, a set of reagents "PCR-OSPA-FACTOR" was utilised for PCR diagnostics to detect the DNA of the sheep and goat smallpox virus in the biological material by Real-time PCR. All animals were vaccinated against nodular dermatitis by a virus vaccine against sheep posthitis and infectious nodular dermatitis of cattle with a cell-derived and dry vaccine “ShipPox-LSD vak”. Animals of the second experimental group were simultaneously treated with the vaccine with the drug "Interferon-B" in a dose of 1 ml per 10 kg of live weight subcutaneously. Animals of the third group were treated with the transfer factor in a dose of 6.0 ml per animal item subcutaneously on

the first and second days. Moreover, the animals of the second and third groups were administered “Asidivit” in a dose of 5 ml per animal item intramuscularly. After vaccination, all animals were followed up clinically, including twice, with an interval of 12 hours. The temperature was calculated daily for 3 days. Biochemical indicators of the liver condition were determined in the blood of animals: cholesterol, total bilirubin, alkaline phosphatase activity. Cholesterol was determined by Ilk, using “BIO-LA-TEST” set. Cholesterol in the presence of acetic and sulfuric acids gives an emerald-green color, the intensity of which is directly proportional to the concentration. Indentification of bilirubin in blood serum is based on the following reaction: under the action of hydrochloric acid, the tetrapyrrole bond of bilirubin is broken and two dipyrroles are formed, which are diazotized by diazobenzosulfan acid to form pink-purple azobilirubin. The activity of alkaline phosphatase in serum was defined by measuring the hydrolysis rate of phosphoric acid ether-p-nitrophenyl phosphate. The hydrolysis rate of the substrate is positively related to the activity of the enzyme in the sample and is measured spectrophotometrically. Serum antibody levels were defined by indirect double antigen-enzyme immunoassay to detect antibodies against capripoxviruses (CPV), including lumpyskindisease (nodular dermatitis), sheep posthitis (SPPV), and goat pox (GTPV) in bovine serum or plasma. The set of instruments for diagnosis was designed by IDvet. In the presence of antibodies, the solution in the well of the plate has a blue color, which turns yellow after adding a stop reagent. In the absence of antibodies, the solution is not stained. Positive samples are considered for SP≥30%.

Statistical data processing was conducted using Microsoft Excel-2003 and the application package "Biometriya".

3 Results and disscussion

No clinical signs of vaccine reactogenicity were observed during clinical monitoring of animals after vaccination. The animals did not have a condition of central nervous system depression, refusal to take food and water. The body position in space is normal, the response to external agencies is appropriate, the motor activity and behavioral responses of heifers are adequate to the time of day and physiological condition. The visible mucous membranes of the nose, conjunctiva, and reproductive system are moderately moist, pale pink in color.

Figure 1 presents the results of measuring the body temperature of animals.

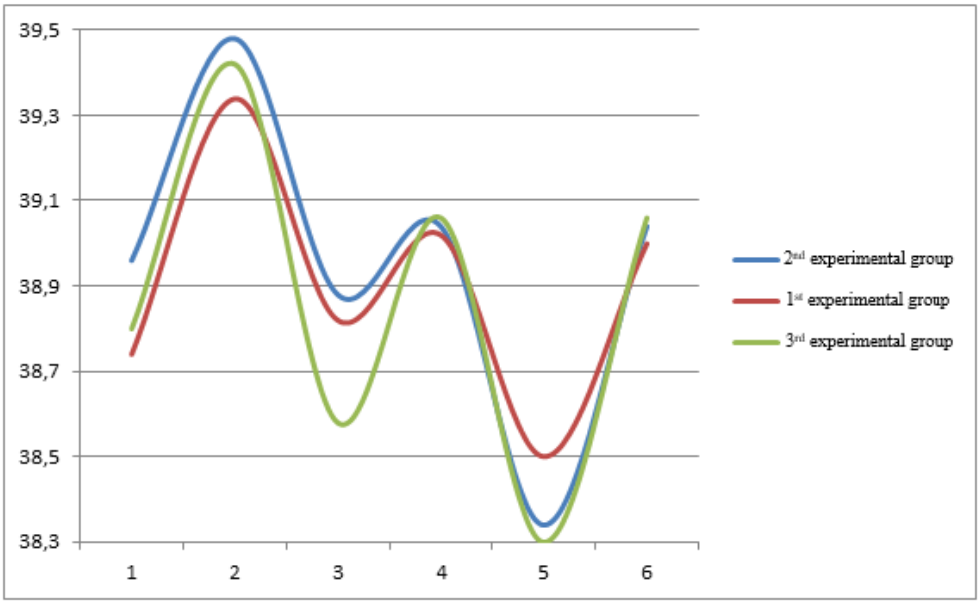

Fig. 1. Variations in body temperature of heifers after vaccination.

The information in the figure indicates the same trend in variations in animal body temperature over the course of six measurements. The greatest increase in body temperature in animals was in the second experimental group, where interferon was applied to stimulate the immune response. Furthermore, these changes were detected over the course of four measurements. The lowest values of animal body temperature were in the third experimental group (transfer factor) 36 and 60 hours after the beginning of the experiment.

For the exception of abortions resulting from animal vaccinations, the possibility of virus isolation through the animal's genital tract was considered. The experimental findings are presented in table 1.

Table 1. The presence of a vaccine virus in animal vaginal swabs

Control period	1st experimental group	2nd experimental group	3rd experimental group
Before vaccination	Vaccine virus was not identified	Vaccine virus was not identified	Vaccine virus was not identified
7th day after vaccination	Vaccine virus was not identified	Vaccine virus was not identified	Vaccine virus was not identified
14th day after vaccination	Vaccine virus was not identified	Vaccine virus was not identified	Vaccine virus was not identified

Information in table 1 shows that there are no vaccine antigens in the body of animals before vaccination and their release through the genital tract of animals after immunization.

The immune response of the animal body after vaccination is followed by deep biochemical changes on the part of all organs and tissues, the accumulation of metabolic products and toxic substances. The primary role in the decontamination of harmful substances is played by the liver. For this reason, some biochemical changes in the blood serum characterizing the function of this organ were considered. They are visually presented in figures 2, 3 and 4.

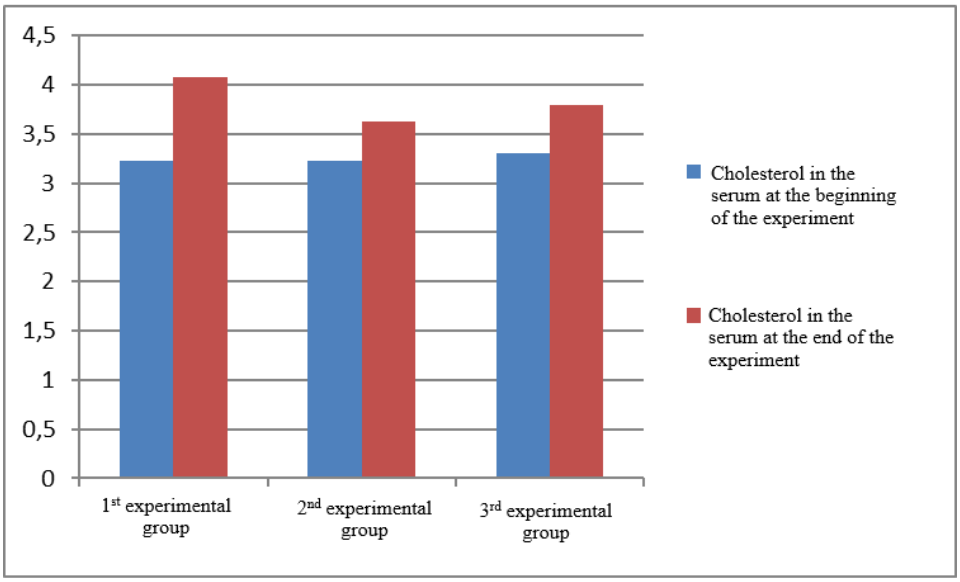

Fig. 2. Cholesterol in the blood serum.

It was revealed that by comparison with the primary observations, the amount of cholesterol in the blood serum of animals of the first experimental group rose by 26.3% ($p<0.01$), in the second experimental group by 12.0%, and in the third group by 14.0%.

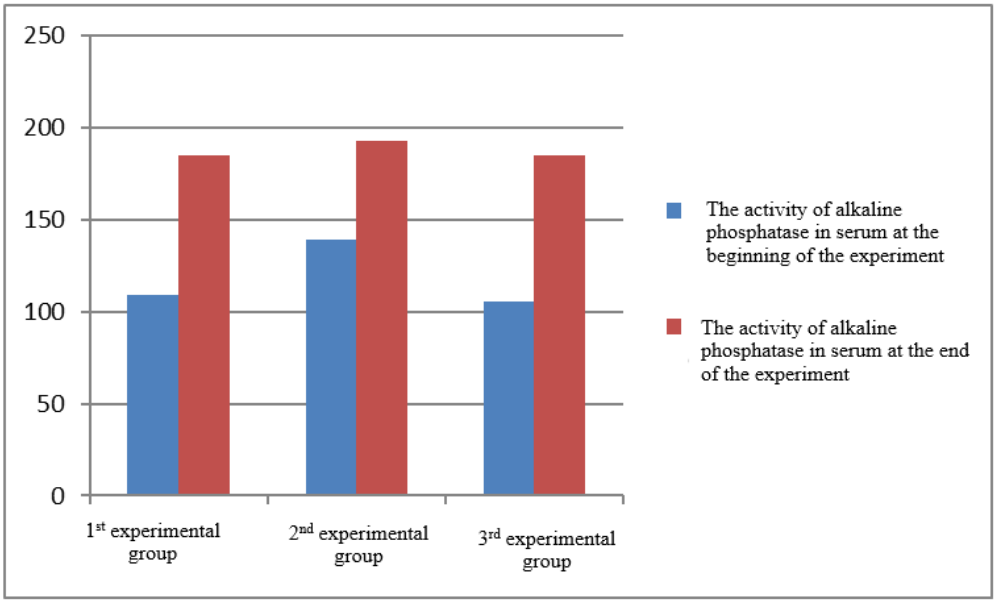

Fig. 3. Activity of alkaline phosphatase in blood serum.

An experiment resulted in an increase in the activity of alkaline phosphatase in the first group by 69.3% ($p<0.01$), in the second group by 38.4% ($p<0.05$), and in the third group by 76.0% ($p<0.01$).

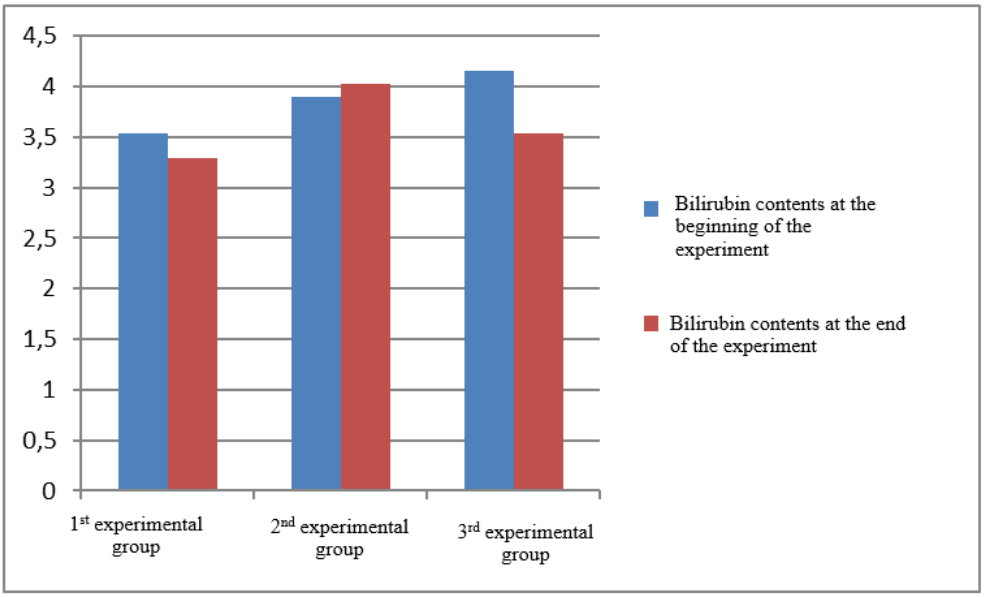

Fig. 4. Bilirubin contents in the blood serum.

According to figure 4, in the first and third experimental groups, the bilirubin content decreased by 7.0% and 14.0%, respectively. In the second experimental group, the bilirubin content increased by 3.0%.

The major goal of animal vaccination against infectious diseases is to develop expressing immunity. Table 2 presents the results of animal immunization. The results were compared within the experimental groups.

Table 2. The effectiveness of vaccination of animals against nodular dermatitis

1st experimental group		2ns experimental group		3rd experimental group	
The increase of antibodies, %	Antibody-positive animals, %	The increase of antibodies, %	Antibody-positive animals, %	The increase of antibodies, %	Antibody-positive animals, %
60,8%	40,0	47,0%	60,0	72,4%*	80,0

* - $p<0,05$

A study of the formation of immunity in animals found that vaccination can create expressing immunity in animals. The largest increase in antibodies was in the third experimental group-72.4% ($p<0.05$). Moreover, the third experimental group had the largest number of antibody-positive animals (80.0%). The smallest increase in antibodies was in the second experimental group of 47.0%. However, the number of antibody-positive animals was 60.0%, which is 20% higher than in the first group, where the antibody increase in blood serum was 60.8%.

4 Conclusions

Vaccination of cattle against nodular dermatitis gives opportunity to develop stable welfare of the herd to this cross-border infection. The use of immunoamplifiers further increases the effectiveness of vaccination and enables to prevent post-vaccination complications. The use

of transfer factor and Asidivit in animal vaccination against nodular dermatitis has reduced the reactogenic properties of the vaccine in the form of a lower temperature reaction to the medicinal preparation of biological origin. The combined application of the immunoamplifier and Asidivit decreased the negative impact of vaccination on the liver of animals. There was the greatest quantitative decrease in bilirubin in the blood serum. It enabled us to obtain a significant reliable increase in antibodies in the blood serum and an increase in the number of antibody-positive animals.

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