Correction of the immunological status of the newborn calves with Interferon

V I Slobodyanik¹, LV Cheskidova², N V Melnikova¹ and V A Stepanov¹

¹ FSBSI “All-Russian Veterinary Research Institute of Pathology, Pharmacology and Therapy”, 114b, Lomonosova str., Voronezh, 394087, Russia
² FSBEI HE “Voronezh State Agricultural University named after Emperor Peter the Great”, 1, Michurina str., Voronezh, 394087, Russia

E-mail: milena.nata@mail.ru

Abstract. The newborn calves have a number of physiological features that make them especially vulnerable to infectious diseases. Therefore, along with serums and vaccines that provide specific immunity, immunomodulators are used to correct the immunological status of animals after giving colostrum. The article presents the data on the study of indices of nonspecific resistance of calves after birth and their correction with interferon alfa-2b. It was found that in the group of calves that were introduced interferon, there was an increase in the number of lymphocytes (T lymphocytes - by 11.9% (P <0.05), B lymphocytes - by 28.2% (P <0.03), and also the phagocytic activity of leukocytes - by 13.5 % (P <0.00001), with a decrease in leukocytes by 12.6% (P <0.01), which was the evidence of the corrective effect of the preparation on the cell-mediated immunity. An increase in serum bactericidal activity (SBA) by 19.4 % (P <0.00001), serum lysozyme activity (SLA) - by 46.3% (P <0.00001), serum complementary activity (SCA) - by 35.3% (P <0.04), as well as immune globulins (γ-globulins - by 1.62 times (P <0.002), total immunoglobulins - by 21.8% (P <0.0005), immunoglobulins G - 23.0 % (P <0.04), which characterized the enhancement of nonspecific humoral immunity, was registered in the blood of calves of the experimental group compared to the control one. Thus, the application of the interferon contributed to the activation of nonspecific humoral and cell-mediated immunity of the newborn calves.

1. Introduction

The high level of resistance of the newborn calves is ensured by a combination of many factors, among which the physiological state of the mother’s organism, the sanitary condition of the habitat, the quantity, quality and time of the first colostrum drink after birth are of primary importance [1, 2, 3]. The colostral immunity of a newborn is composed of maternal colostrum immunoglobulins. The amount of absorbed immunoglobulins greatly determines the level of postnatal formation and functioning of the immune system. If the calf receives colostrum during the first 1-1.5 hours of life, the immunoglobulins appear in serum in 2-3 hours, and their maximum content is registered in 16-18 hours. The intensity of immunoglobulin resorption decreases in 8 hours after birth, and in some animals ceases in 12 hours after birth. In case of insufficient colostral immunity, the microorganisms that cause various diseases easily pass through the immune defense and the problem of age-related immune deficiency of young animals becomes urgent [4, 5, 6, 7]. In this regard, to eliminate and prevent immunodeficiency in the newborn
The calves after giving colostrum, immunomodulators which are prescribed to obtain stable immunity at vaccination are used [8, 9].

In recent years, immunomodulatory drugs of interferons, which affect the immunological reactivity of animals that leads to a reduction or prevention of infection, have been widely used in veterinary medicine [10, 11, 12]. These medications are used for prophylactic and therapeutic purposes in case of gastrointestinal and respiratory diseases of viral and mixed etiology in adult farm animals and young animals, can be prescribed in combination with various chemotherapeutic agents.

The aim of this research was to study the correction of the immune status of the newborn calves with interferon alpha 2b (IFN α-2b).

2. Materials and methods
The research was carried out on the farm of Voronezh region on calves of Holstein breed. Two groups of the newborn animals were formed for the experiment. Each group included 8 animals with an average live weight of 40-45 kg. The calves on the farms are subcutaneously introduced immunoserum serum (contains specific antibodies against parainfluenza-3 viruses, infectious rhinotracheitis, diarrhea -mucous diseases, rotavirus, coronavirus and bovine adenovirus) on the 1st (after giving colostrum), 3rd and 5th days of life for the treatment and prophylaxis of viral pneumoenteritis. The animals of the experimental group were additionally given twofold intramuscular injections of interferon (IFN α-2b) at a dose of 1 ml (5·10^5 IU) with an interval of 48 hours on the 1st and 3rd days of life.

The animals were monitored daily during the experiment. The blood was taken for analysis before giving colostrum and 10 days after the beginning of the experiment. The number of leukocytes was determined on ABX Micros 60 hematology analyzer, T and B lymphocytes were determined using the rosette method, total protein was determined on Hitachi-902 biochemistry analyzer, and protein fractions - by electrophoretic method. The functional activity of phagocytic cells was evaluated by the indices of phagocytic activity of leukocytes (PHAL). Serum complementary activity (SCA), bactericidal activity (SBA) and lysozyme activity (SLA), total and immunoglobulins G were evaluated using standard and standardized methods according to the approved guidelines [12].

Statistical processing of the experimental data was carried out by generally accepted methods of alternative-variation statistics using Statistica 6.0 program. The critical significance level (P) was set by a value of <0.05.

3. Study results and discussion
When observing the animals during the experiment, it was found that the calves of the experimental group did not show any clinical signs of the disease, while three calves from the control group had diarrhea and hyperthermia on the 3rd day.

The changes in the indices of protein metabolism and immune status in calves at the influence of an immunobiological drug and immunomodulator are presented in table 1.

The data in table 1 show that conducting veterinary measures contributed to an increase in the natural nonspecific resistance of the calves. So, in relation to the background values in the blood of animals of the control and experimental groups, an increase in the number of leukocytes and lymphocytes was observed by 1.41-1.61 (P <0.00001-0.00005) and 1.98-2.11 times (P <0.00001), respectively, as well as T and B lymphocytes – by 1.59-1.78 (P <0.00001-0.00005) and 1.65-2.12 times (P <0.0002-0.0005), respectively, a more evident phagocytic activity of leukocytes was registered – by 2.12-2.41 times (P <0.00001). At the same time, the indices of humoral protection increased: SBA - by 1.50-1.79 times (P <0.00001), SLA - by 1.95-2.85 times (P <0.00001), SCA - by 1.76-2.21 times (P <0.0001-0.0002).

When studying changes in protein metabolism, it was found that all the calves at the end of the experiment demonstrated an increase in total protein content by 1.54-1.65 times (P <0.00001), which was associated with a physiological increase in synthetic processes. Moreover, the largest changes are registered in the globulin fraction. The number of β- and γ-globulins increases by 1.64-1.83 times (P <0.00001-0.00005) and 5.24-8.52 times (P <0.00001-0.00005), respectively, in animals of both groups. In addition, an increase in the level of γ-globulins is consistent with an increase in the level of total Ig
in animals by 9.54–11.62 times (P <0.00001), which is due to the change in the calves’ organisms after birth.

**Table 1. Indices of immune status and protein metabolism in calves**

| Indices                      | Before the experiment | At the end of the experiment |
|------------------------------|-----------------------|-----------------------------|
|                              | Control group         | Experimental group          |
| Leukocytes, 10^9/L           | 6.83±0.17             | 10.99±0.32                  |
|     |                       | 9.60±0.27              |
| Lymphocytes, 10^9/L          | 2.36±0.05             | 4.68±0.11                   |
|     |                       | 4.99±0.13               |
| T cells, %                   | 23.06±0.98            | 36.75±1.33                  |
|     |                       | 41.13±1.47              |
| B cells, %                   | 6.44±0.44             | 10.63±0.65                  |
|     |                       | 13.63±1.05              |
| Phagocytic activity of leukocytes, % | 16.53±0.05         | 35.04±0.09                  |
|     |                       | 39.78±0.15              |
| Serum bactericidal activity, % | 20.74±0.11         | 31.03±0.15                  |
|     |                       | 37.05±0.23              |
| Serum lysozyme activity, %   | 1.52±0.02             | 2.96±0.03                   |
|     |                       | 4.33±0.04               |
| Serum complementary activity, % | 2.06±0.05          | 3.63±0.20                   |
|     |                       | 4.55±0.40               |
| Total protein, g/L           | 41.18±0.76            | 63.35±1.73                  |
|     |                       | 67.86±1.74              |
| Albumin, g/L                 | 23.20±0.46            | 22.80±0.73                  |
|     |                       | 24.25±0.47              |
| α- globulin, g/L             | 13.50±0.47            | 13.75±0.75                  |
|     |                       | 10.75±0.59              |
| β- globulin, g/L             | 6.58±0.23             | 12.05±0.45                  |
|     |                       | 10.81±0.47              |
| γ- globulin, g/L             | 1.49±0.15             | 7.81±0.72                   |
|     |                       | 12.69±0.93              |
| Total immunoglobulins, g/L   | 1.60±0.01             | 15.26±0.50                  |
|     |                       | 18.59±0.36              |

At the same time, more significant changes were registered in the blood of animals of the experimental group than in the control one. The number of leukocytes was lower by 12.6% (P <0.01), but at the same time their phagocytic activity was higher by 13.5% (P <0.00001). While the absolute number of lymphocytes in both groups is approximately the same, there is an increase in the number of T and B lymphocytes in the experimental group by 11.9% (P <0.05) and 28.2% (P <0.03), respectively, which indicates the activation of the process of their differentiation.

The indices of humoral nonspecific resistance (SBA, SLA and SCA) in animals of the experimental group were also higher than in the control one by 19.4% (P <0.00001), 46.3% (P <0.00001) and 25.3% (P <0.04), respectively, which indicated a more intense humoral defense.

Despite the fact that there was the same blood increase in total protein and albumin in calves of both groups, more significant changes were registered in the proteinogram of the calves from the experimental group. Compared to the control group, there was registered a significant decrease in α- and β-globulins by 21.8% (P <0.01) and 10.3% (P <0.05), respectively, which indicated a decrease in the level of proteins of the “acute phase” of the inflammatory process and the intensification of metabolism in the organism of calves under the influence of the drug. In this case, blood increase of the concentration of γ-globulins by 1.62 times (P <0.002), total immunoglobulins - by 21.8% (P <0.0005) and immunoglobulins G - by 23.0 (from 10.7 ± 1.04 to 13.16 ± 0.60 g / L; P <0.05) in calves of the experimental group compared to the control one proves the immunomodulating activity of the interferon.

It is necessary to note that according to the studies of Kostyna M.A. and other researchers, blood level of immunoglobulins in calves corresponds to mild hypoinmunglobulinemia, in which they are sensitive to external adverse environmental factors and infections that have been proved by the manifestation of clinical signs of diarrhea in three animals of the control group [13, 14]. At the same time, there were no clinical manifestations of any pathology in the calves of the experimental group and the concentration of immunoglobulins at the end of the experiment was at the lower border of the norm, which indicated the stimulating effect of IFN α-2b on the organism of the newborn animals.
4. Conclusion
The use of IFNα-2b contributed to a more significant increase in the absolute number of lymphocytes, T and B lymphocytes compared to the control. Despite a decrease in the number of leukocytes, their phagocytic activity increased that reflected the strengthening of the cell-mediated immunity. Serum bactericidal, lysozyme and complementary activity also increased in the experimental group that characterized the activation of the humoral response.

Thus, the introduction of Interferon α-2b, possessing immunomodulatory effect, to the calves of the experimental group had a positive effect on their organisms, which contributed to an increase in nonspecific resistance. The interferons can be recommended to farms to increase the efficacy of veterinary activities.

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