Biological Features and Growth Intensity of Calves after Introduction of Tissue Biostimulator to Dry Cows

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Abstract: The article presents the results of studies on the introduction of a tissue biostimulator to dry cows in order to study its effect on some biological characteristics and growth rate of calves obtained from them. Dry cows of the experimental group were injected with a tissue biostimulator subcutaneously, four times with an interval of 14 days at a dose of 22.5 ml/head, control animals – saline solution in the same dose and multiplicity. Calves of the experimental group showed an increase in the total amount of protein in the blood serum by 2.7% (P≥0.05), albumin by 1.2% (P≥0.05), y-globulins by 1.5% (P≥0.05), albumin-globulin coefficient by 5.6% (P≥0.05) in comparison with the control. Experimental animals had a greater live weight from 2 to 6 months of age by 17.9% (P≥0.001) - 23.4% (P≥0.05) in comparison with the control. An increase in average daily and absolute increase in live weight in calves of the experimental group in the 1st and 2nd month of growing by 62.9% (P≥0.05) and 64.2% (P≥0.001) was detected, respectively, a relative increase of 64 5% (P≥0.05) and 40.3% compared with the control.

Keywords: dry cows, calves, biochemical composition of blood, growth rate, tissue biostimulant.

1. Introduction

To grow healthy young animals is one of the important aspects of livestock farming. Obtaining viable calves with high growth energy provides the best disclosure of their genetic potential [1, p. 490; 2, p. 189].

In modern conditions of animal husbandry, special attention is paid to the metabolic processes of newborn young animals in conjunction with the maternal organism, that is, “the maternal body - the fetus - the newborn animal” [3, p. 1].

The metabolic level of calvers in the dry period is characterized by deep metabolic and endocrine changes associated with an increase in the energy metabolism necessary for secretion of colostrum in the initial period of lactation [4, p. 1367; 5, p. 6666]. Metabolism, growth rate and preservation of calves in the initial period of growing depend on the amount of colostrum obtained and the content of protein and fat in it immunoglobulins in it [6, p. 134; 7, p. 1563]. The use of tissue preparations significantly enhances a number of metabolic processes in the body of dry cows, which has
a beneficial effect on the physiological status of newborn young animals and, as a result, increases the growth rate [8, p. 58].

In this regard, the aim of our research was to introduce a tissue biostimulator to dry cows to study its effect on the biological characteristics and growth rate of calves obtained from them.

2. Materials and Methods

The experiment was conducted in 2019 under the production conditions of “Instructional Farm “Prigorodnoye”” JSC on dry cows of the Priobskiy Type of Black-Pied Breed (Table 1) and calves obtained from them.

According to the scheme presented in Table 1, for the experiment there were formed two groups of dry cows-analogues per 10 heads in each (55-60 days before the expected calving) at the age of III lactation and older. When selecting animals, live weight and milk productivity, proceeding the dry period were taken into account.

| Table 1. Scheme of experience |
|-----------------------------|
| **Group**                  | **Number of heads** | **Experience period, days** | **Name of the preparation** | **Dose of subcutaneous injection of the preparation, ml** | **Multiplicity and intervals of preparation administration** |
| Control                    | 10                 | 60                          | Saline solution             | 22,5                                            | Four times in 14 days                                      |
| Experimental               | 10                 | 60                          | Tissue biostimulator        | 22,5                                            | Four times in 14 days                                      |

An experimental batch of biogenic tissue preparation is made of by-products and slaughterhouse offal of Velvet antler deers (RF Patent 2682641). The obtained experimental batches of tissue preparations were tested for toxicity and reactogenicity in white mice according to GOST 31926-2013 “Medicinal products for veterinary use. Methods for determining harmlessness" and to guidelines for 03.06.1980, №115-6А "On bacteriological control of the sterility of veterinary biological preparations."

Blood for biochemical studies in newborn calves was taken 3-5 days after birth from the jugular vein into vacuum tubes (with clot activator). Laboratory studies of blood serum samples were carried out at the FSBSI “Federal Altai Scientific Center for Agrobiotechnology” at the departament “Altai Scientific Research Institute of Animal Husbandry and Veterinary Medicine”, KSBI “Altai Regional Veterinary Center for the Prevention and Diagnosis of Animal Diseases”.

The calf blood serum content of the total amount of protein, calcium, and phosphorus was determined on an enzyme-linked immunosorbent analyzer “ChemWellCombi 2910” using a reagent according to the instructions of Vector-Best CJSC; albumin, α, β and γ-globulins on KFK-5M; globulin, albumin-globulin coefficient, the ratio of calcium to phosphorus - by calculation method.
The live weight was determined by individual monthly weighing of calves on an electronic balance Loadbar2000.

The average daily gain in live weight was determined by the formula:

\[ D = \frac{W_t - W_o}{t}, \]

where  
- \( D \) – the average daily gain, g;  
- \( W_t \) – live weight at the end of the period, kg;  
- \( W_o \) – live weight at the beginning of the period, kg;  
- \( t \) – time between two weighings, days (30 days).

The absolute increase in live weight was determined by the formula:

\[ D = W_t - W_o, \]

where  
- \( D \) – absolute gain, kg;  
- \( W_t \) – live weight at the end of the period, kg;  
- \( W_o \) – live weight at the beginning of the period, kg.

The relative increase in live weight was determined by the formula:

\[ K = \frac{W_t - W_o}{W_o} \times 100, \]

where  
- \( K \) – relative increase, %;  
- \( W_t \) – live weight at the end of the period, kg;  
- \( W_o \) – live weight at the beginning of the period, kg.

3. Results

The biochemical composition of the blood serum of calves obtained from mother cows of the control and experimental groups is presented in Table 2.

### Table 2. Biochemical composition of blood serum of calves

| Indicators       | Control         | Experimental    |
|------------------|-----------------|-----------------|
| Total protein, g/l | 57,2±0,43       | 58,8±0,39*      |
| Albumin, %       | 34,9±0,33       | 36,1±0,16*      |
| Globulins, g/l   | 37,2±0,30       | 37,5±0,27       |
| A/G coefficient, units | 0,54±0,014 | 0,57±0,004*     |
Indicators | Group | Control | Experimental
---|---|---|---
α-globulins, % | | 19.9±0.51 | 16.6±1.61
β-globulins, % | | 14.8±0.91 | 15.4±1.54
γ-globulins, % | | 30.4±1.03 | 31.9±1.67
Calcium, mmol/l | | 2.7±0.14 | 2.9±0.20
Phosphorus, mmol/l | | 1.7±0.43 | 2.2±0.40
Ca/P | | 1.5±0.47 | 1.3±0.34

Note: significantly with respect to control at *P≤0.05.

Analyzing the data presented in Table 2, it can be concluded that the introduction of a new tissue biostimulator at a dose of 22.5 ml/goal for dry cows contributed to an increase in the total amount of protein by 2.7% (P≥0.05), albumin by 1.2% (P≥0.05), β-globulins by 0.6%, γ-globulins by 1.5 % (P≥0.05), calcium by 7.4%, phosphorus by 29.4%, compared with the same indicators in the control. The serum albumin fraction is the finest and is easily mobilized for the synthesis of protein for body tissue, the need for which is high during the period of active growth and development. The albumin-globulin coefficient in the blood serum of young experimental group was higher by 5.6% (P≥0.05) than in the control, which indicates a more intense metabolism in the body. The ratio of calcium to phosphorus in the blood serum of calves of the experimental group was 1.3:1. All indicators of the biochemical composition of blood serum presented in Table 2 were in the reference range.

The dynamics of live weight of young cattle obtained from cows of experimental groups is presented in Table 3.

**Table 3. Dynamics of live weight of calves, kg**

| Indicators | Group | Control | Experimental |
|---|---|---|---|
| At birth | | 42.0±1.83 | 40.9±1.09 |
| 1 month | | 57.1±2.89 | 64.8±4.25 |
| 2 months | | 71.1±2.98 | 87.8±4.17* |
| 3 months | | 90.8±3.87 | 110.7±4.19** |
| 4 months | | 114.3±4.10 | 139.0±6.33** |
| 5 months | | 139.2±5.03 | 168.5±2.89*** |
| 6 months | | 164.5±5.72 | 194.0±3.79*** |

Note: significantly with respect to control at *P≤0.05; **P≤0.01; ***P≤0.001.
The data presented in Table 3 indicate that the introduction of a tissue biostimulator to calvers during the dry period did not contribute to an increase in the live weight of newborn calves. However, in the 1st month of rearing, the young stock obtained from the cows of the experimental group differed by a higher live weight by 13.4%, in the 2nd by 23.4% \((P \geq 0.05)\), in the 3rd by 21.9% \((P \geq 0.01)\), in the 4th by 21.6% \((P \geq 0.01)\), in the 5th by 21.0% \((P \geq 0.001)\) and the 6th by 17.9% \((P \geq 0.001)\) in comparison with analogues of the control group.

The average daily gain in live weight of the calves of the experimental groups is presented in Table 4.

**Table 4. The average daily gain in live weight of calves, g**

| Indicators    | Group          |       |       |
|---------------|----------------|-------|-------|
|               | Control        | Experimental |
| 0-1 month     | 503.3±46.69    | 820.0±114.13* |       |
| 1-2 months    | 466.7±48.29    | 766.7±54.43*** |       |
| 2-3 months    | 656.7±98.83    | 761.1±61.36   |       |
| 3-4 months    | 783.3±122.75   | 944.4±74.95   |       |
| 4-5 months    | 820.0±40.30    | 983.3±134.03  |       |
| 5-6 months    | 812.8±51.39    | 850.0±55.00   |       |
| Total for experience | 680.6±30.84 | 847.2±16.41*** |       |

Note: significantly with respect to control at \(*P \leq 0.05; ***P \leq 0.001\).

According to the data presented in Table 4 it follows that in young animals of the experimental group, the average daily gain in live weight in the 1st and 2nd months of growing is higher by 62.9% \((P \geq 0.05)\) and 64.2% \((P \geq 0.001)\) in comparison with the control. From the third to the sixth month of rearing, the average daily gain in live weight of young animals of the experimental group was 4.5–20.5% higher than in control; however, this difference did not have statistically significant differences.

In general, over the entire period of the experiment, the average daily gain in live weight of young animals obtained from cows of the experimental group increased by 24.4% \((P \geq 0.001)\) than in the control.

Indicators of the absolute and relative average daily gain in live weight of calves participating in the experiment are presented in Table 5.
Table 4. Absolute and relative average daily gain in live weight of calves

| Indicators             | Control                  | Experimental             |
|------------------------|--------------------------|--------------------------|
|                        | absolute average daily gain in live weight, kg | relative average daily gain in live weight, % | absolute average daily gain in live weight, kg | relative average daily gain in live weight, % |
| 0-1 month              | 15,1±1,40                | 35,8±2,85                | 24,6±3,42*                | 58,9±7,79*                |
| 1-2 months             | 14,0±1,45                | 25,3±3,08                | 23,0±1,63***              | 35,5±3,88                |
| 2-3 months             | 19,7±2,97                | 28,4±5,03                | 22,8±1,84                | 25,9±2,35                |
| 3-4 months             | 23,5±3,68                | 26,9±5,05                | 28,3±2,25                | 25,2±1,08                |
| 4-5 months             | 24,6±1,21                | 21,6±1,02                | 29,5±4,02                | 21,2±3,63                |
| 5-6 months             | 25,6±1,96                | 18,5±1,38                | 25,5±1,65                | 15,8±0,75                |
| Total for experience   | 122,5±5,55               | 296,7±20,14              | 152,5±2,95***            | 367,2±12,30**            |

Note: significantly with respect to control at *P≤0.05; **P≤0.01; ***P≤0.001.

Analysis of the absolute increase in live weight, presented in Table 5, allows concluding that the calves of the experimental group at 1 and 2 months of age were significantly superior by 62.9% (P≥0.05) and 64.2% (P≥0.001) analogues of the control group from 3 to 5 months of cultivation, 15.7-20.4% respectively. In the period 5 - 6 months of cultivation, the absolute increase in live weight in the control exceeded 0.4% of the animals of the experimental group. The largest absolute increase in live weight for 6 months of cultivation was obtained in calves of the experimental group (152.5 kg), which is by 24.4% more (P≥0.001) than in the control.

The calves of the experimental group exceeded the control by 64.5% (P≥0.05) and 40.3% only at the age of 1 and 2 months in relative average daily gain in live weight. At the age of 3-6 months, the relative increase in live weight in calves of the experimental group was 1.9–14.6% lower than in the control. In general, over the entire period of the experiment, the young growth of the experimental group exceeded the calves of the control group by 23.7% (P≥0.01) by the relative increase in live weight.

4. Discussion

Biogenic tissue preparations increase the overall tone of the animal organism; activating the activity of its most important physiological systems, improve metabolism, increase growth energy. As a result of their action in animals, average daily growth increases, meat yield grows, and feed costs per unit of production decrease [9, p. 68-69]. At the same time, stimulants awaken to action the potential physiological reserves available in every even healthy animal; they affect animal organism as a whole, and not individual organs, while the mechanism of the therapeutic effect of tissue preparations is still not well understood. In this regard, a more thorough study of the effect on the body of both existing and new tissue preparations is still relevant.
The results of the experiment show that the introduction of tissue biostimulant to dry cows (biologic mothers) provides an increase in the total protein in the blood serum of 3-5 day old calves by 2.7% (P≤0.05), albumin by 1.55 (P≤0.05), γ - globulins by 1.5% (P≤0.05), albumin-globulin coefficient by 5.6% (P≤0.05) in comparison with similar indicators in the control.

The stimulating effect of the tissue preparation on the animal growth and fattening is closely associated with the activation of protein-nitrogen metabolism, aimed at enhancing the transamination reactions, increasing nitrogen retention and protein synthesis in the body [10, p. 10-12].

The experience confirms this indirectly when we introduced a tissue biostimulator four times to dry cows in order to study its effect on the biological characteristics and growth rate of calves obtained from them. The relative increase in live weight increased in calves of the experimental group up to 2 months of age with decreasing dynamics from 64.5% (P≥0.05) to 40.3% in comparison with control animals. In other accounting periods, the growth intensity in young animals obtained from animals of the experimental group was 1.9–14.6% lower than in the control. The high growth rate of experimental calves in the first 2 months of life made it possible to obtain significant differences in the average daily and absolute growths in live weight by 62.9% (P≥0.05) and 64.2% (P≥0.001), due to an initial growth rate of 6 at the age of one month, an increase in the total average daily, relative, and absolute increase in live weight was noted by 24.4% (P≥0.001) - 23.7% (P≥0.01) in comparison with similar indicators in the control group of calves.

5. Conclusion

Thus, a four-time administration of a tissue biostimulator to dry cows at a dose of 22.5 ml/goal contributes to an increase in the total amount of protein by 2.7% (P≥0.05), albumin by 1.2% (P≥0.05), γ-globulin by 1.5% (P≥0.05), albumin -globulin coefficient of 5.6% (P≥0.05) in the blood serum of calves received from them at the age of 3-5 days in comparison with control calves. Young animals obtained from cows of the experimental group had a greater live weight of 23.4% (P≥0.05) at 2 months age, at 3 months respectively, by 21.9% (P≥0.01), at 4 months by 21.6% (P≥0.01), in 5 months 21.0% (P≥0.001) and 6 months 17.9% (P≥0.001). The indicators of average daily and absolute increase in live weight in the 1st and 2nd months of cultivation were higher by 62.9% (P≥0.05) and 64.2% (P≥0.001), respectively, and the relative increase by 64.5 % (P≥0.05) and 40.3% than in the control group.

Acknowledgments

The team of authors thanks the head of the “Instructional Farm “Prigorodnoye”” JSC Igor Vladimirovich Bandeev, for the opportunity to conduct the experiment. We are also grateful to the head veterinarian Legostaev Alexander Petrovich and the forewoman of the central department Gonchugov Vladimir Nikolaevich for their assistance and assistance in conducting the experiment.
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