Brazilian Journal of Biology®

ISSN 1519-6984 (Print)
ISSN 1678-4375 (Online)

Original Article

Realization of reproductive qualities of cows and productivity of young stock

Realização das qualidades reprodutivas de vacas e produtividade de bezerros

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Abstract

For the first time, on the basis of complex research, scientifically based and experimentally proven zootechnical feasibility of using the Prevention-N-A biologics developed by us based on the polysaccharide complex of yeast cells *Saccharomyces cerevisiae* and the aminoglycoside group bactericidal preparation in the technology of obtaining and growing calves in comparison with the previously approved PS-2 preparation. It is proved that three-time intramuscular injection of PS-2 and Prevention-N-A biologics to down-calvers 45-40, 25-20 and 15-10 days before calving in a dose of 10 ml prevents gynecological diseases and increases reproductive function. Under the influence of preparations in cows, the time of separation of the fetal membranes was reduced by 6.0 and 6.4 hours, retention of placenta, post-parturient complications and breast diseases were prevented. The risk of subinvolution of the uterus and endometritis in the first case decreased by 3.0 and 2.0 times, respectively, and in the second – was excluded (P<0.05). Against the background of immunocorrection in cows, the time of onset of heat by 11.6 and 14.2 days, the insemination index by 1.6 and 1.8 times, the service period by 22.4 and 28.4 days, and fertilization in 1 oestrus increased by 2.5 and 3.0 times (P<0.05-0.01). It was found that twice intramuscular injection of PS-2 and Prevention-N-A to calves on 2...3rd and 7... 9th day of life in a dose of 3 ml stimulates their growth and development, reduces the incidence. By the end of the growing period, the animals of the 1st and 2nd experimental groups were superior in live weight to control peers by 4.6 and 7.0 kg, rearing - 13.8 and 17.0 kg, and fattening - by 19.4 and 24.2 kg, respectively (P<0.05-0.01). A similar pattern occurred in the nature of changes in exterior measurements and the growth coefficient of animals of the compared groups. In calves of the experimental groups, the incidence of respiratory and digestive organs decreased by 2.3 and 7.0 times, the recovery time - by 1.3 and 4.3 days, respectively, compared to the control (P<0.05).

Keywords: cattle, stress factors, bio-stimulators, reproductive and productive qualities.

Resumo

Pela primeira vez, fundamentado em pesquisas complexas, apresentamos a viabilidade zootécnica com base científica e experimentalmente comprovada do uso dos produtos biológicos Prevention-N-A desenvolvidos por nós a partir do complexo polissacarídeo de células de levedura *Saccharomyces cerevisiae*, em conjunto com a solução bactericida do grupo aminoglicosídeo para a tecnologia de obtenção e criação de bezerros em comparação com a solução PS-2 previamente aprovada. Está provado que a aplicação da injeção tripla dos produtos biológicos PS-2 e Prevention-N-A em parturientes 45-40, 25-20 e 15-10 dias antes do parto em uma dose de 10 ml por via intramuscular previne doenças ginecológicas e aumenta a função reprodutiva. Sob a influência desta substância, o tempo de ruptura das membranas foi reduzido em 6,0 e 6,4 horas, prevenindo a retenção de placenta, complicações pós-parto e doenças mamárias nas vacas testadas no presente estudo. O risco de subinvolução uterina e endometrite

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Received: February 13, 2024 – Accepted: June 27, 2024

no primeiro caso diminuiu 3,0 e 2,0 vezes, respectivamente e, no segundo, foi eliminado (P<0,05). No contexto da imunocorreção em vacas, foi observado um aumento de 11,6 e 14,2 dias em relação ao tempo de início do cio, 1,6 a 1,8 vezes na taxa de inseminação, 22,4 e 28,4 dias no período de serviço, e a fertilização em 1 estro aumentou 2,5 e 3,0 vezes (P<0,05-0,01). Verificou-se que a injeção dupla de PS-2 e Prevention-N-A em bezerros após 2-3 e 7-9 dias de vida na dose de 3 ml por via intramuscular estimula o crescimento e desenvolvimento, reduzindo a incidência de doenças. Ao final do período de crescimento, os animais do 1º e 2º grupos experimentais apresentaram ganhos de peso em carcaça superiores aos grupo de controle em 4,6 e 7,0 kg, assim como um aumento relacionado à recria - 13,8 e 17,0 kg e engorda - em 19,4 e 24,2 kg, respectivamente (P <0,05-0,01). Um padrão semelhante ocorre na natureza das mudanças de medidas externas e no coeficiente de crescimento dos animais dos grupos estudados. Nos bezerros dos grupos experimentais, a incidência de órgãos respiratórios e digestivos diminuiu 2,3 e 7,0 vezes, e o tempo de recuperação reduziu em 1,3 e 4,3 dias, respectivamente, em comparação ao grupo de controle (P<0,05).

Palavras-chave: bovinos, fatores de estresse, bioestimuladores, qualidades reprodutivas e produtivas.

1. Introduction

Dairy farming is one of the most profitable branches of animal husbandry, and the need for its further development is dictated by the satisfaction of the population's needs for food of their own production, which plays an important role in the country's food security. The black-and-white breed of cattle is the leading number of dairy cattle breeds used in the country (55.7%), which provides the main volume of production of commercial milk and meat, as well as raw materials for the processing industry. It has a great potential for productivity, surpassing many breeds in terms of zootechnical and economic indicators.

As numerous studies show, one of the most important factors determining the achievement of genetic potential of productivity, reproductive abilities, disease resistance, productive longevity of animals of modern highly productive breeds, increasing their feed-conversion ability and, consequently, the successful development of cattle breeding, is compliance with zoohygienic requirements, presented to the chain "feed → keeping conditions → protection of farms from importation of pathogens → obtainment and safety of calves → quality and processing of products → environmental protection → human health". However, modern technologies often disrupt the relationships of the animal organism with the environment and traditional conditions of keeping, feeding and servicing that have developed in the process of phylogeny, separating them from their natural habitat and bringing them closer to the biological machine whose task is to produce target products. Animals cannot avoid the effects of stress factors, which leads to a decrease in the non-specific resistance of the body, various functional disorders and, as a result, to diseases. The physiological status of the maternal organism is reflected in the intrauterine development of the fetus and postnatal ontogenesis of the newborn (Abugaliyev et al., 2019; Donnik and Shkuratova, 2009; Marevskaya and Yakovlev, 2010; Yumaguzin et al., 2011; Baimishev, 2013; Kochish and Tyurin, 2018; Baimukanov et al., 2019).

In the context of the above, at the present stage of cattle breeding development, the problem of preventing adverse effects on the body of technological and environmental factors that cause a decrease in the reproductive and productive qualities of animals is of particular importance (Arutyunyan, 2008; Gerasimova, 2015; Gerasimova, 2017; Chindaliyev et al., 2018; Simurzina and Fomina, 2018; Bekenov et al., 2019a; Bekenov et al., 2019b; Spanov et al., 2019; Baimukanov et al., 2021; Baimukanov et al., 2024).

The aim of this study is to improve the reproductive qualities of black-and-white cattle and realize the productive potential of calves in remote periods of rearing and fattening by activating non-specific resistance of the body with PS-2 and Prevention-N-A biologics.

2. Material and Methods

Experimental studies were conducted in the conditions of a dairy farm CF "E. Aidarbayev" Enbekshikazakhsky district of Almaty region in accordance with the research plan of LLP "Kazakh Research Institute of Animal Husbandry and Feed Production", and the processing of materials was carried out in BI CR "Chuvash Republican Veterinary Laboratory" of the State Veterinary Service of the CR and in the laboratory of the Department of Morphology, Obstetrics and Therapy of FSBEI HE Chuvash State Agricultural Academy.

The objects of research were in-calf (45 days before calving) and freshly calved (3-5 days after calving) cows of the black-and-white Holstein breed, calves from birth and young stock up to 540 days of age. In the scientific and economic experiment, three groups of dry cows were selected based on the principle of pairs-analogues, taking into account the clinical and physiological state, age and live weight of 10 animals each. Groups of newborn calves were selected according to the same principle.

In order to improve the reproductive qualities of black-and-white cattle and realize the productive potential of calves in remote periods of rearing and fattening of young stock, biologics developed by scientists of the Chuvash State Agricultural Academy: PS-2 and Prevention-N-A (V.G. Semenov et al.) were used. Cows of the 1st experimental group were intramuscularly injected with PS-2 at a dose of 10 ml three times 45-40, 25-20 and 15-10 days before calving, and of the 2nd experimental group - Prevention-N-A at the specified dose and time. The calves of the 1st and 2nd experimental groups were intramuscularly injected with PS-2 and Prevention-N-A, respectively, twice on the 2nd ... 3rd and 7th ... 9th day of life at a dose of 3 ml.

3. Results

Indoor climate parameters are shown in Table 1.

From those data presented in Table 1, it follows that the microclimate in the cowshed, calving pen, premises

for raising calves, rearing and fattening young stock corresponded to zoohygienic standards.

The animals were fed according to the rations adopted in the farm, and the balance was coordinated with detailed feeding standards. It was found that the diets provided the needs of the animal body in energy and nutrients, mineral elements and vitamins.

The results of studies of the gynecological condition of cows are presented in Table 2.

Under the influence of PS-2 and Prevention-N-A biologics, the time of separation of the fetal membranes was reduced by 6.0 and 6.4 hours in cows, retention of placenta was excluded, and post-parturient complications and breast diseases were prevented. The risk of subinvolution of the uterus and endometritis during intramuscular injection of PS-2 to cows decreased by 3.0 and 2.0 times, respectively, and when using Prevention-N-A was excluded (P<0.05). Against the background of immunoprophylaxis of the organism in cows, the time of onset of heat was reduced by 11.6 and 14.2 days, the insemination index decreased by 1.6 and 1.8 times, the service period was shortened by 22.4 and 28.4 days, and the fertilization rate in 1 oestrus increased by 2.5 and 3.0 times (P<0.05-0.01).

It was found that the body temperature, pulse rate and respiratory movements in the cows of the experimental groups were within the limits of physiological norms.

The results of hematological studies are presented in Table 3.

The data from this table clearly shows that the number of red blood cells in the blood of cows of the 1st and 2nd experimental groups was higher compared to the control: 35-30 days before calving - by 0.3 and 1.0%, 15-10 days before calving - by 1.7 and 3.3%, 10-5 days before calving - by 5.0 and 4.3%, 3-5 days after calving – by 9.2 and 10.2%

Table 1. Microclimate in animal house.

Indicator	Animal house					
	cowshed	calving pen	preventorium	calf-shed	of rearing	of fattening
T, °C	10,1±0,25	15,0±0,39	15,6±0,18	13,9±0,10	12,7±0,14	10,9±0,15
R, %	70,3±1,14	67,3±0,76	73,4±0,89	76,1±0,4	75,6±0,51	74,6±0,50
v, m/s	0,31±0,02	0,28±0,02	0,19±0,01	0,21±0,01	0,22±0,01	0,24±0,01
KR	1:14	1:13	1:13	1:13	1:13	1:15
DF, %	0,63±0,04	0,68±0,02	0,75±0,02	0,80±0,02	0,81±0,04	0,73±0,04
NH_3, mg/m³	13,5±0,60	8,7±0,52	6,0±0,19	8,8±0,21	8,6±0,37	9,4±0,30
H_2S, mg/m³	7,2±0,26	4,8±0,29	3,2±0,16	5,6±0,18	4,7±0,23	5,0±0,17
CO_2, %	0,20±0,01	0,14±0,01	0,16±0,00	0,22±0,00	0,16±0,01	0,18±0,01
BV, th/m³	43,7±1,56	30,3±1,02	23,1±0,72	34,0±0,79	28,6±0,63	30,9±0,55
Dust, mg/m³	4,2±0,31	2,7±0,25	1,3±0,09	2,9±0,12	2,3±0,12	2,5±0,15

Table 2. Indicators of gynecological condition of cows.

Indicator		Group of animals		
		control	1 experimental	2 experimental
Number of animals		10	10	10
Time of placenta separation, h		13,2±1,02	7,2±0,58*	6,8±0,66*
Retention of placenta		4	-	-
Subinvolution of uterus		3	1	-
Endometritis		2	1	-
Mastitis		2	-	-
Time of the onset of 1 oestrus, days		43,2±1,36	31,6±0,93*	29,0±0,71*
Insemination index		2,6±0,43	1,6±0,24*	1,4±0,19**
Service period, days		87,0±3,05	64,6±1,94**	58,6±1,50**
Fertilized cows:	in the first oestrus	2	5	6
	in the second oestrus	3	4	4
	in the third oestrus	5	1	-

* P<0,05. ** P<0,01.

Table 3. Hematological indicators of cows.

Group of animals	Time of observation, days		Red blood cells, x10^{12}/l	Hemoglobin, g/l	White blood cells, x10^{9}/l
	before calving	after calving			
Control	35 – 30		5,74±0,17	105,2±1,39	7,18±0,14
	15 – 10		5,98±0,17	104,4±1,08	7,14±0,19
	10 – 5		5,98±0,15	103,8±1,24	7,30±0,25
		3 – 5	6,08±0,22	104,0±1,00	7,36±0,28
1 experimental	35 – 30		5,76±0,14	106,0±0,84	7,12±0,23
	15 – 10		6,08±0,07	107,2±0,73	7,36±0,25
	10 – 5		6,28±0,18	107,6±1,36	7,76±0,16
		3 – 5	6,64±0,13	108,4±1,25*	7,62±0,23
2 experimental	35 – 30		5,80±0,17	105,0±0,71	7,14±0,35
	15 – 10		6,18±0,11	106,6±0,93	7,48±0,30
	10 – 5		6,24±0,14	108,2±1,36*	7,80±0,25
		3 – 5	6,70±0,09*	110,4±1,12**	7,78±0,16

* P<0,05. ** P<0,01.

(P<0.05), respectively. The difference in the number of red blood cells in the blood of cows of the experimental groups was insignificant (P>0.05), although the content of these shaped elements was slightly higher in the blood of animals of the 2nd experimental group by 0,04x10^{12}/l (30-25 days before calving), by 0,10x10^{12}/l (15-10 days before calving), by 0,06x10^{12}/l (3-5 days after calving), and 10-5 days before calving, on the contrary, it was higher in cows of the 1st experimental group by 0.04 x10^{12}/l.

The level of hemoglobin in the blood of cows of the 1st and 2nd experimental groups was also higher than in the control group. In addition, the difference in the analyzed hematological index in animals of the control and experimental groups was statistically significant in certain periods of research. That is, in cows of the 1st and 2nd experimental groups for 15-10 days before calving, the concentration of hemoglobin in the blood was higher by 2.7 and 2.1%, respectively (P>0.05), for 10-5 days before calving – by 3.7 and 4.2% (P<0.05), and for 3-5 days after calving – by 4.2 and 6.1% (P<0.05-0.01). However, the difference between the data obtained after using PS-2 and Prevention-N-A, although it was slightly higher in cows of the 2nd experimental group (by 0.6% for 10-5 days before calving and by 1.8% for 3-5 days after calving), but it was statistically unreliable.

So, an increase in the number of red blood cells and the concentration of hemoglobin in the blood of animals of the experimental groups indicates an improvement in their hemapoiesis under the influence of PS-2 biologics, tested earlier, and Prevention-N-A, tested for the first time.

The total number of white blood cells in the blood of down-calvers of the control group varied during the study period from 7.14±0.19 to 7.30±0, 25x10^{9}/l, and in the peers of the 1st and 2nd experimental groups increased from 7.12±0.23 to 7.76±0, 16x10^{9}/l and from 7.14±0.35 to 7.80±0, 25x10^{9} / l, respectively. If the number of white blood cells in the blood of cows of the control group increased by 0,06x10^{9}/l (i.e. by 0.8%) in 3-5 days after calving, then in the 1st and 2nd experimental groups, on the contrary, it decreased by 0,14x10^{9}/l (i.e. by 1.8%) and by 0,02x10^{9}/l (or by 0.3%), respectively. At the same time, the animals of the 1st and 2nd experimental groups outperformed the control groups by this indicator: 15-10 days before calving - by 3.1 and 4.8%, 10-5 days before calving - by 6.3 and 6.8% , and 3-5 days after calving - by 3.5 and 5.7% (P>0.05).

The established dynamics of the number of white blood cells in the blood of cows against the background of intramuscular injection of biologics indicates the activation of cellular factors of non-specific protection of the body. Prevention-N-A had the most pronounced corresponding effect than PS-2, but this difference was insignificant (P>0.05).

The dynamics of color index and average hemoglobin content in red blood cells in cows before and after calving is shown in Figure 1 and 2.

The level of color blood indicator of cows of the control, 1st and 2nd experimental groups tended to decrease in the final period of pregnancy and in the first day after calving from 1.11±0.05 to 1.03±0.03, from 1.11±0.03 to 0.98±0.03 and from 1.09±0.03 to 0.99±0.02, respectively. It should be noted that the color blood index of cows of the 1st and 2nd experimental groups 3-5 days after calving was lower compared to the control data by 5.1 and 4.0%, respectively, but the corresponding difference was unreliable.

A similar pattern was observed in the dynamics of the concentration of hemoglobin in red blood cells of animals of the compared groups. The indicated hematological index decreased in the last 35-30 days of pregnancy and 3-5 days after calving in the control group from 18.38±0.57 to 17.18±0.55 PG, in the 1st experimental group - from 18.44±0.48 to 16.36±0.45 PG and in the 2nd experimental group - from 18.16±0.56 to 16.50±0.37 PG. At the same time, the average hemoglobin content in red blood cells in freshly calved cows of the 1st and 2nd

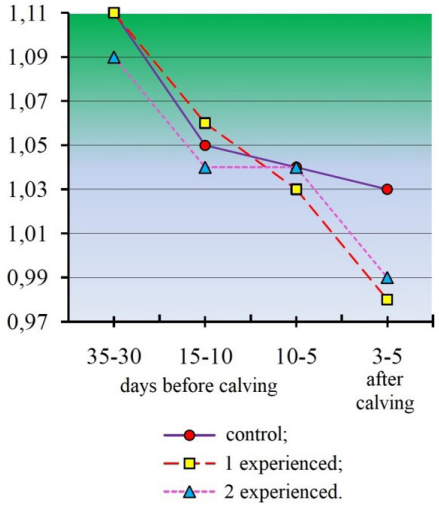

Figure 1. Dynamics of CI.

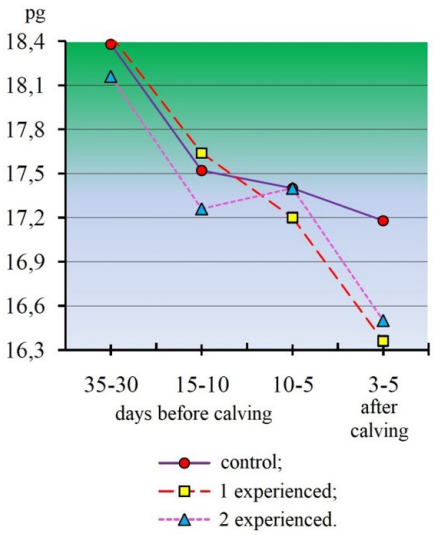

Figure 2. Dynamics of hemoglobin content in red blood cells.

experimental groups was lower by 5.0 and 4.1% than in the control group (P>0.05).

Thus, under the influence of PS-2 and Prevention-N-A, the data of the color index and the average hemoglobin content in the red blood cells of animals did not change significantly.

Analysis of the white cell count showed that the change in the number of basophiles in the blood of control and experimental group animals, regardless of the period of observation before and after calving, was statistically unreliable. These granulocytes varied in the blood of down-calvers and freshly calved cows in a narrow range: in the control group - from 1.0±0.32 to 1.4±0.24%, in the 1st experimental group - from 0.6±0.24 to 1.2±0.20%, and in the 2nd experimental group - from 0.4±0.24 to 1.0±0.32%.

If the number of eosinophiles in the blood of experimental cows of the control, 1st and 2nd experimental groups increased in the last period of pregnancy for 35-30 - 15-10 days before calving from 5.0±0.32 to 5.8±0.20%, from 5.2±0.37 to 6.2±0.20% and from 5.2±0.37 to 6.4±0.24%, then for 10-5 days before calving, a decrease in these granulocytes to 4.8±0.37%, 5.6±0.81% and 5.4±0.51%, respectively. If the number of eosinophiles in the blood of freshly calved cows in the control group remained unchanged (4.8±0.80%), then in the 1st experimental group it decreased (5.4±0.51%), and in the 2nd, on the contrary, it increased (5.6±0.51%). The number of eosinophiles in the blood of animals of the experimental groups was higher compared to the control 35-30 days before calving by 0.2 and 0.2%, 15-10 days before calving - by 0.4 and 0.6%, 10-5 days before calving – by 0.8 and 0.6% , and 3-5 days after calving - by 0.6 and 0.8%, but these changes were statistically unreliable.

Given that eosinophiles are stress-testing factor, a decrease in their amount in the blood 10-5 days before calving and 3-5 days after calving indicates that the animals were under stress, that is, calving is a stress factor. However, given that the number of these shaped elements was greater in the blood of animals of the experimental groups, it can be assumed that the biologics used had a minor, but anti-stress effect.

It was found that the content of stab neutrophiles in the blood of cows of the control, 1st and 2nd experimental groups was consistently reduced by calving, namely in the period 35-30 - 10-5 days before calving from 4.0±0.45 to 3.8±0.37%, from 2.8±0.37 to 2.4±0.24% and from 2.4±0.24 to 2.2±0.20%, respectively. After 3-5 days after calving, the data of this indicator increased to 4.2±0.20 and 2.4±0.24% in the control and 2nd experimental groups, respectively, while in the 1st experimental group it remained unchanged - 2.4±0.24%. It should be noted that the content of stab neutrophiles in the blood of cows of the 1st and 2nd experimental groups was lower than in the control group: for 35-30 days before calving - by 1.2 and 1.6%, for 15-10 days before calving – by 2.2 and 2.4%, for 10-5 days before calving – by 1.4 and 1.6%, and for 3-5 days after calving - by 1.8 (P<0.05) and 1.8% (P<0.05), respectively.

The dynamics of segmentonuclear neutrophiles in the blood of experimental cows before and after calving did not reveal a specific pattern. However, it should be noted that if the number of these forms of neutrophiles in the blood of animals of the 1st and 2nd experimental groups before calving was higher than in the control group: 30-25 days before calving - by 0.6 and 1.0%, 15-10 days before calving – by 0.6 and 0.4%, 10-5 days before calving - by 0.4 and 0.2%, then 3-5 days after calving, on the contrary, lower – by 0.2 and 0.6% (P>0.05), respectively.

Given that neutrophiles have a pronounced phagocytosis, the established qualitative changes in the stages of their development indicate the activation of the cell link of non-specific resistance of the body under the influence of approved biologics.

It was found that if the content of lymphocytes in the blood of cows of the control group varied in the studied periods before and after calving from 56.6±1.17 to 58.6±0.60%, then in the 1st and 2nd experimental groups

it consistently increased from the beginning of the experiment to its end from 58.0±0.55 to 59.6±0.81% and from 58.4±0.51 to 60.0±1.00%. Moreover, the number of lymphocytes in the blood of animals of the 1st and 2nd experimental groups for the entire period of research was higher than in the control group: 35-30 days before calving – by 0.2 and 0.6%, 15-10 days before calving - by 1.4 and 2.0%, 10-5 days before calving – by 0.6 and 1.2% , and 3-5 days after calving – by 1.0 (P<0.05) and 1.4% (P<0.05), respectively.

The obtained data allow to conclude that the biologics used activated the production of lymphocytes by hematopoietic organs. Prevention-N-A had a more pronounced immune-stimulating effect.

The number of monocytes in the blood of cows of the 1st experimental group was higher in comparison with control data for 35-30 days before calving – by 0.2%, for 15-10 days before calving – by 0.2% and 3-5 days after calving – by 0.8% (P>0.05). Animals of the 2nd experimental group also outperformed their control peers in terms of monocyte levels in the blood in some research periods: 15-10 days before calving - by 0.2%, 10-5 days before calving - by 0.4% and 3-5 days after calving – by 0.8%. However, the established changes were not reliable, that is, the biologics used did not affect the production of these shaped blood elements.

Thus, intramuscular injection of biologics to cows for 45-40 days, 25-20 and 15-10 days before calving activates cellular factors of non-specific protection and stress resistance of the body, as evidenced by the physiological leukocytosis, moderate neutropenia with a shift of the nucleus to the right, lymphocytosis and eosinophenia, with a more pronounced corresponding effect of Prevention-N-A, tested for the first time, than PS-2, tested earlier (Table 4).

It was found that PS-2 and Prevention-N-A increased protein metabolism, production of albumins (plastic material) and γ-globulins (humoral factor of non-specific resistance). These biochemical parameters in animals of the 1st and 2nd experimental groups on 3-5 days after calving were higher than the control values by 3.2 and 2.8 g/l, 1.4 and 1.3 g/l, 2.7 and 2.1 g/l, respectively (P<0.05-0.01). The decrease in γ -globulin fraction of protein in the blood serum of experimental cows after calving can be assumed to be associated with the production of colostrum lactoglobulins, which is aimed at the formation of colostral immunity in newborn calves. A significant increase in γ-globulins in the blood serum of cows of experimental groups during dry and milk periods indicates the activation of the humoral link of non-specific resistance of the body under the influence of biologics.

Intramuscular injection of PS-2 and Prevention-N-A biologics to down calvers increased the blood alkaline reserve by 3.8 and 5.2 vol % of CO_2 (P<0.05-0.01) due to activation of buffer systems, glucose levels by 0.36 and 0.30 mmol/l (P<0.05-0.01), total calcium by 0.18 and 0.20 mmol/l (P<0.05) and inorganic phosphorus by 0.27 and 0.19 mmol/l (P<0.05), respectively. It should be noted that PS-2 had a more pronounced stimulating effect on protein and carbohydrate metabolism, and Prevention-N-A – normalized the acid-base state of the body and mineral metabolism. It was found that the preparations did not affect the exchange of provitamin A.

The dynamics of the main hematological indicators of non-specific resistance of the cow's body is clearly shown in Figures 3-7.

It was found that the phagocytic activity of white blood cells of the control group cows varied in the final period of pregnancy from 48.0±2.35% to 49.2±1.50%. And in the 1st and 2nd experimental groups, it consistently increased from 48.2±2.31 to 52.8±1.93% and from 51.2±0.86 to 53.2±1.46%. The difference between these values of the control and the 1st and 2nd experimental groups of animals was

Table 4. White cell count of cow blood.

Group of animals	Time of observation, days		The group and type of white blood cells					
			granulocytes, %				agranulocytes, %	
	before calving	after calving	basophiles	eosinophiles	neutrophiles		lymphocytes	monocytes
					stab	segmentonuclear		
Control	35 – 30		1,2±0,20	5,0±0,32	4,0±0,45	27,0±1,14	57,8±1,24	5,0±0,37
	15 – 10		1,4±0,24	5,8±0,20	4,8±0,37	26,8±0,37	56,6±1,17	4,6±0,58
	10 – 5		1,2±0,37	4,8±0,37	3,8±0,37	27,4±0,93	58,2±1,11	4,6±0,40
		3 – 5	1,0±0,32	4,8±0,80	4,2±0,20	27,0±0,60	59,0±0,60	4,0±0,51
1 experimental	35 – 30		1,2±0,20	5,2±0,37	2,8±0,37	27,6±0,51	58,0±0,55	5,2±0,40
	15 – 10		1,0±0,32	6,2±0,20	2,6±0,24	27,4±0,24	58,0±0,32	4,8±0,40
	10 – 5		0,8±0,20	5,6±0,81	2,4±0,24	27,8±0,92	58,8±1,20	4,6±0,32
		3 – 5	0,6±0,24	5,4±0,51	2,4±0,24*	27,2±0,92	59,6±0,81*	4,8±0,51
2 experimental	35 – 30		1,0±0,32	5,2±0,37	2,4±0,24	28,0±0,45	58,4±0,51	5,0±0,32
	15 – 10		0,6±0,24	6,4±0,24	2,4±0,24	27,2±0,37	58,6±0,40	4,8±0,37
	10 – 5		0,4±0,24	5,4±0,51	2,2±0,20	27,6±1,33	59,4±0,93	5,0±0,84
		3 – 5	0,4±0,24	5,6±0,51	2,2±0,24*	27,6±0,97	59,8±1,00*	4,4±0,80

* P<0,05.

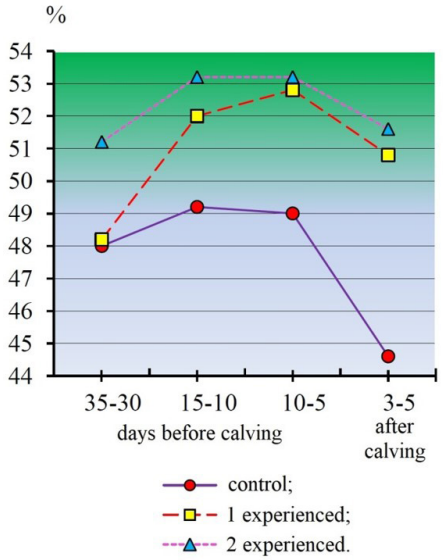

Figure 3. Dynamics of phagocytic activity.

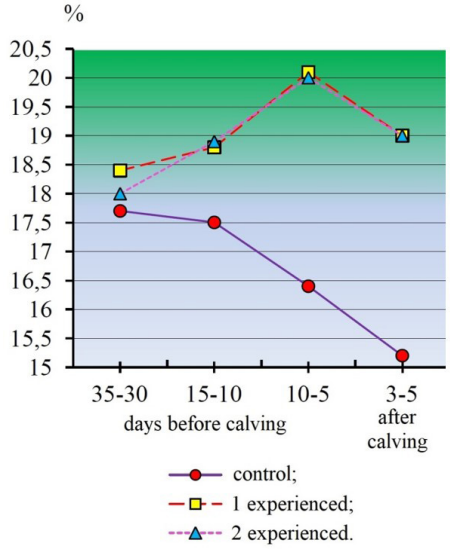

Figure 5. Dynamics of lysozyme activity.

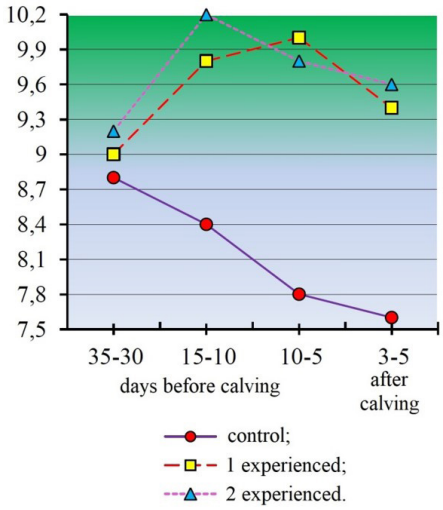

Figure 4. Dynamics of phagocytic index.

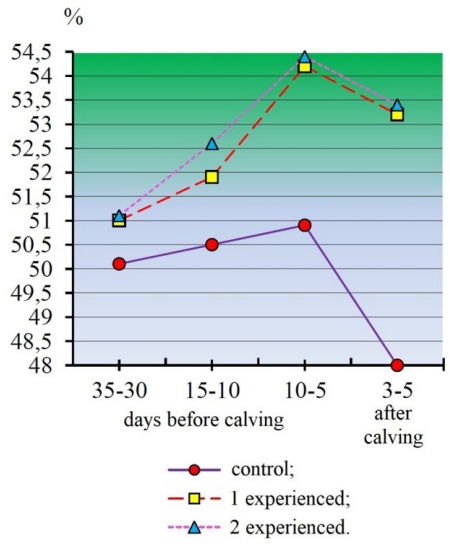

Figure 6. Dynamics of bactericidal activity.

unreliable and was equal to 2.8 and 4.0% (15-10 days before calving) and 3.8 and 4.2% (10-5 days before calving). After calving, phagocyte activity decreased in the control group to 44.6±1.69%, in the 1st and 2nd experimental groups - to 50.8±2.22% and 51.6±1.69%, respectively. The level of the studied indicator of non-specific resistance was higher in cows of the 1st and 2nd experimental groups by 6.2 and 7.0% compared to the control ($P<0.05$), respectively (Table 5).

Consequently, the biologics Prevention-N-A increased phagocytic activity of white blood cells more pronounced than the previously tested PS-2.

If the phagocytic index of the blood of cows in the control group decreased before calving from 8.8±0.37 to 7.8±0.37, then in the 1st experimental group, on the contrary, it steadily increased from 9.0±0.32 to 10.0±0.32. In animals of the 2nd experimental group, the specified indicator of the cell link of non-specific resistance of the body also increased from 9.2±0.37 to 10.2±0.49 when observed in the period 35-30-15-10 days before calving, but its decrease to 9.8±0.80 was established 10-5 days before calving. It should be noted that the phagocytic index was higher in cows of the 1st and 2nd experimental groups by 1.4 (i.e. 16.6%) and 1.5 (or 21.4%) 15-10 days before calving and 2.2 (i.e. 28.2%) and 2.0 (or 25.6%) 10-5 days before calving, respectively, compared to the control ($P<0.05$-0.01). After calving, the data of this indicator in the animals of the experimental groups decreased and amounted to 7.6±0.51, 9.4±0.24 and 9.6±0.51, respectively. At the same time, the phagocytic

Table 5. Dynamics of total protein and protein fractions in cow blood serum.

Group of animals	Time of observation, days		Total protein, g/l	Protein fractions, g/l				
	before calving	after calving		albumins	globulins	α-globulins	β- globulins	γ- globulins
Control	35 – 30		73,9±0,67	31,2±0,24	43,3±0,60	11,3±0,59	9,7±0,19	22,3±0,23
	15 – 10		74,1±0,58	31,1±0,24	43,6±0,60	11,1±0,33	10,0±0,15	22,5±0,20
	10 – 5		74,2±0,43	31,0±0,18	43,7±0,68	11,1±0,36	10,2±0,20	22,4±0,32
		3 – 5	73,1±0,67	30,5±0,33	41,5±0,24	11,1±0,31	10,2±0,16	20,2±0,12
1 experimental	35 – 30		74,9±0,63	30,9±0,34	44,2±0,73	11,1±0,51	10,3±0,20	22,8±0,50
	15 – 10		76,0±0,70	31,7±0,34	45,1±0,54	11,3±0,48	10,3±0,14	23,5±0,41
	10 – 5		76,0±0,69	32,0±0,30*	44,9±0,70	11,0±0,35	10,3±0,25	23,6±0,31*
		3 – 5	76,3±0,60**	31,9±0,26*	44,6±0,59**	11,5±0,53	10,2±0,22	22,9±0,23***
2 experimental	35 – 30		74,9±0,63	31,6±0,14	43,7±0,62	11,5±0,21	9,8±0,19	22,4±0,33
	15 – 10		76,1±0,47*	32,1±0,34*	44,9±0,62	11,6±0,15	10,1±0,19	23,2±0,30
	10 – 5		76,1±0,45*	31,9±0,24*	45,3±0,49	11,6±0,25	10,2±0,20	23,5±0,30*
		3 – 5	75,9±0,78*	31,8±0,27*	43,9±0,71*	11,1±0,33	10,5±0,31	22,3±0,32***

* P<0,05. ** P<0,01. *** P<0,001.

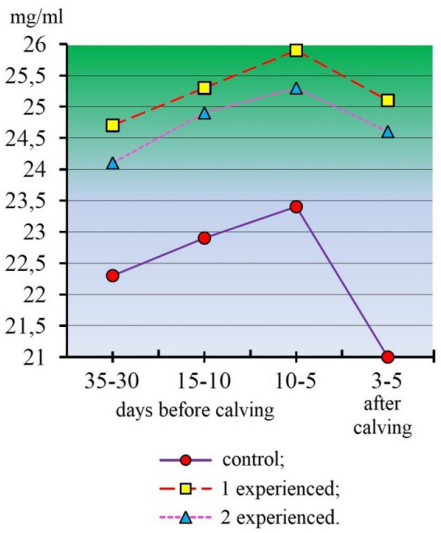

Figure 7. Dynamics of immunoglobulin concentration.

index was higher in the animals of the experimental groups compared to the control by 1.8 (i.e. 23.7%) and 2.0 (or 26.3%), respectively (P<0.05).

In other words, the biologics caused stimulation of the specified cellular factor of non-specific resistance of the body, and this effect was most pronounced when using the Prevention-N-A developed by us.

The activity of lysozyme in the blood plasma of down-calvers of the control group decreased, and in animals of the 1st and 2nd experimental groups increased and for 10-5 days before calving was equal to 16.4±0.27%, 20.1±0.24 and 20.0±0.54%, respectively. The indicated activity in animals of the experimental groups was significantly higher by 3.7 and 3.6% compared to the control group (P<0.001). After calving of cows, the lysozyme activity of blood plasma decreased both in the control and in the 1st and 2nd experimental groups of animals and amounted to 15.2±0.37%, 19.0±0.21 and 19.0±0.66%, respectively, that is, it was higher in both experimental groups by 3.8% (P<0.001).

The results of these studies indicate that the first-time tested preparation Prevention-N-A is able to stimulate the specified humoral factor of nonspecific resistance of the body, but the difference in the corresponding effect between the tested preparations was insignificant (P>0.05).

The established fact is confirmed by the dynamics of bactericidal activity of blood serum. The indicated activity of blood serum of down-calvers increased both in the control and in the accepted variants of experiments and for 10-5 days before calving was 50.9±0.90%, 54.2±1.30 and 54.4±1.11%, respectively. At the same time, it was higher in animals of the 1st and 2nd experimental groups by 3.3 (P>0.05) and 3.5% (P<0.05). After calving, the bactericidal activity of animal blood serum decreased and on 3-5 days was: in the control group – 48.0±0.85%, in the 1st experimental group – 53.2±1.07% and in the 2nd experimental group – 53.4±1.43%. That is, in cows of the experimental groups, it was significantly higher by 5.2 and 5.4% (P<0.05).

Consequently, the preparations used in the experiments stimulated the bactericidal activity of blood serum, activating the humoral link of non-specific resistance of the body.

The concentration of immune-globulins in the blood serum of cows increased in the period 35-30 – 10-5 days before calving from 22.3±1.03 to 23.4±0.89 mg/ml in the control group, from 24.7±0.49 to 25.9±0.25 mg/ml and

from 24.1±0.77 to 25.3±0.72 mg/ml in the 1st and 2nd experimental groups, and after calving, on the contrary, decreased by 2.4 mg/ml (i.e. by 11.4%), 0.8 (3.2) and 0.7 mg/ml (or 2.8%), respectively. At the same time, 10-5 days before calving, the animals of the experimental groups exceeded the level of immune-globulins in the blood serum of the control groups by 2.5 and 1.9 mg/ml (or 10.7 and 8.1%), 3-5 days after calving – by 4.1 and 3.6 mg/ml (or 19.5 and 17.1%).

That is, the use of the developed preparation Prevention-N-A in down-calvers activates the synthesis of immune-globulins, but the difference in the corresponding effect in comparison with the previously approved preparation was insignificant.

Based on the conducted studies, it can be summarized that intramuscular injection of PS-2, which was tested earlier, and Prevention-N-A, which was developed and tested for the first time, in a dose of 10 ml 45-40, 25-20 and 15-10 days before calving, contributed to an increase in the non-specific resistance of the body. When choosing a preparation, it should be taken into account that PS-2 activates mainly humoral, and Prevention-N-A – cell factors of non-specific resistance.

4. Conclusion

Thus, PS-2 and Prevention-N-A biologics, activating the non-specific resistance of the body of calvers and newborn calves to the effects of environmental and technological factors of the environment, prevent post-parturient complications and gynecological diseases of cows and improve their reproductive qualities, and in calves contribute to the prevention of respiratory and digestive diseases, activate growth and development, improve fattening and slaughter qualities of young stock.

Acknowledgements

The research was carried out under the budget program for 2018-2020. Code: BR06349627 "Transfer and adaptation of technologies on automation of technological processes of milk production based on model dairy farms containing 1000 or more milker cows".

References

ABUGALIYEV, S.K., YULDASHBAYEV, Y.U.A., BAIMUKANOV, A.D. and BUPEBAYEVA, L.R., 2019. Efficient methods in breeding dairy cattle of the Republic of Kazakhstan. *Scientific journal. Bulletin of NAS RK*, vol. 4, no. 380, pp. 65-82. http://doi.org/10.32014/2019.2518-1467.94.

ARUTYUNYAN, A.A., 2008. Improving the technology of keeping down calvers and newborn calves. Youth and science of the XXI century. In: *Materials of inter-regional scientific-practice conference of young scientists, postgraduates and students*. 2008, Cheboksary. Cheboksary, pp. 3-7.

BAIMISHEV, K.H.B., 2013. Reproductive abilities of Holstein heifers. In: *Proceedings of Nizhnevolzhsky Agrouniversity Complex: science and higher professional education*. 2008, Volgograd. Volgograd: Nizhnevolzhsky Agrouniversity Complex, pp. 146-150.

BAIMUKANOV, A.D., BISSEMBAYEV, A.T., YULDASHBAYEV, Y.A., CHINDALIYEV, A.E., SHAMSHIDIN, A.S., AMERKHANOV, K.A., SAGINBAYEV, A.K. and AUBAKIROV, K.A., 2024. Reproductive Indicators of the Alatau Cattle Breed of Kazakhstan Population. *Online Journal of Biological Sciences*, vol. 24, no. 1, pp. 64-70. http://doi.org/10.3844/ojbsci.2024.64.70.

BAIMUKANOV, A.D., YULDASHBAYEV, Y.A., DEMIN, V.A., MAGOMADOV, T.A. and AUBAKIROV, K.A., 2021. Efficient Breeding in Kazakhstan Alatau Cattle Breed Population. *American Journal of Animal and Veterinary Sciences*, vol. 16, no. 4, pp. 318-326. http://doi.org/10.3844/ajavsp.2021.318.326.

BAIMUKANOV, D.A., SEMENOV, V.G., KALMAGAMBETOV, M.B. and SEIDALIEV, N.B., 2019. Transfer and adaptation of technologies on model dairy farms. *Bulletin Of Chuvash State Agricultural Academy,* vol. 2, no. 9, pp. 45-52.

BEKENOV, D.M., SPANOV, A.A., KENCHINBAYEV, N.S. and BAIMUKANOV, A.D., 2019a. Updating the treatment method of the follicular ovarian cysts in cows of the dairy productivity direction in the East-Kazakhstan region. *News Of The National Academy Of Sciences Of The Republic Of Kazakhstan: Series Of Agricultural Sciences,* vol. 5, no. 53, pp. 83-87. https://doi.org/10.32014/2019.2224-526X.64.

BEKENOV, D.M., SPANOV, A.A., SULTANBAI, D.T., ZHAKSYLYKOVA, G.K. and BAIMUKANOV, A.D., 2019b. The effect of canola meal application in the diet of dairy cows of Holstein breed in «Bayserke Agro» LLP. *Bulletin Of National Academy Of Sciences Of The Republic Of Kazakhstan,* vol. 6, no. 382, pp. 83-86. https://doi.org/10.32014/2019.2518-1467.148.

CHINDALIYEV, A. YE., BAIMUKANOV, D.A., KARYNBAYEV, A.K. and CHINDALIYEV, YE., 2018. Results of the targeted selective and breeding work of the simmental red-and-motley breed of dairy cattle. *Bulletin Of National Academy Of Sciences Of The Republic Of Kazakhstan*, vol. 6, no. 376, pp. 34-38. https://doi.org/10.32014/2018.2518-1467.24

DONNIK, I.M. and SHKURATOVA, I.A., 2009. Features of adaptation of cattle to adverse environmental factors. *Kuban Veterinary Medicine*, vol. 5, pp. 16-17.

GERASIMOVA, N.I., 2015. Implementation of reproductive and productive qualities of cattle by domestic biostimulators. In: *Youth and innovation: Materials of XI All-Russian scientific-practice conference of young scientists, postgraduates and students.* 2015, Cheboksary. Cheboksary, pp. 135-138.

GERASIMOVA, N.I., 2017. To the problem of realization of the bioresource potential of black-and-white cattle. Youth and innovation. *In: Materials of All-Russian scientific-practice conference of young scientists, postgraduates and students.* 2017, Cheboksary. Cheboksary, pp. 70-73.

KOCHISH, I.I. and TYURIN, V.G., 2018. Ecological and hygienic measures in the production of biologically complete and high-quality livestock products. In: *Achievements of science and practice in solving topical problems of veterinary and animal science: Materials of All-Russian scientific-practice conference.* 2018, Cheboksary. Cheboksary, pp. 67-75.

MAREVSKAYA, V.Y.U. and YAKOVLEV, S.G., 2010. Correction of non-specific resistance of cattle in the biological chain "mother-fetus-newborn". In: *Contribution of young scientists to the future of Chuvashia: Materials of VI All-Russian scientific-practice conference of young scientists, postgraduates and students, devoted to the 90th anniversary of the creation of the Chuvash Republic.* 2010, Cheboksary. Cheboksary, pp. 84-87.

SIMURZINA, Y.E.P. and FOMINA, N.M., 2018. Improving the reproductive qualities of cows with domestic biologics. The development of agricultural science as the most important condition for the effective functioning of the country's agro-

industrial complex. In: *Materials of VI All-Russian scientific-practice conference devoted to the 70th anniversary of the birth of the honored worker of the higher school of the Czech Republic and the Russian Federation, doctor of veterinary sciences, Professor N.K. Kirillov*. 2018, Cheboksary. Cheboksary, pp. 203-206.

SPANOV, A.A., BEKENOV, D.M., SULTANBAI, D.T., ZHAKSYLYKOVA, G.K. and BAIMUKANOV, A.D., 2019. The effect of canola meal application in the diet of dairy cows of holstein breed in Bayserke Agro LLP. *Reports of the national academy of sciences of the Republic of Kazakhstan,* vol. 5, no. 325, pp. 21-24. https://doi.org/10.32014/2019.2518-1483.135.

YUMAGUZIN, I.F., YAKHIN, F.F. and ARDASHIROV, S.S., 2011. Herd reproduction - an important element of dairy cattle breeding efficiency. *Agricultural solution /Animal Husbandry,* vol. 3, pp. 40-41.