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Original Article

Assessment of the impact of feeding technology of black-and-white breed heifers on growth and development indicators during the dairy period

Avaliação do impacto da tecnologia de alimentação de novilhas de raça preto e branco nos indicadores de crescimento e desenvolvimento durante o período leiteiro

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Abstract

Proper cultivation of heifers largely determines the optimal manifestation of the genetic productivity of animals. The purpose of this study was to identify the optimal technology for growing black-and-white heifers in the dairy period to realize the genetic potential in the conditions of the northern region of the Republic of Kazakhstan, namely the Kostanay region. To conduct experiments on the farm, two groups of heifers of 10 heads each were formed, immediately after their birth. The selected groups differed in feeding technologies: the control group received the diet adopted on the farm, the feeding technology was changed for the experimental group in order to increase the intensity of heifer growth. The live weight and linear body sizes of heifers were monitored monthly. The new technological scheme of cultivation for the experimental group of heifers included the rejection of dairy feed at the age of two months and the use of ViaCorn 4 starter compound feed, as well as the active use of juicy and coarse feeds, unlike the heifers of the control group who were fed dairy feed until the end of the dairy growing period (up to 6 months). The live weight, average daily gain and linear body sizes of heifers of the experimental group significantly exceeded similar indicators of peers of the control group. The superiority in average daily live weight gains over the heifers of the control group averaged 287.6 g over 6 months. The change in the technological scheme of feeding towards the rejection of dairy feeds at 2 months and the addition of a starter, as well as compliance with the technology of milking colostrum in newborn calves in the experimental group contributed to the better development of the axial and peripheral skeleton, chest organs of animals, which will create prerequisites for the formation of highly productive cows of a pronounced dairy type. The concentration of total protein in the blood of the heifers of the experimental groups at 2 months of age was higher than that of the control group peers by an average of 1.89 g/l and at the age of 6 months - by 3.37 g/l, which indicates a higher protein metabolism in the blood of the heifers of the experimental group.

Keywords: black-and-white breed, feeding technology, blood protein, colostrum, forced drinking of colostrum, live weight gain, milk growing period.

Resumo

O cultivo adequado de novilhas determina em grande parte a manifestação ideal da produtividade genética dos animais. O objetivo deste estudo foi identificar a tecnologia ideal para o cultivo de novilhas preto e branco no período leiteiro para realizar o potencial genético nas condições da região norte da República do Cazaquistão, a saber, a região de Kostanay. Para a realização dos experimentos na fazenda, foram formados dois grupos de novilhas com 10 cabeças cada, imediatamente após o nascimento. Os grupos selecionados diferiram nas tecnologias de alimentação: a dieta adotada na fazenda foi oferecida ao grupo controle; já a tecnologia de alimentação foi alterada para o grupo experimental, a fim de aumentar a intensidade do crescimento das novilhas. O peso vivo e o tamanho linear do corpo das novilhas foram monitorados mensalmente. O novo regime tecnológico de cultivo para o grupo experimental de novilhas incluiu a rejeição de alimento lácteo aos dois meses de idade e a utilização de alimento composto para animais de arranque ViaCorn 4, bem como a utilização ativa de alimentos suculentos e grosseiros, ao contrário das novilhas do grupo controle, que receberam alimento lácteo até o final do período de produção leiteira (até seis meses). O peso vivo, o ganho médio diário e os tamanhos corporais lineares das novilhas do grupo experimental excederam significativamente os indicadores semelhantes dos pares do grupo controle. A superioridade nos ganhos médios diários de peso vivo em relação às novilhas do grupo controle foi de 287,6 g em seis meses. A mudança no esquema tecnológico de alimentação para a rejeição de alimentos lácteos aos dois meses e a adição de um iniciador, bem como a conformidade com a tecnologia de ordenha de colostro em bezerros recém-nascidos no grupo experimental, contribuíram para o melhor desenvolvimento do esqueleto axial e periférico

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e dos órgãos torácicos dos animais, o que criará pré-requisitos para a formação de vacas altamente produtivas de um tipo leiteiro marcante. A concentração de proteína total no sangue das novilhas do grupo experimental foi superior à dos pares do grupo controle, com uma média de 1,89 g/l aos dois meses de idade e de 3,37 g/l aos seis meses de idade, o que indica um metabolismo proteico mais elevado no sangue das novilhas do grupo experimental.

Palavras-chave: raça preto e branco, tecnologia alimentar, proteína do sangue, colostro, consumo forçado de colostro, ganho de peso vivo, período de crescimento do leite.

1. Introduction

Young animals determine the future productivity of the herd and the profitability of milk production, therefore, the reduction of the unproductive period of use of animals associated with the economic costs of raising repair heifers is becoming increasingly important. Tozer and Heinrichs (2001) noted in their research that full-fledged feeding of dairy calves is a fundamental factor of optimal productivity throughout life and profitability of a dairy farm, as well as the fact that due to the significant gap between birth and the first calving, it is difficult for most dairy farmers to link the influence of calf rearing technologies and dairy productivity of cows.

To date, in many farms of Kostanay region, the age of the first calving of cows is 27-31 months, that is, the first fruitful insemination is carried out at the age of 18-22 months. So in the farm where the experiment is being implemented, in 2021 the average age of the first calving for the herd was 954 days, in 2020 – 933 days, in 2019 – 993 days. These data indicate that there has been no positive dynamics over the past 3 years, moreover, insemination of heifers begins no earlier than at the age of 22 months with a live weight of heifers of at least 400 kg.

Abeni et al. (2019) in their studies note that a high growth rate often leads to a decrease in the age of puberty, and, consequently, the first calving can occur as early as 20 months of age. The onset of puberty, as a rule, is a consequence of the early achievement of the standard body weight adopted for the breed, and is also associated with the exterior features of the animal (Abeni et al., 2019).

The milk growing period is characterized not only by morphological and functional changes in the digestive system, but also by a significant restructuring of the metabolism between the digestive and circulatory systems, increased protein, mineral and water metabolism in the body.

Young growing animals are able to give high gains with relatively more economical energy costs and high use of feed protein. At a young age, calves give gains with a relatively high protein content and less fat. It is advisable to use this biological feature, providing the necessary conditions for intensive growth of young animals (Sivkin et al., 2021).

As you know, the main requirement for breeding young animals is the compliance of the signs of growth and development. The correlation of growth and development processes is of great practical importance. For dairy animals, earlier development is desirable for the fastest achievement of the period of their economic use.

The consumption of solid feed is important for stimulating the development of scar tissue and adaptation to a future solid diet, and is also used as a criterion for weaning dairy calves (Silper et al., 2014).

The purpose of the research was to identify the optimal technology for growing black-and-white heifers in the dairy period to realize the genetic potential in the conditions of the Kostanay region.

To achieve this goal, the following tasks were solved:

- to identify the effect of the amount of milk feed being drunk on the growth rate of young animals during the growing period;
- to determine the intensity of growing heifers of the experimental and control groups on the basis of live weight indicators and basic body measurements by growth periods;
- to determine the effectiveness of the use of forced colostrum drinking by means of a drencher;
- determine the relationship between live weight and measurements;
- to determine the protein content in the blood of heifers of the studied groups at the age of 2 and 6 months.

2. Material and Methods

The research was carried out on the farm of Zarya JSC, which is located in the village of Arkhipovka, Mendykarinsky district, Kostanay region. JSC "Zarya" is one of the large specialized farms of the Kostanay region for the production of milk. The farm breeds black-and-white cattle with the active use of Holstein bulls.

The objects of the study were heifers of Holstein black-and-white cattle breed aged from birth to 6 months.

For experiments on the farm, two groups of heifers of 20 heads each were formed, immediately after their birth. The control and experimental groups are formed according to the principle of analogues. The selected groups differed in feeding technologies: the control group received the diet adopted on the farm, the feeding technology was changed for the experimental group in order to increase the intensity of heifer growth.

The experimental group differed from the control group in the number of dairy feeds fed, as well as the addition of ViaCorn 4 starter compound feed from the manufacturer VIAMIN. So, the heifers of the experimental group were fed whole pasteurized milk until the age of 2 months, and the heifers of the control group were fed whole milk for the first 2 months, the next 2 months - ZCM. Starter compound feed ViaCorn 4 was given to heifers of the experimental group of 250 g per head per day, starting from birth to 3 months, from the beginning of the 3rd month, the starter was mixed with dry crushed in a ratio of 50/50 and its dacha was continued for another month. The control group was fed whole-grain oats instead of starter feed, which was given without restrictions. Starting from the second month, the calves of the experimental group were transferred to water, completely excluding

dairy feed. Also, from the age of 2 months, the experimental and control groups were fed steamed feed mixture in the amount of 1.5 kg per head per day for up to 6 months. The distribution of the feed mixture was carried out once at lunchtime. For the experimental and control groups, hay and haylage were freely available.

Thus, the heifers of the control group received a diet developed by specialists of the farm 5-7 years ago, based on outdated practices. At the same time, there was a violation of the colostrum drinking technology in the farm, so in the control group colostrum was given not immediately after birth, but waiting for the arrival of the milkmaid. For the experimental group, the first colostrum was drunk in the amount of 10% of the total weight of the calf, that is, about 3-3.5 liters immediately after birth, using thawed colostrum from the existing colostrum bank. During the prophylactic period from birth to 7 days, the heifers of the experimental and control groups received whole milk 3 times: in the morning and in the evening 2.5 liters each, 2 liters at lunch, and about 7 kg per day.

A detailed feeding scheme for the control and experimental groups is shown in Table 1.

Also in the experimental group, a drencher and a colostrum defroster were used to feed heifers during the colostrum period.

In the post-lactation period, the method of group maintenance (10 heads in a cage) was used for heifers of the experimental and control groups, respectively, group drinkers were used.

During the research, classical zootechnical methods were used. The live weight of heifers was determined by monthly weighing on mechanical scales with an accuracy of 0.5 kg, in the morning before feeding and watering the animals.

For completeness and objectivity of research, body measurements were taken monthly, while the following tools were used: measuring stick, measuring compass, measuring tape.

The total protein content in the blood of experimental animals aged 2 and 6 months was determined using a refractometer.

The method of correlation analysis is used in the work. Biometric data processing was carried out using the methods of Hoffman-Kadoshnikov P.B. and Lartseva S.H. with the determination of general statistical values and the reliability of the difference (P) according to the Student.

3. Results and Discussion

Differences in technological schemes of feeding experimental groups of heifers led to a natural change

Table 1. Feeding scheme of heifers of control and experimental groups up to 6 months of age.

Age		Daily cottage, kg						
		Control group			An experienced group concentrates			
month	decade	Whole milk	hay	haylage	Whole grain oats	starter	Steamed grain mixture	Crushed grain
1	1st	07/jul	-	-	-	- / 0.25	-	-
	2nd	05/mai	Accustomed	-	1 / -	- / 0.25	-	-
	3rd	05/mai		-	1 / -	- / 0.25	-	-
2	4th	05/mai	0.2 /0.2	-	1 / -	- / 0.50	-	-
	5th	05/mai	0.3 / 0.3	Accustomed-	1 / -	- / 0.50	-	-
	6th	05/mai	0.5 / 0.5		1 / -	- / 0.50	-	-
3	7th	6 / -	0.7 / 0.7	0.5 / 0.5	1 / -	- / 0.50	- / 3	0.50 / 0.50
	8th	6 / -	1.0 / 1.0	1.0 / 1.0	1 / -	- / 0.50	- / 3	0.50 / 0.50
	9th	6 / -	1.3 / 1.3	1.5 / 1.5	1 / -	- / 0.50	- / 3	0.50 / 0.50
4	10th	6 / -	1.5 / 1.5	02/fev	1 / -	- / -	- / 3	01/jan
	11th	6 / -	1.5 / 1.5	02/fev	1 / -	- / -	- / 3	01/jan
	12th	6 / -	1.5 / 1.5	03/mar	1 / -	- / -	- / 3	01/jan
5	13th	- / -	2.0 / 2.0	03/mar	1 / -	- / -	- / 3	01/jan
	14th	- / -	2.5 / 2.5	04/abr	1 / -	- / -	- / 3	01/jan
	15th	- / -	3.0 / 3.0	05/mai	1 / -	- / -	- / 3	01/jan
6	16th	- / -	3.0 / 3.0	05/mai	1 / -	- / -	- / 3	01/jan
	17th	- / -	3.5 / 3.5	06/jun	1 / -	- / -	- / 3	01/jan
	18th	- / -	3.5 / 3.5	07/jul	1 / -	- / -	- / 3	01/jan
Total		680/320	260/260	400/400	170 / -	- /37.5	- /120	105 / 105

in growth and development indicators. The actual confirmation of the conducted studies is shown in Table 2.

During the research, it was found that the heifers of the experimental and control groups differed significantly in live weight. As the heifers of the experimental group grew, they developed better, had a higher live weight than the heifers of the control group. So, the difference in drinking colostrum and giving a starter manifested itself in the superiority of the experienced heifers over the control, and amounted to 8.4 kg or 34.9% at the age of 1 month. As can be seen from Table 2, every month the advantage of heifers of the experimental group over the control group is becoming more pronounced. So, the difference between the indicators in 2 months was 20 kg or 28.1% in favor of the experimental group, during this period the heifers of the experimental group stopped being fed dairy feed and ViaCorn 4 starter compound feed was mixed with a grain mixture in a percentage ratio of 50/50. After the cessation of giving milk, the advantage of heifers of the experimental group also remained and amounted to 31.1 kg or 32.6% in 3 months. From the age of 4 months, the heifers of the experimental group stopped being fed starter, but the positive dynamics remained and the differences in live weight between the groups amounted to 36 kg or 30.8%, at 5 months – 41.6 kg or 29.8%, respectively. At the age of 6 months, the differences in live weight between heifers increased and amounted to 53.6 kg or 32.1% in favor of heifers of the experimental group.

Differences in live weight during the dairy growing period between groups of experimental animals are due to the unequal value of the average daily increments, the dynamics of which is presented in Table 3.

The average daily increments of heifers of the experimental group during the dairy growing period were at a high level – on average from 757.9 to 847.2 g. Already at the age of 1 month after birth, the superiority of heifers of the experimental group by 335.3 g or 69.9% is noted. In further age periods, the heifers of the experimental group differed more and more dramatically in average daily growth from similar indicators of their peers in the control group. The increased average daily gains persisted until the end of the dairy period, the heifers of the experimental group grew more intensively by 60%. The heifers of the control group began to show growth potential only after reaching the age of 4 months and reached the maximum increase in the period of 5-6 months, unlike the heifers of

Table 2. Dynamics of live weight of experimental groups of heifers in the dairy period, kg.

Age. months.	An experienced group			Control group		
	X ± mx	δ	Cy*** (%)	X ± mx	δ	Cy*** (%)
At birth	24.1 ± 0.5	3.62	0.15	23.8 ± 0.2	0.87	0.04
1 month	48.6 ± 1.8	9.28	0.19	38.2 ± 2.1	10.68	0.28
2 month	71.3 ± 2.5*	14.76	0.21	51.4 ± 2.5	12.51	0.24
3 month	96.7 ± 3.1	11.57	0.12	64.3 ± 2.6	13.01	0.20
4 month	116.8 ± 3.9	12.43	0.10	80.8 ± 3.2	16.17	0.20
5 month	139.6 ± 3.9	17.26	0.11	98.0 ± 3.2	15.86	0.16
6 months	171.8 ± 1.7	20.5	0.12	118.2 ± 3.2**	16.50	0.14

Note: *P >0.99; **P > 0.90; ***Cy-coefficient of variation.

Table 3. Live weight gains of experimental groups of heifers during the dairy period.

Age period, months	An experienced group			Control group			Average daily increase, ± to control, g
	Live weight gains						
	Average daily increase, g	Absolute gain, kg	Relative increase, %	Average daily increase, g	Absolute gain, kg	Relative increase, %	
0-1	814.4	24.5	67.2	480.0	14.4	46.5	334.4
1-2	757.9	22.7	37.9	440.0	13.2	29.5	317.9
2-3	847.2	25.4	30.3	430.0	12.9	22.3	417.2
3-4	862.9	20.1	23.6	550.0	16.5	22.7	312.9
4-5	792.5	22.8	17.7	573.3	17.2	19.2	219.2
5-6	794.2	32.2	15.1	673.3	20.2	18.7	120.8
0-2	786.2	47.2	98.86	460.0	27.6	73.4	326.2
0-6	811.5	147.7	150.3	524.4	94.4	133.0	287.1

the experimental group, in which the maximum average daily increase was observed at 3-4 months of age.

In general, during the dairy growing period, the superiority of heifers of the experimental group in terms of average daily live weight gains over peers of the control group was 287.1 g, which is clearly shown in Figure 1.

To study growth, data on changes in individual parts of the body of growing animals are usually used. Measurements of experimental animals are presented in Table 4.

As a result of the research, it was found that the heifers of the experimental group were superior to their peers in all body measurements. Thus, according to measurements of the oblique length of the trunk at the age of 2 months, the difference relative to the control was higher by 5.4 cm or 6.8%, and at the age of 6 months, this difference was 4.4 cm or 3.9%. According to latitudinal measurements of the body, such as chest girth behind the shoulder blades, chest depth and chest width, the difference between the groups at the age of 2 months was 8.4 cm (9.3%), 1.8 cm (5.7%), 2.7 cm (14.8%), respectively, and at the age of 6 months the difference increased and amounted to chest circumference behind the shoulder blades 12.2 cm or 10% ($P > 0.90$), the depth and width of the chest are 2.2 cm, respectively. In terms of height measurements, the heifers of the experimental group were superior to their peers of the control group, so at the age of 2 months, the difference in height measurements at the withers was 6.9 cm or 8.2%, the height in the sacrum was 6 cm or 6.8%, and also at the age of 6 months, the growth of the axial skeleton was suspended, and the differences between the groups in height at the withers were 5 cm (4.9%) and 4.2 cm (4%) in height in the sacrum. Thus, the greatest differences were observed in the indicator "chest girth", which confirms the fact that the change in feeding technology leads to an increase in latitudinal measurements and an increase in the massiveness of animals.

The exterior profile (Figure 2) clearly confirms the numerical data and shows that the greatest differences were in latitudinal measurements, such as chest circumference behind the shoulder blades, chest width, width in the shoulder pads, width in the hip joints, width in the sciatic mounds. At the same time, altitude measurements, such as height at the withers, height at the rump, were characterized by the lowest level of the coefficient of increase with age. The experimental groups did not differ in the bone index (pastern girth).

Measurements of the physique give an idea only of a unilateral change in the proportion of the body. While the physique indices indicate a change in proportions and interrelated measurements, calculated on the basis of the measurements obtained are presented in Table 5.

As can be seen from Table 5, the lowest stretch index was characteristic of the heifers of the control group at 1 and 2 months. The downness index, which characterizes the development of body weight, turned out to be relatively higher in the heifers of the experimental group. According to the breast index, there were also differences depending on the level of feeding of heifers in favor of the experimental group.

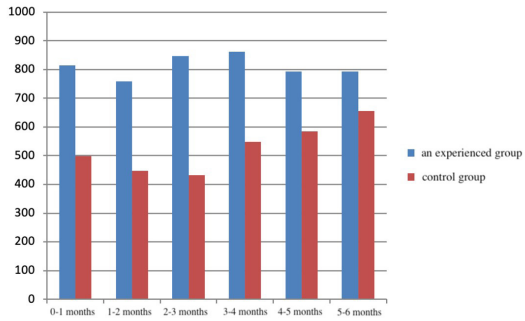

Figure 1. Dynamics of the average daily growth of young animals of the experimental and control group of JSC Zarya.

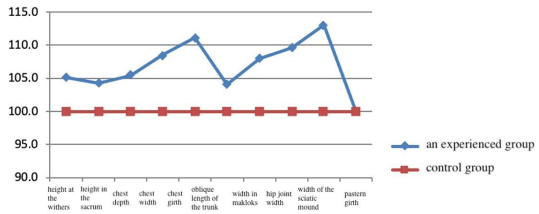

Figure 2. Exterior profile of experimental heifers at the age of 6 months.

In order to determine the degree of correlation between changes in live weight and measurements of the physique of heifers, we calculated the correlation coefficient in dynamics (Table 6). The determination of this dependence will reveal which of the body measurements are most actively changing following the change in the animal's live weight.

A positive correlation was observed in the experimental group of repair heifers. Thus, a significant relationship was found between live weight and height at the withers, the value ranged from 0.31 to 0.71, between live weight and height in the sacrum – from 34 to 0.71, as well as chest depth, where the value of the correlation coefficient varied from 0.34 to 0.81.

Blood samples of experimental heifers for the study of protein content were taken at the age of 2 months and 6 months (Table 7).

The concentration of total protein in the blood of the heifers of the experimental group at 2 months of age was higher than that of the control group peers by an average of 1.89 g/l and at 6 months - by 3.37 g/l, which indicates a higher protein metabolism in the blood of animals of the experimental group.

In modern conditions of milk production, the problem of raising young animals is of great importance, since the further manifestation of the economically valuable qualities of dairy cattle depends on it.

A strategically important direction determining successful cultivation for the farms of Kostanay region and Kazakhstan as a whole is biologically complete feeding, which guarantees proper development and good health of heifers, and as a result maximum productivity. In this

Table 4. Measurements of experimental heifers during the dairy growing period, $X \pm m_x$.

Group	Age	Body measurements cm									
		height at the withers	height in the sacrum	chest depth	chest width	chest girth	oblique length of the trunk	width in makloks	hip joint width	width of the sciatic mound	pastern girth
An experienced group	10 days	79.5 ± 1.2	81.5 ± 1.2	29.8 ± 1.4	15.0 ± 1.1	82.8 ± 1.3	74.8 ± 1.8	14.8 ± 1.0	19.5 ± 0.5	10.8 ± 0.25	9.5 ± 0.3
	1 month	79.6 ± 1.1	83.1 ± 1.0	31.0 ± 0.8	16.9 ± 0.9	83.7 ± 1.0	72.6 ± 1.0	15.3 ± 0.6	20.3 ± 0.7	12.2 ± 0.5	9.7 ± 0.2
	2 months	83.3 ± 1.1	88.2 ± 1.1	31.5 ± 1.2	18.2 ± 0.7	90.5 ± 1.3	79.9 ± 0.9	17.9 ± 0.6	19.1 ± 0.8	13 ± 0.4	10.2 ± 0.2
	3 months	87.7 ± 1.3	91.9 ± 1.4	36.8 ± 1.2	24.1 ± 1.4	98.8 ± 1.2	88.4 ± 1.3	22.4 ± 0.6	26.1 ± 1.1	15.4 ± 0.7	10.4 ± 0.2
	4 months	89.3 ± 2.1	95 ± 2.0	36 ± 1.3	23.2 ± 1.4	101.7 ± 1.1	93.8 ± 2.7	19.8 ± 0.5	21.5 ± 0.8	13.7 ± 1.2	10.8 ± 0.2
	5 months	98.3 ± 0.9	101.3 ± 0.9	41.7 ± 2.7	26.3 ± 0.7	110 ± 1.7	103.3 ± 1.8	26 ± 3.2	25.3 ± 2.3	18.3 ± 0.9	11.2 ± 0.2
	6 months	102.2 ± 2.3	103.6 ± 2.3	42.6 ± 3.4	28 ± 0.5	121.4* ± 5.5	113.6 ± 3.8	32.4 ± 1.5	25.2 ± 1.7	20.8 ± 1.2	12.8 ± 0.7
Control group	10 days	73.0 ± 0.9	77.8 ± 0.5	24.0 ± 1.5	13.0 ± 0.9	76.3 ± 1.1	70.3 ± 1.3	12.8 ± 0.9	17.0 ± 0.4	10.3 ± 0.3	9.6 ± 0.4
	1 month	76.2 ± 0.7	77.2 ± 0.6	26.9 ± 0.4	14.0 ± 0.4	74.4 ± 0.8	68.0 ± 0.8	12.9 ± 0.4	16.2 ± 0.5	9.5 ± 0.3	13.8 ± 0.2
	2 months	76.4 ± 0.7	82.2 ± 0.8	29.7 ± 0.8	15.5 ± 0.5	82.1 ± 0.6	74.5 ± 0.8	15.5 ± 0.6	17.3 ± 0.6	11.2 ± 0.3	10.0 ± 0.2
	3 months	82.8 ± 0.7	84.3 ± 0.4	33.7 ± 0.8	21.2 ± 1.1	87.8 ± 0.9	84.9 ± 0.9	17.7 ± 0.4	22.9 ± 1.1	12.0 ± 0.6	10.7 ± 0.2
	4 months	84.0 ± 1.5	88.8 ± 1.5	33.7 ± 1.2	21.3 ± 1.1	96.0 ± 1.4	90.8 ± 1.4	18.5 ± 2.3	20.2 ± 0.7	13.8 ± 0.8	11.3 ± 0.2
	5 months	95.3 ± 0.3	99.7 ± 0.7	37.3 ± 2.8	24.3 ± 0.7	105.3 ± 0.9	101.0 ± 1.2	24.7 ± 2.9	23.0 ± 2.5	17.0 ± 0.6	11.7 ± 0.3
	6 months	97.2 ± 0.9	99.4 ± 1.1	40.4 ± 2.8	25.8 ± 0.6	109.2** ± 0.9	109.2 ± 1.9	30.0 ± 0.9	23.0 ± 2.3	18.4 ± 1.0	12.8 ± 0.5

Note: *P > 0.90; **P >0.99.

Table 5. Indices of the physique of the experimental groups for the dairy growing period.

Group	Age	Physique indices							
		long legs	sprawl	pelvic-thoracic	thoracic	downed	overgrowth	small distance of the sciatic mound	bony
An experienced group	10 days	42.0	96.2	101.4	50.3	110.7	102.5	137.0	11.9
	1 month	40.7	89.2	110.5	54.5	115.3	104.4	125.4	11.9
	2 months	45.5	97.6	101.7	57.8	113.3	105.9	137.7	12.2
	3 months	45.7	102.6	114.8	65.5	111.8	104.8	136.4	11.9
	4 months	49.0	108.1	117.2	64.4	108.4	106.4	144.5	12.1
	5 months	55.9	105.9	101.2	63.1	106.5	103.1	142.1	11.4
	6 months	60.5	112.3	86.4	65.7	106.9	101.4	155.8	11.8
Control group	10 days	40.1	94.1	102.0	54.2	108.5	106.5	123.8	12.3
	1 month	40.9	91.2	108.6	52.1	109.5	101.3	135.7	11.5
	2 months	37.4	95.9	100.0	52.0	110.1	107.6	137.7	11.8
	3 months	42.1	100.8	120.1	63.0	103.4	101.9	147.2	10.5
	4 months	43.9	105.0	115.3	63.4	105.7	105.8	133.7	11.6
	5 months	56.2	105.1	98.6	65.2	104.3	104.5	145.1	11.2
	6 months	55.6	111.2	86.0	63.9	100.0	102.3	163.0	11.8

Table 6. Relationship of measurements and live weight of heifers of experimental groups.

Group	Age	Correlation: live weight/body measurements:									
		height at the withers	height in the sacrum	chest depth	chest width	chest girth	oblique length of the trunk	width in makloks	hip joint width	width of the sciatic mound	pastern girth
An experienced group	10 days	0.37	0.53	0.36	0.70	0.33	0.58	0.22	0.38	0.13	0.22
	1 month	0.53	0.34	0.43	0.51	0.50	0.51	0.45	0.34	0.44	0.53
	2 months	0.46	0.56	0.34	0.34	0.38	0.22	0.19	0.51	0.28	0.22
	3 months	0.31	0.47	0.41	0.11	0.31	0.40	0.19	0.48	0.28	0.40
	4 months	0.71	0.70	0.81	0.02	0.45	0.08	0.18	0.64	0.53	0.57
	5 months	0.63	0.63	0.47	0.03	0.53	0.53	0.48	0.47	0.37	0.03
	6 months	0.62	0.71	0.37	0.31	0.46	0.63	0.37	0.52	0.40	0.62
Control group	10 days	0.09	0.21	0.29	0.09	0.05	0.44	0.43	0.59	0.98	0.59
	1 month	0.05	0.60	0.42	0.56	0.21	0.31	0.09	0.09	0.01	0.25
	2 months	0.48	0.33	0.49	0.42	0.57	0.34	0.01	0.40	0.42	0.65
	3 months	0.21	0.05	0.54	0.13	0.31	0.78	0.27	0.57	0.18	0.74
	4 months	0.59	0.66	0.13	0.39	0.44	0.06	0.26	0.74	0.30	0.90
	5 months	0.48	0.24	0.26	0.42	0.34	0.52	0.34	0.69	0.24	0.24
	6 months	0.55	0.36	0.31	0.34	0.32	0.29	0.47	0.16	0.03	0.06

Table 7. Indicators of protein levels in the blood of experimental groups.

Age, months	An experienced group	Control group
	The indicator of total protein in the blood, g / l	
2 months	58.02 ± 0.36	56.13 ± 0.21
6 months	74.61 ± 0.97	71.24 ± 0.93

regard, the identification of the optimal technology for growing heifers, which will lead to excellent development of animals and complete preparation for calving at the optimal time and high milk productivity in the future, is the main goal of this study.

As you know, colostrum is extremely important for a newborn calf. Italian scientists in their research also note the importance of good colostrum management practice, which provides for feeding calves at least 4.0 liters of good quality colostrum (i.e. with a concentration of immunoglobulin Ig G ≥50.0 g/l within 6 hours after birth) to achieve the minimum level of passive immunity necessary to protect against infectious diseases. Insufficient consumption of colostrum leads to a violation of the transmission of passive immunity, a condition that occurs when the concentration of IgG in the serum of calves is less than 10.0 g/l during 48 hours of life, and which threatens the health and survival of calves (Lora et al., 2019).

In this regard, for the experimental group, in order to improve the available feeding technology, a refractometer was used to assess the quality of colostrum, a defroster for heating with quality preservation, as well as a drencher to provide heifers with the necessary amount of colostrum. It is also worth noting that in the post-production period, the use of group drinkers on the farm did not allow each heifer to receive the necessary amount of milk.

Taking into account the above, as well as the age of the first calving of cows, there is a need to change the feeding technology in the farm. As part of our research, the feeding ration of heifers during the dairy growing period was changed.

Thanks to the use of a new technological scheme, at the age of 2 months, the superiority of the experimental group over the control group is noted in terms of an average daily increase of 326.2 g, which is probably due to the use of starter compound feed in the experimental group, which contributes to the full development of the pre-ventricles and the formation of the microflora of the scar. The starter also contains soybean meal and sunflower meal, which are sources of protein and essential amino acids, and corn and barley provide the calf with energy, as well as hercules, linseed cake, beet pulp and probiotic, which are part of the starter, improve digestion, reduce the risk of diarrhea.

Forced drinking of colostrum by means of a drencher for the experimental group also showed its positive results in the form of high gains, since the heifers of the experimental group received the necessary amount of colostrum in a timely manner, and, consequently, the proper level of immunoglobulins. The heifers of the control group received colostrum with a violation of the soldering technology and, accordingly, showed smaller gains and were characterized by low resistance.

It should be noted that significant differences in the live weight gains of the experimental groups are due to the improvement of management in the farm, the change of management personnel and tighter control over the processes.

Also, the use of a new technological scheme allowed the heifers to reach a live weight of 171.8 kg by the age of 6 months, which exceeds the breed standard by 31.8 kg or 22.7%. So, in Kazakhstan, they still adhere to the standard of live weight at the age of 6 months at the level of 140 kg.

Thus, the improvement of the feeding scheme available on the farm made it possible to obtain higher average daily gains in live weight of heifers during the dairy growing period.

A huge role in the selection of animals for use in conditions of intensive milk production technology is played by the indicators of the exterior of animals, which are formed under certain environmental conditions under the control of the genotype and change with age.

Based on the results of the study, it can be concluded that the change in the technological scheme of feeding towards the rejection of dairy feeds in 2 months for the experimental group and the addition of a starter, the active use of coarse and juicy feeds, as well as the forced watering of colostrum to newborn calves with the help of a drencher, contributed to the better development of the axial and peripheral skeleton, chest organs animals, which creates prerequisites for the formation of highly productive cows of a pronounced dairy type.

The data obtained indicate that measurements such as the depth and width of the chest and the circumference of the chest behind the shoulder blades, characterizing the development of the chest, as well as the width in the flocks and hip joints, indicating the degree of pelvic development, differed in the maximum level of the coefficient of increase with age in the experimental group of heifers.

At the same time, the height at the withers, the sacrum and the circumference of the pastern increased to a lesser extent. At the same time, the chicks of the experimental groups differed in the maximum value of the studied indicator, and the peers of the control group – the minimum.

Thus, by the end of the milk period, the superiority of the heifers of the experimental group over the analogues of the control group in all body measurements was observed, which indicated the best development of heifers.

The scientific value of our research consisted in monthly determination of linear body sizes of heifers. Studies like ours have not been conducted enough, in this regard, the objective results we have obtained will make a significant contribution to the study of the exterior and constitutional features of animals. Thus, our studies confirm that changes in feeding conditions lead to changes in the exterior characteristics of animals, which is also confirmed by the studies of Esaulenko (2015).

It should be noted that the object of the study was Holstein black-and-white heifers, which had a height at the withers at the age of 10 days at the level of 76.2 cm, which fully corresponds to the studies of Litovchenko et al.

(2013), who analyzed measurements of newborn Simmental heifers and gave a similar indicator at the level of 71.8 cm.

At the age of 1 month, our measurements of the height at the withers averaged 77.9 cm, which is within a significant difference with the studies of American scientists, where purebred Holstein heifers were characterized at the level of 83.8 cm (Hoffman, 2000). At the age of 2 months, the experimental heifers of JSC Zarya had an average height in the sacrum of 85.2 cm, unlike American Holstein heifers, characterized by a height in the sacrum at the level of 91.4 cm. According to latitudinal measurements, the same pattern remained, so at the age of 2 months: the heifers of JSC Zarya had measurements of the width in makloks at the level of 16.7 cm, unlike the Holstein peers, in whom this indicator was equal to 17.8 cm.

Thus, Holstein black-and-white heifers of Kazakhstan are characterized by less developed altitude and latitude measurements compared to American Holstein heifers. However, in terms of height measurements and torso extension, they surpass Russian simmentals.

The reliability of measurements of heifers at the age of 6 months is consistent with the results of some scientists. So, in the studies of Esaulenko (2015), in the experiment, which the heifers of the black-and-white breed had a chest width of – 23.4-26.2 cm, in the studies of Negreeva (2005) at the level of – 21.4-21.8 cm, in the studies conducted by the authors of this article on the farm, engaged in breeding black-and–white breeds - at the level of 24.6 cm (Esaulenko, 2015).

It is interesting to note the fact that the systematic holsteinization of black-and-white cattle carried out in JSC Zarya led to bone thinning in animals, so the measurement of the "girth of the pastern" averaged 12.8 cm, which is 1.1 cm less than that of red Tambov cattle (Negreeva, 2005) and 1.2-2.4 cm less than in black-and-white cattle of Russian breeding (Esaulenko, 2015), 1.1 cm of black-and-white cattle of Kazakh breeding (Papusha and Naimanov, 2006).

Currently, stretched, tall animals are promising in dairy cattle breeding, which are characterized by adaptive plasticity, a fairly high level of productive qualities. In order to determine the type of physique on the basis of a comparison of interrelated measurements of individual articles of the body, physique indices were calculated.

The index of legginess indicates the relative development of the length of the legs of animals and allows you to establish the underdevelopment of animals within one farm. So, too large an index of legginess indicates underdevelopment in the postnatal period, and too small for underdevelopment in the uterine period. The data obtained by us indicate that the index of legginess of the heifers of the experimental group was at the level of 65%, which is 4.9% more than that of the heifers of the control group.

Studies conducted by Esaulenko (2015), Negreeva (2005) and Papusha and Naimanov (2006), show that the index of heifers aged 6 months ranges from 53-59%. The elongation index can be used to judge the relative length of the body, a large elongation index suggests the presence of embryonalism, a small one – infantilism. In our studies, the stretch index at the age of 6 months was 111-112%, was within the results of other authors (in the studies of Esaulenko, 2015 - 98%, Negreeva, 2005 - 117%, Papusha and Naimanov, 2006 - 105%). The dynamics of the pelvic index shows a significant development of the breast width compared to the width in makloki, so with the age of the animal, this index decreases, since the breast develops relatively more than the width of the sacrum.

Based on the enormous importance of blood in metabolism and other important processes of the vital activity of the animal organism, we investigated the indicator of the total protein content in the blood of experimental animals. Proteins are involved in the creation of a unique biological structure of living cells and determine the metabolism between blood and tissues. By the amount of protein in the blood serum, it is possible to judge the degree of resistance of the body, as well as the intensity of metabolic processes.

In our studies, a higher content of the total protein index in the blood was found in heifers raised according to a new improved feeding scheme. Thus, the concentration of total protein at 6 months of age in the blood of heifers of the experimental groups was higher than that of the control group peers by an average of 3.37 g/l, which indicates a higher protein metabolism in the blood of animals of the experimental group. The data obtained are consistent with the research of Kasaeva (2014) in the studies of which, the protein index for the experimental and control groups at the age of 6 months averaged 73.6 g/l, as well as in the studies of Sherbakova (2007), the analyzed indicator was 66.4 g/l.

4. Conclusions

Thus, reducing the consumption of dairy feed from 1040 kg to 320 kg with the simultaneous inclusion of starter feed in the amount of 37.5 kg% and the addition of steamed feed mixture in the amount of 120 kg per head contribute to the production of live weight at the end of the dairy period by 53.6 kg or 31.2% higher than that of the control group peers. The improvement of the feeding scheme available on the farm made it possible to obtain higher average daily live weight gains of black-and-white heifers. Thus, the average daily increase in heifers of the experimental group as a whole over a 6-month period was 811.5 g, which is 287.1 g more than in heifers of the control group.

The change in the technological scheme, different from the one available on the farm, contributed to a more harmonious development of the body, characteristic of dairy cattle, as evidenced by the indicators of body measurements. It should also be noted that the high concentration of protein in the blood of animals of the experimental group shows a sufficient degree of resistance of the body and the intensity of metabolic processes.

The results of the study indicate a positive effect of the addition of ViaCorn starter feed to the diet of black-and-white breed heifers of Zarya JSC, as well as forced watering of colostrum, as well as improvement of the management system and management in the farm.

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