The study of the effect of carbohydrate-vitamin-mineral concentrate lizunets solevit on the health of milk cows

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Abstract. In modern conditions of the keeping farm animals, namely cows, it is necessary to include an appropriate amount of vitamins and mineral substances into their diet. Compared to other herbivores, cattle need a large amount of feed per unit weight, which makes it less profitable. Therefore, the diet should cover energy costs, vitamin and mineral necessary, since the lack of minerals in animals’ organisms causes severe health problems and a sharp decline in productivity. Because of this reason we have studied the effect of carbohydrate-vitamin-mineral concentrate “Lizunets Solevit” on dairy cows. On the basis of the conducted study, it was established that the palatability of feeds by experimental animals for the period of the experiment amounted was: 92.3% for the first control group; and 95.1% for the second experimental group that was higher than that in the control group by 2.9%. Introduction carbohydrate-vitamin-mineral concentrate “Lizunets Solevit” to the diet contributes to the better digestion of nutrients and assimilation of minerals substances, which is confirmed by the fact that hematological and biochemical parameters were within the physiological norm. It also contributes to the increase in milk amount of cows by 10.4% and allows to get economic efficiency from a cow equal to 4.7 RUB for 1 RUB additional costs.

1. Introduction

Intensive livestock holding implies nutritious balanced ration of farm animals on the main organic, mineral substances and vitamins that play an important role in metabolism. It’s scientific fact that nutritious balanced ration of farm animals contribute to the full implementation of the genetic potential occurs, which allows to profit by the sale of the product [1,2].

In recent years, in connection with the transition to market relations in stockbreeding, as well as in all agriculture, there have been substantial changes. The sharp rise in the prices for industrial and agricultural goods, reducing the level of providing fodder and other factors have broad about the crisis in dairy industry and other branches of animal husbandry, which has resulted in a drastic deterioration of head of cattle and accordingly the decrease in the level of milk performance [3,4].

In this situation, dairy farms apply the necessary measures to increase the animal products with minimal labor, fodder and funds. Yet, despite all the odds against by the country’s livestock, dairy cattle breeding remains profitable [5,6].
Agricultural animals to the normal existence it is necessary to receive vitamins and minerals. Compared to other herbivores, cattle need a large amount of feed for a unit of mass, which makes its content less profitable. That is why the diet should cover not only energy costs but also vitamin and mineral needs. Partial lack of mineral substances causes animals serious health disorder and a sharp decrease in productivity. Providing the needs of highly productive animals in vitamin and mineral balance, it is possible to achieve the greater productivity, fully revealing the genetic potential of the breed, a high level of metabolism [7].

The availability of animals with vitamins and minerals is determined by the biogeochemical characteristics of the soil. The characteristics of the biogeochemical habitat affect the content of vitamins and minerals in feed and water. Each individual habitat area is characterized by its own composition of mobile forms of elements. In different areas, they can vary greatly in their composition [8].

The cow's body passes a number of physiological states - the period of dry sludge, calving and lactation. In accordance with this division, there are different approaches to feeding a cow at a certain stage of the physiological cycle and, accordingly used feed additives.

Lactation - it is an intense physiological process that requires the high energy costs for the excretion of milk. Animals experience a particularly high energy demand after calving, when the nutrients of the diet do not completely compensate for the loss of energy for the milk production. Therefore, as a rule, during the initial lactation period, cows often have a significant energy deficit, which can lead to serious metabolic disorders.

To addition to the low content of mineral substances in the basic feed, their diet is not balanced with the needs which in turn change at different stages of development. Heifers, for example, needs a completely different mineral supplement than millet cows. Therefore, animals at different stages of physiological and age development should be fed according to their needs [9].

Using vitamin and mineral premixes in feeding dairy cattle, you can avoid osteodystrophy, parakeratosis, increase the productivity of cow during the milking period, increase the protein and fat content in milk, reduce the open period. Premixes will help to reduce feed costs per unit of production and extend the term of economic use of cows [10].

Domestic premixes are not always able to satisfy the needs of livestock in vitamin and mineral substances, as a result the activity of metabolic processes decreases, productivity and immunity. To normalize the mineral metabolism, providing animals with vitamins, many farms of the Republic use expensive feed additives of European companies, which also do not always meet the requirements of the animals contained in our conditions.

Compared with the carbohydrate-vitamin-mineral additive for bulls, cows and heifers "Briquette Lizunets" based on table salt (64.0%), sugar, molasses, vitamins A and D3, macro and microelements. (TU BY 100069735.066-2010, Republic of Belarus).

The disadvantage of this composition is the absence of urea, sulfur, vitamin E and insufficient concentration of microelements, which with modern technology of keeping and feeding dairy cattle cannot provide a normal level of metabolic processes in the body, health and productive longevity and safety of livestock.

In comparison with the fodder additive (RF patent No. 2208338, A23 K1 / 16, 2003) for agricultural animals, including dolomite flour, halite waste, phosphonys, sapropel and premix containing macro and microelements in the following proportions of components, wt. % : dolomite flour 8.0, halite waste 26.0, phosphonys 24.0, tricalcium phosphate 20.0, premix 2.0 and sapropel - the rest. At the same time, the premix additionally contains, g: iron sulphate 3200-4000, copper sulphate 450-600, zinc sulphate 2000-2500, cobalt carbon dioxide 18-25, cobalt chloride 36-42, manganese sulphate 4200-4800 potassium iodide-10-14, sodium Selenite-7-9, as well as, million IU: vitamin A 300-400, vitamin D 40-60, vitamin E 200-300 and turf oxide – the rest. The additive is prepared in the form of a dry mixture in dosing mixers and add into the grain feed in an amount of 2-5% by weight, according to physiological feeding norms.
The disadvantage of this method of preparing a balancing additive is that it is difficult to evenly distribute its ingredients, and during the transportation there is a danger of their stratification, vitamins can decompose during the storage, and microelements can react with each other.

Carbohydrate-vitamin-mineral concentrate "Lizunets Solevit" is a synergistic complex of natural natural feed components, macro and microelements, vitamins and other biologically active substances that regulate the scar and intestinal digestion, metabolism in the body having the following composition.

- Table salt 23%
- Monocalcium phosphate 18%
- Beet molasses 16%
- Chalk stern 9%
- Premix P-60-3 10%
- Sugar 8%
- Zeolite activated 4%
- Magnesium oxide 4%
- Urea 3%
- Bentonite clay 2%
- Sapropel dry 3%

It is obtained by preliminary mechanical mixing of the components. Then the homogeneous mixture is laid out in plastic buckets and placed in a hydraulic vibration press with a sliding working table for four cells (buckets) under 150 atmospheric pressure. The purpose of the work - it is to study the effect of the newly developed carbohydrate-vitamin-mineral concentrate "Lizunets Solevit" on dairy cows, corrective deficiency of carbohydrates, minerals and vitamins in the diet, taking into account the biogeochemical characteristics of the region and the fodder production, which passed preclinical researches on laboratory animals.

Carbohydrate-vitamin-mineral concentrate "Lizunets Solevit" – it is a new high-quality product that is a synergistic complex of natural natural fodder components, macro and microelements, vitamins and other biologically active substances that regulate the scar and intestinal digestion, metabolism in the body and allows the implementation of the genetic potential of productivity of various technological groups of animals.

2. Experimental

To determine the effectiveness of carbohydrate-vitamin-mineral concentrate "Lizunets Solevit", correcting the lack of carbohydrates, minerals and vitamins in the diet of highly productive dairy cows, black cattle breed, selected by the principle of analogues, according to the method of A. I. Ovsyannikov, with a yield of 5-6 thousand kilograms per lactation, in LLC "New Life" of the Kukmor district, Republic of Tatarstan in the winter persistent period, scientific and economic experience was conducted during the period of divorce. According to the developed scheme of the experiment, the animals of the first control group received the main diet (hay, haylage, silage and concentrates). Animals of the second experimental group received in addition to the main diet carbohydrate-vitamin-mineral concentrate "Lizunets Solevit" in the mouth for licking. Hematological and biochemical analyses were carried out in the laboratory on an automatic analyzer. Experimentally obtained material was processed using the Microsoft excel program. The determination of the validity of differences by the student's t-criterion was processed using Microsoft Excel.

3. Results and considerations

Based on the research conducted, it was established that the eating of feed by experimental animals during the period of the experiment was different. The first control group the feed intake during the day was 92.3%, then in the experimental group it was 95.1% or 2.9% higher than the control group.
At the same time, the eating of carbohydrate-vitamin-mineral concentrate "Lizunets Solevit" in the experimental group of animals was 156.0±1.34 g per day.

Introduction to diet the carbohydrate-vitamin-mineral concentrate "Lizunets Solevit" promotes better digestion of nutrients and absorption of minerals in the diet, which is confirmed by hematological and biochemical parameters of experimental animals after 61 days of eating animals in both groups were within physiological norms (table 1 and 2).

Table 1. Hematological parameters of the blood of lactic cows.

| Rate                              | Normal                        | Group                                      |            |            |
|-----------------------------------|-------------------------------|-------------------------------------------|------------|
|                                   |                               | control                                   | experimental |
|                                   |                               | baselines at the end of the experience     | baselines at the end of the experience |
| Hemoglobin, g/DL                  | 9.0-13.9 g/DL                 | 9.87±5.31                                 | 10.5±3.22  | 10.0±3.01  | 12.1±1.92 |
| Red blood cells, 10³/l            | 5.0-10.1 g/µl                 | 6.89±0.12                                 | 7.48±0.23  | 7.61±0.25  | 8.41±0.13 |
| White blood cells, 10³/l          | 5.0-16.0 g/µl                 | 10.9±1.80                                 | 10.3±2.85  | 11.2±1.15  | 11.5±2.15 |
| The content of lymphocytes, %     | 20.0-60.3%                    | 30.4±2.42                                 | 35.8±2.16  | 32.8±3.74  | 39.7±3.91 |
| The absolute number of lymphocytes, 10³/l | 1.5-9.0 x 10⁹/l             | 2.5±1.56                                  | 3.3±192    | 2.9±2.45   | 3.7±3.18  |
| Ratio of basophils, eosinophils, and monocytes, % | 4.0-12.1 % | 10.7±2.81                                 | 12.4±3.47  | 11.1±3.15  | 12.3±2.72  |
| The content of granulocytes, %    | 30.0-65.0%                    | 54.2±4.77                                 | 52.7±3.47  | 53.7±4.14  | 52.7±5.42  |
| Number of granulocytes, 10⁹/l     | 2.3-9.1 x 10⁹/l              | 3.4±2.54                                  | 5.8±3.18   | 5.7±2.82   | 6.4±3.17   |
| Absolute ratio of basophils, eosinophils and monocytes, 10⁹/l | 0.3-1.6 % | 1.3±0.29                                  | 1.4±0.62   | 1.1±0.16   | 1.5±0.35   |
| Hematocrit, %                     | 28.0-46.0%                    | 39.4±5.73                                 | 42.1±6.46  | 37.7±5.74  | 45.7±4.65  |

Based on the data shown in table 1, it can be concluded that the concentration of hemoglobin in the experimental group increased by 13.2% in relation to the control group, and the content of red blood cells and white blood cells increased by 11.06 and 10.4%, which indicate the normal course of redox processes and compliance with physiological norms in the blood of lactating cows [9].

The ratio of basophils, eosinophils, monocytes and granulocytes content without significant changes and remains within the physiological norm. There is a slight increase in the absolute number of lymphocytes by 10.8%, as well as the number of granulocytes and hematocrit by 9.3 and 7.8%, respectively.

Table 2. Biochemical parameters of the blood of lactic cows.

| Rate                          | Normal   | Group                                      |            |            |
|-------------------------------|----------|-------------------------------------------|------------|
|                               |          | control                                   | experimental |
|                               |          | baselines at the end of the experience     | baselines at the end of the experience |
| Total protein, g / l          | 66-78    | 66.7±3.41                                 | 67.9±4.72  | 69.1±4.25  | 72.1±3.72  |
| Albumins, g / l               | 23-43    | 37.1±2.30                                 | 38.6±2.14  | 41.7±3.51  | 42.5±2.46  |
| Globulins, g / l              | 35-43    | 29.6±1.17                                 | 29.3±1.26  | 27.4±1.47  | 29.6±1.17  |
| Urea, mmol / l                | 3-7.5    | 3.8±0.91                                  | 5.1±1.52   | 4.8±1.25   | 5.4±1.95   |
| Glucose, mmol / l             | 1.8-5.8  | 3.34±2.37                                 | 4.2±3.97   | 4.1±4.73   | 5.1±3.83   |
No less important are proteins in the animals’ body. They form the basis of living structures. In the body, there is a constant exchange between tissue proteins and plasma proteins. The content of total protein, which characterizes the state and level of metabolism in the body of animals, in the experimental group was higher by 5.82%. The content of albumins and globulins increased in the blood of animals of the experimental group in relation to animals of the control group by 9.2 and 1.0%, respectively. The blood glucose level of the animals in the experimental group increased by 21.4% compared to animals in the control group.

The concentration of potassium and chlorine and sodium in the serum of animals in the experimental group was higher by 12.9%, 3.1% and 5.1% in relation to the control group. There was an increase in urea content in blood serum in animals of the experimental group in relation to the control group by 5.8%.

During the period of scientific and economic experience, natural milk yield in animals of the control group was 18.0 kg per day, in the experimental group - 19.5 kg, which is 8.3% higher. The productivity of cows in terms of basic fat content (3.4%) of milk in animals of the control group was 20.2 kg, in the experimental group - 22.3 kg, which is 10.4% more than in animals of the control group, the results are presented in (table 3).

| Rate                              | Group          |
|-----------------------------------|----------------|
|                                    | control       | experimental |
| Gross yield for the period of experience, kg | 4462          | 4836         |
| The average daily milk yield, kg   | 18.0±2.14     | 19.5±1.91    |
| In % to control                    | 100           | 108.3        |
| Density, kg / m³                   | 1028.5±0.14   | 1028.5±0.12  |
| Mass fraction of fat, %            | 3.81          | 3.89         |
| Mass fraction of protein, %        | 2.87          | 2.89         |
| Milk fat yield, kg                 | 0.686         | 0.759        |
| Milk protein yield, kg             | 0.517         | 0.563        |

Table 3. Milk productivity of lactic cows.

Protein and fat content in milk was slightly higher in animals of the second experimental group. Apparently, feeding "Lick Selmevit" the experimental group of cows resulted in an increase in the content of protein and fat in milk.

The costs of feed per 1 kg of natural milk in the experimental group amounted to 0.77 EKE, which is 8.3% lower than in the control group.

The calculation of economic efficiency showed that the use of carbohydrate-vitamin-mineral concentrate "Lizunets Solevit" in diets had an impact on the economy of milk production, the results presented in (table 4).
Table 4. Economic effectiveness of feeding "Lizunets Solevit" in the diets of lactating cows (n=8).

| Rate                                                                 | Control          | Group         |
|----------------------------------------------------------------------|-----------------|---------------|
| Average daily yield, natural fat content, kg                         | 18.00±2.12      | 19.50±3.04    |
| The average daily milk yield, basic fat (3.4%), kg                   | 20.17±1.42      | 22.30±1.37    |
| Difference with the control, kg                                      | -               | 2.13±1.87     |
| %                                                                  | 100.00          | 110.56        |
| Realization cost of 1 kg of basic fat milk (3.4%), RUB.              | 24.00±2.75      | 24.00±3.71    |
| Realisation cost of 1 kg of milk of basic fat content (3.4%), RUB.   | 432.00±5.81     | 468.00±6.42   |
| Difference to control, RUB.                                         | -               | +36.00        |
| The cost of the drug per day, rubles/goal.                          | -               | 6.24±1.89     |
| Economic efficiency: on 1 goal., rub. for 1 rub. additional costs, RUB.| -               | 29.76±0.94    |
|                                                                      | -               | 4.7±0.75      |

Calculations show that the studied concentrate contributed to the economic effect per 1 cow in the amount of 36.0 rubles. and 1 RUB. additional costs-4.7 rubles. compared with the control.

4. Summary
The investigated carbohydrate-vitamin-mineral concentrate "Lizunets Solevit" feeding cows in the winter persistent period to balance the feed ration for energy, sugar, the most important macro and microelements, as well as vitamins, helps to increase the feed ration of animals by 2.9%, improves its conversion, normalizes physiological processes, restores productive health and increases the use of high potential milk productivity.

In the composition in the general blood test, concentration of hemoglobin in the experimental group increased by 15.2% compared with the control, and the content of erythrocytes and leucocytes increased by 12.4 and 11.6%, which is within the physiological norm.

According to the results of blood biochemical parameters, the total protein content increased by 5.82%. There was a slight increase in the content of albumins and globulins by 9.2 and 1.0%, and the level of glucose increased by 21.4%.

There were no significant differences in the mineral composition of blood between the control and experimental groups, although the experimental group showed a tendency to increase the content of mineral substances on average from 0.85 to 11.4%.

Introduction carbohydrate-vitamin-mineral concentrate "Lizunets Solevit" in the diet of lactating cows during winter period increases milk cows 10.4% and allows to obtain economic efficiency per cow is 4.7 RUB 1 RUB additional costs.

At the same time, dairy productivity increases in terms of the basic fat content of 10.6%, and feed costs (EKE) are reduced by 8.3%.

References
[1] Hellberg R S et al. 2017 Food Control 80 23-8
[2] Karre L et al. 2013 Meat Sci 94(2) 220-7
[3] Tomasevic I and Rajkovic A 2015 Procedia Food Sci 5 285-8
[4] Petracci M et al 2013 Trends Food Sci Technol 33 27-39
[5] Mani-López E et al 2012 Food Res Int 45(2) 713-21
[6] Kalaba V et al. 2017 IOP Conf. Ser.: Earth Environ Sci 85(1) 012082
[7] Dumortier J et al. 2012 Environ Res Lett 7(2) 024023
[8] Cassidy E S et al. 2013 Environ Res Lett 8(3) 034015
[9] Vilgis T A 2015 Reports on Progress in Physics 78(12) 124602
[10] Mariella J et al. 2014 Theriogenology 81 526-34