



Nutrients Used in the Diet of Calves with a Biologically Active Supplement

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Paper ID: 12A11N

Volume 12 Issue 11

Received 02 May 2021

Received in revised form 04

August 2021

Accepted 15 August 2021

Available online 01

September 2021

Keywords:

Phytomineral complex;
Biologically active feed
additives; Heifer feed;
Glucolyux F; Compound
feed; Nitrogenous feed
substances; Bioelement
feed; Energetic feed;
Digestible protein;
Mineral supplement;
Calve feed cost.

Abstract

We have studied the effects of the Phyto-mineral complex Vitafit feed supplement in academic and economic experience in the cultivation of replacement young animals. This supplement consists of alfalfa hay extract with the addition of biogenic trace elements. The use of the additive is calculated from 10-50 mg/kg of live weight, both separately and when fed together with the enzyme Glucolyux F with a rate of 500 g per ton of animal feed. Using this technique of feeding, the fixation of nitrogenous substances of the feed increases by 3.35%, crude fiber by 6.35% and crude fat by 3.02% as well as nitrogen retention by 8.4%. In the blood of calves, there is a growth in the indicators of redox processes, better use of nitrogenous substances in the diet, an increase in the content of biogenic trace elements. Due to this, the bodyweight of heifers during the reference period is higher than analogs with a diet without supplements by 8.1%, while with the separate use of these feed supplements, the difference is only 3.6 and 5.7%.

Disciplinary: Agricultural Technology, Animal Sciences (Animal Nutrition and Feed Technology).

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Cite This Article:

Ovchinnikov, A.A., Ovchinnikova, L.Yu., Matrosova, Yu.V., Erenko, E.N. (2021). Nutrients Used in the Diet of Calves with a Biologically Active Supplement. *International Transaction Journal of Engineering, Management, & Applied Sciences & Technologies*, 12(11), 12A11N, 1-8. <http://TUENGR.COM/V12/12A11N.pdf> DOI: 10.14456/ITJEMAST.2021.224

1 Introduction

Special focus is given to mineral elements in the list of indicators of compulsory norm-setting of rations for full-fledged feeding of farm animals and poultry. The biological implication of most of them has been studied quite fully. However, the provision of the body's needs requires consideration of many factors. The key factors are their presence in the trophic chain through which they enter the animal and human body.

Many Russian researchers have proved that if one or another mineral element is sufficiently contained in the diet, the quantitative demand of the body for metabolic processes is not enough,

since many macro- and microelements have both antagonistic and synergistic connections. It has to do, specifically, with the regional content of elements in the soil, water, and, accordingly, in forage crops. The theory of biogeochemical provinces by A.P. Vinogradov allowed developing actions for the prevention and treatment of endemic diseases, both animal and human, in each Russian region.

Speaking about the zone of the Southern Urals and Northern Kazakhstan, Kabysh [1] identified endemic zones and proposed their own rules of biogenic trace elements. Their use provided a significant increase in the safety and productivity of farm animals, respectively, and the profitability of production.

Nevertheless, the simplest and less expensive way to fill the deficit in the diet of individual nutrients has been and remains the use of their oxides, sulfuric acid, sulfuric salts, and chlorides. The dissociation degree of their salt element and their intake into the body is different, which has been proven in the works of All-Russian Scientific and Research Institute researchers [2, 11]. The more digestible form is organic ones. They are chelating complexes, the use of which initially in an injectable form, and then as part of a pre-mix of compound feed increased the digestibility of the elements. The current feed industry can successfully use ultrafine forms of trace elements (UFPs) and get a production effect no lower than with mineral and organic analogs [3, 4]. However, in this case, the limiting factor is the high cost of production of UFPs, which leads to an increase in the cost of a unit of manufactured products.

The issue of the use of biologically active substances from plant raw materials has recently gained the spotlight. Extracts of essential oils from seeds and leaves, bark, and root system are registered as herbal medicinal products with high immunostimulating effects, antibacterial properties, sorbents of toxins, and mycotoxins. Based on the extraction technique, such herbal medicinal products as Eracond, Lutsevita, Eramin, etc. were obtained. This rule is also used in the production of Vitafit from alfalfa hay with the enrichment of the extract with a set of biogenic trace elements [7]. Its beneficial effect on the growth and development of calves and piglets of the preweaning period has shown considerable results in the growth and development of animals, the safety of livestock, the body's resistance to diseases of infectious and non-infectious etiology. Nevertheless, its compatibility of the use with other biologically active supplements is still unexplored.

Our studies aimed to compare the productivity of calves of the preweaning period while including the Phyto-mineral supplement Vitafit and the enzyme Glucolyux F. in their diet. The objectives of this study were to compare the weight of calves, the amount of feed consumed, its costs per unit of body weight, the degree of digestibility of nutrients and the course of metabolic processes in the body, retention of the main elements in the organs and tissues of the animal. Moreover, the calculation of indicators of economic efficiency of production was also of great importance.

2 Material and Methods

In an agricultural enterprise specializing in milk production, 48 calves were chosen. All the animals were divided into four groups. Heifers were selected into groups considering age, breed, and body weight. They were kept by a group method with individual feeding with dairy feeds and from a common feeder with coarse, juicy feeds and a mineral supplement. The experimental supplement Vitafit from alfalfa hay consisted of a set of biogenic trace elements: iodine, manganese, cobalt, copper at the rate of 10-50 mg /kg of live weight. It was fed individually to each animal of the II and IV experimental groups of 100 ml/head. per day within the entire reference period. The animals from the III experimental group got the Glucolux F enzyme separately to the main diet in an amount of 0.5 kg/t of compound feed, and in the IV group, a similar amount of it was given together with Vitafit in the same dosage.

The changes in the growth of experimental animals were recorded by individual weighing, followed by the estimation of weight parameters. The differences in the interior parameters of the animals' bodies were checked by 5 heads from each group at the ages of 4 and 6 months, specifying the number of quantitative morphological and biochemical tests. The effectiveness of using the organic part of the diet was rated by their intake and excretion from the body at the age of 4 months, on 3 heads from each group. The obtained data indicated the use of the organic part of the feed, the deposition of nitrogen in the body as well as the degree of absorption of calcium and phosphorus.

The cost recording of feed and its actual consumption was performed by two-day adjacent monthly feedings. This made it possible to establish the consumption of energy and protein for each kilogram of body weight gain as well as to assess the payment of feed products and the profitability of production.

All the data was processed biometrically and the degree of difference between the compared indicators was found.

3 Results and Discussion

The raising of a repair stock of heifers in the farm largely depends on the final goals and objectives. Thus, the heifer rearing plan will include the standard of the final live weight of animals at the end of the preweaning period. It means that while reaching the age of 6 months, and the feeding scheme will reflect the norm of drinking dairy products (milk and skim milk). We were able to establish the difference in body weight by feeding the test subjects with supplements in the diet of the experimental animals (Figure 1).

The live weight of calves at the beginning of the accounting period had no significant differences during the first two months of cultivation. From the third month, the live weight of calves of the IV experimental group exceeded the I control group by 4.4% ($P \leq 0.001$). The given difference remained in this group until the age of 6 months when it reached 6.2% ($P \leq 0.001$). Glucolyux F enzyme supplement demonstrated a positive effect from the age of 5 months of calves, when the difference with analogs of the control group was 4.2% ($P \leq 0.001$), as at the end of the

reference period. If the Phyto-mineral complex is added to the diet of calves of the II experimental group, there is a tendency to increase their live weight gain, which made a difference with the control group of 4.20 kg, in the III by 6.67 kg, in the IV group by 9.60 kg, or 3.6%, 5.7 and 8.1%.

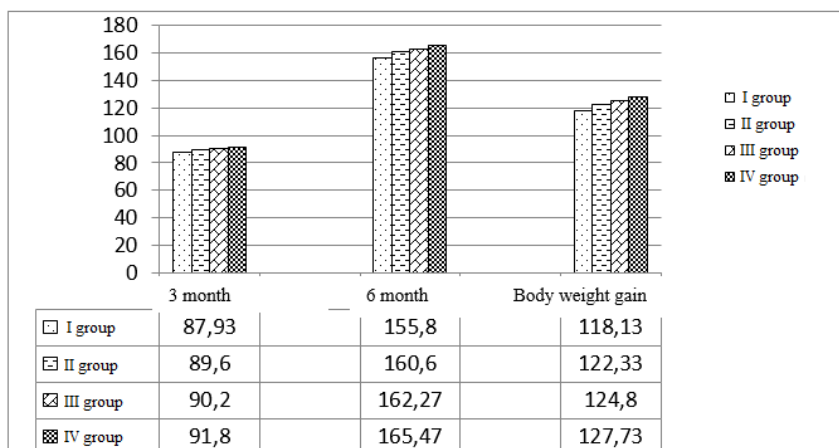
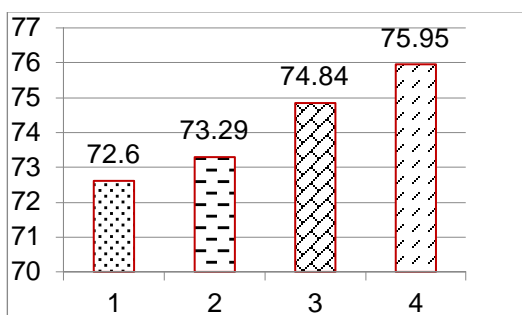
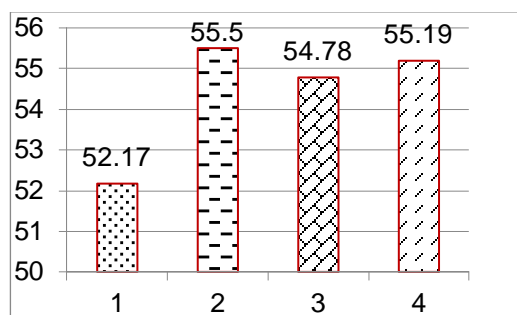


Figure 1: Live weight of calves, kg

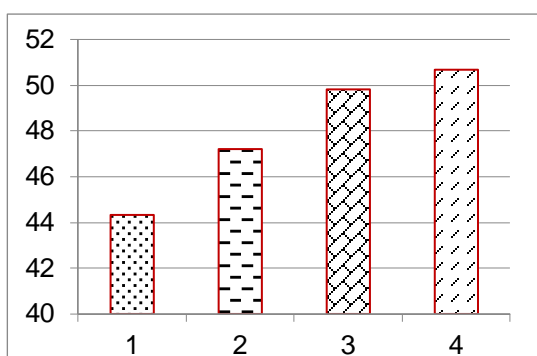
The formation of muscle, bone and adipose tissue largely depends on the effective usage of the organic part of the feed in any diet. The retention of nutrients can be affected by biologically active substances, the degree of which is specified in the balanced experiment, the data of which is given in Figure 2.



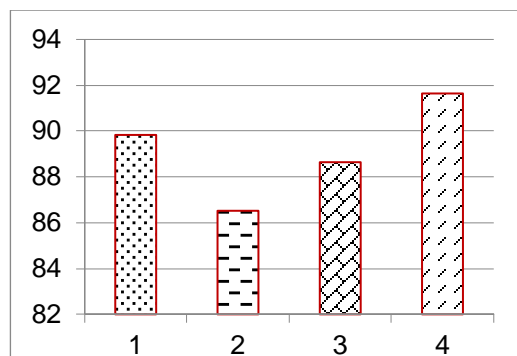
a) protein



b) fat



c) fiber



d) nitrogen-free extractive fraction

Figure 2: Digestibility coefficients of the organic part of the calves' diet, %

The bioelements in the vegetable supplement of II calves' group in comparison with the I control group increased the digestibility of crude fat by 3.33% ($P < 0.05$), while an enzyme supplement contributed to an increase in the better use of nitrogenous substances in the diet by

2.24%, crude fiber by 5.49%, crude fat by 2.61% ($P < 0.05-0.01$). If the tested supplements were used comprehensively in the diet of IV group of calves, the difference in the digestibility of the analyzed indicators was 3.35%, 6.35%, and 3.02% respectively ($P \leq 0,05-0,01$). The uptake of nitrogen-free extractive substances of the diet was high in all groups and had no significant differences.

Taking into account that certain minerals (zinc) are vital for the animal to maintain a high level of enzymatic activity of the pancreas, and manganese - for proteolytic processes in the liver, it can be assumed that these feed supplements affect the use and deposition of nitrogenous substances in the body. Moreover, together with the enzyme, their balance should be much higher, which is consistent with the data of the biochemical composition of the blood of calves. It should be noted that if animals were fed with one basic diet of nitrogenous substances, the body deposited an average of 22.38 g, then with a vegetable mineral supplement more by 3.4%, with an enzyme - by 8.4% ($P < 0.05$), with combined use by 14.2% ($P \leq 0.001$). Respectively, in the blood of experimental animals, the level of total protein increased from 75.80 g/l in the control group by 0.5-1.3%; in the II group at the end of the preweaning period, with the addition of an enzyme by 6.1-7.5% ($P \leq 0.001$), in IV group by 8.2-9.0% ($P \leq 0.001$). The application of nitrogenous substances of the feed can be indirectly judged by the quantitative content of urea in the blood, which decreased respectively from 3.24 mmol/l by 1.2, 1.6, and 1.7 times ($P \leq 0.001$).

Creatinine is a key indicator characterizing the condition of the excretory system of the body - the kidneys. The apparent tendency of its reduction in the blood of animals of experimental groups emphasizes the higher functional activity of the kidneys relative to nitrogenous substances.

We did not observe any noticeable differences in lipid metabolism in the blood of experimental animals, while the amount of glucose significantly grew.

The feed supplements in this study did not change the morphological composition of blood. Nevertheless, there was a tendency to increase the content of erythrocytes and leukocytes per unit volume of blood.

The introduction of a mineral component into the Vitafit Phytocomplex affected their blood levels: even at the age of 4 months, the level of copper in the blood of II group of calves in comparison with control analogs was higher by 25.9% ($P \leq 0.001$), in group IV by 18.5% ($P \leq 0.05$), zinc by 23.8 and 20.6% ($P \leq 0.05$), cobalt by 1.8 times, manganese by two times. This conformity was preserved at a later age of calves at 6 months.

The obtained absolute increase in live weight of calves during the growing period and accounting for the fed nutrients of the diet provided for determining their consumption per unit of body weight gain. The relevant data is given in Table 1.

Table 1: Calculation of the consumed nutrients of the diet per unit of body weight gain (per head)

Indicator	Group			
	I	II	III	IV
Feed consumed:				

Energetic feed units	489.71	498.17	501.28	505.09
Protein, kg: - whole	82.29	83.42	74.84	84.59
- digestible	59.74	61.14	61.93	64.25
Obtained live weight gain, kg	118.13	122.33	124.80	127.73
Nutrients consumed per unit of body weight gain:				
- energetic feed units	4.15	4.07	4.02	3.95
in % to the I group	100.0	98.2	96.9	95.4
- digestible protein, g	506	500	496	503
in % to the I group	100.0	98.8	98.1	99.5

If the consumption per unit of body weight gain of calves of the control group was 4.15 EFU and 506 g of digestible protein, the mineral supplement in the II experimental group reduced them by 1.2-1.8%; the application of the enzyme in the III group - by 1.9-3.1%; in the IV experimental group the difference was 0.5-4.6%.

The assessment of the payment for feed products will additionally provide an opportunity to establish the difference in physical terms for the production of live weight of calves. Moreover, it will give a more complete description of the supplements under study (Table 2).

Table 2: Economic indicators of calf rearing evaluation

Indicator	Group			
	I	II	III	IV
Energetic feed units used	489.71	498.17	501.28	505.09
Obtained live weight gain, kg	118.13	122.33	124.80	127.73
Obtained live weight per 100 EFU of feed, kg	24.12	24.56	24.90	25.29
in % to the I group	100.0	101.8	103.2	104.8
The cost of 1 kg of live weight gain, thousand rubles	0.18	0.18	0.18	0.18
Additional products obtained, thousand rubles	-	4.20	6.67	9.60

If during the growing period of calves in the I control group, the payment for feed products in kind amounted to 24.12 kg of live weight, in the II group this indicator was higher by 1.8%, in the III by 3.2%, and in the IV experimental group by 8.2%, drawing up the number of additional products of 4.20 thousand rubles, 6.67 and 9.60 thousand rubles per head.

4 Conclusion

The herbal extracts, infusions, decoctions are widely used as drugs in animal husbandry. Today, another way of their bactericidal nature has been revealed. It is the presence of quorum-inhibiting compounds [8]. Meanwhile, the saturation of plant extracts with biogenic trace elements provides an opportunity to consider them as supplements with high immunostimulating, immunomodulating, and bactericidal properties [9]. In this regard, the digestibility of divalent trace elements grows due to the formation of strong chelating complexes with monosaccharides and free amino acids formed during hydrobarothermal processing of vegetable raw materials. Meanwhile, biogenic trace elements intensify the enzymatic activity of the endocrine glands and promote the

nutrients' application in the diet. Together with an enzyme, the complex enhances the use of nitrogenous feed substances in the body, which has a positive effect on the average daily weight gain and reduces feed costs.

The obtained data is consistent with the previously performed studies by Remezov [7] with a similar Phytomineral complex; by Atlanderova and Duskaev [10] with an extract of oak bark; by Kononenko et al. [12] with feed supplements of enzymes in the diet of farm animals and poultry.

In consequence, it is advisable to use a Phytomineral complex in the diet of growing young cattle obtained from alfalfa hay and enriched with biogenic trace elements (zinc, manganese, cobalt, copper, iodine) at the rate of 10-50 mg/kg of live weight together with the enzyme Glucolyux F with an input rate of 0.50 kg/t of compound feed. These activities will enhance the digestibility of nutrients in the diet, the use of nitrogenous feed substances, the growth and development of animals and reduce the cost of feed for the breeding of herd replacements.

5 Availability of Data and Material

Data can be made available by contacting the corresponding authors.

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