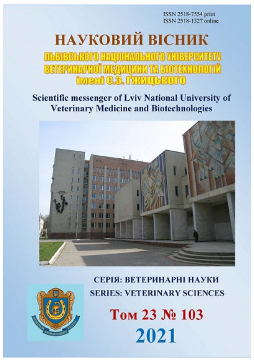

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Quality of cattle meat when feeding the mineral supplement "Stimulus +"

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To find out the influence of the mineral supplement "Stimulus +" on the intensity of physiological processes and productivity of bulls. To achieve this goal, we set ourselves the following tasks: 1. To study the effect of the additive "Stimulus +" on the hematological parameters of experimental bulls. 2. Investigate the effect of the drug "Stimulus +" on the quantitative and qualitative indicators of meat (slaughter quality, morphological and chemical composition of carcasses) and its biological value. To study the effect of the mineral supplement "Stimulus +" on the productivity of animals. The obtained results make it possible to correct the diets of experimental animals, which will positively affect erythropoiesis, respiratory function, certain areas of protein, energy, and hydrocarbon metabolism in young cattle, which will increase their productivity and improve the quality of beef obtained from them. Changes in the biochemical parameters of the blood of animals fed the mineral supplement were revealed. It is established to increase the productivity of animals by feeding them a mineral supplement, which indicates a more rational use of physiological resources of the body of experimental animals. It was found that feeding the animals led to an increase in slaughter yield by 3.8 % compared to control. It was found that during long-term storage (14 days) in the meat of animals of the control group, several changes indicate the beginning of spoilage of meat, and the meat of animals fed with mineral supplements was of good quality, as well as veterinary assessment was the best and more resistant to spoilage during storage. In order to prevent microelementosis of fattening cattle for fattening, increase their productivity, improve the physicochemical and veterinary-sanitary indicators of meat, and the profitability of production, we recommend adjusting their diets, according to previous studies.

Key words: *microelements, mineral supplement, cattle, "Stimulus +".*

Introduction

The issue of providing the population of Ukraine with food of animal origin can now be considered critical. This is due to both a sharp decline in livestock and their productivity. At the same time, the downward trend is progressing every year, and it is pretty difficult to stop it in the coming years. The main factors that led to this process are the haste of insufficiently substantiated reforms in the agricultural sector, the lack of parity prices for livestock products for a long time, unjustified reduction of livestock in the public sector, the collapse of the material and technical base in animal husbandry, a sharp deterioration of the fodder base, virtually destroyed domestic and domestic dairy cattle and combined productivity, well adapted to the natural and climatic conditions of a region (Farionik & Gnatyuk, 2017; Farionik, 2018; Borshch et al., 2020; 2021; Bashchenko et al., 2021).

The feeding rates of dry cows and heifers are determined by body weight and planned productivity. Cows below average fattening and young (before the third lactation) feeding rates are increased by 1–2 feeds. The following structure of the diet is recommended: hay, grass cutting – 30–35 %, haylage or silage of good quality – 25–30, roots – 5–6, concentrated feed – 25–30 %. For one feed. from the diet of dry cows and heifers should have digestible protein – 110 g, sugar – 90–110, calcium – 9, phosphorus – 6–7, salt – 8–10 g, carotene – 45–50 mg, copper – 8–10, zinc – 50, manganese – 50, cobalt – 0.5–0.8; iodine – 0.4–0.6 mg, vitamin D_2 – 1 thousand IU, tocopherol – 40 mg. The sugar-protein ratio should be 0.8–1.0 (Kravtsiv, 2006; Grymak et al., 2020).

At low protein levels, calves are born with morphological immaturity of the intestine, the absorption of immunoglobulins in them is reduced by 40–50 %. Since the first 10–15 days of dryness are characterized by unstable inhibition of milk secretion, juicy and concentrated feeds are excluded from the diet during this period. 10–15 days before calving silage and roots are replaced by hay (10–12 kg), the amount of concentrated feed is reduced to 1–1.5 kg (give cereal concentrates), and two or three days before calving, they are entirely excluded. All feed during the dry season should be of good quality. Feed contaminated with mycotoxins that contain nitrates or other toxins above acceptable levels should not be fed. Raising calves begins with fetal development. Therefore, it is necessary to organize the proper feeding and maintenance of pregnant cows (Cook et al., 1992).

The duration of the dry period should be 50–60 days; it depends on the future productivity of the cow, the growth and development of the fetus in the womb, and the further development of the calf. After fertilization, the embryo's development is prolonged. First, it can vary depending on the breed, weight, size, and other characteristics of the parents (Kravtsiv, 2006). That is why the dry period should be considered a period of recovery of protein, fat, mineral salts, and vitamins. As noted by O. P. Dmitrochenko, the adequacy of adequate nutrition of cows and heifers in the dry season can be judged by the increase in their live weight. The diet should be equivalent to cows' diet with a daily milk yield of ten to fifteen kilograms.

In the last quarter of pregnancy, the fetus thrives. During this period, the appetite of animals decreases due to a decrease in the volume of scar and abomasum due to fetal development. Therefore, the need for nutrients is covered by increasing its energy value. During the dry season, the average daily gain of cows should be two months before calving – 900–1000. The same applies to heifers. Inadequate feeding of pregnant cows is often the cause of abortions, the birth of weak, underdeveloped offspring. The fetus is susceptible to feeding and retention during the transition from embryonic to the fetal period (beginning of the third month of pregnancy) and at the beginning of intensive absolute growth (seven-eight-month pregnancy) (Chow et al., 1990; Mavrommatis et al., 2021).

The dry matter of the fruit consists of 70 % protein, so pregnant cows need to increase protein levels. Of great importance for the development of the fetus is the provision of the mother with carotene and vitamins D. In winter, in the diets of pregnant cows per 100 kg of live weight should be given 30–50 mg of carotene and 1–1.5 thousand IU of vitamin D. By the time of calving, the cows must be in factory condition. The diet of dry cows and heifers should include good quality legume hay, at least one and a half kilograms per 100 kg of live weight per day, succulent feed (silage, haylage, roots, tubers), mixtures of concentrated feed, and mineral supplements. From concentrates, it is better to give wheat bran, oatmeal, and also compound feed. Hay and silage can be replaced with good quality haylage at the rate of 15–20 kg of cow per day. In summer, the main food in cows' diets should be grass cereals and legumes with small additions of concentrates and mineral fertilizers. Keeping dry cows is loose with free access to the walking yard. Depending on the climatic zones, indoor air temperature ranges from 8 to 10–12 °C for tethered and from 0 to 5 °C for loose tethering in cold weather. The relative humidity of the premises should not exceed 70%. The air velocity is 0.5 m/s. Illumination of cowsheds is within: natural 1: 12–1: 15, artificial – 4.0–4.5 W/mg. The concentration of carbon dioxide should not exceed 0.25 %. Air exchange (ventilation) averages 80–120 m^3/h. per cow or not less than 17 m^3/h. for every 100 kg of live weight of adult animals and not less than 20 m^3/h. For calves (Cook et al., 1992; Mazur et al., 2020).

Health control of cows and heifers in the dry shop includes weekly clinical examination (fatness, skin condition, hair, breast, organs, edema of the lower abdominal wall, limbs, between the jaw space); a quarterly clinical study of 10–15 cows, blood tests from them (total protein, calcium, phosphorus, carotene, vitamin D, reserve alkalinity, sugar) and urine (ketone bodies and pH). Blood is taken 50–60 days before calving from cows that have no clinical signs of disease. When metabolic disorders are detected, a course of group therapy is performed, the effectiveness of which is checked by repeated blood tests of the same cows 10–15 days before calving. Indicator strips (Comiur-Test, pentophan, manophan) can be used for urine examination, obtaining 5–10 different indicators. The strip is immersed in urine for 12 s and 1 min. (Farionik & Kravtsiv, 2008).

Females may develop clinical mastitis, breast edema, abortion, vaginal inversion, prenatal dependence, and other diseases during the dry period. Mastitis often occurs at the beginning and end of dryness. Examination and palpation of the breast are used to diagnose mastitis. When changes are detected in Petri dishes, the secret is milked, and its visual assessment is performed. In clinically healthy, properly run cows, the breast and nipples are wrinkled. Its lobes are symmetrical, and the skin is elastic, mobile. The parenchyma on palpation is not painful, elastic – the secret of straw, saffron color, sticky, homogeneous, from semi-liquid to thick consistency. In sick animals, the secretion of a watery consistency, inhomogeneous, there are impurities of pus, blood. In cows, patients with mastitis are treated with massage, pathogenetic (novocaine blockade), and etiotropic (antibacterial drugs) therapy. The use of hormonal (oxytocin and others) is not recommended.

Prevention of immune deficiencies in young animals includes organizational and economic, zootechnical, and special veterinary measures. Organizational and economic includes providing the uterine population of young animals with full feeding, creating optimal conditions for keeping young animals. Of great importance in preventing age-related immunodeficiencies is the correct organization of the feeding regime of newborns with colostrum. Special veterinary measures should carry out preventive immunosuppressive and immunostimulatory therapy with biological, chemical, and physical factors. It is recommended to administer immunocorrectors (RBS tube preparations, levamisole, etc.) to cows 1–3 weeks before calving. Of particular note are the group use of vitamins, trace elements, essential amino acids, nucleic acids and their salts, ultraviolet radiation of the uterus, and calves (Roman et al., 2020; Mylostyvyi et al., 2021; Kurtyak et al., 2021; Denkovich et al., 2021).

To increase the local protection of the digestive tract, enterobifidine is given orally at a dose of 3–4 ml/kg from the first day of life with colostrum for five days. Active exercise of heifers increases their appetite and positively affects the formation of milk productivity – the primary source of ultraviolet radiation of animals and solar radiation. Under the influence of ultraviolet rays with a wavelength of 280–320 mm in the skin of animals are formed biologically active substances and vitamin D, which increases the reactivity of the organism. That is why the exercise and grazing of heifers and heifers are mandatory for animals. Many works are devoted to the grazing of animals. Allocate throughout the summer of 0.3–0.4 hectares of pasture per adult head. Young animals need less of them. Before grazing animals on pasture, they must be given fiber-rich food to avoid indigestion. This is especially important in the transition period from stall maintenance to grazing (Kravtsiv, 2006).

Heifers older than six months of age should be grazed daily during the day for four to five hours on cultivated pastures with a grazing system. Intensive fattening, as a rule, lasts 120–150 days and ends when the young reach a live weight of 420–450 kg. The average daily gain in this period should be at least 900–1000 g The most crucial period of fattening is its beginning because the animal is affected by some stressors that can cause disease and reduced productivity. During this period, the rations should consist of the same foods that they consumed before. Particular attention during fattening should be paid to the acquisition of technological groups, taking into account the live weight (difference not more than 10–15 kg), age (difference within one month), and sex. Cattle, complete with homogeneous indicators, are better fattened, faster reaches the planned final live weight and condition. It should be remembered that older cattle, which have lost the inherent high growth rate for the young organism, even with intensive fattening, do not show high gains in live weight.

Fattening cattle in the summer in Ukraine is the most effective. Animals can be successfully fattened on rations, in which the main are green fodder (natural lands and sown), and silage and concentrated -additional. In such rations, feed to nutrient content ratio can be, %: grass – 50 –60, silage – 25–30, and complete feed – 15–20. In farms that do not have silage in the summer, it is advantageous to fatten cattle on grass and concentrate specific weight in diets from 15 to 35 % in terms of nutrition.

During summer fattening, it is advisable to feed cattle twice a day with the distribution of grass in four doses – 2 times in the morning from 6 to 10 o'clock and two times in the evening – from 17 to 21 o'clock. Under such conditions, the animals receive food in cooler weather and have two long periods for rest. It is essential to properly organize the gradual transfer of animals from winter to summer feeding. The transition period should last at least two weeks. At the beginning of this period, green fodder should be fed in small quantities – 3–5 kg in the first five days and, increasing daily by 2–3 kg, by the end of the second week to bring to complete norm.

The use of corn-phosphate concentrate (CPC) in feeding fattening bulls allowed to get UAH 57.5 per head during the fattening period. Additional income when given it in the diet of 1 kg. After applying 1.5 kg of KFH, the additional profit for the experiment amounted to UAH 99.5. Growing and fattening cattle on green fodder in the summer provides labor savings while achieving much fuller use of nutrients in fodder obtained per unit area occupied by fodder crops. But in addition to fattening on green fodder, you can use other types of fattening, namely silage, haylage, beet pulp, bard (Kravtsiv, 2006).

An important role in cattle fattening is silage, which is widely used in all areas of Ukraine, as the cost of its feed unit is much less than other succulent feed, and in quality, it is close to green feed. When fattening cattle in silage to young animals' diet, taking into account age, fatness, and its period, it is introduced 20–25 kg, and adult animals – 35–40 kg per day, or 5–7 kg per 100 kg of live weight. Haylage has become widespread in cattle fattening, especially in large industrial complexes. Combining good quality haylage with concentrated feed provides high gains in fattening and good meat quality (Chow et al., 1990; Mavrommatis et al., 2021).

Harvested haylage is better to use in the form of feed mixtures. The composition of such feed mixtures for fattening is introduced 50–60 % of haylage and 40–50 % of compound feed for nutrition. The rate of feeding haylage of young animals weighing 300–350 kg – 10–12 kg, and weighing 350–400 kg – 15–17 kg per day. However, the high productivity of cattle for fattening with haylage can be achieved only under high-quality conditions. Pulp is a valuable fodder for cattle fattening. However, despite the excellent feed qualities, there is a lack of protein and phosphorus in the pulp. Many trace elements, vitamins A and D, excess moisture, calcium, iron, and acid pulp – organic acids. Pulp fattening begins with a preparatory period of up to 10 days, during which the animals are accustomed to eating pulp. Then its norm is gradually increased and brought to 45–50 kg for young animals and 60–80 kg – for adult cattle. To maintain a good appetite and normal digestion in animals, they are fed up to 3 kg of roughage and 1.5–1.0 kg of molasses. The number of substances that are not enough to replenish due to concentrated feed.

In the production of alcohol, as a residue is formed bard – bread, bread and potato, molasses. It is proved that the cost of 1 feed unit of a diet at fattening cattle using a bard happens very low, especially at its correct and maximum use. Genetic and non-genetic factors determine the quantitative and qualitative indicators of beef. Growth intensity, muscle formation, bone, and fat tissues are closely related to the biological characteristics of individual breeds. When growing young for meat, there are several systems and periods. That is, growing young for meat can be intense, moderate, and extensive. When developing the technology of beef production, the biological requirements of the animal organism are taken into account, and therefore distinguish phases (three periods) of the production process – growing, rearing, and fattening.

The growing and fattening animals in dairy farming include farms with industrial technology with a completed turnover of the herd with the acquisition of young 10–15 days of age. Intensive fattening of cattle provides the highest productivity and product quality.

The aim of this study was to determine the physiological feasibility of feeding the animals a mineral supplement. To achieve this goal, the following tasks were set: To find out the influence of the mineral supplement "Stimulus +" on the intensity of physiological processes and productivity of bulls.

To achieve this goal, we set ourselves the following tasks:

1. To study the effect of the additive "Stimulus +" on the hematological parameters of experimental bulls.
2. To study the effect of the drug "Stimulus +" on the quantitative and qualitative indicators of meat (slaughter quality, morphological and chemical composition of carcasses) and its biological value.
3. To study the effect of the mineral supplement "Stimulus +' on the productivity of animals.

Materials and methods

All the manipulations with the animals were conducted according to the European Convention for the Protection of Vertebrate Animals used for Experimental and other Scientific Purposes (Official Journal of the European Union L276/33, 2010).

The material for our research was black-spotted bulls of the second period of fattening with a live weight of 185–200 kg. The experiment was formed three groups of 15 heads, one control and two experimental; the scheme of the experiment is presented in table 1.

Table 1
Scheme of experiment

Groups	Number of goals in the group	The nature of feeding
control	15	The basic diet
I experimental	15	The basic diet + "Stimulus +" (0.2 mg/kg body weight)
II experimental	15	The basic diet + "Stimulus +" (0.3 mg/kg body weight)

Veterinary and sanitary examination and quality indicators of carcasses and internal organs were carried out in accordance with the "Rules of veterinary inspection of slaughter animals and veterinary examination of meat and meat products".

Analysis of the research results was performed using the Statistica 6.0 software package. Probability differences was evaluated by Student's t-criterion. The results were considered reliable at $P \leq 0.05$.

Results and discussion

Proteins are molecular organic compounds made up of amino acid residues. They are the primary building material of cellular structures that perform numerous functions. The only source of synthesis of a new protein is feed proteins, so the body's protein metabolism is closely linked to their proteins. The total protein content in the serum of experimental animals at the experiment is mostly regular. Slightly lower than the normative content of total protein in the blood of animals of the control and second experimental groups – 69.4 and 68.8 g/l, respectively. At the same time, no significant difference in total protein content in the blood between groups of analogs was found. The qualitative composition of blood plasma proteins is very diverse. The main fractions are albumins and globulins. The function of albumins is to maintain the colloidal osmotic pressure of plasma, the concentration of hydrogen ions, and the transport of various substances, including bilirubin, fatty acids, minerals, drugs. The albumin content to the total amount of proteins in the blood of experimental animals within the norm from 44.3 % to 44.9 %, no significant differences between groups were found.

Table 2
Biochemical parameters of cattle blood (M ± m; n = 5)

Indicator	Group		
	control	I experimental	II experimental
Protein, g/l	69.4 ± 0.5	70.3 ± 0.6	68.8 ± 0.6
Albumin, %	44.65 ± 2.9	44.3 ± 3.1	44.9 ± 2.6
Globulin, %	55.35 ± 3.3	55.7 ± 2.9	55.1 ± 2.8
Protein index	0.805 ± 0.1	0.793 ± 0.1	0.813 ± 0.1
Alkaline phosphatase, E/l	92.0 ± 4.3	91.2 ± 4.4	94.1 ± 4.6
Ca, mmol/l	3.0 ± 0.1	3.1 ± 0.1	3.1 ± 0.1
P, mmol /l	1.5 ± 0.1	1.5 ± 0.2	1.6 ± 0.1
Cu, mmol/l	0.51 ± 0.02	0.51 ± 0.02	0.52 ± 0.01
Zn, mmol/l	1.98 ± 0.1	1.99 ± 0.1	1.98 ± 0.1
Fe, mmol/l	274.2 ± 11.4	271.1 ± 14.2	275.4 ± 14.0
Mn, mmol/l	0.04 ± 0.01	0.04 ± 0.01	0.03 ± 0.02
Co, mmol/l	0.01 ± 0.002	0.01 ± 0.002	0.01 ± 0.002

Globulins perform mainly the function of protection, being protective antibodies (immunoglobulins). A sharp increase in the content of globulins in the blood of animals occurs in infectious diseases, acute inflammatory processes because immune bodies and antitoxins are by nature γ- and β-globulins and accumulate in the blood of animals during immunization. According to the content of globulins, there are no significant differences between the animals of the control and experimental groups. Their number averages 55.35–55.7 %.

Biochemical analysis of cattle blood when removing animals from the experiment is presented in table 3.

Table 3
Biochemical parameters of the blood of animals removed from the experiment (M ± m; n = 5)

Indicator	Group		
	control	I experimental	II experimental
Protein, g/l	71.3 ± 2.9	76.3 ± 2.6	78,4 ± 2,8
Albumin, %	45.3 ± 0.9	45.8 ± 0.8	46,0 ± 1,0
Globulin, %	54.7 ± 3.3	54.2 ± 2.9	54,0 ± 2,35
Protein index	0.833 ± 0.08	0,845 ± 0,03	0,853 ± 0,07
Alkaline phosphatase, E/l	102.2 ± 7.56	92,77 ± 4,38	108,4 ± 7,36
Ca, mmol/l	3.24 ± 0.01	3,34 ± 0,02*	3,47 ± 0,01*
P, mmol/l	1.97 ± 0.04	2,13 ± 0,04*	2,03 ± 0,03
Cu, mmol/l	0.63 ± 0.02	0,89 ± 0,01*	1,07 ± 0,02*
Zn, mmol/l	2.09 ± 0.11	2,78 ± 0,17*	3,04 ± 0,12*
Fe, mmol/l	288.9 ± 8.2	307,1 ± 7,3	316,3 ± 5,9*
Mn, mmol/l	0.11 ± 0.01	0,15 ± 0,01*	0,19 ± 0,01*
Co, mmol/l	0.02 ± 0.001	0,03 ± 0,002*	0,03 ± 0,002*

As a result of the conducted research, it was established that the general protein content in the blood serum of experimental animals corresponded to the norm. However, despite the statistically insignificant difference in total protein content, there is a tendency to increase this figure in animals of the experimental groups: 76.3 g/l and 78.4 g/l, respectively. The protein index in the first and second experimental groups' animals was higher than animals in the control group, respectively, by 1.4 % and 2.4 % and was 0.845 and 0.853, respectively. Following this indicator can be judged on animals' more intensive protein metabolism that received the mineral supplement "Stimulus +".

The biochemical composition of the blood is relatively constant with the correct and complete supply of nutrients to animals. Insufficient or excessive intake of nutrients disrupts the nature of metabolic processes in tissues, which is reflected in the blood composition. The study of mineral metabolism based on the results of biochemical analysis of animal blood showed that the calcium content in the serum of animals ranges from 3.24 mmol/l to 3.47 mmol/l, which corresponds to the normative indicators. In the experimental groups, this figure is significant ($P \geq 0.001$) higher by 3.1 % and 7.1 % compared with the control group.

In order to study the intensity of redox processes in experimental animals, studies of the main hematological parameters were performed (Table 4). At the end of the main period of the study, there were changes in the morphological parameters of the blood. There was a tendency to increase the number of erythrocytes in the blood of animals of the second experimental group compared to the blood of analogs of the control group by 1.1 109 /l ($P \leq 0.05$). At the same time, the concentration of hemoglobin also increased by 10.7 %.

Table 4
Morphological parameters of animal blood (M ± m; n = 5)

Indicator	Group		
	Control	I experimental	II experimental
At the beginning of the experiment			
Erythrocytes, 10^{12}/l	5.61 ± 0.28	5.66 ± 0.33	5.67 ± 0.33
Hemoglobin, g/l	95.3 ± 5.6	95.0 ± 4.3	97.3 ± 5.4
Leukocytes, 10^9/l	6.83 ± 1.09	6.77 ± 0.63	6.80 ± 0.11
At the end of the experiment			
Erythrocytes, 10^{12}/l	5.8 ± 0.3	5.2 ± 0.41	5.9 ± 0.27*
Hemoglobin, g/l	93.3 ± 3.3	100.0 ± 5.7	103.3 ± 6.7
Leukocytes, 10^9/l	6.8 ± 0.20	6.2 ± 0.12*	6.4 ± 0.09*

Thus, in the first-born cows of the first and second experimental groups, the number of leukocytes in the blood was reduced by 0.6 and 1.4 109 /l compared with their content in the blood of analogs of the control group ($P \leq 0.05$).

One of the main ways to increase the productivity of animals and improve the quality of their products is a complete and balanced feeding of essential nutrients and biologically active substances (BAS). However, both the lack and excess of the latter can lead to metabolic disorders in animals and humans, which leads to various diseases (Kravtsiv et al., 1989).

Table 5
Productivity of experimental bulls when feeding them mineral supplement (M ± m, n = 15)

Groups of animals	Live table, кг		Increase	
	the beginning of the experiment	end of the experiment	General, kg	Average daily, g
Control	231 ± 3.7	489.8 ± 3.8	259.8 ± 3.5	720 ± 5.5
I	219.5 ± 3.7	529.8 ± 3.7*	311.3 ± 3.5*	863 ± 5.5*
II	243.4 ± 3.9*	548.7 ± 3.9*	306.3 ± 3.6*	849 ± 5.7*

Biotic levels and synergistic ratios of individual micronutrients allow their use throughout feeding, ensuring optimal metabolism in the contents of the rumen and body tissues, sustainable production of livestock, and environmentally friendly products. In order to eliminate the deficiency of certain trace elements in the body of animals of the experimental farm, the correction of micronutrient nutrition should be carried out after a preliminary analysis of the composition of soils, feed, water, and body tissues.

Feeding animals compound feeds with mineral additives, which include optimal levels, in specific proportions of compounds of deficient trace elements, can increase the meat productivity of livestock by an average of 22.3 % and improve the biological and nutritional value of products. Carcasses and their parts are a collection of muscle, fat, connective, and bone tissue. Muscle tissue is the most valuable part of the meat. In the carcass of cattle, it is 57–62 %. The central structural part of the muscle is the muscle fibers, which combine into bundles separated by layers of connective tissue.

Table 6
Slaughter qualities of experimental bulls when fed with "Stimulus +" (M ± m; n = 15)

Groups of animals	Pre-slaughter live weight, kg	Slaughter mass, kg	Slaughter exit, %	The mass of steamed carcass, kg	The output of the carcass, %	Mass of internal fat, kg	The yield of internal fat, %
C	482 ± 2.4	233.3 ± 3.7	48.41 ± 0.60	224.6 ± 3.33	46.6 ± 0.59	8.72 ± 0.36	1.81 ± 0.04
I	522 ± 2.4*	272.5 ± 3.6*	52.19 ± 0.51*	261.6 ± 3.36*	50.1 ± 0.56*	10.92 ± 0.41*	2.09 ± 0.06*
II	541 ± 2.5*	278.2 ± 3.8*	51.42 ± 0.62*	267.3 ± 3.40*	49.4 ± 0.56*	10.93 ± 0.43*	2.02 ± 0.05*

Meat and its qualitative composition are determined by the quantitative ratio of tissues, namely, its morphological composition, which depends on the species, breed, age, sex, feeding, and housing conditions (Kravtsiv, 2006). Fundamental indicators at slaughter are the yield of a carcass, slaughter yield, and internal fat, which always depend on cattle fattening. Analyzing these data, we can see that feeding animals of experimental groups slightly improves the slaughter quality of experimental bulls. Therefore, comparing the obtained experimental data, it is seen that the use of the mineral additive "Stimulus +" has a positive effect on the slaughter performance of experimental animals.

We are analyzing the obtained data table. 7, which shows a change in the chemical composition of bull meat, shows that "Stimulus +" improves the chemical composition and increases the caloric content of the longest back muscle. The meat of animals of the first group, which was fed a mineral supplement contained 1.53 % ($P < 0.001$) more dry matter than the meat of animals of the control group, protein – 1.46 % ($P < 0.01$), fat – 0.09 %, ash – 0.1 ($P < 0.05$), caloric content was higher by 5.9 % ($P < 0.01$), tryptophan by 0.16 % ($P < 0.02$) and high-quality protein the indicator increased by 1.08 % ($P < 0.01$) compared with the control group.

In the meat of animals of group II, the dry matter content increased by 0.75% ($P < 0.02$), protein by 0.77 %, fat – 0.04 %, ash – 0.04%, caloric content increased by 2, 9 % ($P < 0.01$), tryptophan by 0.13 % ($P < 0.01$) and protein quality increased by 0.8 % ($P < 0.02$) compared to similar indicators in the experimental group.

Table 7
Chemical composition and caloric content of the longest back muscle of experimental animals, % (M ± m; n = 15)

Indicators	Groups of animals		
	Control	I	II
Dry matter	23.57 ± 0.18	25.10 ± 0.20*	24.32 ± 0.20*
Protein	19.25 ± 0.27	20.71 ± 0.30*	20.02 ± 0.25
Fat	2.92 ± 0.05	3.01 ± 0.05	2.96 ± 0.06
Ash	0.90 ± 0.03	1.00 ± 0.03*	0.94 ± 0.03
Caloric content, kJ/kg	4530 ± 30	4796 ± 32*	4661 ± 30*
Tryptophan	1.32 ± 0.03	1.48 ± 0.03*	1.45 ± 0.03*
Oxyproline	0.300 ± 0.01	0.270 ± 0.01*	0.279 ± 0.01
Protein quality indicator	4.4 ± 0.21	5.48 ± 0.21*	5.20 ± 0.20*

Therefore, we can summarize the results that feeding bulls improves beef's chemical composition and nutritional value. At the end of the experiment, a controlled slaughter of bulls was carried out with subsequent veterinary and sanitary examination of carcasses and internal organs. No visible pathological and anatomical changes were detected.

There were also no deviations in the organoleptic characteristics of the meat of animals of all groups: it had a specific odor characteristic of this species, the muscles in the incision were slightly moist, dense, elastic (the hole formed by pressing with a finger, quickly straightened), animal carcasses were light red or dark red.

Physicochemical and sanitary parameters of bull meat are given in Table 8. Physico-chemical parameters and sanitary properties of meat of animals of the first (control) group and two experimental groups immediately after slaughter (steam) and after 48 hours of storage (chilled) indicate that the meat was of good quality and suitable for storage. The table shows that the qualitative reactions with copper sulfate, formaldehyde, Nesler's reagent in animal meat after 48 hours of storage were adverse, and the reaction with benzidine (peroxidase) was positive. The intensity of the color (color index) of meat of animals of II, III experimental groups was higher by 10.3; 9.7 % ($P < 0.01–0.001$) compared to the meat of animals in the control group. The moisture content of meat and its pH from animals of all three experimental groups were slightly lower than in meat of animals of the control group. Single microorganisms, mainly coccal forms (1–3 cells) in animals of experimental groups and 2–3 microorganisms in the control group, were found in smears – prints 48 hours after slaughter.

Table 8

Physico-chemical and sanitary parameters of meat of experimental animals (M ± m; n = 15)

Indicator	Groups of animals		
	I	II	III
Study in 48 hours			
The number of microorganisms in one field of view	2–3	1–3	1–3
pH	5.84 ± 0.03	5.66 ± 0.03***	5.71 ± 0.03**
Reaction with $CuSO_4$	-	-	-
Reaction to peroxidase	+	+	+
Reaction to ammonia	-	-	-
Formalin reaction	-	-	-
Color indicator, E*1000	390 ± 7.20	430 ± 7.24***	428 ± 7.26***
Moisture capacity	63.0	61.12	60.17
Research in 14 days			
The number of microorganisms in one field of view	25–35	24–31	24–31
pH	6.34 ± 0.04	6.21 ± 0.03	6.25 ± 0.03
Reaction with $CuSO_4$	+	+ / -	+ / -
Reaction to peroxidase	-	+ / -	+ / -
Reaction to ammonia	+	+ / -	+ / -
Formalin reaction	+	+ / -	+ / -

After 14 days, we conducted similar studies, which found that the number of microorganisms during storage increased in all groups: 25–35 microorganisms in the meat of animals in the control group; 24–31 – in the meat of animals of II and III experimental groups. In all experimental groups (groups II–III), the number of microorganisms in one field of view of the smear-imprint from the thickness of the longest back muscle was less than in control. Qualitative reactions with copper sulfate, formaldehyde, Nessler's reagent in the meat of animals of the first (control) group after 14 days of storage were positive, with benzidine negative and in the experimental groups – questionable. The meat of the experimental groups was more resistant to spoilage during storage at favorable low temperatures (from 0 to + 2 °C) than the meat of the control group. To calculate the economic efficiency of feeding animals with mineral additives, we used the obtained research results and materials of the annual reports of the experimental farm.

The calculations showed that the feeding of animals gave a significant production and economic effect in all experimental groups without exception. It should be noted that the effectiveness of the mineral additive in the experimental groups was different (Table 9).

The main economic effect of the use of mineral supplements is that the addition to the diet of animals revealed a reduction in the cost of 1 quintal of meat in all experimental groups, respectively, in the first group by 10.0 %; in II – by 8.3 % relative to the control, where the cost of 1 quintal of meat was 427 UAH. All experimental groups showed an increase in net profit per 1 quintal of live weight. Thus, in group I animals, the net profit increased by UAH 43.0, in group II – by UAH 35.5, concerning the control. At the same time, an increase in profitability by 9.52–17.02 percent was established.

Table 9
Economic efficiency

Indicator	Groups of animals		
	Control	I	II
Live weight gain for the period experience, c	2.59	3.10	3,05
Average daily gain, g	719	862	848
Feed costs per 1 quintal of growth	11.0	9.25	9.47
The cost of feed consumed during the experiment per 1 animal, UAH	554	595	597
Total cost per 1 animal during the experiment, UAH	1108	1190	1194
The average selling price of 1 quintal of live weight, UAH	450	450	450
The cost of 1 quintal of live weight at the sale, UAH	427	384	391.5
Profitability, %	5.38	17.2	14,9
Profit per 1 quintal of live weight, UAH	23	66	58.5

Conclusions

Changes in the biochemical parameters of the blood of animals fed the mineral supplement were revealed. It is established to increase the productivity of animals by feeding them a mineral supplement, which indicates a more rational use of physiological resources of the body of experimental animals. It was found that feeding the animals led to an increase in slaughter yield by 3.8 % compared to control. It was found that during long-term storage (14 days) in the meat of animals of the control group, several changes indicate the beginning of spoilage of meat, and the meat of animals fed with mineral supplements was of good quality, as well as veterinary assessment was the best and more resistant to spoilage during storage. In order to prevent microelementosis of fattening cattle for fattening, increase their productivity, improve the physicochemical and veterinary-sanitary indicators of meat, and the profitability of production, we recommend adjusting their diets, according to previous studies.

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