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CULINARY AND TECHNOLOGICAL PROPERTIES OF THE MEAT OF STEERS FED IN A DIET WITH MODERN BALANCING ADDITIVES
КУЛІНАРНО-ТЕХНОЛОГІЧНІ ВЛАСТИВОСТІ М'ЯСА БИЧКІВ ЗА ЗГОДОВУАННЯ В РАЦІОНІ СУЧАСНИХ БАЛАНСУЮЧИХ ДОБАВОК

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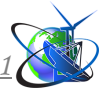
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Abstract. *The results of comprehensive research, which was aimed at studying the impact of new balancing feed additives on the meat of Kazakh white-headed bulls and the quality of the obtained raw materials, are given. It was established that the observed advantage of the experimental groups against the control group was the intensity of their growth energy at the age of 12 months. The bulls of the I and II experimental groups exceeded their live weight control counterparts by 0.53 and 2.07%, respectively; 13 months - 1.10 and 3.23%; 16 months – by 2.49 and 5.43%. In general, during the observation period, the energy of increasing the live weight of steers in the experimental groups was greater than in the control group, by 6.64% in the I group and by 12.33% in the II group. At the age of 15 months. there is a decrease in the relative growth rate in each of the experimental groups, this indicates that the decrease in the growth rate of animals with age is associated with a slowdown in metabolic processes occurring in the body of young bulls, with an increase in the specific mass of differentiated cells and tissues and an increase in the body shares of reserve substances. The results of the research showed that in the average sample of the flesh of calves of the I and II research groups that received feed supplements, tryptophan was more than in the control counterparts by 1.37 and 2.95%, respectively, while oxyproline by 0.34 and 4.16% less. The value of the protein-quality indicator of the meat of the steers of the experimental groups exceeded the value of the control analogues by 1.8 and 7.2%. The highest ratio of muscle tissue to connective tissue is characteristic of the muscles of the I, II experienced groups. In the II experimental group, the transverse banding of most fibers is more clearly expressed. The abundant presence of fatty inclusions determines the presence of "marbling", which favorably affects the taste, organoleptic and consumer properties of meat. The given data give reason to conclude that the bulls of the research groups were distinguished by the greatest intensity of growth, indicators of biological value and the best culinary and technological properties of meat. The research results confirm the feasibility of using new balancing feed additives to increase the meat productivity of young beef cattle.*

Key words: *steers, feed supplement, feeding, ration, meat productivity, beef.*



Formulation of the problem.

In the conditions of the Ukrainian market and to provide the population of the country with high-quality and cheap products of meat cattle breeding, where the State program is implemented in the direction of creating specialized breeds of meat cattle with high genetic potential for milk and meat productivity in different regions of Ukraine. [2]

Currently, targeted work on increasing the volume of production of high-quality, high-value meat raw materials is inextricably linked with the development and application of modern resource-saving growing technologies, the use of optimal types of feeding, taking into account the zonal features and natural inclinations of the region [4].

Analysis of recent research and publications.

The organization of intensive breeding and fattening is based on the use of balancing feed products in the diets of bulls of meat breeds, which contribute to replenishing the deficiency of mineral substances, increasing adaptogenic properties, resistance and productive qualities [5].

Research on the search for and use of non-traditional raw materials, especially of local origin, has not lost its relevance. In this regard, the Bukovyna region has at its disposal huge reserves of natural minerals [7, 13].

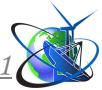
The composition of new fodder includes powdered bishophyte, feed sulfur, stress-correcting amino acid glycine, essential amino acid methionine. Malic acid served as a metabolic regulator, and pumpkin and thistle cakes were used as a protein source. Methionine together with the amino acid glycine was used for the synthesis of creatine, nitrogen-containing compounds that are assimilated into creatine phosphate, providing a certain form of energy reserve [5, 6]. The organization of intensive breeding and fattening is based on the use in the diets of bulls of meat breeds of balancing fodder, which contribute to the replenishment of the deficiency of mineral substances, increase of adaptogenic properties, resistance and productive qualities [3].

Research on the search for and use of non-traditional raw materials, especially of local origin, has not lost its relevance. In this regard, the Bukovyna region has at its disposal huge reserves of natural minerals [9]. The composition of new fodder includes bishophyte powder (Volgograd deposit), feed sulfur, stress-correcting amino acid glycine, essential amino acid methionine. Malic acid served as a metabolic regulator, and pumpkin and thistle cakes were used as a protein source. Methionine together with the amino acid glycine was used for the synthesis of creatine, nitrogen-containing compounds that are assimilated into creatine phosphate, providing a certain form of energy reserve [10, 4, 11].

Research material and methodology.

The planned goal was the basis of our work. The set of studies was aimed at studying the influence of new balancing feed additives on the meat of Kazakh white-headed bulls and the quality of the obtained raw materials. A patent application was submitted for the developed method of feeding

The scientific and economic experience regarding the study of the effect of the developed feed additives on the fattening qualities of young cattle was carried out in



the conditions of the livestock complex at the enterprise in the leading breeding plant of the SE "Chernivetske" DG Bukovyna DSGDS ISG KR NAAS. According to the principle of analogues, three groups of bulls of the Kazakh white-headed breed were formed at the age of 9 months: control and two experimental (10 heads each).

Animals of the control group received the general farm ration (RB). For feeding steers of the I experimental group, OR was used, and the balancing feed supplement "Energoritm" was additionally administered. The youth of the II research group together with the OR consumed the "Imunosil" supplement. These forms were introduced at the rate of 1% of the mass of concentrated feed, daily for 210 days of experience.

Lifetime assessment of growth and development of animals was determined by live weight indicators, analyzing monthly weighing data. To evaluate the exterior, the main measurements of the sexes of the bulls were taken and on their basis, the physique indices were calculated. Measurements were made at the age of 9 and 16 months [12].

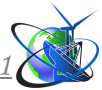
The study of muscle tissue samples of bulls of the control and experimental groups was carried out according to the histological research method in accordance with GOST 51604-2000. In a comparative aspect, the fiber structure of *M.longissimus dorsi*. For histological examination, samples were taken after the cessation of muscle fibrillation. Pieces of muscle tissue with a size of 1×1 cm² with a height of at least 5 mm were cut in such a way as to ensure the possibility of orientation of the muscle fibers relative to the cutting axis of the micropreparation. Sections were prepared on a freezing microtome of the new Mikrom generation (temperature in the chamber -18 ... -20 o C, thickness of sections 10-15 microns). The obtained sections were stained according to the generally accepted method (hematoxylin, eosin). Histological specimens embedded in glycerin-gelatin coverslips were examined and photographed under a Zeiss Axio Imager Z2 electron microscope using a computer video system and Axiovision software, using objectives with magnification from 10X to 40X [1].

Research results.

Live weight is the main criterion for assessing the growth and development of young cattle. In the table 1 shows its dynamics from 9 to 16 months of age. The results of weighing show that in 9-10 months. There were no significant differences in live weight between groups in age.

The advantage of the experimental groups against the control group was shown by the intensity of their growth energy at the age of 12 months. The bulls of the I and II experimental groups exceeded their live weight control counterparts by 0.53 and 2.07%, respectively; 13 months - 1.10 and 3.23%; 16 months – by 2.49 and 5.43%. In general, during the observation period, the energy of increasing the live weight of steers in the experimental groups was greater than in the control group, by 6.64% in the I group and by 12.33% in the II group.

At the age of 15 months. there is a decrease in the relative growth rate in each of the experimental groups, this indicates that the decrease in the growth rate of animals with age is associated with a slowdown in metabolic processes occurring in the body of young bulls, with an increase in the specific mass of differentiated cells and tissues



and an increase in the body shares of reserve substances.

Due to differences in the rate of growth and with practically the same production weight of the animals for the experiment, bulls of the I and II experimental groups reached a live weight of 439.8 and 452.4 kg by the end of the experiment, which is significantly more ($P \geq 0.99$; $P \geq 0.999$) than in the control group by 10.7 and 23.3 kg. Among the experimental groups, the best indicators were obtained in the group of animals that were fed the balancing supplement "Imunosil".

Examination of the exterior in the course of the study showed the superiority of steers that consumed feed additives "Energoritm" and "Imunosil" in all measurements at the age of 16 months. The bulls of the research groups had a more developed and muscular rear part of the body, which indicates optimal expressiveness of meat forms. Their braid length is 16 months. age was higher by 3.81 and 5.08% than in the counterparts of the control group.

Absolute linear measurements cannot fully characterize the exterior profile of animals, since each measurement is considered individually. In this connection, the indices of physique were calculated.

The value of the indices of lopsidedness and massiveness of the experimental stock with the age of growth. At the age of 16 months, according to the avidity index, bulls of the I and II experimental groups exceeded individuals of the control group by 2.67 and 3.38%, respectively. The high intra-life evaluation of the meatness index of young animals that received complex feed supplements was later confirmed by the results of the control slaughter. In order to study the slaughter qualities, at the age of 16 months, a control slaughter of 3 steers from each group was carried out. Control slaughter and deboning of carcasses were carried out at the meat processing plant of Agro Invest CJSC. The data obtained as a result of the experience showed that the additional introduction of balancing feed additives into the composition of the diet had a positive effect on the formation of meat productivity of young animals of the experimental groups. According to the slaughter data, it was established that the pre-slaughter weight of bulls of the II experimental group exceeded the similar indicator of animals of the control group by 6.19%, and of the I experimental group by 3.39%. By the weight of the paired carcass, bulls of the I and II experimental groups exceeded their counterparts from the control group by 5.18 and 9.85%. The yield of carcasses was also higher in the animals of the experienced groups; the difference in their favor compared to the control was 0.96 and 1.89%. The mass of internal fat was greater in steers of the I and II experimental groups than in peers from the control by 7.0 and 11.7%.

The slaughter yield of bulls that received the feed additive "Energoritm" was higher than the control by 1.07%, and in the counterparts that were fed the additive "Imunosyl" it was higher by 2.01%. Since in our experience the most important factor affecting the body of bulls is feeding, we studied the degree of this on the quality of meat production [11].

We studied the biochemical composition of the average pulp sample of experimental bulls based on the content and ratio of essential and replaceable amino acids. The amino acid tryptophan is part of the complete proteins of muscle tissue, and oxyproline is a component of connective tissue proteins.



The results of the research showed that in the average sample of the flesh of calves of the I and II research groups that received feed supplements, tryptophan was more than in the control counterparts by 1.37 and 2.95%, respectively, while oxyproline by 0.34 and 4.16% less (Table 2). The value of the protein-quality indicator of the meat of the steers of the experimental groups exceeded the value of the control analogues by 1.8 and 7.2%.

Table 2 - Biochemical composition of the average meat sample, %

Показник	Групи		
	Контрольна	I дослідна	II дослідна
Триптофан, мг%	387,3±0,91	392,60±1,39*	398,73±0,57***
Оксипролін, мг%	87,20±0,40	86,90±0,25	83,72±0,29**
БЯП	4,44	4,52	4,76

The study of the muscle tissue of the bulls of the experienced groups aims to reveal their characteristic morphological features, which is of primary importance in assessing the quality of the obtained beef. Muscle tissue is the most important of histological tissues, which is the largest constituent element of the animal's body. It is this fabric that gives the meat its specific taste, smell and color.

Analysis of the muscle structure of the studied groups demonstrated the following (Fig. 1). Bundles of fibers are well seen, the boundaries of muscle fibers are expressed quite clearly. Transverse striation is preserved in most of the fibers of the samples of the control and experimental groups. The microstructure of the longest muscle of the control group contains space between fibers, the nuclei of myofibrils are weakly visible.

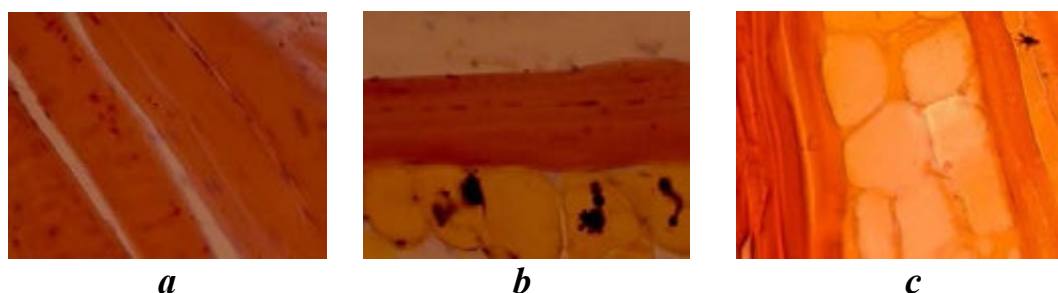


Fig. 1 – Microstructure of the long back muscle of cattle (Longitudinal section): a - control group, b - I experimental group; c - II research group

The main part of the muscle fibers of the I and II experimental groups is elongated and has a linear shape. Nuclei are well-stained with an oval shape, located on the periphery of the sarcoplasm with visible chromatin. The structure of myofibrils is preserved, the alternation of light and dark discs is preserved.

Quality characteristics of meat largely depend on the content of connective tissue in muscles. Supportive connective tissue formations frame the muscle fiber, the border with the sarcolemma. The thickness of the connective tissue layers in the experimental groups is smaller, their structure contains poorly differentiated cellular elements. Using the histological method of staining the Sudan III sections,



accumulations of fat cells were found in the connective tissue layers of the muscles. Significant inclusion of these elements behind the layers of muscle tissue contributes to better taste and acquisition of greater nutrition of meat.

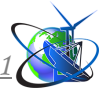
According to the results of the conducted research, the presence of microstructural features in the studied muscles in each group was established. The highest ratio of muscle tissue to connective tissue is characteristic of the muscles of the I, II experienced groups. In the II experimental group, the transverse banding of most fibers is more clearly expressed. The abundant presence of fatty inclusions determines the presence of "marbling", which favorably affects the taste, organoleptic and consumer properties of meat.

Conclusion.

The given data give reason to conclude that the bulls of the research subjects were distinguished by the greatest intensity of growth, indicators of biological value and the best culinary and technological properties of meat groups. The research results confirm the feasibility of using new balancing feed additives to increase the meat productivity of young beef cattle.

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Анотація. Наведені результати комплексних досліджень, який був спрямований на вивчення впливу нових балансуючих кормових добавок на м'ясну бичків казахської білоголової породи та якість отриманої сировини. Встановлено, що спостерігається перевага дослідних груп проти контрольної виявилася інтенсивністю енергії їх зростання у віці 12 міс. Бички I та II дослідних груп перевищували аналогів з контролю за живою масою відповідно на 0,53 та 2,07%; 13 міс. - 1,10 та 3,23%; 16 міс. – на 2,49 та 5,43%. У цілому за час спостереження енергія наростання живої маси бичків у дослідних групах була більшою, ніж у контрольної, у I групі на 6,64 й у II – на 12,33%. У віці 15 місяців. спостерігається зниження відносної швидкості зростання в кожній з піддослідних груп, це свідчить про те, що зменшення швидкості росту тварин з віком пов'язане із уповільненням метаболічних процесів, що протікають в організмі молодняку бичків, з підвищенням питомої маси диференційованих клітин та тканин та збільшенням у тілі частки резервних речовин. Результати проведених досліджень показали, що в середній пробі м'якоті бичків I та II дослідних груп, які отримували кормові добавки, триптофану містилося більше, ніж у аналогів з контролю, відповідно на 1,37 та 2,95%, тоді як оксипроліну на 0,34 та 4,16% менше. Величина білково-якісного показника м'яса бичків дослідних груп перевищувала значення аналогів контролю на 1,8 та 7,2%. Найбільш високе відношення м'язової тканини до сполучної властиво м'язам I, II досвідчених груп. У II дослідній групі поперечна смугастість більшості волокон виражена чіткіше. Рясна присутність жиркових включень обумовлює наявність «мармуровості», що сприятливо позначається на смакових, органолептичних та споживчих властивостях м'яса. Наведені дані дають підставу зробити висновок, що найбільшою інтенсивністю зростання, показниками біологічної цінності та кращими кулінарно-технологічними властивостями м'яса відрізнялися бички дослідних груп. Результати досліджень підтверджують доцільність використання нових балансуючих кормових добавок для підвищення м'ясної продуктивності молодняку великої рогатої худоби м'ясної породи.

Ключові слова: бички, кормова добавка, годування, раціон, м'ясна продуктивність, яловичина.