Morphology and quality of beef with regard to a biostimulator used in the diet of animals

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Abstract. The agricultural food industry is currently facing significant challenges. The development of the food industry, biotechnology, chemistry and related sciences has brought a huge number of new substances that can have a negative effect on humans, the level of environmental pollution has increased, which necessitates stricter requirements for food safety. The relevance of the problems of producing organic food, which has recently gone far beyond the boundaries of purely scientific interests, has made them the subject of discussion for various sectors of society. The demand for safe, environmentally friendly and biologically clean, and high-quality food is growing. At the same time, the production of agricultural and food products should be cost-effective. Today, bio-food markets have already formed in the world: these are plant growing products (fruits, vegetables), animal husbandry (dairy products), baby food, and grain. The growth of the cultural level of the population will increase the demand for beef and its processed products. In this regard, the study and search for safe natural components that affect the yield of meat and are able to efficiently convert the energy of food into organic protein are critical. The paper presents the results of studies of beef meat grown using the technology of intensive cultivation using a biostimulator of natural origin. A positive effect of humic natural substances on carcass morphology and beef quality has been proven. An additional reserve to provide an increase in consumer value and production of safe meat raw materials using a natural peat preparation is shown.

1. Introduction

Increase in the production of high-quality meat products is a problem that has remained relevant over time not only due to the growth of the world’s population, but also due to the search for ways to meet the requirements of humans for high-quality protein [1–5]. It is known that insufficient intake of complete proteins of animal origin with food negatively affects the state of the body, causes its inanition and decreases its protective functions [6–10]. In world practice, the problem of animal protein deficiency is solved through the increase in the number of agricultural livestock and poultry [11–15] or through intensification of cattle raising, and breeding of new animal breeds. Differences in the level of global meat production depend on various factors, including the level of fodder production, yield of grain crops, climatic conditions and development of agriculture [13–17].
Nevertheless, a global trend to transfer from extensive to intensive cultivation technology with the use of a wide variety of substances to intensify metabolism in the body of farm animals and poultry (anti-stress components, complex additives, antibiotics, etc.) is underway [16–19]. The main property of these substances is stimulation of metabolic processes, and, hence, production. Many of them are of synthetic origin, and sometimes their bioavailability is not sufficiently high. Products obtained from such animals are not always of high quality and complete in terms of nutritive and biological value.

Therefore, the search and study of readily available natural biostimulants that can be used in cattle breeding to manufacture high quality beef is of great scientific and practical interest in global food production [19–24].

Such biostimulants of plant origin that can exert an intensifying effect on the organism of animals, include Guvitan-S preparation. An active component of the preparation is peptides, the main part is made of humic acids, as well as polysaccharides, fulvic acids, enzymes, and amino acids.

The aim of the study is to investigate chemical composition and nutritive value of meat from animals raised on a diet supplemented with a plant growth stimulator.

2. Materials and methods
The experiments were carried out on a stud farm. Two similar groups of 3-month bull calves were formed and selected. The first group received the basic ration, while the second group was offered a biostimulant containing a large amount of humic acids. Each group included 15 animals.

The meat quality was assessed at the end of the experiment (before the bulls reached the age of 15 months) by the control slaughter of 3 heads from each group. Slaughter products were studied using standard methods.

3. Results and discussion
At the end of the experiment, the control slaughter of bulls revealed the effect of the biologically active preparation not only on the metabolic rate but also on the yield of relative and absolute indicators of the carcass (figure 1).

![Figure 1](image_url)

**Figure 1.** Results of the control slaughter of experimental animals.

It was found that carcasses of bull calves from the experimental group were heavier by 9.4% (18.9 kg) compared to the indicators of bulls from group 1. The slaughter yield from bulls of the experimental
group was 1.4% higher, and the visceral fat mass was 11.3% greater and amounted to 1.9 kg. Carcass morphology data showed that animals from group 2 were superior in terms of flesh weight over bull calves from the control group by 10.3% or 15.4 kg (figure 2).

**Figure 2.** Morphological composition of carcasses.

The yield of bones from bulls of the experimental group showed a decrease by 0.7% compared to the control group. A similar tendency was observed for the yield of tendons and cartilage, which affected a general indicator of the meat index: the yield of flesh per 1 kg of bones was higher in animals that had a diet supplemented with a plant biostimulator.

The protein/fat ratio and chemical composition of the carcass meat greatly affect the meat quality. During the experiment, an uneven accumulation of nutrients was observed in the body of bulls. It was found that protein and fat content in meat of bulls from the experimental group exceeded similar indicators of the control group by 1.14% and 1.01%, respectively. As a result, the energy value of the meat and carcasses obtained from bulls of group 2 was significantly superior to the analogs of group 1 (figure 3).

The calorie content of 1 kg of the carcass meat of animals from group 2 was 8.49 MJ, which is 7.46% higher than that of meat of bulls from group 1. The difference in the caloric content of the whole carcass meat was 18.56% or 218.72 MJ.

The fat/moisture ratio in the average meat sample was 17.6 and 19.7, respectively, which indicates the physiological maturity of animals from all groups. The beef obtained from animals of the experimental and control groups exhibited a balanced protein/fat ratio, which amounted to 1:0.63 and 1.065, respectively.
Conclusion

The study revealed a positive effect of peat humic substances on morphological parameters and physicochemical properties of beef. Young animals which had a diet supplemented with a biostimulant showed intensive development by the time of slaughter at 15 months of age, the carcass contained 65.93% water, 20.08% of protein, 12.96% fat, and 1.03% ash.

Thus, a biostimulant promotes intensive accumulation of adipose and muscle tissue in the body of animals, which is an additional reserve to increase beef production and to improve its quality.

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References

[1] Morozova N, Musaev F and Zakharova O 2010 Quality of life and consumption of agricultural products (Ryazan: Ryazan State Agrotechnological University named after P.A. Kostychev) [in Russian]

[2] Zinina O, Merenkova S, Rebezov M, Tazeddinova D, Yessimbekov Z and Vietoris V 2019 Optimization of cattle by-products amino acid composition formula Agronomy Research 17 (5) 2127–38 DOI: 10.15159/AR.19.159

[3] Nesterenko A, Koshchaev A, Kenijz N, Akopyan K, Rebezov M and Okuskhanova E 2018 Biomodification of meat for improving functional-technological properties of minced meat Research Journal of Pharmaceutical, Biological and Chemical Sciences 9 (6) 95–105

[4] Zinina O V and Rebezov M B 2016 Biotechnological processing of collagen containing by-products of bovine animals Research Journal of Pharmaceutical, Biological and Chemical Sciences 7 (1) 1530–34

[5] Okuskhanova E, Smolnikova F, Kassymov S, Zinina O, Mustafayeva A, Rebezov M, Rebezov Y, Tazeddinova D, Galieva Z and Maksimiuk N 2017 Development of minced meat ball composition for population from the unfavorable ecological regions Annual Research & Review in Biology 13 (3) 1–9 DOI: 10.9734/ARRB/2017/33337

[6] Okuskhanova E, Rebezov M, Yessimbekov Zh, Suychinov A, Semenova N, Rebezov Y, Gorelik
O and Zinina O 2017 Study of water binding capacity, ph, chemical composition and microstructure of livestock meat and poultry Annual Research & Review in Biology 14 (3) 1–7 DOI: 10.9734/ARRB/2017/34413

Kassymov S, Rebezov M, Ikonnikova A, Fedin I, Rodionov I, Rukhadze S and Bokuchava O 2020 Using of pumpkin and carrot powder in production of meat cutlets: effect on chemical and sensory properties International Journal of Psychosocial Rehabilitation 24 (4) 1663–70 DOI: 10.37200/IJPR/V24I4/PR201274

Kabulov B, Kassymov S, Moldabayeva Zh, Rebezov M, Zinina O, Chernyshenko Yu, Arduvanova F, Peshcherov G, Makarov S and Vasyukova A 2020 Developing the formulation and method of production of meat frankfurters with protein supplement from meat by-products EurAsian Journal of BioSciences 14 (1) 213–18 DOI: 10.31838/jcr.07.02.30

Igenbayev A, Okuskhanova E, Nurgazezova A, Rebezov Ya, Kassymov S, Nurymkhan G, Tazeddinova D, Mironova I and Rebezov M 2019 Fatty acid composition of female turkey muscles in Kazakhstan Journal of World’s Poultry Research 9 (2) 78–81 DOI: 10.36380/jwpr.2019.9

Abilmazhinova B, Rebezov M, Fedoseeva N, Belookov A, Belookova O, Mironova I, Nigmatyanov A and Gizatova N 2020 Study of chemical and vitamin composition of horsemeat cutlets with addition of pumpkin International Journal of Psychosocial Rehabilitation 24 (8) 7614–21 DOI: 10.37200/IJPR/V24I8/PR280773

Rebezov Y, Gorelik O, Bezhin T, Safronov S, Vinogradova N, Ermolova Y, Shcherbakov P, Gritsenko S and Stepanova K 2020 Mineral metabolism features in turkeys International Journal of Psychosocial Rehabilitation 24 (8) 7550–57 DOI: 10.37200/IJPR/V24I8/PR280799

Sharipova A, Khaziev D, Kanareikina S, Kanareikin V, Rebezov M, Okuskhanova E, Suychinov A and Esimbekov Zh 2017 Effects of a probiotic dietary supplementation on the livability and weight gain of broilers Annual Research & Review in Biology 19 (6) 1–5 DOI: 10.9734/ARRB/2017/37344

Sharipova A, Khaziev D, Kanareikina S, Kanareikin V, Rebezov M, Kazanina M, Andreeva A, Okuskhanova E, Suychinov A and Esimbekov Zh 2017 Effects of a probiotic dietary supplementation on the amino acid and mineral composition of broilers meat Annual Research & Review in Biology 21 (6) 1–7 DOI: 10.9734/ARRB/2017/38429

Khaziakhmetov F, Khabirov A, Rebezov M, Basharov A, Ziangulov I and Okuskhanova E 2018 Influence of probiotics Stimix Zoostim on the microflora of faeces, hematological indicators and intensitivity of growth of calves of the dairy period International Journal of Veterinary Science 7 (4) 178–81

Khaziakhmetov F et al. 2018 Effect of probiotics on calves, weaned pigs and lamb growth Research Journal of Pharmaceutical, Biological and Chemical Sciences 9 (3) 866–70 WOS: 000438847100113

Gorelik O, Rebezov M, Gorelik A, Harlap S, Dolmatova I, Zaitseva T, Maksimuk N, Fedoseeva N and Novikova N 2019 Effect of bio-preparation on physiological status of dry cows International Journal of Innovative Technology and Exploring Engineering 8 (7) 559–62

Belookov A, Belookova O, Zhuravel V, Gritsenko S, Bobyleva I, Ermolova E, Ermolov S, Matrosova Y, Rebezov M and Ponomarev E 2019 Using of EM-technology (effective microorganism) for increasing the productivity of calves International Journal of Engineering and Advanced Technology 8 (4) 1058–61

Monastreyev A 1991 Reducing losses and improving the quality of beef Dairy and beef cattle breeding 4 35 [in Russian]
[20] Guber N, Monastyrev A and Rebezov M 2019 *Scientific and practical substantiation of new biotechnological methods for increasing beef production and its nutritional value* (Almaty: Epigraph) [in Russian]

[21] Zelenkov P, Baranikov A and Zelenkov A 2005 *Cattle breeding* (Rostov-on-Don: Phoenix) [in Russian]

[22] Guber N, Rebezov M and Topuria G 2014 Minimization of risks in the implementation of technological innovations in the meat industry (case study of the Southern Urals) *Bulletin of the South Ural State University. Series: Economics and Management* 8 (2) 180–88 [in Russian]

[23] Zakharova O, Morozova N, Musaev F and Zakharov L 2011 *Plant-based feed* (Ryazan: Polytechnic) [in Russian]

[24] Nikiforova T E 2009 *Biological safety of food products* (Ivanovo: Ivanovo State University of Chemical Technology) [in Russian]