Meat productivity and functional properties of meat from Kazakh white-headed bulls with the introduction of an adaptogen system into the diet

Irina Mironova[1], *Ruzel* Khabibullin[1], *Guzel* Salikhova[1*], *Liliya* Zubairova[1], and *Galina* Dolzhenkova[1]

[1]Bashkir State Agrarian University, Ufa, Russia

Abstract. This article provides research on the use of a system of adaptogens of plant and animal origin, such as Leuzea safflower, drone homogenate, and pantocrine. The use of adaptogens in diets stimulates the development of animals, improves biochemical parameters, increases meat productivity and the characteristics of meat raw materials. To assess the effectiveness of adaptogens in diets, control and experimental groups of animals were compiled. Adaptogen preparations were fed to animals for 12 months. During the experiments, meat productivity indicators were determined. At the final stage of the research, an assessment of raw meat obtained from the control and experimental groups was carried out in order to determine its functional and technological properties. During the research, it was found that the use of the adaptogen system increases the meat productivity of animals, improves the quality and technological parameters of meat.

1 Introduction

An exclusive role in the production of the most valuable products for rational human nutrition, first of all, belongs to livestock farming. Particular attention in the structure of the country's agro-industrial complex is given to beef production, the share of which is about 45% of the total gross meat production. With a physiological need equal to 32 kg per capita, it is necessary to use our own resources to increase the annual volume of beef production to 4.5 million tons. Only in this case can state independence from imports be achieved in this vital food product [1, 3-5]. The Volga Federal District ranks second in beef production (827.7 thousand tons) among Russian regions, reaching 29% of the all-Russian production volume [6-9]. This trend can be explained by traditions and national composition of the population, as well as natural and climatic conditions [1, 5]. Currently, there have been positive results in terms of the country's self-sufficiency in meat due to government support and the use of new technologies. According to the forecast, by 2031, self-sufficiency in beef will reach 86%, and beef consumption will reach 14.1 kg per person

* Corresponding author: Salikhov410@yandex.ru

per year [4, 6-12]. It is necessary to pay attention to the quality component of the product, which can be achieved through beef cattle. This fact is confirmed by an analysis of world experience [1].

There are over a thousand breeds of cattle in the world, but only a few dozen are specialized breeds for meat production, and for Russia only 7 breeds are considered effective. According to the comprehensive program “Development of beef cattle breeding in the Republic of Bashkortostan”, approved by Decree of the Government of the Republic of Bashkortostan dated June 17, 2019 N 353, currently the structure of beef cattle breeding in the Republic of Bashkortostan in the breed aspect is as follows: the share of Simmental breed cattle was 73% (58 ,7 thousand heads); Hereford - 5.6% (4.5 thousand heads); Limousin - 4.5% (3.6 thousand heads); crosses of Aberdeen-Angus with Kazakh white-headed – 1.2% (980 heads); crosses of other breeds - 15.7% (12.2 thousand heads). At the same time, there are three breeding farms for breeding specialized beef cattle of the Limousin and Hereford breeds. Thus, in the republic there are quite large opportunities for increasing the number of beef cattle due to the existing areas of forage crops, natural pastures and empty livestock breeding facilities. The Kazakh white-headed breed was approved only in 1950 and took its place as one of the most common meat breeds. The breed was bred on the farms of the Orenburg and Volgograd regions, the Republic of Kazakhstan by crossing Kazakh and partly Kalmyk cattle of the local population with Herefords [6-8]. It has valuable biological properties and high meat productivity. In persistent cold weather, animals develop thick, long, curly fur. The cattle are early maturing, feed and fatten well. It is characterized by adaptability to a wide variety of natural conditions [9].

A modern view of the state of the livestock industry indicates that in order to realize the existing potential of beef cattle breeding, a number of limiting factors must be overcome: technical and technological support, ineffective use of the productive capabilities of individuals and their resistance to technological stress in the production process [1; 8-12]. Consequently, the production process and its efficiency are interconnected with the adaptive abilities of a biological object to the effects of external negative stimuli. In this regard, it is necessary to pay attention to the immune system, which regulates metabolic processes in the body of animals [7]. For this purpose, preparations with adaptive properties of plant nature (Leuzea safroliformes) and animal (pantocrine and drone brood (homogenate) [1-5] attract attention. Thus, a comparative assessment of the productive qualities and functional and technological properties of meat from Kazakh white-headed bulls through the use in the composition of diets, the system of adaptogens of plant and animal nature is important, which determines the relevance of the research topic.

2 Materials and methods

Research conditions: Orenburg region (peasant farm "Zhukovo", Buguruslan district). The living conditions for all animals were the same. Experiment period: from September 2019 to February 2021.

Subjects of the study: 40 bulls of the Kazakh white-headed breed at the age of 6 months until reaching 18 months of age. All animals were divided into 4 groups of 10 animals each according to the principle of analogue groups, which were assigned numbers group I (control), group II, III and IV (experimental).

Material for the experiment: adaptogens of plant nature (Leuzea safflower) and animal (drone homogenate and pantocrine). The studied components were administered in the form of ready-made tinctures, the rate of administration of which was determined at the rate of 0.01 ml per 1 kg of animal body weight. The calculated volume was dissolved in 200 ml of water and given to the animals with drink in the morning. The test drugs were administered for two weeks at two-week intervals for 12 months.

Before starting the main stage of the experiment, a preparatory period of 1 month was organized to achieve homogeneity of the groups. Feeding rations were compiled according to detailed feeding standards, and their nutritional value was similar for all groups of animals and was periodically adjusted. Balancing the composition of diets was carried out in a program designed to calculate its nutritional value, plan the procurement and consumption of feed for different periods of their maintenance (Blagov D.A. et al., 2020).

The rations for young animals consisted mainly of feed grown in the "Zhukovo" peasant farm, where scientific and economic experiment was organized. The growth of bull calves was recorded according to individual weighings in the morning before feeding and watering. The results obtained formed the basis for calculations of absolute and average daily growth, relative growth rate and coefficient of increase in animal weight. To study the weight growth of animals, mechanical scales for young cattle and pigs VT-8908-500CX were used [1-5].

Linear growth was studied based on taking basic measurements at the ages of 6 and 18 months: height at the withers and rump, oblique length of the body, chest depth, chest width behind the shoulder blades, chest girth behind the shoulder blades, width at the hip joints, width at the hip joints, semi-girth of the buttocks, metacarpal girth. Meat productivity was studied when the bulls reached the age of 18 months, after the control slaughter of three animals from each group (methodology VASKHNIL, VIZH, VNIIMP, 1977 and GOST R 54315-2012).

In an average sample of minced meat, the chemical composition was determined according to the VNIIMS method (1984) in terms of moisture content, dry matter, protein, fat, and ash.

Determination of the chemical composition based on the main components. The mass fraction of moisture in the starting raw materials and finished products was determined by drying the samples at a temperature of 100-105 °C for 3 hours in accordance with the requirements of GOST R 51479-99.

The determination of the mass fraction of fat in model minced meats and finished products was carried out using the refractometric method in accordance with the recommendations [2]. The lipid fraction was isolated using organic solvents (α-monobromonaphthalene). The precipitate after extraction was separated by centrifugation.

The mass fraction of mineral substances was determined by ashing the sample at a temperature of 500-700 °C in a muffle furnace for 5-6 hours to constant weight in accordance with the recommendations.

The mass fraction of protein in products was determined by the Kjeldahl method in accordance with the recommendations [2].

Determination of functional and technological indicators. The functional and technological properties of minced meat systems include the following indicators: moisture-binding (MB), water-retaining (WR), fat-retaining (FR) abilities, emulsifying ability (EA), emulsion stability (ES).

Moisture-binding properties were determined by the Grau-Hamm pressing method modified by V. Volovinskaya and B. Kelman. The emulsifying ability and stability of the emulsion were determined by the methods of K. Swift and McCready (USA).

The moisture and fat holding capacity of minced meat was determined during heat treatment by centrifugation and separation of the released moisture and fat and subsequent determination of the volume of the centrifugate. Sensory indicators of model minced meat after culinary processing are in accordance with GOST 9959-91.

3 Results

The scientific and economic experiment was organized in the "Zhukovo" peasant farm, Buguruslan district of the Orenburg region from September 2019 to February 2021. The diet included the following set of feeds: cereal and forb hay, alfalfa haylage, corn silage, barley, oats, meat and bone meal, table salt, feed monocalcium phosphate. The diet was balanced every 3 months in the “Diet 2+” program, taking into account changes in live weight. With age, the total weight of the daily diet increased 3 times due to hay, haylage, and silage, while the weight of introduced barley, oats and meat and bone meal was reduced. In addition to the composition of the diet, an analysis of its structure was carried out.

For 6-month-old bull calves, the share of roughage in the diet structure was 40.47%, which is lower than for 9-month-old animals by 1.59%, 12-month-old animals – by 10.24%; 15-month – by 17.71% and 18-month – by 18.8%. The increase in the share of succulent feed followed a similar pattern. At the age of 6 months there were 22.37% of them, at 9 months – 4.83% more, at 12 months – by 7.23%, at 15 months – by 5.31% and at 18 months – by 10.57 %. For concentrated feeds, the opposite picture is observed. Each quarter their share in the diet structure decreased. Thus, by 9 months the decrease was 6.42%, by 12 – 17.47%; by 15 – by 23.02% and by 18 – by 29.37%.

An important predictive zootechnical and economic indicator of meat productivity is the determination of the live weight of the animal. In our experience, this will allow us to objectively assess the influence of adaptogens of different nature on the young animals of the Kazakh white-headed breed. Analysis of the data obtained indicates the advisability of enriching the diet with adaptogens of both plant and animal nature (Table 1).

Table 1. Age dynamics of live weight of bull calves, kg.

Age, months	Group			
	I (control)	II	III	IV
6	181.8±1.52	180.8±1.68	181.3±1.71	181.9±1.75
9	251.2±2.58	255.0±2.74	257.7±1.94	256.6±2.17
12	329.7±2.83	337.9±3.81	343.1±2.87	340.1±3.09
15	417.8±3.10	431.9±4.25	440.4±2.99*	435.0±3.75
18	499.4±4.37	518.0±4.53	527.9±3.14*	520.4±4.10

Note: * – P≤0.05; ** – P≤0.01; *** – P≤0.001

Due to the fact that groups of animals were formed according to the principle of analogues, therefore, the live weight of bull calves of all experimental groups at the age of 6 months was practically at the same level, 180.8-181.9 kg. It is noted that the cyclical period of giving adaptogen drugs with a two-week break demonstrates an increase in live weight. The adaptogen of plant nature from Leuzea safflower showed an effect already at the next stage of registration and at 9 months of age the difference in live weight compared to control peers was 3.8 kg (1.51%). In subsequent age periods, the intergroup increase became more noticeable: at 12 months - 8.2 kg (2.49%), at 15 months - 14.1 kg (3.37%), at 18 months - 18.6 kg (3 .72%). Animal adaptogens were slightly more active compared to plant ones. Thus, when using pantocrine, the live weight of bulls increased at 9 months - by 5.4 kg (2.15%), 12 months - 10.4 kg (3.15%), 15 months - 17.2 kg (4. 12%), 18 months – 21.0 kg (4.21%) relative to individuals from the control group. In bull calves, in whose diet adaptogen drone homogenate was used, live weight was higher than in animals of group I at 9 months - by 6.5 kg (2.59%), at 12 months - by 13.4 kg (4.06%), at 15 months – by 22.6 kg (5.41%; P≤0.05), at 18 months – by 28.5 kg (5.71%; P≤0.05). Thus, from our data we can draw the following conclusion that the highest increase in live weight was observed when drone homogenate was introduced into the diet of young animals at the rate of 0.01 ml per 1 kg of body weight.

Body type is the most important economic and biological trait, since it characterizes strength, health, and is associated with animal productivity. To conduct scientific and economic experiments, animals were selected according to a number of characteristics, including breed, sex, live weight, which were as close as possible. The homogeneity of the formed groups is evidenced by the data of linear measurements of young animals at the beginning of the experiment. Thus, the measured height at the withers in all groups was in the range of 109.56-109.81 cm, height at the sacrum - 113.02-113.3 cm, chest depth - 48.03-48.15 cm, chest width behind the shoulder blades – 36.09-36.44 cm, chest circumference behind the shoulder blades – 155.61-155.92 cm, oblique length of the body – 127.65-127.81 cm, width at the hip joints – 43.17-43.32 cm , width in elbows – 39.72-39.92 cm, semi-circumference of the butt – 105.72-106.03 cm, circumference of the metacarpus – 18.02-18.12 cm.

At the age of 18 months, all linear body measurements were re-evaluated. From the point of view of the biological characteristics of animal development, it is natural that in all bulls of the Kazakh white-headed breed there was an increase in the size of the articles. You can also notice the body’s response to the consumption of different types of adaptogens, which manifested itself in intergroup differences. Thus, in young animals of the experimental groups, compared with control peers, the height at the withers became higher by 1.29-2.52 cm (1.07-2.09%; $P \leq 0.01$-0.001); height in the sacrum – by 0.79-1.88 cm (0.65-1.54%; $P \leq 0.05$-0.01); chest depth – by 0.85-1.29 cm (1.28-1.94%; $P \leq 0.01$-0.001); chest width behind the shoulder blades – by 0.97-1.81 cm (2.20-4.10%; $P \leq 0.01$-0.001); chest circumference behind the shoulder blades – by 2.28-4.82 cm (1.31-2.77%; $P \leq 0.01$-0.001); oblique length of the body – by 1.20-3.26 cm (0.89-2.43%; $P \leq 0.05$-0.001); width at the hip joints – by 1.10-1.76 cm (2.47-3.95%; $P \leq 0.01$-0.001); width in macrolocks – by 0.59-0.81 cm (1.28-1.76%; $P \leq 0.05$-0.01); semi-circumference of the butt – by 2.48-3.77 cm (2.21-3.36%; $P \leq 0.01$-0.001); metacarpal girth – by 0.31-0.42 cm (1.41-1.91%).

Among the bulls consuming adaptogens, the best development was demonstrated by young animals consuming the adaptogen drone homogenate. Thus, the data presented in the experiment indicate that the value of the linear parameters of body parts generally corresponds to the live weight and biological potential of young animals of the Kazakh white-headed breed.

The data from our experiment indicate that the carcasses of bull calves of all experimental groups had good slaughter qualities. Moreover, in accordance with GOST 34120-2017 “Cattle for slaughter. Beef and veal in carcasses, half-carcasses and quarters” - all carcasses were quite heavy with good muscularity and classified in the first category (this is a group of young cattle, which includes bulls aged from 8 months to two years). It should be noted that adaptogens had a positive effect on the growth and development of Kazakh white-headed bulls, as well as on their slaughter qualities (Table 2).

Table 2. Results of control slaughter of experimental bulls.

Index	Group			
	I (control)	II	III	IV
Live weight pre-slaughter, kg	476.7±4.71	488.7±1.08*	500.0±8.15*	494.7±3.89*
Steam carcass weight, kg	261.1±3.39	272.2±2.69*	282.8±4.56**	278.3±3.20**
Carcass yield, %	54.8	55.7	56.6	56.3
Internal fat mass, kg	14.8±0.21	15.3±0.56	16.0±0.30	15.7±0.08
Yield of internal fat, %	3.10	3.13	3.20	3.17
Slaughter weight, kg	275.8±3.22	287.5±3.17	298.8±4.77**	294.0±3.12*
Slaughter yield, %	57.9	58.8	59.8	59.4

The highest pre-slaughter live weight was characteristic of the young animals of the experimental groups. Thus, in group II bulls, this indicator increased relative to control analogues by 12.0 kg (2.52%; P≤0.05); Group III – by 23.3 kg (4.89%; P≤0.05) and group IV – by 18.0 kg (3.78%; P≤0.05).

The weight of the fresh carcass is the most important natural indicator when evaluating beef at meat processing plants. The largest mass of fresh carcass was obtained from bulls consuming adaptogens. They exceeded their peers from group I by 11.1-21.7 kg (4.25-8.31%; P≤0.05) in this indicator.

Data from the calculation of carcass yield indicate that the maximum values were achieved in the group of bulls of group III, amounting to 56.6%, which is higher in comparison with peers of group I - by 1.8%; Group II – by 0.9% and Group IV – by 0.3%.

The highest synthesis of internal fat was recorded in bulls consuming adaptogens, which were superior in this indicator to peers in the control group by 0.5-1.2 kg (3.38-8.11%), and in internal fat yield - by 0.03- 0.1%.

In terms of slaughter weight, the leadership of bull calves of the experimental groups over the control individuals remained and amounted to 11.7-23.0 kg (4.24-8.34%; P≤0.05-0.01), which was reflected in the increase in their slaughter yield at 0.9-1.9%.

Summarizing the data from the control slaughter, it should be noted that the young animals of the third experimental group, consuming drone homogenate as part of the diet, achieved the best slaughter qualities. We can assume that adaptogens reduced the stress sensitivity of animals during transportation and pre-slaughter housing, since in the stress response the adrenal glands secrete catecholamines (adrenaline and norepinephrine), which through beta receptors promote an increase in heart rate and the breakdown of carbohydrate reserves in skeletal muscles. According to a number of scientists (Waris P.D., Lister D., 1982; Rybalko V.P. et al., 2005), beta receptors are blocked with the help of adaptogens.

To assess the quality indicators of carcasses, they resort to calculated indicators, such as the yield of pulp per 1 kg of bones and per 100 kg of live weight of bulls, meat index (Table 3).

Table 3. Yield of carcass pulp of experimental animals 18 months, kg.

Index	Group			
	I (control)	II	III	IV
Pulp yield: total	201.6±2.78	211.1±1.72*	219.9±3.40**	215.8±2.55**
per 1 kg of bones	4.37±0.05	4.46±0.03	4.55±0.03*	4.53±0.02*
per 100 kg live weight	42.29±0.19	43.20±0.26*	43.99±0.41**	43.63±0.17**
S/N ratio	3.73±0.04	3.80±0.02	3.85±0.02*	3.84±0.02*

The maximum yield of pulp obtained from the entire carcass was observed in the bulls of the experimental groups, exceeding the control by 9.5-18.3 kg (4.71-9.08%; P≤0.05-0.01). Calculation of the pulp yield per 1 kg of bones and per 100 kg of live weight revealed a similar trend. It is enough to note that in terms of the value of the first indicator, the advantage of group II bulls over control individuals was 0.09 kg (2.06%); the second – by 0.91 kg (2.15%; P≤0.05); Group III – by 0.18 kg (4.12%; P≤0.05) and 1.70 kg (4.02%; P≤0.01) and Group IV – by 0.16 kg (3.66 %; P≤0.05) and 1.34 kg (3.17%; P≤0.01), respectively. Calculation of the meatiness index, indicating the ratio of the mass of pulp and bone tissue, showed maximum values in bulls consuming adaptogens. The intergroup difference was 0.07%, 0.12% (P≤0.05) and 0.11% (P≤0.05), relative to animals of group I in favor of analogues of groups II, III and IV, respectively. This indicates that the carcasses of steers consuming adaptogens are of better quality.

To study the influence of plant and animal adaptogens on the quality indicators of meat from Kazakh white-headed bulls, the chemical composition of an average sample of minced meat was assessed (Table 4).

Table 4. Chemical composition of an average sample of minced meat from experimental bulls, %.

Index	Group			
	I (control)	II	III	IV
Moisture	68.49±0.35	67.97±0.18	67.46±0.32*	67.62±0.26
Dry matter	31.51±0.35	32.03±0.18	32.50±0.32*	32.38±0.26
Protein	17.64±0.21	18.39±0.29*	18.93±0.49**	18.61±0.37*
Fat	10.91±0.22	11.36±0.11	12.17±0.13**	11.92±0.05**
Ash	0.87±0.04	0.89±0.05	0.92±0.04	0.90±0.06

During the analysis of moisture, dry matter, protein, fat and ash content, differences were established across groups. In the samples of meat from bulls of group I, the moisture content was higher than that of analogues of group II by 0.52%; Group III – by 1.03% ($P \leq 0.05$) and Group IV – by 0.87%. The data obtained indicate a higher degree of maturity of minced meat in the experimental groups, since the moisture content in the sample decreased.

In terms of dry matter content, a different picture is observed: an increase in the samples of the experimental groups compared to the control. A similar pattern can be seen for the other analyzed indicators. Thus, there was more protein in samples of minced meat from group II – by 0.75% ($P \leq 0.05$); Group III - by 1.29% ($P \leq 0.01$) and group IV - by 0.97% ($P \leq 0.01$) relative to peers of group I, fat - by 0.45%; 1.26% ($P \leq 0.01$) and 1.01% ($P \leq 0.01$), ash – by 0.02%; 0.05% and 0.03%, respectively. An increase in the fat index in the carcass of bull calves in the experimental groups in comparison with the control confirms the high degree of maturity of their meat. In addition, with the fat content in meat ranging from 8-12%, it is characterized by high nutritional value (according to the Institute of Nutrition of the Academy of Medical Sciences).

To study the possibility of using meat from animals raised using adaptogens as a meat base in the technology of meat products, studies were conducted to determine the functional and technological properties of model minced meat. The behavior of model systems in the production of meat products is important in the light of predicting the quality indicators of the finished product, identifying possible defects and developing measures to level them.

The results of determining the main functional and technological properties are presented in Table 5.

Table 5. Functional and technological properties of model minced meat.

Index, %	I (control)	II	III	IV
Total moisture content	68.49±0.35	67.97±0.18	67.46±0.32*	67.62±0.26
Moisture binding capacity	51.27±0.32	53.21±0.15	56.22±0.32	55.28±0.24
Water holding capacity	51.23±0.31	52.22±0.25	54.27±0.31	53.24±0.15
Emulsifying ability	75.58±0.25	76.63±0.28	78.64±0.29	76.64±0.35
Emulsion stability	62.15±0.29	62.55±0.34	62.64±0.35	62.66±0.31

According to Table 5, it can be seen that the maximum indicators of water-binding and water-holding abilities were shown by model systems made from group III bull meat, similar data on emulsifying ability and stability of the emulsion. Such indicators indicate that the protein systems in meat from group III bulls are of higher quality and better bind free moisture and fat during mechanical operations and heat treatment. Structural, mechanical and rheological parameters of model minced meat from bulls of various groups. Adhesion of viscous-plastic food masses occurs at the interface between two solids. Minced meat has abnormal viscosity. The viscosity of such bodies varies depending on shear stress, mass properties and other factors. The reason for the variability of viscosity lies in the structural features of visco-plastic bodies. Minced meats are complex structural systems that combine the properties of elastic, plastic and viscous bodies, but most often manifest themselves as visco-plastic.

Adhesion is determined by hydrogen bonds between carboxyl groups –COOH and amino groups $–NH_2$. The peculiarity of meat products is such that as a result of contact of meat or meat products with the surface, part of the product can be fixed on this surface, forming a kind of adherent layer. Determination of the adhesive properties of model minced meats was carried out according to the recommendations [4].

Table 6. Indicators of stickiness of model minced meat.

Samples of model minced meat	Stickiness, g/cm^2
I (control)	10.4±0.30
II	10.6±0.24
III	10.6±0.25
IV	10.5±0.28

When studying the adhesive properties of model minced meat, it was determined that minced meat from bulls in the control group was slightly inferior to model minced meat from control groups (Table 6). The differences in adhesion among the model minced meats of the experimental groups are insignificant and are within the statistical error.

When studying the behavior of model minced meats under the conditions of the technological cycle for the production of meat products, the dynamics of changes in product yield during heat treatment depending on the composition of the minced meat systems is important. The yield of the product is determined by the difference in the mass of minced meat before and after heat treatment, expressed as a percentage (Table 7).

Table 7. Yield and moisture content in model systems after heat treatment.

Index, %	I (control)	II	III	IV
Total moisture content	61.49±0.35	62.97±0.18	63.46±0.32	62.62±0.26
Output of the product	71.27±0.33	73.21±0.19	76.22±0.35	55.28±0.25

When determining the yield of finished products, the highest yield was obtained from a sample of model minced meat from group III bulls. Other samples II and IV gave a slightly higher yield of finished products compared to the control sample. The moisture content in model minced meat after heat treatment is also maximum for model minced meat from group III bulls.

The assessment of sensory indicators of model minced meat systems from bull meat of various groups was carried out after heat treatment on a seven-point scale. During the assessment, the appearance, severity and depth of color, smell and taste, and consistency were determined (Table 8). Heat treatment was carried out by boiling in water for 30 minutes.

Table 8. Comparative organoleptic evaluation of model minced meats.

Mass fraction	Color	Consistency	Smell	Taste
I (control)	6.5±0.2	6.5±0.3	6.7±0.3	6.3±0.1
II	6.5±0.2	6.5±0.1	6.7±0.2	6.5±0.3
III	6.6±0.3	6.5±0.2	6.7.0±0.3	6.4±0.1
IV	6.6±0.1	6.6±0.2	6.6±0.1	6.5±0.2

An organoleptic evaluation of minced meat systems showed that model minced meat from bulls of different groups differ slightly from each other.

4 Discussion

Thus, the use of adaptogens in the diet of bulls allows us to obtain high-quality nutritious beef with optimal fat content that meets the requirements of the modern consumer. The most optimal composition of beef is typical for groups of bulls consuming adaptogens of animal nature. The technological properties of meat obtained from steers whose diet contains adaptogens significantly exceed the main indicators of functional and technological properties of meat from animals in the control group, which makes it possible to obtain high-quality meat products with good technological properties, allowing to minimize the occurrence of defects during the technological process of producing meat products.

5 Conclusion

In the course of studies carried out in accordance with the goals set to determine the influence of a system of adaptogens of plant and animal origin on meat productivity and technological properties of meat from Kazakh white-headed bulls, it was proven that adaptogens have a positive effect on the growth and development of animals. Adaptogens have a positive effect on the immune system, biochemical parameters, and the depth and efficiency of absorption of nutrients from the diet. All this leads to an increase in the linear size of the animal, an increase in productive qualities, as well as an improvement in the quality of meat. Improving the quality of the protein component of meat has a positive effect on the functional and technological properties of meat. Meat obtained from such animals is characterized by the absence of defects characteristic of animals raised in industrial complexes. The use of such meat raw materials will reliably improve the technological properties of meat products and will reduce the use of food additives aimed at leveling out defects in technological properties. The use of bull meat grown using adaptogens of plant and animal origin allows us to obtain meat products that can be called organic and environmentally friendly.

References

1. I. Mironova, V. Beresnev, H. Tagirov, Z. Galieva, A. Gaag, R. Khabibullin, Meat productivity of hereford breed calves with the carbohydrate complex diet. J. American Journal of Animal and Veterinary Sciences, **16**, **4**, 327-334 (2021)
2. I.V. Mironova, R.M. Khabibullin, M.A. Derkho, S.Yu. Kontsevaya, S.V. Strizhikova, E.K. Ovchinnikova, Morphological changes in the muscle tissue of mice with the use of adaptogens, In: IOP Conference Series: Earth and Environmental Science. Сер. "International Scientific and Practical Conference Biotechnology in the Agro-Industrial Complex and Sustainable Environmental Management", 012083 (2020)
3. R.M. Khabibullin, I.V. Mironova, M.A. Derkho, V.K. Strizhikov, S.V. Strizhikova, A.S. Denisenko, Morphogenesis of the internal organs of mice with the use of adaptogens and physical activity, In: IOP Conference Series: Earth and Environmental Science, "International Scientific and Practical Conference Biotechnology in the Agro-Industrial Complex and Sustainable Environmental Management", 012053 (2020)
4. R.M. Khabibullin, I.V. Mironova, M.A. Derkho, V.K. Strizhikov, S.V. Strizhikova, J. Kouassi, Morphofunctional changes in the kidneys of mice with the use of adaptogens against the background of physical exertion, In: IOP Conference Series: Earth and Environmental Science, "International Scientific and Practical Conference

Biotechnology in the Agro-Industrial Complex and Sustainable Environmental Management", 012052 (2020)

5. I.V. Mironova, R.M. Khabibullin, D.A. Blagov, O.V. Krupina, I.M. Khabibullin, The effective use of adaptogens of various origins on the cattle productivity, J. Open Veterinary Journal, **13**, **6**, 753-764 (2023)
6. A. Lamanov, Y. Ivanov, R. Iskhakov, L. Zubairova, K. Tagirov, A. Salikhov, Beef quality indicators and their dependence on keeping technology of bull calves of different genotypes, J. AIMS Agriculture and Food, **5**, **1**, 1-10 (2020)
7. L. Zubairova, H. Tagirov, I. Mironova, R. Iskhakov, I. Vagapov, Biotechnology techniques in animal nutrition for improving quality indicators of beef and dairy products, J. Biocatalysis and Agricultural Biotechnology, **40**, 102294 (2022)
8. I. Mironova, A. Pleshkov, E. Yarmukhamedova, S. Islamova, A. Nigmatyanov, Efficiency of high-carbohydrate fodder in the diets of holstein cows, J. Veterinary World, **14**, **5**, 1303-1310 (2021)
9. I. Mironova, V. Beresnev, H. Tagirov, Z. Galieva, A. Gaag, R. Khabibullin, Meat productivity of hereford breed calves with the carbohydrate complex diet, J. American Journal of Animal and Veterinary Sciences, **16**, **4**, 327-334 (2021)
10. S. Kanareikina, E. Ganieva, I., Mironova A. Nigmatyanov, I. Gazeev, V. Kanareikin, Effect of different factors on consumer properties of fermented milk products with a functional orientation, J. International Journal of Dairy Science, **16**, **4**, 137-145 (2021)
11. A. Igenbayev, E. Okuskhanova, A. Nurgazezova, Ya. Rebezov, S. Kassymov, G. Nurymkhan, D. Tazeddinova, I.V. Mironova, M. Rebezov, Fatty acid composition of female turkey muscles in Kazakhstan, J. Journal of World's Poultry Research, **9**, **2**, 78-81 (2019)
12. A.K. Suychinov, G.T. Zhumanova, I.V. Mironova, E.T. Akhmadullina, N.N. Kadirov, Z.A. Galiyeva, O.V. Neverova, Investigation of the chemical composition, physicochemical properties, and microstructure of meat patties with amaranth flour, J. Theory and Practice of Meat Processing, **8**, **3**, 183-190 (2023)