IRSTI 68.39.19 https://doi.org/10.26577/eb.2022.v93.i4.010

K.Sh. Nurgazy[1]*, B.O. Nurgazy[1], U.K. Bisenov[2], Zh.M. Suleimenova[1], G.K. Mukash[1]

[1]Kazakh National Agrarian Research University, Kazakhstan, Almaty
[2]Atyrau University named after H. Dosmukhamedov, Kazakhstan, Atyrau
*e-mail: nurgazy_k@bk.ru

BIOLOGICAL VALUE AND TECHNOLOGICAL INDICATORS OF MEAT IN BEEF BULLS OF DIFFERENT GENOTYPES IN THE CONDITIONS OF THE AGRICULTURAL HOLDING "BAISERKE-AGRO"

The most important biological feature of beef bulls is their ability to consume and process a large amount of cheap low-nutritional feed, including waste from crop production and the food industry, into valuable food products for humans. The meat products and leather raw materials obtained at the same time are of high quality.

The aim of the research was to improve and optimize breeding methods to increase the rate of genetic progress of different beef breeds of cattle. Based on the interaction of genotypes, to determine effective methods for improving the breeding and productive qualities of meat breeds of different genotypes to increase the production of high-quality beef.

This article presents the results of studies of meat productivity of beef bulls of different genotypes in the conditions of the agricultural holding "Baiserke-Agro". According to the results of the research, the quality of carcasses and slaughter indicators, the morphological composition of carcasses and individual anatomical parts, the chemical composition of meat and the energy value of raw fat were established.

The conducted studies contributed to the fullest realization of the genetic potential of the productivity of the Aberdeen Angus, Hereford and Kazakh white-headed breeds, as a result, an additional reserve for obtaining high-quality beef was revealed. The proposed methods and techniques of organizing the breeding process allowed to create highly productive beef cattle in the conditions of the agricultural holding "Bayserke-Agro", which contributed to reducing the cost of 1 kg of live weight gain by 5-8% and obtaining additional profit for 1 head by 14-16%.

Key words: Carcass mass, slaughter yield, slaughter mass, meat index, pulp, peers, minced meat.

Қ.Ш. Нұрғазы[1]*, Б.Ө. Нұрғазы[1], У.К. Бисенов[2], Ж.М. Сулейменова[1], Г.К. Мукаш[1]

[1]Қазақ ұлттық аграрлық зерттеу университеті, Қазақстан, Алматы қ.
[2]Х. Досмухамедов атындағы Атырау университеті, Қазақстан, Атырау қ.
*nurgazy_k@bk.ru

«Байсерке-Агро» агрохолдинг жағдайында ет тұқымдарының әртүрлі генотиптеріне жататын бұқашықтар етінің биологиялық құндылығы және технологиялық көрсеткіштері

Етті бұқалардың ең маңызды биологиялық ерекшелігі – олардың көп мөлшердегі арзан қоректік азықты, соның ішінде өсімдік шаруашылығы мен тамақ өнеркәсібінің қалдықтарын адам үшін құнды тағамға айналдыру және өңдеу қабілеті. Алынатын ет өнімдері мен былғары шикізаты жоғары сапамен ерекшеленеді.

Өздерінің генотипінде мықты конституция мен жоғары өнімділікті, жақсы бордақылау және ет қасиеттерін, төзімділік пен стресске қарсы тұра алушылықты, тіршілік ету жағдайлары мен шаруашылықта пайдануға жақсы бейімделу қабілетін біріктіретін ең «үнемді жануарлар» алуды қамтамасыз ететін талаптарға сай жануарлар қажет. Басқа сөзбен айтқанда, қарқынды пайдалануға жақсы бейімделген және өнімділігі жоғары мал алу керек.

Зерттеу мақсаты – әртүрлі ет тұқымды ірі қара малдың генетикалық дамуының қарқындылығын жоғарылату үшін селекция әдістерін жетілдіру және оңтайландыру. Жоғары сапалы сиыр етін өндіруді көбейту үшін генотиптердің өзара әрекеттесуінің негізінде ет тұқымдарының әртүрлі генотиптерінің тұқымдық және өнімдік сапаларын жақсартудың тиімді әдістерін анықтау.

Бұл мақалада **«Байсерке-Агро» агрохолдинг жағдайында** ет тұқымдарының әртүрлі генотиптеріне жататын бұқашықтардың ет өнімділігін зерттеу нәтижелері келтірілген. Зерттеулер нәтижелері бойынша ұшалардың сапасы мен сойыс көрсеткіштері, ұша мен жеке анатомиялық

бөліктердің морфологиялық құрылысы, еттің химиялық құрамы және шикі еттің энергетикалық құндылығы анықталды.

Жүргізілген зерттеулер абердин-ангус, герефорд және қазақтың ақбас тұқымдары өнімділігінің генетикалық потенциалын толық пайдалануға ықпал етті, нәтижесінде жоғары сапалы сиыр етін алудың қосымша көзі анықталды. Селекциялық үдерісті ұйымдастырудың ұсынылған әдістері мен тәсілдері «Байсерке-Агро» агрохолдинг жағдайында жоғары өнімді етті мал алуға мүмкіндік берді, бұл тірі салмақтың 1 ц өсімінің өзіндік құнын төмендетуге және 1 басқа 14-16% қосымша табыс алуға ықпал етті.

Түйін сөздер: ұшаның салмағы, сойыс шығымы, сойыс салмағы, ет көрсеткіші, еттің жұмсағы, құрдастар, тартылған ет.

Қ.Ш. Нұрғазы[1]*, Б.Ө. Нұрғазы[1], У.К. Бисенов[2], Ж.М. Сулейменова[1], Г.К. Мукаш[1]

[1]Казахский Национальный Аграрный Исследовательский Университет, Казахстан, г. Алматы

[2]Атырауский университет им. Х. Досмухамедова, Казахстан, г. Атырау

*e-mail: nurgazy_k@bk.ru

Биологическая ценность и технологические показатели мяса у бычков мясных пород разных генотипов в условиях агрохолдинга «Байсерке-Агро»

Важнейшей биологической особенностью мясных быков является их способность перерабатывать большое количество дешевых питательных кормов, в том числе отходов растениеводства и пищевой промышленности, в ценные для человека продукты питания. Получаемые при этом мясная продукция и кожевенное сырье отличаются высоким качеством.

Нужны животные, отвечающие требованиям, сочетающие в себе крепкую конституцию и высокую продуктивность, хорошие откормочные и мясные качества, выносливость и стрессоустойчивость, хорошую приспособленность к условиям содержания и использования в хозяйстве, обеспечивающие наиболее «экономных животных» в своем генотипе. Другими словами, необходимо получить животных, хорошо приспособленных к интенсивному использованию и обладающих высокой продуктивностью.

Цель исследований – совершенствование и оптимизация методов селекции для повышения интенсивности генетического развития различных пород крупного рогатого скота мясного направления, определить эффективные методы улучшения племенных и продуктивных качеств разных генотипов мясных пород на основе взаимодействия генотипов для увеличения производства качественной говядины.

В данной статье представлены результаты изучения мясной продуктивности бычков разных генотипов мясных пород на примере агрохолдинга «Байсерке-Агро». По результатам исследований определяли качественные и убойные показатели туш, морфологическое строение туш и отдельных анатомических частей, химический состав мяса и энергетическую ценность мясного сырья.

Проведенные исследования способствовали полному использованию генетического потенциала абердин-ангусской, герефордской и казахской белой пород, в результате чего был выявлен дополнительный источник высококачественной говядины. Предложенные методы организации племенного процесса позволили получить высокопродуктивный мясной скот в случае с агрохолдингом «Байсерке-Агро», что способствовало снижению себестоимости 1 кг прироста живой массы на 5-8% и получению дополнительной прибыли в размере 14-16% на 1 голову.

Ключевые слова: масса туши, убойный выход, убойная масса, индекс мясности, мякоть, сверстники, мясо-фарш.

Introduction

Meat productivity and meat quality are largely determined by the characteristics of the genotype of animals, their final live weight, as well as the level and type of feeding. However, the most accurate and complete assessment of it is possible only when animals are slaughtered. The control slaughter of bulls of different genotypes allowed us to identify the characteristic features of quantitative and qualitative indicators of meat products [1, 2, 3].

More other, attaining a high standard of beef quality is important for the attraction and preservation of consumers and to enticing repurchase. For those cattle industries that rely on the export of beef for economic gain, accomplishing the best possible quality of beef becomes a key for maintaining and increasing global market share [4].

Currently, the agro-industrial complex of Kazakhstan faces the task of rapid development and intensification of animal husbandry, as well as improving the efficiency of processing of raw meat. The efficient processing of raw meat not only increases the profitability of products, increases the profits of the meat industry, but also increases the production of high-quality food products available to consumers. In turn, the growth of demand for domestic products is an important incentive to increase the production of meat of the required quality in agriculture [5].

The beef cattle industry is interested in growing progeny faster to achieve an earlier slaughter weight and to improve feed efficiency. More other, carcass weight, percentage of commercial cuts and meat tenderness are features directly related to carcass quality and value [6, 7].

The world studies show that it is important to estimate the genetic parameters simultaneously for all economic important traits (i.e., reproduction, growth and carcass traits) [8].

Heterosis is the beneficial deviation of crossbred progeny from the average of parental lines for a particular trait. [9].

Thus, these results warrant further investigation on the relationship of carcass traits and other traits of importance in the beef selection index, such as antagonistic effects with maternal production efficiency traits. Breed differences are clear and these differences need to be accounted for in genetic evaluations of carcass traits and warrants further work on heterotic effects between individual breeds. The knowledge gap between pedigree breeders and the commercial beef producer could be lessened via carcass trait evaluations. [10].

There are data about the purposeful selection with a breeding work in white-headed, Auliyekolsky, and Hereford cattle breeds in Kazakhstan. Such state farms as Barysh Seysenbay (Bayzak district, Jambyl region), both farms Bagration (Ulan Region, East Kazakhstan region), and Kegen-agro LLP (Rayymbek district, Almaty region) was carried out in this breading research. The scientists of the Kazakh National Agricultural University were conducted in these experiments. And different tests in the milking growing period have shown that calves' growth and development were in the norm, and growth rather was in high intensity [11].

It is well known, weights and weight gains at specific ages or during specific periods are commonly applied as selection criteria in most beef cattle breeding programs in the world, since these traits show moderate to high genetic correlations with carcass weight, are easy to measure, and respond to selection [12].

The practice and experience of domestic and foreign animal husbandry have shown that the improvement of breeding and productive qualities of beef cattle depends not only on a good feed base and the introduction of advanced technologies, but also on the improvement of the genotype of animals, which is achieved by purposeful breeding work.

In turn, the effective use of modern technologies for beef production depends primarily on the availability of animals of the required quality [13, 14, 15].

In this regard, certain requirements are imposed on animals. They must have the ability to continue intensive growth and pay well for feed when growing and fattening in cheap light-type premises or even in open feedlots. At the same time, beef should be characterized by an optimal ratio of nutrients.

One of the most important factors in the intensification of beef cattle breeding is the qualitative improvement of existing and the creation of new breeds, experimental groups, lines, types that ensure high efficiency of beef production [16]. At the same time, the main criteria of the breeding process are the quantity and quality of meat products, the strength of the constitution and the ability to transfer valuable qualities to offspring.

Biologically full-fledged and low-fat beef is obtained only when two biological processes take place in their body during the growth and development of young animals: the growth of muscle tissue and fat deposition, which are combined only in conditions of abundant feeding.

The study of inbreeding patterns has shown that during the growth of an animal, first of all, its live weight changes, which is associated with the accumulation of protein, fat, constituent components of organs and tissues. The composition of growth changes with age, therefore, knowledge of the chemical composition by growth periods also seems to be an important element in the theory of cognition of living organisms. It is important to get not only large animals, but also with a favorable ratio of edible and inedible parts of the carcass [17, 18, 19, 20].

Thus, the rational use of the biological capabilities of animals involves the creation of optimal conditions for feeding and keeping, which allow you to maximize the genetically determined productivity potential while increasing the economic efficiency of their breeding.

The research results have shown that the organization of balanced feeding, satisfying the

need of animals for energy, basic nutrients and biologically active substances, provides the most complete manifestation of their genetic potential for productivity and improvement of product quality [21, 22].

Productive qualities of cattle are primarily determined by their genotype. However, the manifestation of the possible potential is directly dependent on the conditions of growing, feeding and keeping young animals, that is, conditions that would ensure their normal growth and development, high productivity [23]. However, it is known that the conditions of keeping and feeding had a greater impact on the biological energy of growth than the genotype of animals.

To realize the genetic potential of livestock, it is necessary to intensively grow repair young. Heifers raised in unsatisfactory conditions will never become highly productive cows, even if they come from highly productive parents [24].

In the complex of factors influencing the productive qualities of beef cattle, an important place belongs to the conditions of keeping animals. As many researchers point out, underestimating these conditions leads to a decrease in productivity and natural resistance [25].

The method of maintenance has a significant impact on meat productivity, slaughter indicators and meat quality. Thus, the meat of bulls raised indoors and in conditions of limited movement or on a leash contains more fat, has a high pH level and a high moisture-retaining capacity. The influence of the method of keeping animals during cultivation, rearing and fattening on growth, development and meat productivity was reflected in the works [26].

The quality of beef is affected by fatness, age, gender, and breed characteristics of the animal. The meat of young animals is much more tender than the meat of old ones. The use of special cultivation technologies contributes to obtaining meat from castrated bulls similar in tenderness to heifer meat [27].

Material and methodology of research

Experimental studies were conducted in the agricultural holding "Bayserke-Agro" of Talgar district of Almaty region.

The object of research was purebred animals of different meat breeds of cattle. Three groups of bulls of different genotypes were formed: Aberdeen-Angus breed – group I (AA), Kazakh white–headed – group II (KB), Hereford – group III (GF).

The experimental part of the research was carried out according to the scheme using optimized breeding methods to improve the productivity of cattle. All experimental animals were kept according to the technology adopted in beef cattle breeding.

Meat productivity was studied by control slaughter of 3 animals from each group according to the methodology of the All-Union Academy of Agricultural Sciences, the All-Union Institute of Animal Husbandry, the All-Union Scientific Research Institute of the Meat Industry (Russia).

The morphological composition of the carcass was established by deboning the half-carcass, cooled for 24 hours at a temperature of +2-4 ° C. The carcass was deboned according to anatomical parts: I – cervical, II – shoulder-scapular, III – spinal-rib, IV – lumbar, V – hip.

Based on the deboning of the anatomical parts of the half-carcass, the absolute and relative content of the pulp part, bones and tendons, as well as the meat index (pulp yield per 1 kg of bones) in individual anatomical parts and in the carcass were determined.

The chemical composition was determined in minced meat, from an average sample of the pulp part of the half-carcass, in a sample of the longest back muscle and a sample of fat in a complex analytical laboratory. Moisture, dry matter, fat, protein, ash were also determined. To characterize the biological value of meat in the longest back muscle, the amount of defective proteins according to oxyproline was determined by the R. E. Neumann and M. A. Logan, "The determination of collagen and elastin in tissues" method in the modification of V.Verbitsky and D.Deteridge, full-fledged proteins according to tryptophan, moisture capacity was determined by the Grau method in the modification of V.Volovinskaya. In the analysis of fat, the melting point was set according to the generally accepted method, the iodine number was set according to Hüble.

Research results

Carcasses of animals of all groups obtained during slaughter were classified as the highest category and were covered with a continuous layer of fat-watering, while the more developed subcutaneous tissue was found in Kazakh white-headed bulls.

The analysis of slaughter indicators revealed certain differences in the measurements of carcasses of young animals of different genotypes. Thus, the carcasses of the Aberdeen Angus and Hereford bulls were more elongated: in its length they exceeded

the carcasses of Kazakh white-headed bulls by 11.9 cm (3.6%; P>0.99) and by 13.4 cm (4.1%; P>0.99) (Table 1).

The difference in carcass length between Aberdeen Angus and Hereford bulls was insignificant and statistically unreliable.

Table 1 – Measurements and indices of bull carcasses, (X±mx)

Indicator	Genotype		
	AA	KB	GF
Carcass weight, kg	315.2±2.02	302.4±3.32	318.2±2.95
Trunk length, cm	246.2±1.41	238.2±1.42	249.1±0.85
Thigh length, cm	93.6± 1.41	92.1±1.12	94.5±0.85
Carcass length, cm	342.0±1.71	330.1±1.42	343.5±1.17
Hip circumference, cm	117.2±1.12	112.5±1.15	119.8±1.41
Fullness of the carcass, %, (K,)	92.2	91.6	92.6
Hip performance, %, (Kg)	125.2	122.1	126.8

Carcasses of Kazakh white-headed bulls had less developed musculature of the posterior third. In length and hip girth, they were inferior to the analogues of the Hereford breed by 2.4 cm (2.6%; P<0.95) and by 7.3 cm (6.5%; P>0.95).

Carcasses of young Aberdeen-Angus and Hereford breeds, compared with the Kazakh white-headed, were distinguished by a well-muscled back and lumbar part, had well-rounded hips; the advantage in hip performance was 4.7%. Bulls of the Hereford breed surpassed their counterparts by 1.6% according to this index. The index of the fullness of the carcass of Hereford bulls was higher than that of peers of the Aberdeen Angus and Kazakh white-headed by 0.4 and 1.0%.

Bulls of different breeds are characterized by sufficiently high quantitative indicators of meat productivity. However, differences were found in their size in animals of the genotypes used. The carcass weight of Hereford bulls was greater than that of peers of the Aberdeen Angus and Kazakh White-headed by 2 kg (0.6%; P<0.95) and by 17.1 kg (5.7%; P>0.95) (Table 2).

The advantage in carcass yield was 0.2 and 0.8%, respectively. Bulls of the Kazakh white-headed breed were characterized by a greater mass of internal raw fat. Thus, the young Hereford breed was inferior to them by 0.9 kg (6.7%; P>0.99), and Aberdeen Angus bulls by 1.5 kg (10.5%; P<0.95).

Table 2 – Results of control slaughter of bulls at the age of 18 months, $(X \pm m_x)$

Indicator	Genotype		
	AA	KB	GF
Removable weight, kg	563.6±4.32	547.1±11.35	575.6±11.67
Pre-slaughter weight, kg	555.6±5.32	535.2±4.42	557.2±6.43
Carcass weight, kg	316.2±2.17	301.1±3.62	318.2±2.95
Carcass yield, %	56.9±0.11	56.3±0.31	57.1±0.12
Mass of internal raw fat, kg	14.3±0.36	15.8±0.45	13.4±0.26
Output of internal raw fat, %	2.6±0.16	2.9±0.13	2.4±0.17
Slaughter weight, kg	329.6±1.6	316.8±4.27	333.5±3.1
Slaughter exit, %	59.3±0.21	59.2±0.3	59.9±0.31

The slaughter weight of Kazakh white-headed bulls was less than that of the Hereford bulls – by 16.7 kg (5.3%; P>0.95). In terms of slaughter yield, Hereford bulls outperformed their peers by 0.6 – 0.7%.

Thus, the analysis of quantitative indicators of slaughter revealed the advantage of Hereford bulls in terms of carcass weight, yield, slaughter weight and slaughter yield. However, the content of internal raw fat and its yield was high in Kazakh white-headed bulls.

Meat is a high-protein food product, and its nutritional advantages largely depend not only on the total protein content, but also on the ratio of full and incomplete proteins. Therefore, the concept of "protein" cannot fully determine the biological value of meat, since its composition, along with essential amino acids, also includes interchangeable ones. Therefore, the protein value of meat is determined by the ratio of the above amino acids or the so-called protein quality index (PQI).

As a result of the boning of the half-carcass, intergroup differences in its morphological composition were revealed. Thus, the greater absolute mass of the pulp differed in the half-carcasses of Hereford bulls. Their advantage compared to peers of the Kazakh white-headed breed was 3.9 kg (3.2%; P<0.95) (Table 3).

Table 3 – Morphological composition of half-carcasses of bulls, $(X \pm m_x)$

Indicator	Genotype		
	AA	КВ	GF
Half-carcass weight, kg	156.6±1.46	148.6±2.18	159.6±1.1
Pulp, kg	126.7±2.03	123.6±2.42	127.5±2.3
Pulp, %	80.9±0.56	83.2±0.43	79.9±0.78
Bones, kg	25.0±0.55	23.4±0.22	25.7±0.96
Bones, %	16.0±0.45	15.7±0.33	16.1±0.60
Cartilage and tendons, kg	4.7±0.16	3.8±0.05	4.4±0.12
Cartilage and tendons, %	3.0±0.12	2.6±0.08	2.8±0.59
Meat index, %	5.1±0.91	5.3±0.16	5.0± 0.27

Bulls of the Aberdeen-Angus breed surpassed analogues of the Kazakh white-headed by 3.1 kg (2.5%; P<0.95) in this indicator. Meanwhile, in terms of the relative pulp content, Kazakh white-headed bulls outperformed peers of other breeds by 2.3 – 3.3%.

The absolute bone mass of Kazakh white-headed bulls was less than that of the Hereford bulls by 2.1 kg (9.0%; P>0.95). The difference between the animals of the Aberdeen-Angus and Kazakh white-headed breeds was 1.8 kg (7.7%; P<0.95). The relative bone yield was greater in Hereford bulls by 0.1 – 0.4% than in their peers.

There were no significant differences in the meat index, its value in the half-carcasses of animals of the experimental groups varied within 5.0 – 5.3%. The absolute mass of anatomical parts in the Kazakh white-headed bulls was less than that of the peers of the Aberdeen-Angus and Hereford breeds. Thus, the mass of the cervical, shoulder-scapular, dorso-rib, lumbar and hip parts of the half-carcass of Kazakh white-headed bulls was less than that of the Hereford counterparts, respectively, by 1.3 kg (7.8%; P>0.95), 1.4 kg (4.6%; P<0.95), 2.4 kg (5.6%; P>0.95), 0.5 kg (3.4%; P<0.95), 3.2 kg (5.9%; P<0.95) (Table 4).

Differences in the yield of parts of the half-carcass in relation to its mass in the animals of the experimental groups were insignificant. Meanwhile, the relative yield of the most valuable in culinary terms of the hip part in all animals was at a good level and amounted to 33.7 – 34.1%.

The lumbar, hip and cervical parts of the half–carcass were characterized by a high content of pulp in all experimental animals, and the dorsal-costal parts were characterized by a lower content. The morphological composition of animal carcasses of different genotypes had certain differences. Thus, the pulp content in the shoulder-scapular and dorsal-rib parts in the half-carcasses of Hereford bulls was

24.1 kg and 33.5 kg and was greater than that of peers by 0.30 – 0.4 kg (1.2 – 1.7%; P<0.95) and 0.9 kg (2.7%; P<0.95).

In the hip part of the half-carcass, the pulp was contained more in Hereford bulls: it amounted to 42.2 kg against 40.9 kg in peers of the Kazakh white-headed. Meanwhile, its relative content in all anatomical parts of the half-carcass was large in Kazakh white-headed bulls.

Thus, the analysis of the morphological composition of the carcasses revealed that the pulp content was high in the Hereford bulls, the peers of the Aberdeen-Angus breed were slightly inferior to them, and the Kazakh white-headed bulls had a lower content.

Determination of the chemical composition of meat and the ratio of its structural components of protein and fat allows you to identify its value as a food product. A large proportion of dry matter was detected in the meat of Kazakh white-headed bulls: the difference in their favor compared to their peers was 2.99 – 3.75% (Table 5).

Table 4 – Ratio of anatomical parts in the half-carcasses of bulls, ($X \pm m_x$)

Part of the half – carcass	Genotype		
	AA	KB	GF
Neck, kg	16.3±0.27	15.3±0.19	16.6±0.27
To the mass of the half – carcass, %	10.4	10.3	10.4
Shoulder-shoulder blade, kg	30.2±0.58	29.3±0.77	30.7±0.37
To the mass of the half – carcass, %	19.3	19.7	19.2
Dorso – costal, kg	42.7±0.37	40.3±0.67	42.7±0.17
To the mass of the half – carcass, %	27.3	27.1	26.8
Lumbar, kg	15.1±0.2	14.3±0.33	14.8±0.08
To the mass of the half – carcass, %	9.6	9.6	9.3
Hip, kg	53.1±0.97	50.6±0.73	53.8±1.78
To the mass of the half – carcass, %	33.9	34.1	33.7

Table 5 – Chemical composition of the average sample of minced meat, %

Indicator	Genotype		
	AA	KB	GF
Moisture	67.91±1.33	64.92±1.22	68.65±0.81
Dry matter	32.09±1.31	35.08±1.22	31.33±0.81
including: fat	14.21±0.43	17.91±0.42	12.21±0.26
protein	17.1±0.77	16.26±0.56	18.21±0.32
ash	0.89±0.16	0.91±0.22	0.93±0.21

In terms of dry matter content in meat, Hereford bulls were inferior to their peers due to the fact that they had less fat than Aberdeen Angus and Kazakh white-headed bulls by 2.0% (P>0.95) and 5.70% (P>0.999).

The meat of Hereford bulls contained 1.95% (P>0.95) more protein than Kazakh white-headed bulls and 1.11% (P<0.95) more protein than Aberdeen Angus bulls. Bulls of the Hereford breed deposited more protein in the carcass than fat, the reverse pattern was revealed in Kazakh white-headed bulls, therefore, the ratio of protein and fat in animals of different genotypes was not the same. So, in the bulls of the Aberdeen-Angus breed, it was 1:0.83; in the Kazakh white-headed – 1 : 1.1; in the Hereford 1 : 0.67. The Hereford

bulls were characterized by the most optimal ratio of the studied values, however, the meat of Kazakh white-headed bulls was the most preferred for the modern consumer.

The determination of the maturity (ripeness) of meat by the ratio of moisture and fat allowed us to determine that the meat of Kazakh white-headed bulls was more fat – the coefficient was 27.6%, compared to 20.9 and 17.8% in Aberdeen-Angus and Hereford individuals.

Meat precocity was determined by the degree of "maturity" of meat, which was determined by the ratio of water and fat. The meat of Kazakh white-headed bulls was distinguished by a high rate of precocity of 0.54, compared to 0.47 and 0.46 in peers of Aberdeen-Angus and Hereford.

The protein content in 1 kg of pulp in Aberdeen Angus and Hereford bulls was higher than in Kazakh white-headed individuals by 7.3-19.3 g (4.3 – 10.6%), and fat was less by 37.2-57.2 g (20.7 – 31.9%) (Table 6).

Kazakh white-headed bulls had more fat in 1 kg of pulp than protein by 10.1%, while Aberdeen Angus and Hereford bulls had more protein than fat by 19.7 – 49.1%. Therefore, the energy of the Kazakh white-headed breed animals was enclosed in 1 kg of pulp by 1287 – 1789 kJ more than that of their peers. The energy in the flesh of the carcass is less in Hereford bulls: they were inferior to Aberdeen-Angus by 114 MJ and Kazakh white-headed animals by 327 MJ. The energy value of the anatomical parts of the half-carcass was greater in Kazakh white-headed bulls. Thus, the highest energy content in the pulp was found in the hip part, while in Kazakh white-headed bulls it was 464.7 MJ, compared to 429.7 and 408.9 MJ in peers of Aberdeen-Angus and Hereford. The pulp of the neck part of the half-carcasses of Hereford bulls contains 125.9 MJ of energy, shoulder-scapular – 219.9, dorsal-rib – 301.3 and lumbar – 115.2 MJ, which is less than that of peers of the Kazakh white-headed by 15.5 MJ, 33.4, 40.8 and 18.1 MJ, respectively.

Table 6 – Nutrient yield and energy value of the meat part of the carcass

Genotype	It is contained in 1 kg of pulp		Enclosed in 1 kg of pulp energy, kJ	Including energy, kJ		Total energy in the pulp of the carcass, MJ
	protein	fat		protein	fat	
AA	170.1	142.1	9611	4028	5582	2458
KB	162.8	179.3	10898	3857	7044	2671
GF	182.1	122.1	9109	4312	4796	2344

Consequently, the higher fat content in the flesh of the half-carcasses of Kazakh white-headed bulls contributed to a significant advantage in the energy value of the pulp compared to their peers.

Analysis of the biochemical composition of the muscles revealed intergroup differences. Thus, the moisture in the lt65ongest back muscle of Kazakh white–headed and Hereford bulls contained 0.04 – 0.2% more than that of Aberdeen Angus (Table 7).

Table 7 – Chemical composition of the longest back muscle of bulls, %

Indicator	Genotype		
	AA	KB	GF
Moisture	77.39±0.27	77.43±0.33	77.59±0.83
Dry matter	22.62±0.27	22.57±0.33	22.43±0.83
including: fat	2.0±0.13	2.32±0.27	1.33±0.26
protein	19.92±0.21	19.22±0.59	20.31±0.39
ash	0.71±0.13	1.01±0.22	0.79±0.29

In terms of dry matter content, Hereford bulls were slightly inferior to their peers by 0.14-0.19%. However, the protein in the dry matter of the longest muscle in Hereford bulls contained 1.09% more than in Kazakh white-headed individuals, but in terms of fat content they were inferior to them by 0.99%.

It is known that the equilibrium of acids and bases in a living organism finds its expression in the concentration of hydrogen ions. At a low pH value, the maturation processes proceed more intensively, the meat acquires a delicate consistency, a pleasant taste and aroma is formed in it, digestibility increases.

The content of essential and non-essential amino acids in animals of different genotypes was not the same. The Hereford bulls were distinguished by a high content of tryptophan and oxyproline in the muscles. The advantage over peers was, respectively, 17.3-29.4 mg% and 0.6-1.1mg%, respectively (Table 8).

Table 8 – Biochemical value and physico-chemical parameters of the longest back muscle, $(X \pm m_x)$

Indicator	Genotype		
	AA	KB	GF
Tryptophan, mg%	352.3±5.82	340.2±4.97	369.6±2.32
Oxyproline. mg%	57.7±1.43	57.2±1.62	58.3± 1.83
Protein quality indicator	6.11±0.11	5.8±0.13	6.4±0.19
pH	5.8±0.71	5.6±0.21	5.7±0.26
Value	320.1±3.21	305.1±10.43	325.1±6.08
Moisture capacity	58.3±3.61	55.3±3.13	57.4±3.57

The established differences in the content of amino acids in the studied animals influenced the value of the protein quality index. Its value in Hereford bulls was 6.4, which is 0.29 – 0.6 more than in peers.

The suitability of meat for culinary processing, its presentation is determined by the concentration of hydrogen ions (pH). The meat of bulls of all experimental groups had an optimal pH value of 5.6 – 5.8, which indicates its good quality.

The moisture content of the meat of all the animals studied was at a good level, which determined its juiciness, to some extent, tenderness.

The nutritional value of the pulp part of the carcass and its taste qualities are significantly influenced by the physico-chemical composition of the internal raw fat.

The Hereford bulls were distinguished by a high moisture content in the internal fat, their advantage over their peers was 0.7 – 2.81% (Table 9).

Meanwhile, the Kazakh white-headed bulls were characterized by a high dry matter content of 91.42%, which is 2.79% more than the peers of the Hereford breed. The greater amount of dry matter in the internal fat of Kazakh white-headed bulls is due to the advantage in fat content compared to peers of Aberdeen-Angus and Hereford: it was 2.37% and 3.4%.

Table 9 – Physical and chemical parameters of the internal raw fat, $(X \pm m_x)$

Indicator	Genotype		
	AA	KB	GF
Moisture, %	10.69±0.67	8.58±1.56	11.39±0.96
Dry matter, %	89.33±0.65	91.42±1.56	88.63±0.96
Fat, %	87.26±0.52	89.63±1.33	86.23±0.96
Protein, %	1.91±0.22	1.63±0.29	2.17±0.29
Ash, %	0.16±0.03	0.17±0.03	0.21±0.04

Table continuation

Indicator	Genotype		
	AA	KB	GF
Iodine number	27.1±1.54	25.9±2.21	27.3±1.58
Melting temperature	45.9±1.12	47.3±1.22	45.6±0.81

The protein content of Hereford bulls was higher than that of analogues by 0.26 – 0.54%.

The iodine number reflects the amount of unsaturated fatty acids; its value was different for different genotypes. The smaller studied indicator was for Kazakh white-headed bulls; the advantage of peers was 1.2 – 1.4%. There were no special differences in the melting temperature, and, consequently, in the digestibility of animal fats. However, the bulls of the Aberdeen-Angus and Hereford breeds were inferior to the analogues of the Kazakh white-headed by 1.4 – 1.7 ° C.

Conclusions

Thus, the chemical analysis of the meat of bulls of different genotypes indicates that the carcasses of Hereford bulls were characterized by a high protein content, and the young Kazakh white–headed bulls were characterized by a high fat content. Accordingly, the flesh of their carcasses was distinguished by a greater energy value.

The mass of the paired carcass was greater in Hereford bulls – 318 kg, in Aberdeen-Angus and Kazakh white-headed – 315 and 302 kg, the carcass yield was 57.1%, the advantage over peers was 0.2 – 0.8%, in terms of the content of pulp in the carcass and protein in the average sample of minced meat it was 0.8 – 3.9% and 1.11 – 1.95%. However, they had less fat in the carcass than their counterparts by 6.7 – 17.9%.

Conflict of interest

All authors are familiar with the content of the article and have no conflict of interest.

References

1. Vershinin V.A. Economic and biological features and meat qualities of Kazakh white-headed bulls of different genotypes. Abstract of the dissertation of the academic degree of Candidate of Agricultural Sciences / V.A. Vershinin. – Volgograd, 2001. – 25 s.(rus).

2. Isentaev D.A. Meat productivity of Hereford bulls of different intrabreed types. Abstract of the dissertation of the academic degree of Candidate of Agricultural Sciences // D.A. Isentaev, All-Russian Scient.Research Inst.of Metr.Service. – Orenburg, 2002. – 25 p. (rus).

3. Isentaev D.A. Studying the development of meat production of animals of the Hereford breed // Scientific and practical aspects of increasing agricultural production // Materials of the All-Russian Scientific and practical conference. – Orenburg, All-Russian Scient.Research Inst.of Metr.Service – 2004. – P. 57. (rus).

4. Skollan N., Hockett J.-F., Nuremberg K., Dannenberger D., Richardson I., Moloney A. Innovations in beef production systems that increase the nutritional and health value of beef lipids and their relationship to meat quality Meat Science , 74 (1) (2006) , pp. 17-33.

5. Problems of livestock sector development in Kazakhstan (Issues in the Development of the Livestock Sector in Kazakhstan) S.Tazhibaev, K.Musabekov, A.Yesbolova, S.Ibraimova, A.Mergenbayeva, Zh.Sabdenova, M.Seidahmetov. Procedia – Soc. and Behav.Sciences 143 (2014), Pp. 610-614.

6. Nurgazy K., Iskakova Z. Gabit G. Selection and Genetic Aspects of Beef Cattle Breed Improvement in Southeast Regions of Kazakhstan. International Journal of advanced biotechnology and research 8, pp. 705-719 (2017).

7. Razook A.G., Figueiredo L.A., Nardon R.F., Goncalves J.N.S., Ruggieri A.C. Efeitos de raca e da selecao para peso pos-desmame sobre caracteristicas de confinamento e de carcaca da 15ª progenie dos rebanhos Zebu e Caracu de Sertaozinho (SR) Rev. Bras. Zootec., 30 (2001), pp. 115-124.

8. Hickson R.E., Kenyon P.R., Morris S.T. Breed effects and heterosis for productivity traits at first calving of Angus, Holstein Friesian, Jersey and crossbred beef cows Animal Production Science, 54 (2014), pp. 1381-1387

9. Field T.G. Beef Production and management solutions Pearson Education Inc., Upper Saddle River (2007).

10. Caetanoa S.L., Savegnagoa R.P., Boligona A.A., Ramosa S.B., Chuda T.C., Lôbob R.B., Muna D.P. Livestock Science Journal July 2013, Pages 2.

11. Pritchard T.C., Wall E., Coffey M.P. Genetic parameters for carcase measurements and age at slaughter in commercial cattle. The international journal of animal biosciences. Animal 15 (2021) 100090. pp 1-7.

12. Khayatzadeh N., Meszaros G., Utsunomiya Y., Schmitz-Hsu F., Seefried F., Schnyder U., Ferencakovic M., Garcia J.F., Curik I. and Solkner J. Genome – wide mapping of the dominance effects based on breed ancestry for semen traits in admixed Swiss Fleckvieh bulls. Amerikan Dairy Association, journal of Science Volume 102 N. 12, 2019, Pages 11217-11224.

13. Gutkin S.S. Evaluation of bioconversion of protein and feed energy into food protein and energy of meat products in young cattle/S.S. Gutkin, V.G. Volodina, F.H. Sirazetdinov //Agricultural biology. – 2002 No. 6. – Pp. 119-124.

14. Rykov A.I. Scientific and practical aspects of improving the productive qualities of young cattle in beef cattle breeding in Western Siberia: abstract of the dissertation of the Doctor of agricultural Sciences / A.I. Rykov. – Siberian Research and Design-Tech. Institute of Animal Husbandry of the Siberian Federal Sci.Cent. of Agrobiotech. of the Rus.Acad.of Sci. – Novosibirsk, 2003. – 52 p.

15. Bekenev V.A. The necessity of selective transformation of animal husbandry / V.A. Bekenev // Zootechnia. – 2008. – No.4. – Pp. 3-7.

16. Dedov M.D. Breeding work in cattle breeding in modern conditions / M.D. Dedov, N.V. Sivkin // Zootechnia. – 2002. – No.11. – P. 2.

17. Bagriy B. A. Production of high-quality beef / B.A. Bagriy // Zootechniya. – 2001. – No.2. – Pp. 23-26.

18. Bashirov V.D. The influence of the technology of keeping young Simmental breed on its quality indicators of meat / V.D. Bashirov // Materials of Sci. and pract.conf. – Vol. 56: – M. Publishing house "Bulletin of the Rus.Academy of Agri.sciences". – 2003. – Pp. 165-168.

19. Vorobyova S.V. Influence of the quality of protein and fiber of feed on digestion in bulls /S.V. Vorobyova, V.A. Devyatkin, V. Shabanov // Zootechniya. – 2001. – No. 12. – Pp. 9-11.

20. Miroshnikov S.A. Assessment of the balance of feeding according to the coefficient of conformity / S.A. Miroshnikov // Zootechniya. – 2001. – No. 6. – Pp. 18-20.

21. Stepanovsky A.S. Productive qualities of young cattle depending on the types of feeding // Problems of animal science. – Orenburg, 2003 – Pp. 149-153.

22. Ragimov G.I. Growth and development of Hereford bulls depending on different types of feeding/G.I. Ragimov // Socio-econ., polit. and econ.problems in agri. in Russia and the CIS countries: History and modernity. Mat.of the int.symposium. – Orenburg, 2004. – Pp. 230-235.

23. Sidorovich M. Influence, technologies on the adaptation of calves in the prophylactic period /M. Sidorovich // Dairy and meat cattle breeding. – 2003. – No. 5 – From 12-14.

24. Prokhorenko, P.N. Methods of creating highly productive dairy herds /P.N. Prokhorenko // Zootechnia. – 2001. – No. 11. – Pp. 2-6.

25. Levakhin V.I. The influence of various factors of meat cattle breeding technology on the safety, productivity and reproduction of animals / V.I. Levakhin // Beef cattle breeding and prospects for its development. – Collection of scientific works of the All-Rus.Sci. Res. Ins. of Metr.Service – 2000. – Pp. 172-177.

26. Izhboldina S.N. Beef production technology in dairy cattle breeding of the Udmurt Republic /S.N. Izhboldina // Vestn. myasn: cattle breeding. – Materials of the Scientific and practical conference – Ross Academy of Agricultural Sciences, All-Russian Res. Inst.of Metr. Service. – M., 2003. – No. 56. – Pp. 96-101.

27. Yusupov R.S. Scientific and practical justification of the rational use of the productive potential of cattle, taking into account the bioconversion of nutrients in the system "Soil-Plant- Animal": Abstract of the dissert.of the Doctor of agri.sciences / R.S. Yusupov. – Orenburg: Agro University, Orenburg, 2004. – 45 s.