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The Effect of Different Body Conformation Types on Beef Quality in Young Bulls

Kinispay M. Dzhulamanov[1], Marina P. Dubovskova[1], Nikolay P. Gerasimov[1] & Gulzhan N. Urynbaeva[2]

[1] All-Russian Research Institute of Beef Cattle Breeding, Department of Scientific and Technical Information, Russian Federation

[2] Aktyubinsk Institute named S.Baisheva, Kazahstan Republic

Correspondence: Kinispay M. Dzhulamanov, All-Russian Research Institute of Beef Cattle Breeding, Department of Scientific and Technical Information, 460000, Russian Federation. Tel: 7-35-3277-4641. Fax: 7-35-3277-4641. E-mail: nick.gerasimov@rambler.ru

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Abstract

The chemical composition analysis of average meat samples and M. longissimus dorsi testify that the greatest nutrients variability characterizes fat, the protein and mineral substances of carcasses edible part possess relative stability. In the study of qualitative structure of slaughter products the general regularity was revealed – increase of dry matter and fat contents and decrease in moisture with age. The process of fat deposition in the pulp of carcasses of compact body type genotypes was more intensive. That led to the maximum size (38,04%) of dry matter contents. Intensive accumulation of adipose tissue in compact body conformation group of bull-calves already had began with one-year-old age and to 15-month age the protein and fat ratio reached 1:0,65. At the age of 21 months tall animals were the best protein and fat ratio: they had ratio 1:0.83 instead 1:1.28 and 1:0.99 at compact and the medium contemporaries. Compact bull-calves had the highest of a forage's protein and energy expenses into own body nutrients, the smallest had tall contemporaries.

Keywords: beef, body conformation, bulls, chemical composition, Hereford, protein and energy conversion rate

1. Introduction

Efforts of breeders are directed on research of management ways by processes of beef productivity formation of young growth cattle, changing it quantitatively and qualitatively. Reproduction and cultivation of the animals responding to intensive feeding better growth of muscular tissue with moderate fat accumulation are the perspective directions of breeding work (Spears, 1996).

Beef productivity and quality are determined by number of intrinsic (breed, genotype, gender, body conformation and slaughtering age) and extrinsic factors (feeding system, climate, transport, slaughter and post-slaughter conditions, etc.) (Klont et al., 1998; Renand et al., 2001).

It was established that beef quality of fattened animals, in particular its chemical composition, depends on a various of factors among which a certain part is assigned to a genotype . Breeding of high-valuable animals allows transforming forage nutrients into beef cattle production nutrients effectively. At the same time beef usefulness in food relation judging on the ratio of nutrients.

Beef quality are also determined by the histological and chemical parameters of the muscles (Ouali, 1990; Monin and Ouali, 1991; Klont et al., 1998; Vestergaard et al., 2000).

Body conformation has also a significant effect on fattening performance and quality of carcass traits (Koknaroglu and Hoffman, 2010). A system of external linear measurements provides an assessment of maturity and body proportions and type (Bene et al., 2007). Height at either rump or withers has limited value as an indicator of weight traits, and insignificant value as an indicator of cattle function (Alderson, 1999).

The objective of this work was the assessment of beef quality and efficiency of forage bioconversion in beef main nutrients of different constitution types Herefords young bulls.

2. Materials and Methods

The research material comprised Hereford bull-calves. Experiment was conducted in "Amurskoe" breeding farm,

Chelyabinsk region, Russian Federation. Based on their height at sacrum, the one hundred and twenty animals were divided according to the three body conformation types namely: the 1st – compact (n=40), the 2nd – a medium (n=40), the 3rd – tall (n=40) (Table 1).

Weaned young bulls (7-8 months) were placed under feedlot conditions for a period until slaughter. The young bulls were housed in small pens holding ten-fifteen animals each equipped with drinkers and feed-bunks. The animal within the body conformation types were allocated to their respective pens. Bull-calves were weighted monthly health observations were made.

Table 1. Average height at sacrum of bulls with different body conformation

Body conformation	Age, months			
	12	15	18	21
Compact	111.8	116.5	119.0	120.5
Medium	115.0	121.5	123.0	125.0
Tall	119.0	125.0	129.5	131.0

Ten animals from each group were slaughtered at the age of 12, 15, 18 and 21 months. After slaughter the carcasses were dressed, halved into left and right half-carcasses, chilled for 24 h at a temperature of around 4°C and weighted. The average sample of meat and M. longissimus dorsi were collected from each right half-carcasses to evaluate the chemical composition of meat products. Samples of M. longissimus dorsi were collected between the 11th and 13th thoracic vertebrae. The evaluation of chemical composition was based on moisture, dry matter, fat, protein and mineral substances determination according to AOAC Methods (AOAC, 2002).

Nutritional value of meat products determined by the content of tryptophan and hydroxy-proline amino acids and their ratio (protein qualitative indicator). This method allows the ratio of muscle proteins and proteins of connective tissue setting. The yield of nutrients in carcasses was calculated according the chemical composition of the average samples of meat and carcasses weight. The energy value (EV) was evaluated by:

$$EV=(4.1*P+9.3*F)*4.1868/1000$$

where:

P – protein content, g

F – fat content, g

Feed protein and energy conversion in dietary protein and energy were calculated according All-Russian Academy of Agricultural Sciences, All-Russian Institute of Animal Sciences and All-Russian Research Institute of Beef Cattle Breeding methods (1983).

The data of chemical composition were processed to analysis of variance with the use of Statistica 9.0 software (Statsoft Inc., 2009) with the three body conformation types (compact, medium and tall) and four ageing periods (12, 15, 18 and 21 months). Differences between means were calculated using Tukey's test at the 5% level of probability.

3. Results and Discussion

Food and nutritional characteristics of beef are more fully defined with its chemical composition (Table 2). With age of animals dry matter content increases and moisture reduces in average sample of meat. Analysis of dry matter gain dynamics by age periods attests that waveform changes in the growth intensity of this indicator of all groups of young cattle were observed.

Life period of young cattle of all genotypes from 15 to 18 months differed by relatively high dry matter gain in meat. Thus, the increase of the studied indicator in an average meat sample of young cattle of first group was 5.60%, second – 3.01 and third – 4.87%. Moreover, in comparison with other age periods the intense growth of dry matter in meat of bulls with compact conformation of this period was the highest.

In the final period of intensive rearing, despite the high level of feeding, rate of accumulation of dry matter in meat of young animals of all genotypes decreased.

In general, animals with compact conformation by 21-month age had the highest gain in dry matter (8.79 % versus 7.41-7.51).

Specifically when considering the dynamics of dry matter in average meat sample, generally, tall bulls in all cases were inferior in value of this indicator to that of compact animals. Animals of first group were characterized by the maximum value of the studied parameter, animals of the same age of second group occupied an intermediate position in all age periods, due to higher maturing rate of compact young cattle than that of animals with average size and tall. Thus , the advantage of compact animals over animals of the same age with two other genotypes according to specific weight of dry matter content in meat obtained from animals of 1-year age was 1.83-4.72%, in 15 months – 1.36-5.25 %, 18 months – 3.35-5.98 %, in 21 months – 3.21-6.00 %. These differences are due to different degrees of fat accretion in the body of animals in experimental groups.

Protein content in meat of 12-month animals of different conformation was stable. However, the changes were more evident with age in the group of animals with compact body type. Decrease in proportion of protein in average sample of meat from 1-year compact animals to the end of experiment was 3.00 %, having medium - 2.80 % and tall animals - 1.09 %. Consequently, during the final period of rearing there is differentiation: tall bulls will have the advantage by value of this indicator. So, the difference in their favor in comparison with animals of the same age obtained from compact and medium parents was 0.95-1.65 %.

Table 2. Chemical composition of average sample of meat, % (X±Sx)

Indicator	Group	Age, months			
		12	15	18	21
Moisture	I	70,75±0,19	70,47±0,29	64,87±0,55	61,96±0,19
	II	72,58±0,20	71,83±0,88	68,22±1,48	65,17±0,15
	III	75,47±0,25	75,72±0,26	70,85±2,22	67,96±0,40
Dry matter	I	29,25±0,19	29,53±0,29	35,13±0,55	38,04±0,20
	II	27,42±0,20	28,17±0,88	31,78±1,48	34,83±0,15
	III	24,53±0,25	24,28±0,26	29,15±2,22	32,04±0,40
including:					
fat	I	8,98±0,43	11,23±0,41	17,58±0,68	20,88±0,60
	II	6,64±0,73	9,19±0,18	13,53±1,47	16,96±0,60
	III	4,56±0,80	5,38±0,24	9,87±2,28	13,24±0,68
protein	I	19,32±0,50	17,36±0,41	16,71±0,51	16,32±0,50
	II	19,82±0,75	18,03±0,18	17,39±0,12	17,02±0,57
	III	19,06±0,57	18,00±0,09	18,38±0,11	17,97±0,96
ash	I	0,95±0,02	0,94±0,003	0,84±0,020	0,84±0,010
	II	0,96±0,01	0,95±0,010	0,86±0,013	0,85±0,020
	III	0,91±0,02	0,90±0,000	0,90±0,020	0,86±0,040

Meat quality was to some extent characterized by correlation of protein and fat. Compact bulls started intensive fat accumulation from 1-year age and up to 15-month age relation of protein and fat reached 1:0.65, and from18-month age excess of fat was observed. It was characteristic that young cattle of all groups grew fat with advancing age more intensively.

The optimal proportions of protein and fat of bulls with medium and tall body types was observed in 18 months. At the age of 21 months tall animals were the best by this indicator: they had ratio 1:0.83 instead of 1:1.28 of compact bulls and 1:0.99 - of calves from the parents of medium type.

From all groups of animals meat was satisfactory by mineral composition. Calcium content in meat was at the level 0.12 and phosphorus from 2.91 to 3.13 mg%. At the same time meat of progeny from tall parents in 21-month age differed somehow by better mineral composition.

It is known that the ratio of moisture and fat in average meat sample of carcass is characterized by precocity of meat. Received data demonstrate certain inbreed differences by this indicator. So, if optimal value (20%) of meat precocity of compact bulls was established in 15 or 16-month age, then medium animals - in 18 months, then tall animals had it only at the end of rearing. Because of relative precocity of compact bulls it is recommended to grow them up to 15-month age, medium animals - to 18 months and tall type - up to 21 months of age.

It is well-known that meat quality is defined by chemical composition of muscular tissue, proportion of which is more than 70% of carcass weight. That is why during complex assessment of meat with due regard to its qualitative indices the important significance is given to the study of the chemical composition of M.

longissimus dorsi.

The obtained data attest to the fact that character of changing some components of M. longissimus dorsi by genotypes is similar to the same in average sample of meat (Table 3). Comparison of chemical composition of this muscle with average index of carcass meat makes it possible to note that moisture content in average meat sample is low than in rib eye. With increase of fat content quality of muscular tissue enhances, but ratio between fat quantity in average meat sample and in M. longissimus dorsi significantly fluctuate.

Table 3. Chemical composition of M. longissimus dorsi, % (X±Sx)

Indicator															
Dry matter				including											
				fat				protein				ash			
Age, month															
12	15	18	21	12	15	18	21	12	15	18	21	12	15	18	21
I group															
23,46±	23,62±	24,69±	25,55±	1,81±	2,09±	3,52±	4,53±	20,68±	20,55±	20,21±	20,08±	0,97±	0,98±	0,96±	0,94±
0,509	0,306	0,452	0,449	0,130	0,092	0,110	0,135	0,070	0,098	0,096	0,069	0,011	0,013	0,029	0,006
II group															
23,32±	23,27±	23,89±	25,20±	1,52±	1,88±	2,58±	4,06±	20,82±	20,41±	20,34±	20,20±	0,98±	0,98±	0,97±	0,94±
0,408	0,438	0,504	0,408	0,070	0,082	0,140	0,085	0,060	0,038	0,023	0,096	0,010	0,008	0,016	0,008
III group															
23,36±	24,03±	24,13±	24,61±	1,32±	1,69±	2,01±	3,30±	21,06±	21,35±	21,14±	20,36±	0,98±	0,99±	0,98±	0,95±
0,070	0,568	0,510	0,509	0,101	0,097	0,146	0,204	0,433	0,288	0,158	0,113	0,009	0,008	0,018	0,009

With slaughter in 12 months difference in quality of intramuscular fat was in favor of compact bulls in comparison with animals of the same age obtained from tall and medium parents and was 0.49% ($P<0.05$) and 0.29 ($P>0.05$). Established group differences in adipose tissue content in all compared cases remained the same with 15-month genotypes. However, according to weight ratio of fat in muscles, it shall be noted that young cattle with all body types during last two periods of final rearing had more intensive fat accumulation. So, increase of intramuscular fat accumulation of compact bulls was in periods from 15-18 months – 1.43%, 18-21 months – 1.01%. At the same time increase of similar animals from tall and medium genotypes in stated periods were 0.32; 1.29% and 0.70; 1.48% accordingly. Such variability in intramuscular fat accumulation defined significant differences between groups according to the studied index. So, 18-month compact animals advanced over medium and tall animals of the same age by 0.94% ($P<0.01$) and 1.51% ($P<0.01$), and animals of third group, in its turn, was less than that of animals of second group by 0.57% ($P<0.05$).

Decrease in rate of intramuscular fat accumulation in final period of fattening (21 months) of compact young animals was determined by the fact that it reached optimal level in previous age period. And vice versa, medium and tall genotypes in the analyzed period were characterized by highest growth intensity of this index in comparison with other periods of rearing.

With age protein content in M. longissimus dorsi changed. At the same time these changes were insignificant and doubtful. However, the general rule is to reduce the protein in the meat in bulls of all body types with age.

The ash content in meat of animals with various exterior peculiarities remained at the same level, tall bulls had a slight excess of it.

Considering the fact that quality of some proteins in muscle tissue has significant influence on nutritional value of meat products, we determined the content of amino acids tryptophan and hydroxy-proline and their ratio (protein qualitative indicator). This method allows us to set the ratio of muscle proteins and proteins of connective tissue. It is known that all muscle proteins contain tryptophan, which is lacking in connective tissue. However, collagen contains up to 14% of dispensable amino acid – hydroxy-proline which is lacking in complete meat proteins.

Analysis of the obtained data shows that the amino acid content in M. longissimus dorsi was quite high in all age of slaughter. At the same time there was an increase in concentration with age. Moreover, the process of accumulation of essential amino acid in muscle tissue was more intensive than the increase in the content of non-essential amino acid.

Consequently, the increase of protein qualitative indicator with age was observed. Value of this parameter in all cases was above six, which attested to a high biological value of meat products obtained at slaughter of animals with different conformation.

It is known that meat storage stability to a large extent is due to the concentration of free hydrogen ions (pH). Meat obtained after slaughter of young cattle with different genotypes was characterized by an optimal level of studied indicators of animals with all types of conformation. Compact bulls had slightly lower value, especially at the final slaughter.

One of the reserves to increase production of dietary protein is to increase the transformation of energy and protein in dietary protein. The study of this process, depending on the type of animal conformation is of considerable interest.

It is typical that deceleration of protein synthesis occurred in organisms of bulls of all ages, fat deposition enhanced simultaneously. And one-year animals obtained from their parents of compact type have already started intense fat deposition. Up to 18-month age these animals had more fat in 1 kg of carcass flesh, than protein by 5.2%, at the same time young cattle of second and third groups had more protein than fat by 28.1 and 79.2% (Table 4).

Obtained data let us to analyze changes in concentration of protein of animals with different genotypes with age. More protein was synthesized in meat of tall bulls. Content of protein in 1 kg of carcass flesh was higher, than that of animals of second and first groups by 3.3-10.1 g in 18 months of age and 9.2-16.2 in 21 months, that relative terms was 1.9-6.0 and 5.4-9.9%.

Quite rapid increase in later age periods of fat in the carcass with simultaneous reduction of protein synthesis in organisms of tall bulls does not influence on high ability to accumulate dietary protein indicating that their late precocity in comparison with the progeny from compact and medium animals. This once again proves that Hereford tall bulls may accumulate optimum amount of dietary protein in meat up to 21 months of age during appropriate intensive rearing.

Different content of protein and fat in the flesh of carcasses of bulls with different body types influenced the energy value of meat. At the same time increase of studied index was observed with age. So, in the period from 12 months of age up to the final slaughter energy value of 1 kg of meat from compact bulls increased up to 4118 kJ (60.4%), from medium bulls - to 3537 kJ (59.1%) and tall bulls - 3193 kJ (63.3%). Moreover, in all ages of slaughter young compact cattle had maximum value of the energy content in meat (Figure 1).

Table 4. Yield of nutrients and energy value of fleshy part of carcasses of calves by age periods

Group	Age, months	Content in 1 kg of flesh, g		Energy content in 1 kg of flesh, kJ			Total energy in flesh of carcass, mJ
		protein	fat	total	Incl. energy		
					protein	fat	
I	12	193,2	89,9	6813	3316	3497	1292,4
	15	173,6	112,3	7353	2980	4373	1810,5
	18	167,1	175,8	9713	2868	6845	2611,3
	21	163,2	208,8	10931	2802	8130	3126,0
II	12	198,2	66,1	5988	3402	2586	1180,8
	15	180,3	71,6	6673	3095	3578	1694,3
	18	173,9	135,3	8253	2985	5268	2376,6
	21	170,2	169,6	9525	2922	6603	2930,5
III	12	190,6	45,6	5047	3272	1775	1051,1
	15	180,0	53,8	5185	3090	2095	1437,0
	18	177,2	98,7	6998	3155	3843	2188,6
	21	179,4	132,4	8240	3085	5155	2761,8

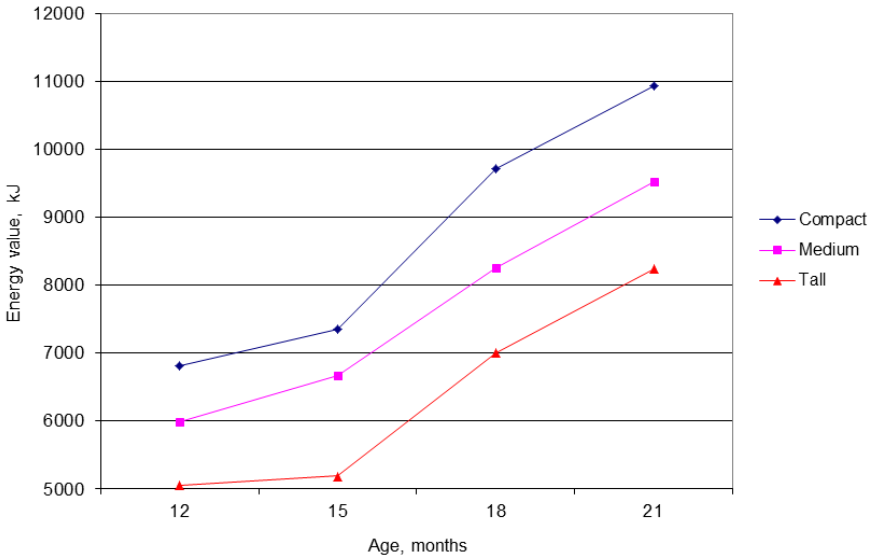

Figure 1. Changes in energy content in 1 kg of flesh, kJ

Content of adipose tissue influenced on its absolute advantage by this indicator from components of meat that is confirmed by the largest amount of its energy value. At the same time, the modern consumer fearing excess energy in the diet, prefer more lean beef.

Bulls obtained from medium and tall parents rather than from compact animals were characterized with more optimal dynamics of this index that was typical for full-value meat production beginning from 18-month age of animals.

Our researchers found out that experimental animals consumed different quantity of protein and fodder energy for 1 kg live weight gain (Table 4). Besides, increase of studied indicator with age was observed. So, increase in consumption of fodder protein for unit of weight gain from12 months up to slaughter of compact bulls was 240 g (26.5%), energy – 18,14 MJ (28.4%), of medium animals – 192 g (20.7%) and 17,06 MJ (26.2%) and of tall animals – 144 g (15.6%) and 13.63 MJ (21.2%).

It is well-known that the absolute yield of protein and fat in body of animal at large determines the characteristics of their synthesis during a given period of postnatal ontogenesis. Calculations show that Hereford cattle of different body types produced different amounts of essential nutrients in body. Thus, the content of dietary protein at 12 months in a body of tall cattle is two, three times higher than the yield of dietary fat, while compact and medium tall types is 1.5:1 and 1.8:1.

At age of 15 months proportions of protein and fat content in body decreased significantly in the first two genotypes. At the same time first group of bulls had protein content in the body that exceeded fat yield only by 15.7% in second - 69.8 %, and group third there was a slight decrease in the studied parameter.

In later (18 and 21 months) age periods in almost all groups of calves and connected with intensification of the process of fat deposition in body, except for tall animals, fat content in body exceeded protein content.

At the same time compact animals in comparison with medium animals had more intense buildup of adipose tissue. Bulls from tall parents had the least fat content with maximum protein content. At the same time the animals of second group occupied an intermediate position by gross output of protein and fat. Suffice to say that at slaughter compact bulls had fat-protein ratio of absolute indices in body 1.62:1, medium bulls – 1.26:1 and tall - ratio of 0.94:1. Data of growth of absolute weight of fat and protein are illustrative. Thus, if protein in bodies of experimental animals from 12 to 21 months increased for 36-60%, and the accumulation of adipose tissue with age increased more than three times.

A somehow different pattern is set by the output of protein, fat and energy in 1 kg of slaughter weight. The value of indicators of fat and energy of bulls of all genotypes increased with age, and proteins varied slightly, with variable increase or, vice versa, decrease of parameters. Thus, the reduction in the yield of protein of bulls with compact body type from 12 to 21 months was 10.1 %, of medium animals - 5.2% and tall - 2.1%, increase in the

yield of fat was 221, 213 and 224 % respectively. Energy yield per 1 kg of pre-slaughter live weight during this period increased in the progeny of compact parents by 2.87 MJ (58.6%), medium - 2.28 MJ (51.6%) and among the sons of tall parents - 1.90 MJ (48.1%).

Established character of nutrients accumulation in the body of calves of different body conformation types had an impact on dynamics of the conversion rate of feed protein and energy in dietary protein and energy of body. At the same time for the whole period young cattle from tall parents was characterized by better ability to transform feed protein into protein of body. Moreover, animals of third group at slaughter went over compact animals of the same age by this indicator by 2.13% and medium tall animals – by 0.71% (Table 5).

With age protein conversion rate decreased in all animals and fat conversion rate increased. So, decrease of protein conversion rate in period from 12 to 21 months in compact bulls was 4.14%, in medium animals – 2.02% and tall animals – 1.39%.

During the assessment of efficient conversion of metabolizable energy it was found out that with age its rate in animals of all groups increased, which in its turn was caused mainly by the accumulation of fat in the body of bulls in comparison with protein.

Analysis of facts more generally shows that tall bulls in all age periods had minimum value of this indicator. So, one-year bulls were inferior to the first group by 1,56%, second group - 0.68% in the 15 months of age, respectively, 1.82 and 0.58%, in 18 months - 2.11 and 0 89% in 21 months - 1.23 and 0.70%.

4. Discussion

In beef cattle breeds, live weight is largely the result of body size at maturity, productive type, and growth rate (Chambaz et al., 2003; Albertí et al., 2005). Visual muscularity and skeletal scores and also measurements are useful as early predictor of productive traits in breed classification (Drennan et al., 2008).

Intramuscular fat in M. longissimus dorsi increases as the fattening progresses and that this increase continues up to the early 20s of month of age at least (Okumura et al, 2007).

In general, the fattening of beef cattle begins at about 10 mo of age and continues for 20 months, so it is completed at about 30 months of age (MAFF, 2000). Intramuscular fat in M. longissimus dorsi increases as the fattening progresses and that this increase continues up to the early 20s of month of age at least (Okumura, T., et al, 2007).

Table 5. Feed protein and energy conversion in dietary protein and energy

Group	Age, months	Consumed for 1 kg of live weight gain		Weight of edible parts of carcass, kg	Nutrients yield in body, kg		Yield for 1 kg of pre-slaughter live weight			Conversion ratio, %	
		protein, g	energy, mJ		protein	fat	protein, g	fat, g	energy, mJ	protein	energy
I	12	906	63,82	159,4	35,58	23,26	99	65	4,90	10,93	7,68
	15	960	66,95	210,1	41,72	36,05	92	80	5,31	9,34	7,72
	18	1066	75,26	237,6	45,43	58,20	91	117	6,75	8,30	8,69
	21	1146	81,96	258,9	48,26	78,19	89	144	7,77	6,79	8,70
II	12	928	64,98	161,6	35,42	19,68	97	54	4,42	10,23	6,80
	15	942	66,91	212,7	43,77	25,77	95	55	4,41	9,57	6,48
	18	1042	74,69	249,1	49,42	47,81	93	90	5,72	8,68	7,47
	21	1120	82,04	273,9	53,08	66,64	92	115	6,70	8,21	8,17
III	12	921	64,58	166,6	36,92	16,21	97	42	3,95	10,31	6,12
	15	932	64,97	223,0	45,78	21,86	94	44	3,96	9,67	5,90
	18	994	72,52	268,1	53,98	39,08	94	68	4,89	9,19	6,58
	21	1065	78,27	292,1	59,16	55,82	95	94	5,85	8,92	7,47

Constantly in every slaughter age of 12, 15, 18 and 21 months in beef from Hereford bull-calves of compact constitution type was more fat from 2,04 to 7,71%, than from medium and high growth types. Differences for accumulation of adipose tissue in the organism are associated with different precocity of coeval animals. Consistent with Sañudo et al. (1998) and Piedrafita et al. (2003) beef cattle with medium adult size characterized by early maturation, high fat and a low lean meat content.

Comparing our data with results of researches by Belkov, Dzhulamanov and Gerasimov (2010), Mazurovskiy,

Surundaeva and Gerasimov (2013) and other scientists who had established the high fat content in beef, we are inclined to believe that such property considerably characterizes a genotype of many cattle breeds of compact (small) constitution type.

Dubovskova (2003), Miroshnikov and Makayev (2012) indicate that efficient beef production requires an breeding work intensification and methods improvement for quality assessing of products from slaughtered animals.

Less expressed ability to obesity at early age is a positive biological feature of new high growth type of Herefords. So, protein synthesis prevails over fat in its organism at later age (18 months), and this is an opportunity to fatten up for higher weight conditions, and that more meets the modern requirements imposed to specialized beef breeds.

Among studied genotypes the best ability to transform a forage protein to food protein characterized bull-calves of high growth constitution type. Our results are confirmed by researches of Kayumov and Eremenko (2001), who noted the highest food protein yield from animals descendants of large (high growth) exterior parents.

5. Conclusion

The average sample of meat and M. longissimus dorsi chemical composition testifies to advantage of compact type of a constitution individuals on fat accumulation and dry matter yield over medium and tall analogs. Analyzed indicators level testifies to a bigger precocity of compact animals. High biological usefulness of meat is confirmed sufficiently high level of protein quality indicator M. longissimus dorsi - 6,68-7,95%. It was found that the best ability to convert feed protein into meat protein characterized bull-calves descendants from parents of tall type of a constitution. Protein conversion rate made from them in 15 months - 9.67; 18 - 9,19% and 21 months - 8.92%, and the compact and medium contemporaries, respectively, in 15 months - 9.34 and 9.57%, in 18 months - 8.30 and 8.68 %, in 21 months - 6.79 and 8.25%.

Thus, bulls-offspring from parents of tall body conformation type were characterized by the best beef qualities in the same fattening and managing conditions that must be considered in the selection process with the Hereford breed in the Southern Urals.

References

Albertí, P., Ripoll, G., Goyache, F., Lahoz, F., Olleta, J. L., Panea, B., & Sañudo, C. (2005). Carcass characterization of seven Spanish beef breeds slaughtered at two commercial weights. *Meat Sci., 71,* 514-521.

Alderson, G. L. H. (1999). The development of a system of linear measurements to provide an assessment of type and function of beef cattle. *Animal Genetic Resources Information, 25*, 45-55.

Amerhanov, H. A. et al. (2012). Order and conditions of beef cattle breeding value estimation. Rosinformagrotech, Moscow, Russia.

AOAC. (2002). *Official Methods of Analysis* (16th Ed). Arlington, VA: Association of Official Chemist.

Belkov, G. I., Dzhulamanov, K. M., & Gerasimov. N. P. (2010). Hereford biological potential using for high quality beef production. *Herald of Russian Academy of Agricultural Sciences, 1*, 79-81.

Bene, S., Nagy, B., Nagy, L., Kiss, B., Polgár, J. P., & Szabó F. (2007). Cpmparison of body measurements of beef cows of different breeds. Arch. *Tierz., Dummerstorf, 50*(4), 363-373.

Chambaz, A., Scheeder, M. R. L., Kreuzer, M., & Dufeya, P. A. (2003). Meat quality of Angus, Simmental, Charolais and Limousin steers compared at the same intramuscular fat content. *Meat Sci., 63*, 491-500.

Drennan, M. J., McGee, M., & Keane, M. G. (2008). The value of muscularity and skeletal scores in the live animal and carcass grades as indicators of carcass composition in cattle. *Animal, 5*, 752-760.

Dubovskova, M. P. (2003). Using of beef breeds of French-Canadian selection. *Milk and meat cattle breeding, 6*, 54-56.

Evaluation of animals on rate of feed conversion efficiency in essential nutrients of meat products (1983). Guidelines. Moscow. All-Russian Institute of Animal Sciences, p.16.

Kayumov, F. G., & Yeremenko, V. K. (2001). Kalmyk cattle breed in South Ural and West Kazakhstan conditions. Scientific publication. Gazprompechat, Orenburg, Russia.

Klont, R. E., Brocks, L., & Eikelenboom, G. (1998). Muscle fibre type and meat quality. *Meat Sci., 49*, 219-229.

Koknaroglu, H., & Hoffman, M. P. (2010). Effect of frame score on performance and carcass characteristics of

steers finished in feedlot or backgrounded for various time on pastures and finished in the feedlot. *Arch. Tierz, 53, 4*, 426-435.

MAFF. (2000). Japanese Feeding Standard for Beef Cattle. Minist. Agric., Forestry and Fish. Tokyo, Japan.

Mazurovskiy, L. Z., Surundaeva, L. G., & Gerasimov, N. P. (2013). Features of beef productivity formation of different ecological and genetic types of Hereford cattle. *Herald of beef cattle breeding, 2*(80), 11-14.

Miroshnikov, S. A., & Makaev. Sh. A. (2012). Genotypes selection with desirable productivity parameters of Kazakh white-headed cattle. *Herald of beef cattle breeding, 4*(78), 13-20.

Monin, G., & Ouali, A. (1991). Muscle differentiation and meat quality. In R.A. Lawrie (Ed.), *Development in meat science, 5.* Elsevier applied science publisher, London and New York.

Okumura, T., Saito, K., Sakuma, H., Nade, T., Nakayama, S., Fujita, K., & Kawamura T. (2007). Intramuscular fat deposition in principal muscles from twenty-four to thirty months of age using identical twins of Japanese Black steers. *J. Anim. Sci., 85*, 1902–1907.

Ouali, A. (1990). Meat tenderization: possible causes and mechanism. A review. *J. Muscle Foods, 1*, 129-165.

Renand, G., Picard, B., Touraille, C., Berge, P., & Lepetit, J.） 2001). Relationships between muscle characteristics and meat quality traits of young Charolais bulls. *Meat Sci., 59*, 49-60.

Sañudo, C., Alfonso, M., Sánchez, A., Berge, F., Dransfield, E., Zygoyiannis, D., Stamataris, C., … Fisher, A., (2003). Meat texture of lambs from different European production systems. *Aust J Agr Res., 54*, 551-560.

Spears, J. W. (1996). Beef nutrition in the 21 century. *Animal Feed Science and Technology, 58*, 29-35.

Statsoft Inc. 2(009). STATISTICA (data analysis software system), Version 9.0. www.statsoft.com

Vestergaard, M., Oksbjerg, N., & Henckel, P., (2000). Influence of feeding intensity, grazing and finishing feeding on muscle fibre characteristics and meat colour of semitendinosus, longissimus dorsi and supraspinatus muscles of young bulls. *Meat Sci., 54*, 177-185.

Zelepuhin, A. G., et al. (2005). Short guide for conducting scientific research. Training manual. All-Russian Research institute of beef cattle breeding. Orenburg. Russia.