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Amino acid composition of the longest back muscle (*m. longissimus dorsi*) young animals of specialised beef breeds

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Abstract. The relevance of the study consisted in the investigation of the qualitative characteristics of beef as a source of complete protein and the content of essential amino acids that determine its biological and nutritional value. The purpose of the study was to determine the content of non-essential and essential amino acids and conduct a comparative analysis of the amino acid composition of the longest back muscle (*m. longissimus dorsi*) in young animals of specialised beef breeds. The studies were conducted on Aberdeen-Angus, Volyn Beef, and Charolais bulls grown using meat cattle breeding technology in the Polissia zone of Ukraine. Control slaughter of experimental animals was performed at the age of 18 months. 3 animal units were selected from each breed, from which samples of the longest back muscle (*m. longissimus dorsi*) at the level of 9th-11th ribs were taken for research. The amino acid content was determined on an analyser by liquid ion exchange chromatography. Inter-breed differences in the quantitative content of non-essential and non-essential amino acids were found. In particular, the meat of Aberdeen-Angus bulls was characterised by the highest content of essential amino acids,

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among which methionine (6.84-16.5%), lysine (6.6-10.37%) and leucine (7.9-8.6%) dominated. For Charolais beef, elevated levels of lysine and valine were determined, while animals of the Volyn Beef breed had an advantage in leucine content. Among non-essential amino acids, glutamic acid (12.7-13.3%) and aspartic acid (8.9-10.09%) accounted for the largest share. The results obtained show that the quality of beef largely depends on breed characteristics, which determines its nutritional value, biological usefulness, and organoleptic properties. The higher content of methionine and histidine in Aberdeen-Angus meat indicates more intensive processes of intramuscular fat development, which provides better marbling and energy value of young meat of this breed. The results of the study can be used in practice for the selection and breeding of meat cattle with an optimal amino acid composition of meat to increase its nutritional and biological value

Keywords: beef; Aberdeen-Angus; Volyn Beef; Charolais; essential amino acids; biological value

Introduction

One of the main tasks of the livestock industry is to provide the population with food and raw materials. Meat of various animal species is the most important product for ensuring a healthy and balanced diet for people around the world, as a source of complete protein. The lack of protein can lead to negative effects on the human body, which can manifest itself in the form of a decrease in metabolism and the immune system, disruption of certain organs or systems. In the structure of global meat production, the first place is occupied by the production of poultry meat, the second – pork, and the third place is occupied by bovine cattle meat.

Most scientific publications have demonstrated a significant advantage of using animal protein in the human diet, which is characterised by a high balance of essential and non-essential amino acids and is the closest to the amino acid composition of the human body (Bal-Prylypko *et al*., 2022). Research by O.S. Yaremchuk *et al.* (2022) demonstrated that the introduction of protein-vitamin premix in the diet of bulls significantly increases not only productive indicators (weight growth, slaughter yield), but also the chemical composition of muscle tissue, in particular, dry matter and protein, which indicates the possible effect of feeding on the amino acid profile. This highlights the need for comprehensive consideration of both genotypic and alimentary factors when assessing the quality characteristics of beef. According to O.I. Kolisnyk *et al.* (2018), the most valuable components of meat are proteins that are highly digestible and contain essential amino acids for the human body: arginine, histidine, tryptophan, leucine, isoleucine, valine, threonine, lysine, methionine, and phenylalanine, which are not synthesised in the human body and must come from food. Beef obtained from animals of specialised beef breeds has an optimal ratio of muscle, bone and adipose tissue, which determines the quality of meat, its nutritional value, technological and organoleptic properties. According to M.J. Lopez & S.S. Mohiuddin (2023), animal meat consumption is important because it contains amino acids that can be converted to carbohydrates and are called glucogenic amino acids. Some amino acids give rise to specialised products. For example, tyrosine can be converted to hormones such as thyroid hormones, epinephrine, norepinephrine, and melanin. Methionine, in its active form known as S-adenosylmethionine, plays a crucial role in cellular processes by transferring the methyl group to various substances through a process called transmethylation. Cystine and methionine are the main sources of sulphur.

According to A. Paliy *et al.* (2020; 2024), differences in the amino acid profile of beef were found in animals of Black Pied, Red Steppe, Simmental, Lebedyn, and Ukrainian Grey breeds. The

researchers argued that the highest biological value was inherent in samples of Ukrainian Grey beef breed that was dominated by both Red Steppe and Black Pied breeds in terms of amino acid index. According to G. Bittante *et al.* (2024), the amino acid composition of beef and veal in animals of local origin (beef × dairy crossbreds) significantly differed in the content of 16 out of 21 amino acids, which highlights the role of the genotype in shaping the biological value of meat. The results obtained confirmed the need for further study of the influence of breed characteristics on the amino acid profile, since they determine the nutritional quality and organoleptic characteristics of products. S.-H. Lee *et al.* (2019) investigated the amino acid composition of animal meat of two local cattle breeds, and found that the increased content of alanine and glutamine in beef gives a more pronounced and rich "umami" taste, which affects the benefits for consumers when choosing meat. G. Bischof *et al.* (2022) stated that the content of essential amino acids that make up beef, such as isoleucine, leucine, methionine, phenylalanine, tyrosine, and valine, positively correlates with the duration of meat maturation. In particular, they affect the taste, appearance, juiciness, and tenderness of beef, and the researchers concluded that protein metabolism depends on the breed.

It is worth noting that there is growing attention to the investigation of the biological usefulness of food products, in particular of animal origin, and the study of the role of amino acids in the human body. Based on the analysis of sources, it should be noted that the factors that directly affect the biological usefulness of beef were not sufficiently considered. That is why it is relevant to investigate the amino acid composition and the ratio of non-essential and essential amino acids in meat obtained from young animals of specialised beef breeds that were kept at one farm in the Polissia zone of Ukraine.

The purpose of this study was to determine the content of non-essential and essential amino acids and conduct a comparative analysis of the amino acid composition of the longest back muscle (*m. longissimus dorsi*) in young animals of specialised beef breeds.

Materials and Methods

The study was conducted on cattle of specialised beef breeds that were raised up to 18 months of age using the technology of beef cattle breeding in the Polissia zone of Ukraine at LLC Agrofirma "Kyivska" during 2018-2020. For the purpose of the study, three experimental groups of animals were established: 20 Aberdeen-Angus bulls were selected for Group 1, 20 Volyn Beef bulls for Group 2, and 20 Charolais bulls for Group 3. Before weaning, bulls were kept together with cows on free suckling using the technology of specialised meat cattle breeding, and after weaning on fattening sites. Animals of all experimental groups were fed the main diet. In the structure of the feed ration of bulls in terms of energy nutritional value, concentrated feeds accounted for 29.7-30.5%, coarse – 26.1-26.4, and green feeds – 43.4-43.9%. The diet was balanced in terms of nutrient content, considering the age and physiological needs of young animals.

In order to analyse the chemical and amino acid composition of meat, 3 animals were selected from each experimental group at the age of 18 months, which were analogous in age and live weight, and their control slaughter was carried out. After slaughtering the animals and assessing the quality of the carcasses, beef samples were taken for testing 24 hours later. Samples were taken from the longest back muscle (*m. longissimus dorsi)* at the level of 9^{th}-11^{th} ribs, as it is considered the most representative for evaluating the quality characteristics of meat. The average weight of samples was 100-200 g, after sampling, was marked with the breed and individual number of the animal and transported at temperatures up to +2…+4°C to the laboratory. The study was conducted in compliance with ethical standards and rules for handling animals in accordance with the regulations of the European Convention for the Protection of Vertebrate Animals Used for

Experimental and Other Scientific Purposes (1986) and Order of the Ministry of Education and Science, Youth and Sports of Ukraine No. 249 (2012).

The content of non-essential (asparagine, serine, glutamic, proline, cystine, glycine, alanine, tyrosine, arginine) and essential (threonine, valine, methionine, isoleucine, leucine, phenylalanine, histidine, lysine) amino acids was determined on the automatic analyser of AAA amino acids T-339m (Czech Republic) by liquid ion exchange chromatography. Statistical analysis of the results obtained was performed using the Microsoft Exel 2017 computer programme. The level of statistical significance P (∗P > 0.95; ∗∗P > 0.99; ∗∗∗P > 0.999) was determined using the Student's t-test, considering statistical errors and the probability of comparing similar indicators.

Results and Discussion

The bulk of the nutrients in meat are proteins, which, unlike plant-based proteins, are mainly complete proteins. They contain all the vital amino acids that are not synthesised in the human body. As a result of studies of the amino acid composition of the longest back muscle, differences in the content of unchanged amino acids were established (Table 1).

Table 1. *Content of essential amino acids in the longest back muscle (m.longissimus dorsi), M ± m (n = 9)*

Amino acid	Animal breed		
	Aberdeen-Angus n = 3	Volyn Beef n = 3	Charolais n = 3
Protein, %	18.80 ± 0.52	18.82 ± 0.34	18.80 ± 0.13
Threonine, mg/100g	0.42 ± 0.03	0.42 ± 0.02	0.37 ± 0.00
Valine, mg/100g	0.74 ± 0.33	0.97 ± 0.03	1.04 ± 0.03
Methionine, mg/100g	2.82 ± 0.71	1.44 ± 0.03	1.08 ± 0.02∗
Isoleucine, mg/100g	1.11 ± 0.11	0.77 ± 0.04∗∗	0.81 ± 0.05∗
Leucine, mg/100g	1.36 ± 0.10	1.38 ± 0.09	1.25 ± 0.04
Phenylalanine, mg/100g	0.94 ± 0.09	0.76 ± 0.06	0.80 ± 0.01
Histidine, mg/100g	0.97 ± 0.09	0.81 ± 0.01	0.69 ± 0.01∗∗
Lysine, mg/100g	1.19 ± 0.31	1.06 ± 0.02	1.63 ± 0.01
Essential amino acids, mg/100g	**9.55 ± 1.77**	**7.60 ±v0.31**	**7.68 ± 0.18**

Note: ∗P > 0.95; ∗∗P > 0.99; ∗∗∗P > 0.999

Source: compiled by the authors

Analysis of Table 1 shows that at the age of 18 months, Aberdeen-Angus bulls had the highest total content of essential amino acids, in particular, methionine, isoleucine, phenylalanine, and histidine. Charolais breed prevailed in terms of valine and lysine content, and its analogues of the Volyn Beef breed had a slightly higher amount of leucine. These differences between animals of the breeds under study ensure the development of different protein profiles in the meat of animals of different breeds. In terms of the content of essential amino acids in meat, Aberdeen-Angus animals exceeded the analogues of the experimental groups 2 and 3 by 20.4% and 19.6%, respectively, which indicates high quality indicators of beef of young animals of Group 1. Meat of young Charolais was characterised by a higher content of lysine – 1.63 mg/100 g against 1.19 and 1.06 mg/100 g in animals of groups 1 and 2, which takes part in the reactions of transamination and deamination of amino acids in the body, thereby affecting the synthesis of essential amino acids. The advantage in terms of valine content, which helps to maintain nitrogen balance, which is important for growth and development, in animals of this breed ranged from 6.7 to 28.8%. In the longest back muscle of young animals of

the Volyn Beef breed, the leucine content was 1.4% and 9.4% higher compared to analogues of the Aberdeen-Angus and Charolais breeds, respectively. Based on the analysis of the content of non-essential amino acids, animals of the Aberdeen-Angus breed were preferred for the content of glutamic acid, Volyn Beef breed – for the content of aspartic acid, serine, proline, alanine, arginine, and Charolais breed – for the content of glycine and tyrosine (Table 2).

Table 2. *Content of non-essential amino acids in the longest back muscle (m. longissimus dorsi), M ± m (n = 9)*

Amino acid	Animal breed		
	Aberdeen-Angus n = 3	Volyn Beef n = 3	Charolais n = 3
Protein, %	18.80 ± 0.52	18.82 ± 0.34	18.80 ± 0.13
Asparagine, mg/100g	1.54 ± 0.14	1.72 ± 0.01	1.59 ± 0.05
Serine, mg/100g	0.61 ± 0.01	0.64 ± 0.02	0.61 ± 0.02
Glutamine, mg/100kg	2.28 ± 0.04	2.08 ± 0.07*	2.01 ± 0.05
Proline, mg/100g	0.36 ± 0.07	0.45 ± 0.01	0.42 ± 0.04
Cystine, mg/100g	0.06 ± 0.01	0.06 ± 0.01	0.05 ± 0.02
Glycine, mg/100g	0.40 ± 0.08	0.46 ± 0.02	0.48 ± 0.00
Alanine, mg/100g	0.69 ± 0.15	1.09 ± 0.03*	1.06 ± 0.02*
Tyrosine, mg/100g	0.83 ± 0.01	0.88 ± 0.05	0.92 ± 0.09
Arginine, mg/100g	0.87 ± 0.10	1.01 ± 0.11	0.94 ± 0.04
Non-essential amino acids, mg/100g	**7.65 ± 0.61**	**8.39 ± 0.32**	**8.07 ± 0.33**

Note: *P > 0.95; **P > 0.99; ***P > 0.999

Source: compiled by the authors

Analysis of non-essential amino acids showed that the breeds under study have a different tendencies in the accumulation of certain compounds. The highest level of glutamic acid (2.28 mg/100 g) was determined in Aberdeen-Angus meat, which may indicate a more intense synthesis of protein structures, while in Volyn Beef this indicator was lower (2.08 mg/100 g). The animals of Volyn Beef and Charolais showed an increased content of alanine (1.09 and 1.06 mg/100 g, respectively), which may indicate the features of energy metabolism and the accumulation of compounds involved in the development of sweetness in beef taste. Volyn Beef breed also had an advantage in the content of aspartic acid (1.72 mg/100 g), which together with glutamic acid is involved in the development of acidity of muscle tissue, which affects the juiciness and tenderness of meat. The Charolais breed was characterised by increased levels of glycine (0.48 mg/100 g) and tyrosine (0.92 mg/100 g), which may be conditioned by the specifics of the synthesis of collagen and pigment compounds. The total content of non-essential amino acids was highest in the Volyn Beef breed (8.39 mg/100 g), which confirms a more intensive accumulation of these compounds in the protein structure of muscles. A common pattern for all breeds is the predominance of glutamic and aspartic acids, which in combination with alanine form the basis of metabolic processes and affect the organoleptic properties of meat. Thus, breed differences are found not only in the total content of non-essential amino acids, but also in the specific profile of their accumulation, which is important for assessing the biological and taste value of beef.

Based on the analysis of the percentage content of amino acids in the longest back muscle, among the essential amino acids in animals of the breeds under study, methionine accounted for the largest percentage in the protein composition of dry muscle tissue – 6.84-16.5%, lysine – 6.6-10.37%, and leucine – 7.9-8.6%. In terms of the content of non-essential amino acids, glutamic

acid accounted for the largest share – 12.7-13.3% and aspartic acid – 8.9-10.09%. The cystine content in beef was the lowest and only 0.3-0.4%, depending on the breed (Fig. 1).

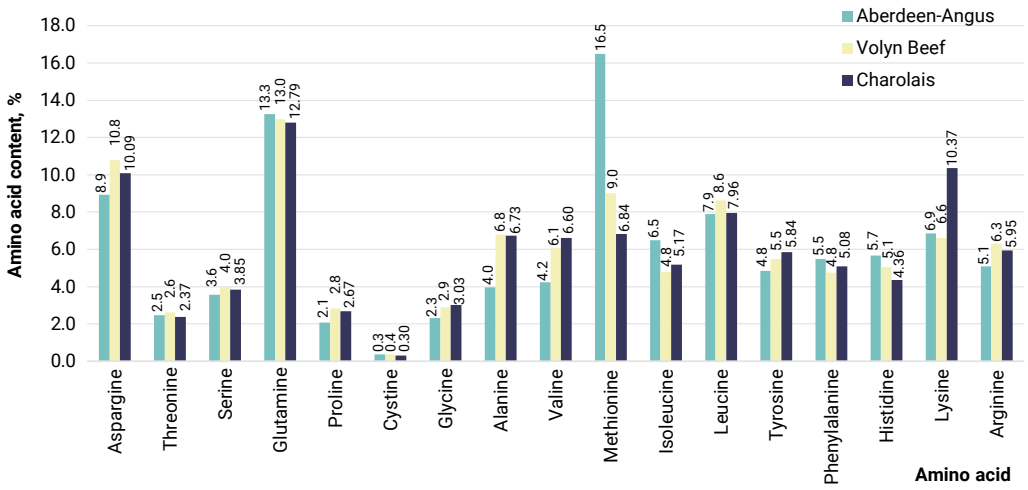

Figure 1. *Amino acid content in the longest back muscle*
Source: compiled by the authors

Analysis of Figure 1 shows that in samples of the longest back muscle taken from bulls of specialised beef cattle breeds, methionine, lysine, and leucine, and among the non-essential amino acids, glutamic and aspartic acids, which determines the biological value of the meat of the animals under study. The highest content of menionine was observed in animals of the Aberdeen-Angus breed, the difference with other groups was 45.4% and 58.5%, respectively. Notably, in all experimental groups, the high content of glutamic acid between the groups was within 3.8%. Animals of the Volyn-Beef breed had an advantage in the content of aspartic amino acid by 17.5% (Group 1) and 6.5 % (Group 3) and leucine by 8.1 and 7.4%, respectively.

The results of current research are partially consistent with the study by O.P. Razanova *et al.* (2023), which proved the superiority of Charolais bulls in terms of valine content – by 7.4%, isoleucine – by 45.3% ($p < 0.001$), leucine – by 15.2% ($p < 0.001$), lysine – by 7.8%, threonine and phenylalanine + tyrosine – by 6.5% ($p < 0.05$) and 7.5% ($p < 0.01$) compared to animals of the Aberdeen-Angus and Black Pied breeds. The study by G. Hollo *et al.* (2007), who studied amino acid profile of Hungarian Grey and Holstein-Frisian Beef breeds, no significant inter-breed differences were found, with the exception of histidine content. According to J. Vopálenský *et al.* (2017), a study of the muscle tissue of bulls of eight beef breeds raised in Southern Bohemia showed significant inter-breed differences in amino acid composition. Among essential amino acids, the largest proportion was lysine (8.8-10.4%), while the content of methionine ranged from 2.4-2.9%, threonine – approximately 4.6%, valine – 5.1%, isoleucine – 4.8%, leucine – 8.2%, phenylalanine – 4.1%, histidine – 4.2%, and arginine – 8.0%. Statistically significant differences ($p \leq 0.05$) were recorded for most essential amino acids, with the exception of valine and leucine. Among non-essential amino acids, the largest proportion of protein in the dry matter of muscle tissue was glutamic acid (13.9-15.1%), while the lowest values were characteristic of serine and tyrosine; other indicators were: aspartic acid – 9.3%, serine – 4.0%, proline – 5.3%, glycine – 5.5%, and alanine – 6.1%. The current

study noted similar trends. The high percentage of glutamic acid (13.9-15.1%) in the muscle tissue of young Aberdeen-Angus, Volyn Beef, and Charolais is consistent with the data by J. Vopálenský *et al.* (2017), where this figure was 14.8-16.8%. Simultaneously, animals of the Volyn Beef breed showed a preference for the content of aspartic acid (11.7% more compared to Aberdeen-Angus) and alanine (36.5% more), while Charolais had a higher level of lysine (37% more compared to Volyn Beef breed). The established inter-breed differences in the content of essential amino acids (methionine, lysine, isoleucine, phenylalanine, and histidine in Aberdeen-Angus; lysine and valine in Charolais; leucine in Volyn Beef) confirm the authors' conclusions regarding the determining role of the genotype in the amino acid profile of beef. Thus, the results of the current study are consistent with previous scientific data and complement them, demonstrating the specific features of animals raised in the Polissia zone of Ukraine.

The current study indicates that a relatively high percentage of glutamic acid (13.9-15.1%) is an important indicator, which is fully consistent with the data by J. Subrt *et al.* (2002), which give a value of 14.8-16.8%. The researchers also found significant differences in the content of essential amino acids: 30.16% in Montbeliarde to 34.50% in Maine-Anjou, and 30.22% in Hereford to 33.75% in Aberdeen-Angus animals. Among the essential amino acids in meat, lysine prevailed – 7.76-8.75%. Significant differences in the content of amino acids such as threonine, valine, and isoleucine were found in animals of combined productivity. Significant differences ($P < 0.05$) in the levels of glutamic acid, asparagine, proline, serine, and alanine were found among non-essential amino acids. Comparison with data of J.D. Wood & C. Rowlings (2011) showed that, in addition to breed differences, feeding conditions and the influence of climatic factors are an important factor in the development of the amino acid composition of meat. The researchers emphasised that changes in the feed base and increased temperature stress can lead to variations in the content of individual amino acids, in particular, glutamic and aspartic acids, which in the current study also proved to be the most variable among non-essential amino acids. This suggests that the specific profile of Volyn Beef and Charolais animals may be conditioned not only to the genotype, but also to adaptation to growing conditions.

According to S. Fujimura & M. Kadowaki (2006), the content of glutamic acid significantly affects the taste of meat. For other amino acids, the effect on aroma prevails, along with the enhancement of taste – the so-called umami. According to S.A. Michalchenko *et al.* (2024), an interbreed difference in the content of amino acids in beef obtained from three dairy cattle breeds was established. According to researchers, among the essential amino acids, lysine is quantitatively dominant and accounts for 5.02-7.85%, among the substituents – glutamine 10.93-12.66%. In the current study, the level of lysine in Charolais was 37% higher than in Volyn Beef, while in Aberdeen-Angus, the preference for histidine was 19-40%, depending on the breed in comparison. G. Caire-Juvera *et al.* (2013), investigating the amino acid composition of various types of animal products, established the highest content of the essential amino acid lysine in cattle meat. According to researchers, the content of this amino acid affects the quality of beef, its amino acid profile, and protein digestibility indicators. These results are also confirmed by the data of the current study, where Volyn Beef and Charolais had lysine in the range of 1.06-1.63 mg/100 g, which is higher than that of Aberdeen-Angus (1.19 mg/100 g).

G. Hollo *et al.* (2001), investigating the effect of the breed factor on the amino acid profile of cattle meat, established the advantage of Simmental breed in terms of glutamic acid and serine content compared to Holstein animals. Using the GCM model in their research, the researchers concluded that natural belonging does not affect the amino acid composition of beef. According to Y.H. Kim *et al.* (2016), the content of non-essential and essential amino acids is directly or indirectly related to the taste and aroma of meat, being

substrates of chemical reactions that form aromatic compounds during cooking. According to researchers, valine, tyrosine, isoleucine, phenylalanine, tryptophan, and leucine are associated with a bitter taste; alanine, methionine, glutamine, glycine – with sweetness of meat; aspartic and glutamic acids, histidine, asparagine – with a sour taste; glutamic and aspartic acids – with a salty taste. The results obtained in the current study are consistent with these results: Volyn Beef has higher levels of aspartic acid, while Charolais and Volyn Beef have higher levels of alanine, which forms specific differences in the taste profile of beef. Similar patterns were noted by W. Zhang *et al.* (2010), who emphasised that the amino acid composition of meat directly affects its functional value, in particular, its water retention capacity, juiciness, and texture. The higher content of glutamic and aspartic acids recorded in the current study may lead to better sensory characteristics of meat, while increased levels of alanine and glycine are associated with the development of sweet taste shades. Thus, the results confirm that the breed specificity of the amino acid composition is of practical importance for processing and improving the functional quality of meat products. Similar data were provided in the paper by S. Filin *et al.* (2023), where the amino acid composition of semi-finished meat products was studied. The researchers showed that the amino acid profile in meat raw materials has stable differences between control and experimental samples, which confirms the importance of genotypic and technological factors in the development of qualitative characteristics of meat products. Comparison with the current results shows that similar patterns can be traced in pure meat of different breeds of cattle, where variations in the amino acid composition determine both biological value and organoleptic properties.

Summarising the results, it should be noted that the amino acid profile of the longest back muscle of young animals of specialised beef breeds has a distinct breed specificity. The established differences in both the content of essential and non-essential amino acids indicate different intensity of protein and energy metabolism in animals of different breeds. The combination of increased levels of individual amino acids forms not only the biological, but also the taste value of beef. The results obtained confirm that the genotype is a key factor in the development of quality indicators of meat and can be used in breeding work to increase the nutritional and organoleptic value of products.

Conclusions

Based on the results of studies conducted on young animals of specialised beef breeds, it can be concluded that the amino acid composition of the longest back muscle of young cattle depends on the breed affiliation of animals. Among the essential amino acids in animals of the breeds under study, methionine had the highest percentage in the protein composition of dry matter of muscle tissue – 6.84-16.5%, lysine – 6.6-10.37%, and leucine – 7.9-8.6%. The highest content of essential amino acids was observed in the meat of Aberdeen-Angus bulls. In particular, animals of this group exceeded their peers of Charolais and Volyn Beef breeds in terms of methionine content by 45-58%, isoleucine – by 26-43%, phenylalanine – by 17-24%, and histidine – by 20-40%, which confirms their ability to form beef with high biological value. Young Charolais meat was characterised by increased levels of lysine and valine, which are important factors of nitrogen metabolism and protein synthesis, and the lysine content in Charolais reached 1.63 mg/100 g, which is 37% more than in Volyn Beef. While animals of the Volyn Beef breed showed an advantage in the content of leucine, this breed also had higher levels of aspartic acid (11.7% more compared to Aberdeen-Angus) and alanine (36.5% more), indicating a more intense energy metabolism. Analysis of non-essential amino acids showed that glutamic acid (12.7-13.3%) and aspartic acid (8.9-10.09%) accounted for the largest share in all groups, which are key in ensuring energy metabolism and muscle tissue acidity. In Charolais,

glycine and tyrosine were more prevalent, which may indicate the specifics of the synthesis of collagen structures and pigment compounds.

The results obtained indicate that the breed features of the amino acid composition determine the different nutritional and biological value of meat, which should be considered when conducting breeding work to obtain high-quality beef. The established patterns emphasise the decisive role of genotype in determining meat quality indicators. That is why, in the future, it is necessary to determine the amino acid profile of animals of other breeds and investigate the relationship of amino acid composition with organoleptic qualities.

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Conflict of Interest

None.

References

[1] Bal-Prylypko, L., Nikolaenko, M., Cherednichenko, O., & Stepasyuk L. (2022). Trends of the development of the meat processing industry of Ukraine and practical approaches to the optimisation the recipe of sausage products. *Ekonomika APK*, 29(5), 10-19. doi: 10.32317/2221-1055.202205010.

[2] Bischof, G., Witte, F., Terjung, N., Januschewski, E., Heinz, V., Juadjur, A., & Gibis, M. (2022). Effect of sampling position in fre sh, dry-aged and wet-aged beef from *M. longissimus dorsi* of Simmental cattle analyzed by ^{1}H NMR spectroscopy. *Food Research International*, 156, article number 111191. doi: 10.1016/j.foodres.2022.111334.

[3] Bittante, G., Cecchinato, A., Tagliapietra, F., & Amalfitano, N. (2024). Amino acid profiles of veal and beef meat obtained in intensive fattening or dairy farming as affected by beef from dairy breed combinations. *Italian Journal of Animal Science*, 24(1), 101-108. doi:10.1080/1828051X.2024.2441358.

[4] Caire-Juvera, G., Vázquez-Ortiz, F.A., & Grijalva-Haro, M.I. (2013). Amino acid composition, score and in vitro protein digestibility of foods commonly consumed in northwest Mexico. *Nutrición Hospitalaria*, 28(2), 365-371.

[5] European Convention for the Protection of Vertebrate Animals Used for Experimental and Other Scientific Purposes. (1986, March). Retrieved from https://rm.coe.int/168007a67b.

[6] Filin, S., Bal-Prylypko, L., Nikolaenko, M., Holembovska, N., & Kushnir, Yu. (2023). Development of technology for plant-based minced semi-finished products. *Animal Science and Food Technology*, 14(2), 100-112. doi: 10.31548/animal.2.2023.100.

[7] Fujimura, S., & Kadowaki, M. (2006). Improvement of meat taste by dietary components. *Bulletin of the Faculty of Agriculture, Niigata University*, 58, 1-7.

[8] Hollo, G., Csapo, J., Szucs, E., Tozser, J., Repa, I., & Hollo, I. (2001). Influence of breed, slaughter weight and gender on chemical composition of beef. Part 1. Amino acid profile and biological value of proteins. *Asian-Australasian Journal of Animal Sciences*, 14(11), 1555-1559. doi: 10.5713/ajas.2001.1555.

[9] Hollo, G., Nuernberg, K., Hollo, I., Csapo, J., Seregi, J., Repa, I., & Ender, K. (2007). Effect of feeding on the composition of longissimus muscle of Hungarian Grey and Holstein Friesian bulls. III. Amino acid composition and mineral content. *Archiv für Tierzucht*, 50(6), 575-586. doi: 10.5194/aab-50-575-2007.

[10] Kim, Y.H.B., Kemp, R., & Samuelsson, L.M. (2016). Effects of dry-aging on meat quality attributes and metabolite profiles of beef loins. *Meat Science*, 111, 168-176. doi: 10.1016/j.meatsci.2015.09.008.

[11] Kolisnyk, O.I., Uhnivenko, A.M., Antoniuk, T.A., & Prudnikov, V.H. (2018). *Meat productivity of cattle*. Kyiv: Komprynt.
[12] Lee, S.-H., Kim, C.-N., Ko, K.-B., Park, S.-P., Kim, H.-K., Kim, J.-M., & Ryu, Y.-C. (2019). Comparisons of beef fatty acid and amino acid characteristics between Jeju Black cattle, Hanwoo, and Wagyu breeds. *Korean Journal for Food Science of Animal Resources*, 39(3), 402-409. doi: 10.5851/kosfa.2019.e33.
[13] Lopez, M.J., & Mohiuddin, S.S. (2023). Biochemistry, essential amino acids. In *StatPearls*. Treasure Island (FL): StatPearls Publishing
[14] Michalchenko, S.A., Korkh, I.V., Paliy, A.P., Boiko, N.V., Kovalenko, L.V., Pavlichenko, O.V., Vyrvykyshka, S.M., & Morozov, M.G. (2024). Amino acid composition of beef depending on the breed and age of dairy bulls. *International Journal of Agricultural Technology*, 20(6), 2405-2422.
[15] Order of the Ministry of Education and Science, Youth and Sports of Ukraine No. 249 "On the Procedure for Carrying out Experiments and Experiments on Animals by Scientific Institutions". (2012, March). Retrieved from https://zakon.rada.gov.ua/laws/show/z0416-12#Text.
[16] Paliy, A., Michalchenko, S., Korkh, I., Rodionova, K., Tkachuk, S., Khimych, M., Dankevych, N., & Boiko, N. (2024). Formation of the biological value of beef protein depending on the age and breed of bulls. *Potravinarstvo Slovak Journal of Food Sciences*, 18, 834-846. doi: 10.5219/2003.
[17] Paliy, A., Nanka, A., Marchenko, M., Bredykhin, V., Paliy, A., Negreba, J., Lazorenko, L., Panasenko, A., Rybachuk, Z., & Musiienko, O. (2020). Establishing changes in the technical parameters of nipple rubber for milking machines and their impact on operational characteristics. *Eastern-European Journal of Enterprise Technologies*, 2(1(104)), 78-87. doi: 10.15587/1729-4061.2020.200635.
[18] Razanova, O.P., Holubenko, T.L., Bernyk, I.M., Novgorodska, N.M., & Solomon, A.M. (2023). Biological value of veal obtained from bulls of different breed origin and grown using dairy and meat breeding technology. *Bulletin of Sumy National Agrarian University. Series: Livestock*, 3(54), 55-62. doi: 10.32782/bsnau.lvst.2023.3.8.
[19] Subrt, J., Kracmar, S., & Divis, V. (2002). The profile of amino acids in intramuscular protein of bulls of milked and beef commercial types. *Czech Journal of Animal Science*, 47(1), 21-29.
[20] Vopálenský, J., Suchý, P., Straková, E., & Šimek, F. (2017). Amino acid levels in muscle tissue of eight meat cattle breeds. *Czech Journal of Animal Science*, 62(8), 339-346. doi: 10.17221/96/2016-CJAS.
[21] Wood, J.D., & Rowlings, C. (Eds.). (2011). *Nutrition and climate change: Major issues confronting the meat industry*. Nottingham: Nottingham University Press.
[22] Yaremchuk, O.S., Razanova, O.P., Skoromna, O.I., Chudak, R.A., Holubenko, T.L., & Kravchenko, O.O. (2022). Post-slaughter indicators of meat productivity and chemical composition of the muscular tissues of bulls receiving corrective diet with protein-vitamin premix. *Regulatory Mechanisms in Biosystems*, 13(3), 219-224. doi: 10.15421/022228.
[23] Zhang, W., Xiao, S., Samaraweera, H., Lee, E.J., & Ahn, D.U. (2010). Improving functional value of meat products. *Meat Science*, 86(1), 15-31. doi: 10.1016/j.meatsci.2010.04.018.

Амінокислотний склад найдовшого м'яза спини (*m. longissimus dorsi*) молодняку спеціалізованих м'ясних порід

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Анотація. Актуальність дослідження полягає у вивченні якісних характеристик яловичини як джерела повноцінного білка та вмісту незамінних амінокислот, що визначають її біологічну й харчову цінність. Метою роботи було визначити вміст замінних та незамінних амінокислот та провести порівняльний аналіз амінокислотного складу найдовшого м'яза спини (*m. longissimus dorsi*) молодняку спеціалізованих м'ясних порід. Дослідження проводилися на бугайцях абердин-ангуської, волинської м'ясної та шароле, вирощених за технологією м'ясного скотарства у зоні Полісся України. Контрольний забій піддослідних тварин проводили у віці 18 місяців. З кожної породи відбирали по 3 голови, у яких брали зразки найдовшого м'яза спини (*m. longissimus dorsi*) на рівні 9-11 ребра для дослідження. Вміст амінокислот визначали на аналізаторі методом рідинної іонообмінної хроматографії. Встановлено, що міжпородні відмінності у кількісному вмісті замінних та незамінних амінокислот. Зокрема, м'ясо бугайців абердин-ангуської породи характеризувалося найвищим вмістом незамінних амінокислот, серед яких домінували метіонін (6,84-16,5 %), лізин (6,6-10,37 %) та лейцин (7,9-8,6 %). Для яловичини шароле визначено підвищений рівень лізину та валіну, тоді як тварини волинської м'ясної породи мали перевагу за вмістом лейцину. Серед замінних амінокислот найбільшу частку становили глутамінова (12,7-13,3 %) та аспарагінова кислота (8,9-10,09 %). Отримані результати засвідчують, що якість яловичини значною мірою залежить від породних особливостей, що зумовлює її харчову цінність, біологічну повноцінність та органолептичні властивості. Вищий вміст метіоніну та гістидину у м'ясі абердин-ангусів свідчить про інтенсивніші процеси формування внутрішньом'язового жиру, що забезпечує кращу мармуровість та енергетичну цінність м'яса молодняку даної породи. Результати дослідження можна використати на практиці для відбору та розведення м'ясної худоби з оптимальним амінокислотним складом м'яса з метою підвищення його харчової та біологічної цінності

Ключові слова: яловичина; порода абердин-ангус; волинська м'ясна; шароле; незамінні амінокислоти; біологічна цінність