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THE MORPHOLOGICAL COMPOSITION OF ANATOMIC CARCASS PARTS IN YOUNG PIGLETS THAT BELONG TO DIFFERENT BREEDS

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The results of studies morphological composition of anatomical carcass parts in young piglets that belong to different breeds and with different pre-slaughter mass have been presented.

It has been established that the specific weight of shoulder-scapular part is reduced with the increase of slaughter weight in carcasses of piglets Large White breed and Pietrain breed but the dorsal lumbar part is increased. The specific weight of pelvic femoral part in carcasses of both breeds remains practically unchanged.

Specific peculiarities of meat Pietrain breed include increased pH levels, poorer tenderness, moisture retention, color intensity, and more significant weight loss during heat treatment. In addition, pork of Pietrain breed has reduced dry matter content, but it has a tendency to increase the protein content and pork of Large White breed has increased fat content. Such increased fat content in pork of Large White breed was caused its difference in energy value. According to the indicators of dry matter and melting point, the preference for the fat of Large White breed was established, which confirms its higher quality compared to the fat of Pietrain breed. The tasting evaluation proved that broth and meat of Pietran breed received significantly lower marks due to aroma, taste and tenderness indices compared with the meat and broth of Large White breed.

Keywords: *pigs, young piglets, large White breed, Pietrain breed, physicochemical properties, chemical composition, muscle tissue, anatomical cuts, carcass, morphological composition, tasting evaluation.*

Despite the difficult epizootic situation in pig breeding in Ukraine (the spread of African plague virus), pork production in meat balance of the country continues to occupy high positions. Thus, according to official statistics, the specific weight in the structure of meat balance of Ukraine in 2018 is 34.7 %, while poultry meat – 53.2 %, beef – 10.3 %, meat of other types – 1.8 % [1].

In addition, the modernization of production for the last 10–15 years in the conditions of modern reconstructed pig farms has significantly improved production indicators because of the use different crossbreeding and hybridization schemes and qualitative changes in the feed base. At the same time, in leading agroformations, the age of reaching live weight of 100 kg in young pigs is 165–175 days, the average daily gain during the fattening period is 820–1000 g, the feed consumption (complete feed) per kilogram of live weight gain is 2.8 kg or less [2, 8].

However, the issue of improving the qualitative composition of carcasses, physicochemical properties and chemical composition of pork, with the use of animals specialized meat breeds and mixtures of foreign origin [3] is relevant and defines the prospect of further re-

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search [3–8].

Goal of research is to investigate the morphology of carcasses, the physicochemical properties and the chemical composition of the longest muscle of the back and fat of young pigs of different genotypes and different preslaughter weights.

Materials and methods of researches. The study was conducted under the conditions of LTD "Artsyz Meat Company", LTD "AF" Shabolat "of Odessa Region, in the laboratory of zoochemical analysis of the Institute of Pig Breeding and Agricultural Production of the UN of Ukraine, at the chair of Technology of Livestock Products Production and Processing in Odessa State Agrarian University and in the laboratory of Animal Husbandry in the Institute of Cereals NAAS of Ukraine (2018–2019).

The object of research was young pigs of Large White breed of domestic origin with improved meat quality (25 % of the conditional blood of Large White breed of domestic origin, 75 % of the conditional blood of Large White breed of French origin and Pietrain of French origin.

Studies of morphological composition of pig carcasses [9, 10], physicochemical properties and chemical composition of the longest muscle of the back and fat were investigated by the methods of A.M. Polivoda and others [11], A. V. Popov and others [15] and in accordance with GOST 23042-86; GOST 9793-74; GOST 9794-74 [12, 13–15, 16].

The obtained research results were processed by the methods of variational statistics using a personal computer in the MS Excel 2010 application program [17, 18].

Research results. The analysis of the data in Table 1 shows that the relative mass of natural anatomical cuts in carcasses of young pigs of different breeding directions is characterized by a common pattern of change in their absolute and relative indices, provided that preslaughtered live weight is increased from 100 to 120 kg. Thus, with the increase of pre-slaughtered live weight in carcasses of young pigs of White Large breed, the specific weight of shoulder-scapular part is reduced by 2.3 % (from 34.5 to 32.2 %), the specific weight of dorsal lumbar part is increased by 2.2 % (from 32.9 to 33,0 %), the specific weight of pelvic femoral part ranges from 32,87 to 32,81 %.

With the increase of pre-slaughter live weight in carcasses of yound pigs of Pietrain bre-

1. The absolute and relative mass of anatomical parts of carcasses young pigs of different breeds and different pre-slaughter weight, $(\overline{X} \pm S_{\overline{X}})$

Breed	Body parts	Pre-slaughter weight, kg			
		100		120	
		absolute mass, kg	relative weight, % by weight of half-carcass	absolute mass, kg	relative weight, % by weight half-carcass
LTD "AF" Shabolat "					
Large White	S *	11,0 ± 0,16	34,5	13,6 ± 0,11	32,2
	D **	10,4 ± 0,24	32,6	14,7 ± 0,27	34,8
	P ***	10,5 ± 0,51	32,9	13,9 ± 0,55	33,0
LTD "Artsyz Meat Company"					
Pietrain	S	10,9 ± 0,09	34,2	14,9 ± 0,08	32,6
	D	10,2 ± 0,18	31,9	15,2 ± 0,23	33,3
	P	10,8 ± 0,39	33,9	15,6 ± 0,43	34,1

** Shoulder-scapular. ** Dorsal lumbar. *** Pelvic femoral.*

ed the specific weight of shoulder-scapular part is reduced by 1.6 % (from 34.2 to 32.6 %), the dorsal lumbar part is increased by 1.4 % (from 31.9 to 33.3 %), the pelvic femoral part – tends to increase by 0.2 % (from 33.9 to 34.1 %).

It was found that in the carcasses of young pigs of Pietrain breed with pre-slaughter weight of 100 kg, the highest content of muscle tissue was found in pelvic femoral part, 77.0 %, which is 13.2 % more than in pigs of Large White breed (Table 2). The difference according to this indicator between animals of these genotypes in shoulder-scapular cuttings is 14.5 %. The increase content of muscle tissue in these cuttings causes their significant commercial value.

The highest content of fat and bones was

2. The morphological composition of anatomical parts of carcass in young pigs of different breeds and with different preslaughtered live weight ($\overline{X} \pm S_{\overline{X}}$)

Breed	Body parts	Pre-slaughter weight, kg					
		100			120		
		Morphological composition of half carcass, %					
		meat	Fat	bone	meat	fat	bone
LTD "AF" Shabolat "							
Large White	S [1]	62,3 ± 0,47	26,6 ± 0,19	11,1 ± 0,21	61,4 ± 0,17	27,6 ± 0,06	11,0 ± 0,11
	D [2]	57,7 ± 0,56	27,3 ± 0,25	15,0 ± 0,41	54,8 ± 0,20	32,4 ± 0,21	12,8 ± 0,28
	P [3]	63,8 ± 0,58	22,7 ± 0,78	13,5 ± 0,20	61,9 ± 0,28	27,3 ± 0,22	10,8 ± 0,29
LTD "Artsyz Meat Company"							
Pietrain	S	76,8 ± 0,86 ***	12,7 ± 0,86 ***	10,5 ± 0,31	75,5 ± 0,90 ***	14,6 ± 0,90 ***	9,9 ± 0,29 *
	D	67,5 ± 0,57 ***	19,5 ± 0,39 ***	13,0 ± 0,26 *	66,4 ± 0,67 ***	20,9 ± 0,46 ***	12,7 ± 0,26
	P	77,0 ± 0,54 ***	10,4 ± 0,96 ***	12,6 ± 0,62	74,2 ± 0,64 ***	13,5 ± 1,10 ***	12,3 ± 0,57

*1– shoulder-scapular. 2 – dorsal lumbar. 3 – pelvic femoral. * P <0.05. ** P <0.01. *** P <0.001.*

3. Results of physical - chemical analysis of meat ($\overline{X} \pm S_{\overline{X}}$), n = 3

Live weight, kg	pH, units of acidity	Tenderness, p	Water-holding capacity, %	Intensity of color, units ecst. x 1000	Losses during culinary processing, %
Large White Breed					
100	5,5 ± 0,04	9,4 ± 0,46	59,1 ± 2,60	72,7 ± 1,75	18,6 ± 0,93
120	5,6 ± 0,03	9,2 ± 0,39	61,2 ± 2,54	78,3 ± 0,88	17,0 ± 0,58
TS [1]	5,2–5,8	8,3–12,2	53,0–64,0	51,0–82,0	-
Pietrain Breed					
100	5,3 ± 0,06 *	13,2 ± 0,76 *	54,2 ± 1,02	58,1 ± 2,77 *	29,4 ± 0,91 **
120	5,5 ± 0,05	12,2 ± 0,97 *	55,0 ± 1,17	58,7 ± 2,83 **	26,7 ± 0,88 ***
TS	5,2–5,8	8,3–12,2	53,0–64,0	51,0–82,0	-

1 – technological standard [7].

found in dorsal lumbar cuttings of pigs Large White breed (27.3 and 15.0 %) and Pietrain breed (19.5 and 13.0 %).

When pre-slaughter weight of the young pigs increased to 120 kg, the maximum content of muscular tissue was detected in the pelvic femoral cuttings of Large White breed (61.9 %). Pietrain animals have an increase in the content of muscle tissue in the shoulder-scapular (75.5 %). The content of muscle tissue in the shoulder-scapular cuttings of pigs Large White breed is 61.4 %, in the pelvic femoral cuttings of pigs Pietrain breed –74.2 %. The maximum fat and bone content were found in the dorsal lumbar cuttings of both breeds, where the fat content of the Large White breed was 32.4 %, the bones – 12.8 %; for Pietrain breed, the corresponding figures were – 20.9 % and 12.7 % respectively.

The difference in the content of meat and fat in carcasses was statistically highly reliable ($p < 0.001$) in different natural anatomical cuttings in young pigs of different breeds. The predominance of these indicators was established in pigs of Pietrain breed over analogues of Large White breed. The difference in bone content in different naturally anatomical cuttings of carcasses of pigs different breeds was statistically unreliable. In most cases, there was only a tendency for preference or preference for bone content in dorsal lumbar parts at 100 kg live weight and in shoulder-scapular at 120 kg live weight ($p < 0.05$).

In general, it should be noted that the morphological composition of carcasses of young pigs Pietrain breed has a characteristic specifi-city that is significant advantages in the content of meat in all anatomical cuttings of carcasses in accordance with the relevant indicators in Large White breed, but it is necessary to clearly understand their different purpose in modern hybridization and hybridization schemes.

The results of studies the physical-chemical properties of muscle tissue are shown in Table 3.

In terms of active acidity, which play a significant role in the conservation of meat and characterize the level of biochemical processes in muscle tissue after slaughter, pig meat of both weight categories had no statistically significant differences – this indicator was practically the same, it ranged from 5,3 to 5.6 acidity units, which were within the technological standard (pH = 5.2–5.8). At the same time, with the increase of slaughter weight and the age of the animal, there was a tendency to decrease the acidity index.

The lowest tenderness corresponds to the best indices, and the highest value, respectively, is marked by the inferior tenderness. In relation to this indicator, it was established within the technological standard (8.3–12.2 s), but with the exception of meat of pigs Pietrain breed with slaughter weight of 100 kg. Meat of Pietrain breed had the worst tenderness, as confirmed by our research.

The tenderness of meat is determined by its moisture-holding capacity, pH level, amount of connective tissue and fat, muscle fiber thickness and degree of meat maturation [7]. An important meat index is its moisture-holding ability, which depends on the presence of a "free" and "protein-bound" moisture substances. There was no statistically significant difference between breeds due to this indicator, which meet the requirements of technological standard (53.0–64.0 %), but there was a tendency for preference due to this indicator in pigs of Large White breed.

A similar pattern of preference was found in the intensity of coloring in favor of meat of pigs of Large White breed compared with the meat of Pietrain breed. In addition, meat of Large White breed has a tendency to increase due to this indicator with increasing live weight and, accordingly, the age of animals, unlike pigs Pietrain breed. Indicators of both breeds fully meet the requirements of the technological standard – 51,0–82,0 units. ecst. x 1000.

Relative to the mass loss rate of meat during heat treatment, they were significantly higher when slaughtered pigs with a live weight of 100 kg, smaller when slaughtered pigs with a live weight of 120 kg in the cuttings of both breeds.

The results of our studies showed that increased dry matter content was observed in pigs of Large White breeds (Table 4). Regardles the live weight at slaughtering, there was a tendency to increase protein content in meat of pigs Pietrain breed and the fat content – on the contrary in the meat of pigs Large White breed, there was practically no difference in the content of ash, calcium and phosphorus.

4. Chemical composition of muscle tissue of young pigs of different breeds and pre-slaughter live weight ($\overline{X} \pm S_{\overline{X}}$), n = 3

Indicator	Breed			
	Large White		Pietrain	
	Live weight, kg			
	100	120	100	120
Moisture, %	75,0 ± 0,25	74,4 ± 0,26	76,6 ± 0,84	76,3 ± 0,65
Dry matter, %	25,0 ± 0,25	25,6 ± 0,26	23,4 ± 0,84	23,7 ± 0,65
Protein, %	20,2 ± 0,48	20,3 ± 0,30	21,0 ± 0,68	21,2 ± 0,81
Fat, %	3,7 ± 0,26	4,2 ± 0,27	1,3 ± 0,12	1,4 ± 0,16
Ash, %	1,1 ± 0,03	1,1 ± 0,02	1,1 ± 0,03	1,1 ± 0,04
Ca, %	0,045 ± 0,0006	0,046 ± 0,001	0,040 ± 0,002	0,050 ± 0,001
P, %	0,188 ± 0,008	0,196 ± 0,004	0,200 ± 0,011	0,200 ± 0,012
Energy value, kcal	114,1	119,0	95,7	97,4

5. Physico-chemical parameters of subcutaneous fat of young pigs of different breeds and pre-slaughter live weight, ($\overline{X} \pm S_{\overline{X}}$), n = 3

Live weight, kg	Breed					
	Large White			Pietrain		
	hygroscopic moisture, %	melting point, °C	the number of refraction	hygroscopic moisture, %	melting point, °C	the number of refraction
100	6,4 ± 0,17	31,3 ± 0,45	1,4600 ± 0,001	9,7 ± 0,56	34,2 ± 1,08	1,4600 ± 0,001
120	5,6 ± 0,09	33,3 ± 0,21	1,4604 ± 0,001	8,8 ± 0,83	35,0 ± 1,43	1,4620 ± 0,001

Increased fat content of pigs Large White breed caused a difference in energy value. Thus, increased indicators of energy value showed meat of young pigs Large White breed and for raising the slaughter weight to 120 kg compared to the same value of meat from young pigs Pietrain breed.

Fat, as a technical product, must have a high melting point for its long-term storage, but it has the best culinary properties with a low melting point [7]. In our studies, the discrepancy between the different age groups of animals in terms of fat melting temperature was insignificant: higher values of fat melting temperature were characterized by the animals increasing the slaughter weight to 120 kg. The breed difference in this indicator was relatively pronounced and confirmed the increased quality of fat of pigs Large White breed compared to the fat Pietrain breed.

Refractive index, which characterizes the optical density of a substance and reflects the degree of fat's unsaturation. If more unsaturated fatty acids contained in the fat, refractive index would be the higher. The refractive index varied slightly between 1.4600 and 1.4604 in both breeds. A slight trend was in animal fat with an increase in slaughter weight from 100 kg to 120 kg.

Pig meat of Pietrain breed had worse indicators of tenderness, which led to its rigidity and confirmed by the conducted tasting evaluation (Table 6).

6. Tasting evaluation of broth and pig meat of Large White and Pietrain breeds, $\overline{X} \pm S_{\overline{X}}$

Live weight, kg	Indicators of tasting evaluation of broth, score							
	aroma		taste		Color		Transparency	
	Breed							
	LW	P	LW	P	LW	P	LW	P
100	4,5 ± 0,14	4,1 ± 0,12	4,3 ± 0,16	3,9 ± 0,10	4,9 ± 0,16	3,9 ± 0,09	3,5 ± 0,14	4,3 ± 0,08
120	5,0 ± 0,00	4,1 ± 0,10	4,5 ± 0,17	4,0 ± 0,12	5,0 ± 0,00	4,3 ± 0,11	4,0 ± 0,14	4,5 ± 0,05
		Meat tasting indicators						
	aroma		taste		Tenderness		Color	
	Breed							
	LW	P	LW	P	LW	P	LW	P
100	5,0 ± 0,00	3,1 ± 0,16	4,0 ± 0,22	3,0 ± 0,38	4,6 ± 0,17	3,6 ± 0,29	4,5 ± 0,10	3,9 ± 0,07
120	5,0 ± 0,00	3,4 ± 0,18	4,2 ± 0,16	3,2 ± 0,29	4,8 ± 0,11	3,8 ± 0,18	4,9 ± 0,15	4,1 ± 0,09

Broth and meat of pigs Pietrain breed on the background of all other indicators (maximum score 5 points) received significantly lower scores in terms of aroma, taste and tenderness compared to samples of Large White breed. The difference between the different weight groups is statistically unreliable, but there was a tendency to improve the taste, color, tenderness with the increase of live weight and accordingly the age of animals.

Conclusions

1. With the increase of pre-slaughter live weight in carcasses of yound pigs Pietrain and Large White breeds, the specific weight of shoulder-scapular part was reduced by 2.3 and 1.6 %, the dorsal lumbar part was increased by 2.2 and 1.4 %, the pelvic femoral part was practically unchanged.

2. The meat content of all anatomical cuttings of the carcasses of pigs Pietrain breed had a significant advantages over the Large White breed.

3. The specific characteristics of meat Pietrain breed include the increased indicators of active acidity (pH level), poorer indices of tenderness, moisture retention capacity, color intensity, more significant weight loss of meat during heat treatment, but it tends to increase in protein content, and fat content – on the contrary, preference is given to pigs of Large White breed, which determines the difference in its energy value.

4. According to the indicator of dry matter, the melting point, it was established the preference for the fat of Large White breed, and confirmed its higher quality of fat compared with the fat of Pietrain breed.

5. Tasting evaluation of broth and meat proved the advantage of Large White breed over the Pietrain breed. In addition, there was a tendency to improve the tasting indicators with the increase of animals live weight from 100 to 120 kg, and accordingly the age of animals.

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Сусол Р. Л.[1], Халак В. І.[2], Сусол Л. О.[1] Тацій О. В.[1] Морфологічний склад анатомічних частин туш молодняку свиней різних генотипів. *Зернові культури. Т. 3. № 2. С. 337–344.*

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Наведено результати досліджень морфологічного складу анатомічних частин туш молодняку свиней різних порід з неоднаковою передзабійною масою. Встановлено, що при збільшенні забійної живої маси в тушах молодняку свиней великої білої породи та породи п'єтрен питома вага плечолопаткової частини зменшується, а спиннопоперекової – збільшується. Питома вага тазостегнової частини у тушах обох порід залишається практично без змін.

До специфічних особливостей м'ясної продукції породи п'єтрен слід віднести підвищені показники рівня pH, гірші показники ніжності, вологоутримуючої здатності, інтенсивності забарвлення, більш значні втрати маси м'ясом при його термічній обробці. Крім того, м'ясо свиней породи

п'єтрен відзначається пониженим вмістом сухої речовини, але встановлено тенденцію до підвищення в ньому вмісту протеїну, а за вмістом жиру, навпаки, перевага була на боці м'яса молодняку свиней великої білої породи. Підвищений вміст жиру у м'ясі свиней великої білої породиі зумовив різницю за його енергетичною цінністю. За показниками сухої речовини і температури плавлення кращим виявилось сало, одержане з туш молодняку свиней великої білої породи, ніж породи п'єтрен, що свідчить про підвищену його якість. При дегустації м'яса і бульйону значно нижчими оцінками за такими показниками, як аромат, смак та ніжність, відзначалась порода п'єтрен порівняно з великою білою.

Ключові слова: *свині, молодняк, велика біла порода, п'єтрен, фізико-хімічні властивості, хімічний склад, м'язова тканина, анатомічні відруби, туша, морфологічний склад, дегустаційна оцінка.*

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Сусол Р. Л.[1], Халак В. И.[2], Сусол Л. А.[1], Таций А. В.[1] Морфологический состав анатомических частей туш молодняка свиней разных генотипов. *Зерновые культуры. Т. 3. № 2. С. 337–344.*

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Приведены результаты исследований морфологического состава анатомических частей туш молодняка свиней разных пород и при разной предубойной массе. Установлено, что при увеличении убойной живой массы в тушах молодняка свиней крупной белой породы и породы пьетрен удельный вес плечелопаточной части уменьшается, а спиннокрестцовой – увеличивается. Удельный вес тазобедренной части в тушах обеих пород остается на том же уровне.

К специфическим особенностям мяса породы пьетрен можно отнести повышенные показатели уровня pH, худшие показатели нежности, влагоудерживающей способности, интенсивности окраски, более значительные потери массы мясом при его термической обработке. Кроме того, мясо свиней породы пьетрен отличается пониженным содержанием сухого вещества, но установлена тенденция к повышению в нем содержания протеина, а по содержанию жира, наоборот, преимущество имеет м'ясо молодняка свиней крупной белой породы. Повышенное содержание жира в мясе свиней крупной белой породы обусловливает разницу в его энергетической ценности. По показателям сухого вещества и температуры плавления лучним оказалось сало, полученное с туш молодняка свиней крупной белой породы. При дегустации мяса и бульона более низкими оценками по таким показателям, как аромат, вкус и нежность, отличалась порода пьетрен по сравнению с крупной белой породой.

Ключевые слова: *свиньи, молодняк, крупная белая порода, пьетрен, физико-химические свойства, химический состав, мышечная ткань, анатомические отрубы, туша, морфологический состав, дегустационная оценка.*