

UDC: 636.4.082

ASSESSMENT OF THE QUALITY OF MODERN COMMERCIAL PORK PRODUCTS

DOI: <https://doi.org/10.15673/fst.v14i2.1718>

Article history

Received 24.09.2019
Reviewed 12.11.2019
Revised 14.04.2020
Approved 02.06.2020

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Cite as Vancouver style citation

Garmatyk K, Susol R, Broshkov M, Danchuk O, Panikar Ih, Susol L. Assessment of the quality of modern commercial pork products. Food science and technology. 2020;14(2):41-49. DOI: <https://doi.org/10.15673/fst.v14i2.1718>

Цитування згідно ДСТУ 8302:2015

Assessment of the quality of modern commercial pork products / Garmatyk K. et al // Food science and technology. 2020. Vol. 14, Issue 2. P. 41-49 DOI: <https://doi.org/10.15673/fst.v14i2.1718>

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Introduction. Formulation of the problem

Commercial pork production in Ukraine has been developing quite dynamically during the last decade: the overall production has increased, and new, intensive technologies have been introduced. At the same time, there has been growing concern about the quality of pork produced under present-day conditions of intensive commercial production. It is sad to admit that today, pig producers in Ukraine give little weight to the quality of pork. That is why scientists should be able to foresee and prevent any potential problems. The problem of pork quality must be raised as early as today. Further acceleration of the performance and production rates in the

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Abstract. By a morphological study of carcasses of young pig stock of different origin, it has been proved that up-to-date crossbreeding schemes using meat-type breeds as parents increase the percentage of meat in a carcass and optimise the lean-to-fat ratio. Physicochemical analysis of pork obtained from pigs of different breeds has shown that all the parameters investigated are within the current physiological standards. Most parameters have shown no significant difference, though tend to exhibit some peculiarities associated with the effect of a genotype on how this or that physicochemical characteristic manifests itself. The use of the Piétrain breed as the sire line decreases the intramuscular fat content, and hence the calorific value of pork. The back fat of this breed has the highest melting point, which indicates its high storability, but somewhat lower cooking properties than those of similar products obtained from offspring of Large White and Landrace parents. The pH and water-holding capacity of the pork of Piétrain-sired offspring make it quite similar to PSE (Pale, Soft, Exudative) meat: this pork is slightly less tender and paler in colour and exhibits greater weight loss during thermal processing. Also, the result of a comprehensive sensory evaluation of boiled pork and pork broth obtained from Piétrain-sired young stock was the lowest, which is consistent with most of the physicochemical properties of pork from pigs of this genotype. So, it is the 75% purebred Landrace that should be favoured as a terminal sire line in crossbreeding programmes in order to obtain pork and bacon of improved quality in intensive commercial swine production systems. It is recommended to combine Piétrain and Duroc lines to produce terminal sires, ½ (Piétrain + Duroc), that will be further mated with two-breed-cross dams – ½ (Large White + Landrace).

Keywords: quality, sensory evaluation, pork, commercial production, hybridisation.

pig industry may adversely affect the quality of raw materials supplied to the processing plant and then the quality of products delivered to end consumers. It is the quality of commercially produced pork that this paper is focused on.

Analysis of recent research and publications

In a competitive environment, the quality of food is the most important factor ensuring its successful production. Analysis of consumption of meat and meat products has shown that the concept of "quality" for a modern consumer goes way beyond its purely biological definition. This concept is determined by three interrelated aspects a consumer wants to rely on,

which require constant attention of science and practice: the quality of a product, the quality of its laboratory testing, and the quality of its production process [1].

Multipurposeness and unique character of pigs' muscle tissues is due to their high calorific value, balanced amino acid profile of proteins, and presence of biologically active substances. These characteristics, in combination, ensure the normal physiological state and utilisation of nutrients in the human body. No doubt, pork is an important component of human diets across the world. It has been a leader of food production and consumption for many years due to a number of social and economic factors [2]. To date, pork makes more than 40% in the EU meat balance. It is known that pork and back fat are in the front rank of traditional consumer products in Ukraine. However, today, pork accounts just for 30% in the national meat balance [3]. This is why when placing emphasis on the present-day national output, it is crucial to focus on how to maintain the high quality of pork, since it remains a valuable calorific food of great biological and strategic importance essential for good nutrition, well-being, and health of Ukrainians.

Subcutaneous pork fat (fatback) contains about 92-94% of fat, 4-4.5% of water, and 1.3-1.5% of stromal vascular fraction. As compared to tallow, fatback is more palatable and digestible while being high in calories [3].

The human body requires 60-80 g of fat a day, which is comprised of 10% of polyunsaturated fatty acids, 30% of saturated fatty acids, and about 60% of monounsaturated fatty acids [2]. This is exactly how fatty acids are distributed in pork fat [3]. The biological value of intramuscular and subcutaneous fat in pigs is due to the increased levels of essential polyunsaturated fatty acids (especially arachidonic acid) and not easily available vitamins A, D, E, and carotene [4].

Arachidonic acid, which can be found in pork fat, is absent in vegetable oils and cannot be synthesised in the human body. Besides, pork fat contains a vitamin-like substance or vitamin P (which is a combination of arachidonic, linoleic, and linolenic acids) and the trace element selenium. They have a positive effect on the capillary permeability, vascular tone, and liver function, and are essential for strengthening the immune system and lipid metabolism in humans and animals [3,5].

The percentage of saturated fatty acids in lipids of mature animals also increases with age. Fats are lacking in the meat of malnourished animals, and the digestibility of such fats is poorer.

The rates of intensification of commercial pork production technologies over the last 20-30 years (employment of fast-growing swine genotypes, concentrate feeding, increased stocking density, etc.) make it necessary to control a complex of pork quality parameters: the nutritive and biological value, the

sensory (organoleptic), morphological, physical, functional, processing, hygienic, toxicological, and other characteristics of pork. Thus, assessing the quality of commercial pork products in Ukraine remains a topical issue.

Special emphasis in modern research is placed on comprehensive solution of a number of problems which have only been aggravated under conditions of intensive commercial production. One of these issues is how to counter the effects of biological antagonism in pigs. It is well recognised that meat quality declines with an increasing meat content in a carcass [5]. Modern commercial pig production, which is based on intensive manufacture of lean pork and maximisation of profit over the shortest time possible, has been recently facing a severe problem: abnormalities in the level of biological processes in living pigs affect the quality of carcass maturation after slaughter and contribute to development of different defects in meat [6-8]. In most cases, commercial swine hybrids characterised by high live weight gain and high rates of muscle tissue growth yield pork with poor physicochemical quality characteristics that match the defect criteria PSE (pale, soft, exudative meat) and DFD (dark, firm, dry meat) [3]. The mentioned defects are typically found in the most valuable cuts of pork, and processing such raw materials requires extra costs. The PSE defect is identified mainly in the longissimus muscle and in the hind quarter muscles: *m. longissimus dorsi* – 86.6%, *m. sememembranous* – 73.7%, *m. gluteus medius* – 70%, and in other muscles – 40%. The ratio of different types of muscle fibre (glycolytic, oxidative, and intermediary) determines whether a muscle is likely to manifest signs of the PSE defect [9,10].

Thus, the breed, health status, and age of animals at slaughter are important factors which determine the quality grade of pork for processing. There are various factors contributing to the development of meat quality defects; these may be related to genetics or arise during the growing phase, transportation, or at slaughter. In this regard, the issues of pork quality depending on the breed-of-origin of animals are of primary importance.

It is sad to admit that pig producers in Ukraine are known for not paying proper attention to the quality of pork. Hence, the processing industry loses profits because of high moisture losses in carcasses and semi-finished products while thawing, salting, curing, and smoking pork products, and because valuable cuts of pig carcasses often have to be processed to produce cheaper products [5]. This is why it is of great importance to foresee potential problems related to the quality of pork, as further acceleration of the performance and production rates in the pig industry may negatively affect the quality of pork and pork products delivered to the end consumer.

One should understand that high-quality pork can be obtained at moderate rates of pigs' growth (with a fattening period of 6-8 months) if the principles of

ecological or, rather, organic production are employed. Such pork is tender and aromatic, without excessive moisture and weight losses during ageing and processing, and is perfect for long-term storage [11]. The key factor limiting organic pork production is its high cost and individuals' low purchasing power. That is why commercially produced pork comprises the largest portion of the total meat production in Ukraine. So, scientists and manufacturers should direct their joint efforts to solve the problem of the product quality within a comprehensive system of high-quality pork production "from farm to table."

Improving the quality characteristics of swine carcasses of modern specialised meat breeds and hybrids, the physicochemical properties, and chemical composition of pork as a raw material for meat-processing plants is a topical problem of great practical interest [12-17].

The purpose of our research is quality assessment of carcasses, pork, and fat of pigs of different genotypes under the present-day conditions of intensive commercial pork production. To this end, we have solved the following **tasks**:

- morphological study of carcasses of pigs crossbred from different combinations of breeds;
- chemical analysis and determination of the basic processing characteristics of muscle tissue and subcutaneous fat of pigs of different genotypes;
- sensory evaluation of boiled pork and pork broth made from samples collected in different groups of pigs.

Research materials and methods

The objects of the study were carcasses of Large White pigs of Ukrainian origin (the control group) and carcasses collected in six experimental groups of young stock produced by multi-combination crossbreeding in accordance with the design of the on-farm experiment presented in Table 1.

For all animals in all experimental groups, the feeding programme and housing conditions were the same, typical of technologies where some production processes are mechanised and automated. Throughout the experiment, the animals were given complete dry

mixed rations in accordance with zootechnical standards [3]. We employed concentrate feeding, and the animals had free access to water. Pigs grown under the conditions of commercial pig farming for 167-184 days since birth, upon gaining 100 kg of live weight, were moved to the finisher group for control slaughters.

After slaughter, the carcasses were gradually cooled down, and after 24-hour maturation at +2–4°C, their morphology was examined by boning the right side of each carcass and weighing its morphological components: lean, fat, and bones. We calculated the percentage of each component in the carcasses and the lean-to-fat ratios.

The quality of the longissimus muscle samples (*m. longissimus dorsi*) and subcutaneous back fat collected from the right half-carcasses in the region of the 9th–12th vertebrae was analysed in the laboratory according to standard procedures [18].

The physicochemical quality parameters of muscle tissue were assessed in accordance with the guidelines of Lenin All-Union Academy of Agricultural Sciences and with regulatory documents (ISO 2917:1999, IDT): National Standard of Ukraine (NSU) ISO 2917:2001.

These are the parameters determined in the samples 48 hours after slaughter. The pH level (NSU ISO 2917:2001) was measured using a portable pH-meter pH-150M (Belarus); the water-holding capacity was determined by the Grau and Hamm press method; the pork tenderness was evaluated by D. Levantin's method using a Warner–Bratzler shear machine [18]; the colour intensity was measured by the photocolourimetric method using a photocolourimeter KFK-3 (Russia) [18]; losses due to thermal processing were calculated as the difference in the sample weight before and after treatment with dry heat in a bain-marie for 50 minutes [5]. In the freshly rendered fat from the subcutaneous layers, the moisture content was determined by drying at 105°C, and the melting point was measured in a straight open-end capillary tube, 1.5 mm in diameter, with an Amarell digital thermometer AMA-digit ad 14th (Germany) [18].

Table 1 – Design of the on-farm experiment

Group	Parents		Feeder young stock (n=20)
	Dams (n=10)	Sires (n=3)	
	Genotype		
I control	Large White	Large White	Large White
II experimental	Large White	Landrace	½ (Large White + Landrace)
III experimental	F ₁ *	Large White**	¾ Large White + ¼ Landrace
IV experimental	F ₁	F ₁	½ (Large White + Landrace)
V experimental	F ₁	Landrace**	¾ Landrace + ¼ Large White
VI experimental	F ₁	Piértrain	¼ Large White + ¼ Landrace + ½ Piértrain
VII experimental	F ₁	½ (Piértrain + Duroc)	¼ Large White + ¼ Landrace + ¼ Piértrain + ¼ Duroc

Notes: * F₁ – crossbred dams and terminal sires (½ Large White + ½ Landrace);

** Large White and Landrace parental lines.

The chemical composition of pork was determined following the standard methods [18] and regulatory documents: National Standard (GOST) 23042-86 and 9793-74. To this end, the total moisture content in the pork was determined by drying at 100–105°C; the intramuscular fat was measured by Soxhlet extraction, with petroleum ether used as a solvent; the mineral ash content was measured after the samples had been subjected to the temperature 450°C in a muffle furnace; and crude protein was measured by the Kjeldahl method. The energy value of pork (longissimus muscle) was calculated from the results of the chemical analysis and made 4.0 kcal per gram of protein and 9.0 kcal per gram of fat [18].

The optimal values of the key quality parameters of pork in this study determined on the basis of the standards reported in [3,5] were as follows: water-holding capacity 53–65%; tenderness 8.4–12.2 kgf; intramuscular fat content 1.2–3.3%; melting point of back fat 29.7–42.0°C. The optimal pH levels calculated according to [4] were pH24 5.6–6.2 and pH48 5.2–5.8 [7].

The sensory characteristics of boiled pork and pork broth made from the longissimus muscle samples taken in the region of the 9th–12th vertebrae of carcasses of pigs from different experimental groups were scored on a 5-point scale by an expert committee following the requirements of NSU 4823.2:2007. The samples (150–200 g) were boiled for one hour. Water was added at a ratio of 1:10, and salt was added at a rate of 1% of the pork weight. Neither herbs nor spices were used while cooking.

The measurement results obtained were analysed by means of statistical variation techniques using the application MS Excel 2010 run on a personal computer.

Results of the research and their discussion

The results of morphological evaluation of carcasses of the studied young pig stock of different breed-of-origin are given in Table 2. These data make it clear that all experimental groups of crossbred young stock are superior to the control group of purebred Large White pigs by the meat percentage in the carcasses. In particular, the dressing percentage is higher by 0.7-1.2% (groups II–IV), 2.3% (group V),

4.8% (group VI), and 4.0% (group VII) as compared to that in the control group. However, the carcass fat content in the control group is higher than that in all experimental groups by 0.6–3.3%. The statistically significant differences in the carcass fat content between the young pigs in the control group and the crossbreds in the experimental groups are 1.9% (group V; $p < 0.01$), 3.3% (group VI; $p < 0.001$), and 3.1% (group VII; $p < 0.001$). The difference in the bone content between the control group and experimental groups II–V is negligible and not statistically significant. However, this difference is more profound between the control group and experimental groups VI and VII: they had the lowest carcass bone percentages 0.9% and 1.5%, respectively, lower than in the control group ($p < 0.05$). The evaluation of the meatiness of carcasses was based on the lean-to-fat ratio and has shown the lowest value in the control group (2.3:1). This parameter is slightly better in experimental groups II–IV (2.37-2.53:1) and moderately better in experimental group V (2.60:1). The maximum improvement of the meatiness of carcasses, as compared to the control group, is recorded in the young stock in experimental groups VI–VII (2.77-2.83:1). In general, the morphological analysis of the carcasses of young stock of different breed-of-origin allows concluding that up-to-date crossbreeding schemes, with the Landrace, Duroc, and Piétrain breeds used as paternal lines, increase the meatiness of carcasses. This is confirmed by an increased meat content in carcasses and a better lean-to-fat ratio, which, in its turn, accounts for the current high demand for meatier pork on both global and national markets. This improvement of the lean percentage in carcasses due to using pigs of modern meat breeds in the classical crossbreeding and hybridisation schemes has been proved in the studies of different authors [3,8,10,17].

The chemical analysis of muscle tissues of young stock of different breed-of-origin (Table 3) has shown that all the parameters considered are within the current physiological limits. Most parameters show no significant difference ($p > 0.05$), though tend to exhibit some peculiarities associated with how the genotype effects on the manifestation of this or that chemical characteristic of muscle tissue.

Table 2 – Morphology of carcasses of young pig stock of different breed-of-origin, % ($\bar{X} \pm S_{\bar{X}}$)

Group	Meat	Fat	Bones	Lean-to-fat ratio
I	60.9±0.28	26.5±0.22	12.6±0.21	2.30
II	62.1±0.36	25.5±0.24*	12.4±0.22	2.43
III	61.8±0.39	25.4±0.27	12.8±0.19	2.43
IV	61.6±0.33	25.9±0.23	12.5±0.22	2.37
V	63.2±0.32**	24.6±0.29**	12.2±0.24	2.60
VI	65.7±0.21***	23.2±0.28***	11.1±0.28*	2.83
VII	64.9±0.33***	23.4±0.23***	11.7±0.25*	2.77

Notes: hereinafter * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Table 3 – Physicochemical characteristics of muscle tissues of the young stock under study, % ($\bar{X} \pm S_{\bar{x}}$), n=3

Group						
I	II	III	IV	V	VI	VII
Moisture (%)						
73.7±0.68	73.3±0.44	73.4±0.49	73.2±0.30	72.8±0.38	72.8±0.43	72.4±0.33
Dry matter (%)						
26.3±0.44	26.7±0.38	26.6±0.59	26.8±0.41	27.2±0.46	27.2±0.40	27.6±0.40
Fat (%)						
4.2±0.31	4.4±0.33	4.5±0.33	3.6±0.24	4.2±0.22	2.4±0.26*	3.8±0.39
Protein (%)						
21.0±0.29	21.2±0.33	21.0±0.38	22.0±0.47	22.0±0.36	23.7±0.33**	22.6±0.33*
Ash (%)						
1.1±0.01	1.1±0.01	1.1±0.01	1.2±0.02*	1.1±0.02	1.1±0.01	1.2±0.02
Energy value (kcal)						
121.8	124.4	124.5	120.4	125.8	116.4	124.6

The distribution of the dry matter is quite specific: the dry matter content is the lowest (26.3%) in pork of purebred Large White pigs in the control group, and it gradually increases (by 0.4–1.3%) in pork of crossbred pigs in the experimental groups.

This increase in the percentage of dry matter in pork of crossbred pigs in the experimental groups as compared to the control group results from a 1.9–2.7% increase in the percentage of crude protein in pork of crossbreds in groups IV–VII while the fat content decreases by 0.4–1.8% in animals in groups IV, VI, and VII. At the same time, the mineral ash content is practically the same in all groups (1.1%). The only exception is pork of crossbreds in groups IV and VII, which is by 0.1% higher in mineral ash than the other groups.

The analysis of the energy value of the longissimus muscle in different groups of pigs has indicated that higher energy values are due to the increased intramuscular fat content. The lowest fat content is in pork of the Piétrain-sired young crossbred stock in group VI that inherited this specific trait from their parents. The energy value of pork obtained from pigs in groups I, IV, and VI is rather low. The energy value of pork of crossbred pigs in groups II, III, V, and VII is higher, with practically no variations within these groups. It is worth noting that the energy value of the longissimus muscle of pigs of modern high-yielding meat genotypes has tended to decrease over the last 20 years, which is confirmed by other authors' findings [8].

The melting point of pork fat as a derivative product should be high in order to allow its safe storage. On the other hand, the cooking properties are better in the fat with a lower melting point [10]. The analysis of the physicochemical characteristics of subcutaneous fat of pigs of different breed-of-origin (Table 4) has shown that the difference in the fat melting point among most groups of pigs is not significant. It should be mentioned that the melting point is higher for the fat of the Piétrain-sired young crossbred stock in group VI. This indicates its good storability, though somewhat lower cooking properties. The refractive index of the rendered lard characterises its optical density and indicates the degree of unsaturation of fatty acids. The higher the content of unsaturated fatty acids in fat, the higher the refractive index is. The refractive indices range 1.4595–1.4701 in all the groups. It should be highlighted that the refractive index is the highest for the fat of the Piétrain-sired young crossbred stock in group VII, which confirms the highest degree of unsaturation of fats in pigs of this group.

Table 5 summarises the results of the physicochemical analysis of pork of young crossbreds obtained from different combinations of breeds. The pH level plays an important role in the technological process of preserving and processing pork and determines the rate of autolytic processes in muscle tissue after slaughter.

Table 4 – Physicochemical characteristics of subcutaneous fat of young pig stock of different breed-of-origin ($\bar{X} \pm S_{\bar{x}}$), n=3

Parameters	Group						
	I	II	III	IV	V	VI	VII
Moisture, %	6.3±0.19	6.4±0.16	6.4±0.11	6.5±0.17	6.2±0.13	6.7±0.10	6.6±0.14
Melting point, °C	34.8±0.32	33.9±0.27	34.7±0.36	35.1±0.28	34.5±0.24	38.4±0.19***	35.0±0.22
Refractive index	1.4599±0.001	1.4602±0.001	1.4600±0.001	1.4595±0.001	1.4609±0.001	1.4701±0.002**	1.4624±0.001

Table 5 – Physicochemical characteristics of meat of young pig stock of different breed-of-origin ($\bar{X} \pm S_{\bar{X}}$), n=3

Parameters	Group						
	I	II	III	IV	V	VI	VII
pH	5.9±0.09	5.5±0.07*	5.7±0.06	5.9±0.11	5.6±0.09	5.3±0.05**	5.5±0.07*
Tenderness, kgf	7.6±0.18	9.6±0.12***	8.7±0.14**	7.7±0.09	9.8±0.11***	13.6±0.07***	11.6±0.08***
Water-holding capacity, %	60.2±1.62	58.4±1.44	59.7±1.58	60.1±1.31	57.3±1.08	52.6±0.96*	53.3±1.11*
Colour intensity, ext. units x 1,000	68.1±2.04	65.6±1.82	64.5±2.00	63.3±1.76	64.4±1.46	60.2±1.72*	62.7±2.24
Weight loss during cooking, %	34.5±1.01	33.9±1.16	34.2±1.37	34.6±1.29	34.3±0.98	37.8±0.61*	37.1±0.77

Our findings show some peculiarities of pork obtained from pigs in different groups under study. In particular, the pH level of the pork samples collected in experimental groups II, III, V, and VII is practically the same, while the pH of the samples from the control group and group IV is higher (5.9). The pH level of the pork samples from group VI, with a higher percentage of the Piétrain genes, is by 10.2% lower, which is statistically significant ($p < 0.01$). It is interesting that the pH level of pork obtained from pigs in group VI is close to the criterion for the PSE defect, as the pH of NOR meat is 5.6–6.2.

Tenderness of meat is determined by its water-holding capacity, pH, percentage of connective tissue and fat, muscle fibre thickness, and degree of ageing after slaughter [3,5]. Regarding pork tenderness, it is worth noting that this parameter is within the technological standards (8.3–12.2 kgf) for all the samples examined. However, the pork samples collected from ½ Piétrain young crossbreds (group VI) are characterised by greater firmness. The tenderest were the pork samples from the purebred Large White pigs in the control group. The muscle tissues of crossbreds in groups II, III, V, VI, and VII are firmer as compared to the control group, with a statistically significant difference of 26.3% ($p < 0.001$), 14.5% ($p < 0.01$), 28.9% ($p < 0.001$), 78.9% ($p < 0.001$) and 52.6% ($p < 0.001$), respectively. These results suggest that the firmer consistency is specific to pork obtained from Piétrain pigs: Piétrain sires used in crossbreeding and hybridisation programmes pass this genetic trait to their offspring.

Water-holding capacity is an important parameter of pork quality. It depends on the presence of free moisture and moisture bound to a protein substance. The normal range of water-holding capacity is 53.0–66.0%. There is no statistically significant difference in this parameter between the control group and experimental groups II–V.

However, the water-holding capacity tends to decrease in the pork samples from pigs in experimental groups VI and VII. Primarily, this is due to their accelerated growth rates and a younger age at which they gain the market weight. The water-holding capacity of the pork samples collected in these experimental groups is, respectively, by 12.0% and

11.5% lower than that in the control group (with $p < 0.05$). by the parameter of water-holding capacity, the pork from pigs in experimental group VI matches the PSE defect criteria. Likewise, it has been established that the pork colour intensity of the purebred Large White pigs in the control group is consistently superior to that in all the other groups. The colour intensity values of the pork samples from the groups under analysis fully meet the technological standards (51.082.0 ext. units x 1,000), though the colour intensity is by 11.6% lower (with $p < 0.05$) for the pork samples from group VI as compared to the control group.

As regards the weight losses during thermal processing, this parameter is but slightly higher in the samples from experimental groups II–V, but for the samples from groups VI and VII, it is higher, respectively, by 9.6% and 7.5% (with $p < 0.05$), as compared to the control group. The weight loss in the muscle tissue during thermal processing of the samples from groups VI and VII allows classifying them as PSE pork, because they exceed the standard limits (25–35%).

The final stage of our study was sensory evaluation of boiled pork and pork broth cooked using the carcass samples collected from pigs of different breed-of-origin (Table 6). According to the agreed scoring system of sensory evaluation, the broths that has got the highest total score and ranked first are those from the samples of experimental groups V (¾ Landrace+¼ Large White) and VII (¼ Large White+¼ Landrace+¼ Piétrain+¼ Duroc). The broths from the samples of the control group (purebred Large White) and of experimental group II (½ (Large White+Landrace)) have been ranked second and third, respectively, though there is no statistically significant difference between their scores. The expert committee have given the fourth and fifth rank to the broths cooked from the samples of experimental groups IV (½ (Large White+Landrace)) and III (¾ Large White+¼ Landrace), respectively. The broth cooked from the group VI samples (¼ Large White+¼ Landrace+½ Piétrain) has been scored lowest. It should be noted that the broth was given so low a score, because its thickness (transparency), aroma, and flavour were too poor.

Table 6 – Sensory evaluation score of boiled pork and pork broth ($\bar{X} \pm S_{\bar{X}}$), n=20

Parameters	Group						
	I	II	III	IV	V	VI	VII
Sensory evaluation score of pork broth							
Aroma	4.4±0.11	4.5±0.12	4.2±0.12	4.0±0.07**	4.5±0.11	3.8±0.09***	4.5±0.11
Flavour	4.2±0.09	4.4±0.11	4.1±0.12	4.2±0.09	4.8±0.09***	3.5±0.15***	4.7±0.11***
Colour	4.7±0.11	4.1±0.14***	4.0±0.13***	4.4±0.13	4.2±0.16*	3.9±0.12***	4.4±0.10
Transparency	4.0±0.16	4.2±0.12	4.0±0.13	4.3±0.13	4.5±0.14*	4.1±0.10	4.4±0.13
Total score	17.3	17.2	16.3	16.9	18.0	15.3	18.0
Ranking	2	3	5	4	1	6	1
Sensory evaluation score of boiled pork							
Aroma	4.9±0.07	4.6±0.11*	4.4±0.11***	4.2±0.09***	4.7±0.11	3.7±0.11***	4.6±0.11*
Flavour	4.3±0.13	4.1±0.14	4.0±0.10	4.2±0.12	4.4±0.11	3.4±0.13***	4.2±0.12
Colour	4.2±0.12	4.0±0.15	4.1±0.12	4.3±0.11	4.1±0.18	3.2±0.17***	3.8±0.22
Transparency	5.0±0.00	4.0±0.13***	4.2±0.09***	4.4±0.11***	4.1±0.14***	3.0±0.16***	3.8±0.17***
Total score	18.4	16.7	16.7	17.1	17.3	13.3	16.4
Ranking	1	4	4	3	2	6	5

The sensory evaluation of boiled pork from pigs of different breed-of-origin has indicated that according to the agreed ranking system, the highest total score and first rank has been given to the boiled pork from the control group (Large White purebreds of Ukrainian origin).

The boiled pork from groups V (¾ Landrace+¼ Large White) and IV (½ (Large White+Landrace)) has been ranked second and third, respectively, though there is no statistically significant difference between their scores. The boiled pork from experimental groups II (½ (Large White+Landrace)) and III (¾ Large White+¼ Landrace) with similar total scores has been ranked fourth. The fifth rank has been given to the boiled pork from experimental group VII (¼ Large White+¼ Landrace+¼ Piétrain+¼ Duroc). The boiled pork from group VI (¼ Large White+¼ Landrace+½ Piétrain) has got the lowest score (13.3) and rank.

Conclusion

A morphological study of carcasses of the surveyed young pig stock of different breed-of-origin has proved that up-to-date crossbreeding schemes using Landrace, Duroc, and Piétrain breeds as parents increase the percentage of meat in a carcass by 0.7-4.8%, as compared to the control group of Large White

purebreds. The use of the Piétrain breed as the sire line decreases the intramuscular fat content and the calorific value of pork, and results in a higher fat melting point, which somewhat lowers its cooking properties, as compared to similar products obtained from the offspring of the Large White of Ukrainian breeding and the Landrace of foreign origin. Besides, by its pH level, tenderness, water-holding capacity, and weight loss during thermal processing, the pork from Piétrain-sired offspring matches the PSE meat criteria (Pale, Soft, Exudative), which is confirmed by the sensory evaluation of boiled pork and pork broth.

To obtain pork of improved quality in intensive commercial swine production systems, the Landrace breed should be favoured as a terminal sire line in crossbreeding and hybridisation programmes. It should be mated with two-breed-hybrid dams (½ (Large White+Landrace)), which will allow achieving 75% of Landrace genes in the resulting hybrids. It would be desirable to precombine the ultra-meat Piétrain line with the Duroc breed to produce terminal sires (½ (Piétrain+Duroc)) that will be further mated with two-breed-cross dams (½ (Large White+Landrace)). This strategy will prevent a number of potential problems related to the processing and cooking properties of pork.

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ОЦІНКА ЯКОСТІ ПРОДУКЦІЇ СУЧАСНОГО СВИНАРСТВА ПРОМИСЛОВОГО ВИРОБНИЦТВА

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Анотація. Аналіз морфологічного складу туш молодняка свиней різної походження доводить, що застосування сучасних схем схрещування з використанням в якості батьківських форм м'ясних порід сприяє підвищеному вмісту м'яса у туші та оптимізації показника співвідношення м'ясо : сало. Аналіз фізико-хімічних показників свинини різної породної належності свідчить, що всі враховані показники знаходилися в межах існуючих фізіологічних норм. За більшістю показників не встановлено достовірної різниці, проте прослідковуються певні специфічні особливості, що пов'язано з впливом генотипу на прояв тих чи інших фізико-хімічних показників. Використання в якості батьківської форми свиней породи п'єтрен призводить до зниження вмісту внутрішньом'язового жиру, а звідси енергетичної цінності м'яса, а сало має найвищу температуру плавлення, що саме свідчить про його придатність до тривалого зберігання та дещо гірші кулінарні характеристики порівняно з аналогічними продуктами одержаними від великої білої породи та породи ландрас. М'ясо за показником активної кислотності, вологоутримуючої здатності наближається до м'яса з PSE-характеристиками, воно має дещо гірші показники ніжності, є більш блідим за кольором, відзначається підвищеними втратами маси при термічній обробці. Комплексна оцінка за результатами дегустації м'яса та бульйону від групи молодняка, де в якості батьківської форми використано свиней породи п'єтрен також показала найнижчі результати, що узгоджується з більшістю фізико-хімічних показників м'яса свиней даного генотипу, тому з метою одержання м'ясо-сальної продукції підвищеної якості за її інтенсивного промислового виробництва слід надавати перевагу таким батьківським формам у заключних схемах схрещування як ландрас з часткою умовної кровності до 75%. Породу п'єтрен краще попередньо поєднувати з породою дюрорк при виробництві термінальних кнурів ½ (п'єтрен + дюрорк) з подальшим їх використанням на двохпородних гібридних матках ½ (велика біла + ландрас).

Ключові слова: якість, дегустаційна оцінка, свинина, промислове виробництво, гібридизація.

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