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QUALITY AND TECHNOLOGICAL SUITABILITY OF MEAT FROM POLISH NATIVE BREEDS FOR THE PRODUCTION OF TRADITIONAL PORK PRODUCTS

S u m m a r y

Background. Organic production is identified with high quality of raw materials, health-promoting properties, and earlier – with animal welfare and sustainable development of agricultural production. Hence, the use of raw materials obtained from animals of native breeds is popular, which is associated with cultural heritage and support for local farms, especially for cattle producers. The production of salami type sausage, dry-cured bacon, dry-cured or cooked gammon, roasted ham in buckwheat or roulade of piglet, traditionally manufactured from regional meat, is also important for local authorities in promoting the region. Hence, it is important to highlight the qualities of available animal raw materials originating from domestic breeds.

Results and conclusions. The meat and fat of native pig breeds ‘Puławska’ (Pw), ‘Złotnicka White’ (ZW) and ‘Złotnicka Spotted’ (ZS) are characterized by a different technological quality and unique consumption value. A chemical composition affects the functional characteristics – the water, protein and fat content has an impact on the texture profile, organoleptic quality and safety. TheZS and Pw meat hasgreater fatness compared to the ZW meat, while the ZW meat has a higher palmitic and oleopalmitic acid content. The Pw and ZS meat differs in fatty acids proportions (DA, LA, SA, AA, CLA). The pH_{24} and water retention of the Pw, ZW and ZS meat indicate resistance to DFD and PSE defects. The meat of Polish native breeds is suitable for the production of traditional meat products (Pw, ZW, ZS), cooked hams and sirloins (ZW, ZS), as well as dried, smoked and non-smoked sausages (ZS). The aim of this study was to describe the selected properties of the meat of three Polish native breeds of pigs (PW, ZW, ZS) that determine its quality and technological suitability for the production of pork products using traditional methods.

Keywords: Pulawska, Zlotnicka White, Zlotnicka Spotted, technological suitability

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Introduction

Grounds for technological suitability

In recent decades, there have been changes in the livestock industry, including the management of large commercial farms in fully controlled and automated conditions. The progressive intensification of breeding and treatment resulting in increased productivity were the reason for the gradual displacement of native (domestic, homeland) breeds of pigs from farms by animals with better efficiency. This direction was fully supported by the development of new technologies and systems identifying hazards at all stages of production (from the field to the table). Native breeds were never suitable for breeding in large herds and small areas without access to grassland, therefore they were successively eliminated from farms.

Approximately 603 pig breeds are known and described in the world, of which 543 belong to local breeds (Integrated Taxonomy Information System ITIS, https://www.usgs.gov/tools/integrated-taxonomic-information-system-itis). Native breeds have been associated with humans for over 6,000 years. Due to their being able to easily adapt to harsh environmental conditions, they are still present on poorly mechanized farms. They are characterized by good health, longevity, fertility, considerable resistance to diseases and stress. The meat of native breeds is still of good quality with breed-specific marbling. The quality of meat enables the production of unique regional products based on old manufacturing traditions.

Consumer acceptance

Due to the change in consumer awareness, the EU's meat production and consumption are expected to decline. By 2031, the EU's pork meat consumption, based on the average from 2019 ÷ 2021, is estimated to decrease by about 8 % to 21.5 million tons. While the average pork consumption in 2018 was 69.8 kg per person, it will drop to 67 kg by 2031 (https://www.oecd-ilibrary.org). According to the Polish Institute of Agricultural and Food Economics National Research Institute (http://www.ierigz.waw.pl), the average Polish consumer eats 70.5 ÷ 73.5 kg of meat per year, about 40 kg of pork from intensive farming. The National Research Institute of Animal Production (https://iz.edu.pl/en/) has prepared the "Native Breed" label, generally for all animal species. The idea is to mark products from local farms of native breeds, which are distinguished by very good meat quality, good product quality, nutritional value and traditional production technology. So far, the meat of the Puławska breed has been very well marked. Up to 500 Puławska pigs from a single farm go to slaughterhouses each year (https://www.agropolska.pl). In a year, just over 20 Złotnicka pigs from a single farm go to slaughterhouses. Large amounts of half-carcasses are ordered by well-known restaurants operating in major cities, including Warsaw

(https://www.tygodnik-rolniczy.pl). It is known that the production of high-quality pork is forced by customer expectations. Since consumers are looking for meat products attractive in terms of nutrition, which are convenient to use, minimally processed, free from chemical additives (clean-label) and produced with a technology similar to the traditional one, it is worth considering the use of meat from native breeds of pigs for production. Approximately 71 % of consumers pay attention to the chemical composition and quality of purchased food, while 64 % of them are ready to pay more for better quality [33]. Organoleptic characteristics of meat products and animal welfare determine consumer preference [15, 21, 34, 39].

EU acceptance

The European Union (EU), based on the provisions of the Treaty of Maastricht of 1992, additionally promotes food production using traditional methods. The policy supports the development of small farms and regional meat plants interested in the use of native pig breeds. The EU supports programs for native genetic resource protection, providing financial support to France for the 'Gascon' breed (Midi-Pyrénées region) or to Italy for the protection of the 'Nero Casertano' (Campania region) and 'Apulo-Calabrese' (Calabria region). In Hungary, a protection program concerns the native breed 'Mangalica' (also 'Mangalitsa' or 'Mangalitza'). In Scandinavia, extensive-breed pigs account for about one-third of the market and this share is constantly increasing. The 'Puławska' (Pw), 'Złotnicka White' (ZW) and 'Złotnicka Spotted' (ZS) breeds are protected by the program for the Conservation of Genetic Resources of Farm Animals as an essential component of biodiversity, established on 29 August 1996 [4, 5, 35]. These breeds differ from currently preferred utility trends, showing, among others, varying meatiness and fatness (Table 1). They are derived from the harsh climatic conditions of northern Polish regions. The share of Pw, ZW and ZS breeding sows according to the data published as part of the program for the conservation of genetic resources in 2021 was: 2 167, 936 and 690, respectively. For comparison, the Central Statistical Office estimated the head count of all pigs in Poland to be at 10 242 400 in a similar period.

Carcass quality

Pw, ZW and ZS pigs are characterized by a 10.5 % lower meatiness compared to 'Polish Large White' (PLW) and 'Polish Landrace' (PL) [34, 38]. The carcasses of the Puławska breed represent class U, with an average meatiness of 50.56 %. The carcasses of the ZS and ZW breeds achieve the R class of commercial quality, with an average meatiness of 45.40 and 46.33 %, respectively (Table 1). The burden of the *RYR1* (ryanodine receptor) gene that determines the susceptibility of pigs to stress is found only occasionally [1, 8, 20, 42].

Table 1. Characteristics of Pulawska, Zlotnicka White and Zlotnicka Spotted breeds
Tabela 1. Charakterystyka ras Puławska, Złotnicka Biała i Złotnicka Pstra

Characteristics / Właściwości	Pw	ZW	ZS	References / Literatura
Utilitarian type / Typ użytkowy	Fat-meat Tłuszczowo-mięsny	Meat Mięsny	Meat-bacon Słoninowy	1, 4, 46
Body mass (kg) / Masa ciała (kg)	200-280 s. 250-350 b.	200-250 s. 250-300 b.	200-300 s. 300-350 b.	4,23
Slaughter weight (kg) / Masa ubojowa (kg)	100-120	100-120	100-120	9,27
Meatiness (%) / Mięsność (%)	54.8-55.0 s. 53.5-53.6 b.	49.5-51.3 s. 51.9-56.9 b.	47.0-48.2 s. 48.4-52.5 b.	23,40,42,44
Slaughter yield (%) / Wydajność ubojowa (%)	80.3	72.1	80	11, 46
Loin eye height (mm) / Wysokość oka polędwicy (mm)	50.5-52.0 s. 50.0-50.8 b.	44.9-46.7 s. 42.5-49.7 b.	40.4-46.8 s. 40.8-43.5 b.	40,42,44,46
Back fat thickness (mm) / Grubość słoniny (mm)	12.8-13.6 s. 13.8-14.9 b.	16.9-19.2 s. 11.7-15.6 b.	19.3-21.3 s. 15.4-19.8 b.	40,42,44, 46

Explanations / Objaśnienia:
Pw – Pulawska / Puławska, ZW – Zlotnicka White / Złotnicka biała, ZS – Zlotnicka Spotted / Złotnicka pstra, s. – sows / lochy, b. – boars / knury

Meat quality

The chemical composition of meat determines the carcass tissue composition and depends on many factors, including utility type, breed, sex, age, body mass and environmental conditions [6, 26, 27, 43]. Extensive rearing leads to changes in carcass fatness and thus affects the nutritional value and a number of organoleptic characteristics such as color, taste, tenderness and juiciness [6, 26]. Fresh Pw, ZW and ZS meat is pale red with varying hue and saturation [50]. It has a mild taste similar to blood, is slightly sour-sweet and bitter. The aroma is noticeably determined by the lactic acid. Meat with a higher pH appears to be less salty and flavorful than meat with lower values [26, 46].

Meat product promotion

In EU countries, traditional products made from the meat of native pig breeds are highly appreciated. The examples include the Spanish 'Ibérico' ham, the Tuscan 'Cinta senese', 'Basque' ham and the 'Corsican' prisuttu, produced, respectively, from the 'Iberian', 'Cinta Senese', 'Pie Noir du pays Basque' and 'Corsican Black' or 'Corsican Spotted' pig meat. The share of domestic pig meat on the Polish market is registered on the List of Traditional Products, created to identify and promote the Polish culinary tradition. Until now, several products have been registered by the Ministry of Agriculture and Rural Development, including 'Wielkopolska Pork Złotnicka' (*Wielkopolska wieprzowina złotnicka*, 2006), 'White sausage in a jar' made of the ZS meat (*Biała*

kiełbasa w słoiku, 2007), 'Leg roasted from a Złotnicka White pig' (*Udziec pieczony ze świni złotnickiej białej*, 2007) and 'Pig of the Puławy Breed' (*Świnie rasy puławskiej*, 2009) [17, 22, 23, 37].

Chemical properties determining meat quality

Water

Technological processes such as drying, smoking, baking and storage of meat and meat products reduce the water content and therefore, change the organoleptic characteristics. It has been stated in numerous studies that the water content of LTL (*musculus longissimus thoracis et lumborum*) muscle in Pw is 69.8 ÷ 74.0 %, ZW: 72.4 ÷ 73.7 % and ZS pigs: 69.2 ÷ 73.6 % (Table 2). The values obtained for Polish traditional pig breeds (Pw, ZW, ZS) are within the range of lean commercial pork (72 %), PL x PLW crossbreeds (74.3 %) and PL x (D x P) (72.3 %) [17]. For Pw gilts,

Table 2. Basic chemical composition of Pulawska, Zlotnicka White and Zlotnicka Spotted breeds meat
Tabela 2. Podstawowy skład chemiczny mięsa ras Puławska, Złotnicka Biała i Złotnicka Pstra

Breed / Rasa	Water (%) / Woda (%)	Protein (%) / Białko (%)	Fat (%) / Tłuszcz (%)	Ash (%) / Popiół (%)	Muscle / Mięsień	References / Literatura
Pw	73.70	22.40	2.50	1.20	LT	13,14
	71.60	22.00	3.70	1.20	LT	14
	-	23.37	2.41	1.13	LTL	1
	73.99	22.40	2.20	1.11	LTL	22
	72.81	22.95	3.00	1.10	LTL	30
	73.60	21.40	3.20	1.20	LT	25
	70.76	23.67	4.07	1.50	LL	9
	69.8	23.3	5.5	-	LTL	11
ZW	72.40	24.50	1.87	-	LL	16
	73.70	21.70	3.0	1.10	LT	25
ZS	73.30	22.30	3.10	1.10	LT	13
	73.53	23.27	2.04	-	LL	16
	73.64	22.79	2.17	1.12	LTL	20
	71.74	24.54	3.44	-	LTL	40
	69.19	23.59	3.02	0.94	LT	19
	72.70	22.10	3.40	1.20	LT	25
	70.89	25.23	2.25	1.63	LL	9
	70.5	25.2	2.6	-	LTL	11

Explanations / Objaśnienia:
Pw – Pulawska / Puławska, ZW – Zlotnicka White / Złotnicka biała, ZS – Zlotnicka Spotted / Złotnicka pstra, LTL – *musculus longissimus thoracis et lumborum*, LL – *m. longissimus lumborum*, LT – *m. longissimus thoracis*, IMF – intramuscular fat / tłuszcz śródmięśniowy

a water content of 71.7 ÷ 73.7 % for LT (*m. longissimus thoracis*) was reported by Florowski et al. [13] as well as Florowski et al. [14]. According to Cebulska et al. [9], when analyzing the fatteners of each breed, the water content was 70.8 in the LL (*m. longissimus lumborum*), and 70.9 % for the Pw and ZS breed, respectively.

Protein

As a consequence of water loss, the protein content increases and affects the increase in hardness, chewiness and cutting force. Thus, maintaining proper proportions between the water and protein, as well as fat content, is crucial in meat processing [29, 40, 50]. Through the emulsification of fat, myofibril proteins allow even distribution of ingredients. They also form a permanent gel, which gives the final structure to ready-made meat products [31]. The average protein content of raw pork loin is 21 %, smoked 25 % and roasted 30 % [24]. The meat of Pw, ZW and ZS traditional pig breeds provides high protein contents 21.4 ÷ 23.7 %, 21.7 ÷ 24.5 % and 22.1 ÷ 25.2 %, respectively (Table 2). The average protein contents of the LL muscle are: 23.8 % (PL x PLW) and 24 % (PL x (D x P)) [17]. The above amount of protein is similar to that for the LL muscle, while for the PL x PLW and D x P crossbreeds, it reaches 23.4 % [9].

Fat

As stated in literature, a fat content of 2.5 ÷ 3.0 % optimally shapes the organoleptic characteristics like tenderness and juiciness [9, 10, 42, 49, 50]. The share of fat in tissues significantly affects the content of other chemical components. The ZS (2.0 ÷ 3.4 %) and Pw (2.2 ÷ 4.1 %) meats show greater fatness compared to the ZW meat (1.9 ÷ 3 %), PL x PLW (1.5 %), as well as PL x (D x P) (2.5 %) crossbreeds [17] (Table 2). The content of fat in the LTL muscle for domestic pig breeds from Serbia and Italy is larger and equals 4 % of ‘Mangalica’ (Ma), 5.1 % of ‘Moravka’ (Mo), as well as 3.3-4.3 % of ‘Nero Siciliano’ (NS) meat [25, 26, 36, 47]. In comparison, the PLW commodity breed is characterized by the intramuscular fat content at the level of < 2 % [36]. A large part of traditional products is still produced preserving the natural cover of external fat, with back fat or just back fat. The carcasses of ZS, despite increased fatness, give back fat with a thickness similar to commodity crossbreeds, whereas a significantly thicker back fat is obtained from Pw pigs [2, 7, 9, 42, 44, 45, 46].

Fatty acid profile

It has been confirmed in research that the content of saturated, mono- and polyunsaturated acids in LTL and LL muscles of both Zlotnicka and Pw pigs depends on the composition of the genotype, feed and breeding method [9, 11, 25, 28, 41, 43]. Migdał et al. [25] and Cebulska et al. [9] indicate statistically significant differences in the content of: palmitic, oleic, linoleic (LA), α -linolenic (ALA), gamma-linolenic (GLA), arachidonic (AA) and eicosatrienoic acid (DGLA) (Table 3).

Table 3. Fatty acids profile of Pulawska, Zlotnicka White and Zlotnicka Spotted breeds meat
Tabela 3. Profil kwasów tłuszczowych mięsa ras Puławska, Złotnicka Biała i Złotnicka Pstra

FA (%)	Pw	ZW	ZS	References / Literatura	FA (%)	Pw	ZW	ZS	References / Literatura
C-16:0	20.51	27.51	23.03	32	C-20:0 (AA)	0.14	0.17	0.14	25
	24.02	-	23.68	11		0.36	-	0.38	9
	24.27	-	23.56	13	C-20:1 n-9	0.73	0.43	0.50	25
C-16:1 n-7	3.41	4.42	3.45	32		0.72	-	0.60	9
	4.05	-	3.55	11	C-20:4 n-6	1.24	0.38	1.97	25
C-18:0	10.60	11.61	10.70	32		1.43	-	2.29	9
	11.65	-	11.18	11	C-20:5 n-3 (EPA)	0.05	0.03	0.09	25
	11.74	-	11.01	13		0.13	-	0.11	9
C-18:1 n-7	4.79	4.58	5.56	32		0.10	-	0.11	25
	4.62	-	4.03	11	C-22:4 n-6	0.26	0.06	0.21	9
C-18:1 n-9	46.80	45.34	40.86	32		0.18	-	0.28	9
	43.33	-	39.18	11	C-22:5 n-3 (DPA)	0.26	0.06	0.29	25
	42.88	-	39.52	13		0.43	-	0.32	9
C-18:2 n-6 (LA)	7.79	2.94	8.66	32		0.43	-	0.31	11
	6.18	-	10.91	11	C-22:6 n-3 (DHA)	0.01	0.01	0.09	25
	6.16	-	10.85	13		0.04	-	0.05	9
C-18:3 n-3 (ALA)	0.43	0.17	0.32	32		0.04	-	0.01	11
	0.30	-	0.49	11	Summary:				
	0.29	-	0.52	13	Podsumowanie:				
C-18:3 n-6 (GLA)	0.08	0.03	0.06	32	SFA	37.79 ÷ 38.16	-	36.95-37.20	
	0.10	-	0.12	11	PUFA n-3	0.75÷ 0.97	0.27	0.79-1.08	
					PUFA n-6	8.29 ÷ 9.58	3.47	10.92-14.13	
					PUFA	9.23 ÷ 12.77	12.85	9.23-15.19	
					n-6/n-3	8.79 ÷ 8.89	-	12.94-13.39	

Explanations / Objaśnienia:
Pw – Pulawska / Puławska, ZW – Zlotnicka White / Złotnicka biała, ZS – Zlotnicka Spotted / Złotnicka pstra, FA – fatty acids / kwasy tłuszczowe

Cebulska et al. [9] additionally differentiate the LL muscle of Pw and ZS meat with the content of oleopalmitic, vaccenic and adrenic acids. In the meat of PL x PLW white pigs, Grześkowiak et al. [17] indicate the content of oleopalmitic (3.7 %) and oleic acids (43.9 %) as similar to Pw, and higher LA (9.5 %), arachidonic (2.6 %), adrenic (0.4 %) and DHA content (0.1 %). According to Migdał et al. [25] and Cebulska et al. [9], the ZW meat, in comparison to Pw, ZS, PL x PLW and PL x (D x P) crossbreeds, is characterized by a significantly higher content of palmitic and oleopalmitic acids and a lower content of polyunsaturated fatty acids, including: LA, ALA,

GLA, eicosapentaenoic (EPA), docosapentaenoic (DPA) and docosahexaenoic acid (DHA). This translates into total values of PUFA n-3 and PUFA n-6 of the Pw and ZS meat, significantly higher than the values obtained for the ZW (0.3 % and 3.5 %) meat. In the research by Debrecéni et al. [11], it was confirmed that the content of PUFA n-3 is higher in IMF of ZS as well as Pw than in Ma and 'Slovak Large White' (SLW).

Micronutrients

Micronutrients shape the WHC (water holding capacity) and thus, indirectly affect the tenderness and juiciness of fresh meat. They also reduce the water activity (aw) of raw meat, making it more resistant to the development of microorganisms and enhance the flavor of processed meat [35]. The ZS meat is characterized by a higher ash content (0.9 ÷ 1.6 %), and significant differences between the breeds are found in zinc and iron contents [9].

Physico-chemical properties

The pH values, 45 minutes (pH_{45}) and 24 hours (pH_{24}) after slaughtering, are the indicators of meat quality features, such as texture, juiciness and color. RFN (red, firm, normal) meat, with pH_{45} values higher than 5.8, and pH_{24} values ranging from 5.5 to 6.0, are most desirable for consumers and producers. Results for the Pw, ZW and ZS breeds generally indicate the correct course of post-mortem glycolysis (Table 4). Water retention and pH_{24} effects indicate the properties of the Pw, ZW and ZS meat which are not only very attractive for technology, but also free from DFD (dark, firm, dry) and PSE (pale, soft, exudative) defects [39, 40]. Water content and WHC, participating in collagen thermohydrolysis at 57 ÷ 65 °C during cooking, baking, frying, shape the texture of meat and products from native breeds. The meat of Pw is characterized by greater WHC variability (from 18.31 to 33.85 % of free water). Similar variability is found for the meat of the ZS breed (from 22.10 to 32.66 %), while in the ZW meat, the average WHC is 29.88 % [34].

An important characteristic describing the exudation and loss of meat weight during storage and distribution is the volume of drip loss. A lower drip loss is characteristic of the meat from the pure-bred group of ZS pigs, as compared to PLW x PL crossbreeds, and it totals 2.53 % and 4.38 %, respectively [20]. The Pw meat, despite a larger drip loss (1.7 ÷ 4.7 %) and thermal leakage (24.9 ÷ 35.9 %), is characterized by WB shear force at the level 36.1 N/cm^2. The ZS meat has a drip loss within the range of 2.4 ÷ 3.4 %, thermal leakage of 27.9 ÷ 29.4 %, and WB shear force of 43.3 N/cm^2. The crossbreeds give incomparable drip loss values: 4.3 % (PL x PLW) and 3.0 % (PL x (D x P)), as well as thermal leakage: 29.2 % and 24.3 %, respectively [23]. Cebulska et al. [9] describe the drip loss values of the PL x PLW and D x P crossbred meat (4.6 %) and thermal leakage (28.4 %).

Table 4. Physico-chemical properties of Pulawska, Zlotnicka White and Zlotnicka Spotted breed meat
Tabela 4. Parametry fizyko-chemiczne mięsa ras Puławska, Złotnicka Biała i Złotnicka Pstra

Parameters	Pw	ZW	ZS	References / Literatura	Parameters	Pw	ZW	ZS	References / Literatura
$pH_{45\ min}$	-	6.40-6.60	-	37	$pH_{24\ h}$ (log $molc^{-1}$)	-	5.53	5.56	16
	-	6.38	6.32	16		-	-	5.50	39
	-	-	6.39	39		5.54	-	-	1
	-	-	6.33	6		5.41	-	-	22
	6.06	-	-	1		5.63	-	-	51
	6.07	-	-	22		5.58	-	-	30
	6.78	-	-	51		5.6	-	5.6	11
			6.39	19					
	6.11	-	-	30					
	6.55	-	6.52	9					
	6.5	-	6.4	11					
WHC (%)	21.03	-	-	30	Drip loss $_{24\ h}$ (%) Wyciek naturalny (%)	3.7	-	3.3	13
	20.03	-	-	22		-	3.36	3.41	16
	33.85	-	-	16		-	-	2.55	6
	18.31	-	-	51		-	-	2.36	40
	-	29.88	32.07	16		4.20	-	-	23
	-	-	32.66	39		1.75	-	-	51
	-	-	22.10	13		2.95	-	-	30
						2.26	-	2.95	9
						4.7	-	2.9	11
Cooking loss (%) Wyciek termiczny (%)	-	27.62	29.36	16	WB shear force (N/cm^2) Siła cięcia (N/cm^2)	36.07	-	43.27	9
	-	-	27.91	39					
	35.92	-	-	1	Tenderness (N/cm^2) Kruchość (N/cm^2)	-	-	44.54	20
	27.46	-	-	22					
	24.89	-	21.80	9					

Explanations / Objaśnienia:
Pw – Pulawska / Puławska, ZW – Zlotnicka White / Złotnicka biała, ZS – Zlotnicka Spotted / Złotnicka pstra, WHC – water holding capacity / zdolność zatrzymania wody

Processing potential

Adaptation to production potential

Consumers are still prone to including traditional meat products prepared from local raw materials in their daily diet. For sausages and salami, producers can allocate the meat of older pieces and those heavily fatted, especially in combination with the meat of young male animals, which can be used to prepare ham for consumption after cooking or as a delicate raw product. The meat of Pw is characterized by appropriate

muscle fiber and IMF structure, decisive for marbling [43]. The Pw meat can be utilized for the production of ripened cured meat [48]. The meat of ZW pigs is more universal. It can be intended for manufacturing smoked products, as well as traditional pork, or a combination of pork and beef sausages, especially those dried, which constitute a range of local products associated with a specific region [12, 20, 21]. The examples of the use of Polish meat from native pig breeds are presented in Table 5. It has been found that sows of the ZS breed may be intended for the production of heavy fatteners, due to the good mast results achieved at high body mass [12, 18, 19], as well as the Pw breed [3]. The authors highlight the fact that the least greasy loins are obtained from the ZS × PLW crossbred meat (1.9 %), when fat from pork is found at a level of 2.3%. To improve the production results of native breeds, they are crossed with D and PLW ones. The research proves that crossing ZS pigs with D and PLW contributes to an increase in the meatiness of carcasses and a decrease in the thickness of back fat, but only in the case of hybrids containing 50 % of both breed genes [18, 19].

The suitability of meat from Pulawska, Zlotnicka White and Zlotnicka Spotted pigs in traditional cuisine:

1. Dry-cured sausage is produced from pork with the addition of beef, back fat, garlic, allspice and coriander, and dried in a ventilated cool room for 2 months.
2. Dry-cured ham is cured for 3 weeks in beer or porter, honey, laurel leaves, pepper, cloves and allspice, dried in a ventilated place for 2 ÷ 3 days and smoked in cold smoke for 14 ÷ 18 days.
3. Dry-cured sirloin is cured for 10 ÷ 14 days with the addition of bay leaf, pepper, allspice and marjoram, smoked in warm smoke for 2 ÷ 4 days in a casing (intestine, cloth or gauze); sirloin produced for longer storage is smoked in cold smoke for up to 10 days and for quick consumption brewed.
4. Cooked ham is cured, then wet for a few days with the addition of sugar, salt, spices and garlic, dried for 2 ÷ 3 days, smoked in cold smoke for 8 ÷ 12 days. It can be eaten raw or boiled after 24 hours wetting.
5. Roasted ham in buckwheat cake is cured for 3 days in marinade (bay leaf, juniper fruit, marjoram and garlic) rubbed, covered with buckwheat flour, wheat flour and wheat bran, baked and glazed with dry white wine sauce, honey, juniper and garlic.
6. Roasted ham is soaked for 12 hours in whey, covered with a pestle, rubbed with garlic, cut into squares or triangles, roasted and served with horseradish colored with carrots or beets.
7. Dry-cured or cooked gammon is cured with the addition of bay leaf, black pepper and allspice for about 10 days, wrapped in a membrane removed from the fat or inserted into a purified bladder, gauze or canvas, smoked in warm smoke for 4 ÷ 5 days for several hours a day; it is suitable for consumption as raw or cooked.

8. Dry-cured bacon is cut in half and juxtaposed skin down and up, cured with the addition of sugar and pepper for 10 days and smoked with cold smoke for 7 ÷ 10 days.
9. Roasted shoulder is rubbed with salt, spices, stuffed with garlic, roasted in the oven at decreasing temperature to get the baked skin and proper juiciness of meat.
10. Salted back fat is rubbed with salt, allspice, bay leaf and garlic, preserved with dry salt for at least 2 weeks. It can be eaten raw or fried as an embellishment for other dishes.
11. Lard is intended for spreading bread, prepared in many ways, but always the main ingredients are bacon, onion, salt and spices; in some regions, the addition of dried sausage and pork shoulder is eagerly sought.
12. Roulade of piglet (3 ÷ 4 weeks old, weight 6 ÷ 7 kg), after cutting the bones, cutting off the head and legs, it is gutted, seasoned with white pepper, nutmeg, meat stuffing, liver, gherkins, boiled eggs and peeled pistachios, curled and wrapped with cloth, boiled.
13. Roasted piglet (weight 2 ÷ 3 kg) is salted on the outside and inside for 1 hour before baking, stuffed with meat-offal stuffing or buckwheat, and baked.

Conclusions

1. The meat of the native Pulawska, Złotnicka White and Złotnicka Spotted pig breeds, due to the appropriate proportion of chemical components and good WHC, is intended for the production of a wide range of regional products. Marbling creates not only the individual appearance and attractiveness of slices in cross-section, but also noticeable juiciness and aroma.
2. The high content of protein increases the nutritional value of meat from native pigs, as opposed to industrial breeds. It is important to have all available information on the quality of native meat breeds, which can be used by the current meat industry.
3. Polish indigenous pig breeds are more suitable for the breeding and production of special meat products due to acceptable fattening, carcass parameters and the quality of meat.

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JAKOŚĆ I PRZYDATNOŚĆ TECHNOLOGICZNA MIĘSA POLSKICH RAS RODZIMYCH DO PRODUKCJI TRADYCYJNYCH WYROBÓW WIEPRZOWYCH

S t r e s z c z e n i e

Wprowadzenie. Produkcja ekologiczna utożsamiana jest z wysoką jakością surowców, właściwościami prozdrowotnymi, a wcześniej z dobrostanem zwierząt i zrównoważonym rozwojem produkcji

rolnej. Stąd popularne jest wykorzystywanie surowców pozyskiwanych od zwierząt ras rodzimych, co wiąże się z dziedzictwem kulturowym i wsparciem lokalnych gospodarstw, zwłaszcza producentów bydła. Produkcja kiełbasy typu salami, boczku suszonego, baleronu suszonego lub gotowanego, szynki pieczonej w kaszy gryczanej czy rolady z prosiaka, tradycyjnie wytwarzanych z regionalnego mięsa, jest również ważna dla władz lokalnych w promocji regionu. Stąd ważne jest przypomnienie walorów dostępnych surowców zwierzęcych, pochodzących od ras rodzimych.

Wyniki i wnioski. Mięso i tłuszcz świń ras rodzimych „Puławska" (Pw), „Złotnicka Biała" (ZW) i „Złotnicka Pstra" (ZS) charakteryzuje się odmienną jakością technologiczną i wyjątkową wartością konsumpcyjną. Skład chemiczny wpływa na właściwości użytkowe – zawartość wody, białka i tłuszczu wpływają na profil tekstury, jakość organoleptyczną i bezpieczeństwo. Mięso ZS i Pw charakteryzuje się większym otłuszczeniem w porównaniu z ZW, podczas gdy mięso ZW zawiera większą ilość kwasu palmitynowego i oleopalmitynowego. Mięso Pw i ZS różni się udziałem DA, LA, SA, AA i CLA. Wartości pH_{24} i retencja wody wskazują na odporność mięsa na wady DFD i PSE. Mięso ras rodzimych nadaje się do produkcji wyrobów dojrzewających (Pw, ZW, ZS), szynek gotowanych i polędwicy (ZW, ZS) oraz kiełbas suszonych, wędzonych i niewędzonych (ZS). Celem pracy jest przedstawienie wybranych cech mięsa trzech polskich ras rodzimych świń (Pw, ZW, ZS), które decydują o jego jakości i przydatności technologicznej do produkcji wyrobów wieprzowych metodami tradycyjnymi.

Słowa kluczowe: Puławska, Złotnicka Biała, Złotnicka Pstra, przydatność technologiczna