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**Analysis of the quality pork obtained from carcasses fatteners
of Polish Landrace and Pulawska breed**

Analiza jakości mięsa pozyskanego z tusz tuczników rasy polskiej
białej zwisłouchej oraz puławskiej

Summary. The aim of the research was the analysis of the physicochemical and sensory quality of pork. The research material consisted of 40 fatteners Polish Landrace and Pulawska breeds from a family farm in the Lublin region. The studies determined the influence of the breed on tissue composition of ham, loin and neck. The experimental materials were samples obtained from ham and loin in laboratory tests. In these elements the attributes allowing to assess the technological and sensory quality were determined. The obtained results show that the meat fatteners of both breeds were characterized by a high technological quality. However, better sensory quality was characteristic of the meat obtained from carcasses of Pulawska breed pigs.

Key words: pork, technological quality, sensory quality, Pulawska breed, Polish Landrace

INTRODUCTION

The breeding works are closely related with the needs of pork market. Currently seeks to receive a large amount of meat about high technological, nutritional and sensory quality. Research shows that the quality of pork depends on environmental factors e.g. zoohygienic conditions, nutrition [Grela *et al.* 2013, Madrid *et al.* 2013], activities related to the slaughter [Correa *et al.* 2013] and genetic factors: the type of utility, breed [Florowski *et al.* 2006] and sex [Kortz *et al.* 1996]. Although the environmental factors to a greater extent may be modified by human, influence the quality of pork only about 30% [Koćwin-Podsiadła 1998]. The remaining 70% are genetic factors.

The production of pork in Poland is based of fattening gilts and barrows [Tuz *et al.* 2001]. The results of research show a significant statistical differences between the slaughter value of gilts and barrows [Eckert 2006, Knecht *et al.* 2009]. Carcasses gilts despite lower daily gain have lower fatness and higher meatiness. Sex of fatteners also affects the chemical composition of meat. Meat of gilts characterized by a higher content of protein, while the barrows – intramuscular fat [Eckert and Orzechowska 2002]. Color of meat is very important for the consumer, as one of the main factors influencing the buy this element. According to Lattore *et al.* [2003] desirable light color of meat is more common in carcasses gilts than barrows.

Improvement of attributes for slaughter such as reduction fatness, increase meatiness and eliminating defective meat, one can get in the way of selection of animals and mating pairs of parents with high productivity [Grzeškowiak *et al.* 2010]. The selection of couple for crossbreeding should consider maximum of their genetic and physiological predispositions.

The aim of this study was analysis of the physicochemical and sensory quality meat obtained from fatteners carcasses of Polish Landrace and Pulawska breed from family farm in Lublin region.

MATERIAL AND METHODS

The study included fatteners Polish Landrace and Pulawska breed. Pigs were kept in family farm in the Lublin region. Farm has realized Pulawska Pig Genetic Resources Conservation Programme. Fatteners were divided into two groups: I – Pulawska breed; II – Polish Landrace. Each group consisted of 20 gilts. Fatteners were slaughtered in meat establishments in accordance with the procedure used in this kind of institutions. Body weight was the range from 104.6 to 109.3 kg.

The technological quality of meat was determined by identifying the percentage of muscle, fat and bone in ham, loin and neck and assay physical indicators in samples the loin (*musculus longissimus lumborum*) and ham (*musculus adductor femoris*) such as pH 45 minutes after slaughter (pH₄₅), 24 hours after slaughter (pH₂₄) – camera pH starter CPU, the percentage of water loose – the method of Grau and Hamm [1952] as modified by Pohja and Ninivaara [1957]. Also the chemical compositions were assayed: fat-weight according to the method after extraction (Soxhlet) to ISO 1444:2000; ash-weight according to the method by PN-ISO 936:2000; protein- according to the method of Foss-Kjeldahl by PN-75/A-04018.

The sensory quality loin and ham based on evaluation organoleptic according to the methodology defined by the Litwińczuk *et al.* [2000]. Ten people participated in the study (5 women and 5 men) who have identified a 5-point scale: color (intensity, desirability) smell (intensity, desirability), tastiness (intensity, desirability), juiciness and tenderness.

The results were analyzed statistically using STATISTICA vs. 5.0 by calculating the means, standard variations and determining the significance of differences between groups of pigs using one-way analysis of variance (Duncan's test).

RESULTS AND DISCUSSION

After statistical analysis of the results of dissection of the most valuable elements (Tab. 1) showed that breed influenced ($P \leq 0.05$) in fat tissue content in the loin and the neck. Loin obtained from fatteners carcasses of Pulawska breed contained 2.58 kg and 0.55 kg fat more than the same element derived from carcasses Polish Landrace gilts. In the case of the neck difference in fat content was 0.34 kg in favor of the Pulawska breed gilts.

Table 1. Tissue composition of ham, loin, shoulder and neck obtained from carcasses porkers Polish Landrace and Pulawska breed

Tabela 1. Skład tkankowy szynki, schabu, łopatki i karkówki, pozyskanych z tusz tuczników rasy polskiej białej zwistouchej i puławskiej

Weight (kg) Masa (kg)	Ham Szynka				Loin Schab				Neck Karkówka			
	Pulawska breed puławska		PL Pbz		Pulawska breed puławska		PL pbz		Pulawska breed puławska		PL pbz	
	\bar{x}	SD	\bar{x}	SD	\bar{x}	SD	\bar{x}	SD	\bar{x}	SD	\bar{x}	SD
Meat Mięso	5.22	1.22	5.65	1.33	2.93	0.68	3.55	0.70	1.91	0.38	2.06	0.41
Bone Kości	0.71	0.08	0.69	0.08	1.26	0.28	1.25	0.31	0.72	0.14	0.65	0.15
Back fat Słonina	2.32	0.49	1.96	0.48	2.58 ^a	0.50	2.03 ^b	0.52	1.38 ^a	0.38	1.04 ^b	0.31

a, b – The values in the lines marked with various letters differ significantly at $P \leq 0.05$

a, b – Wartości w wierszach oznaczone różnymi literami różnią się istotnie przy $P \leq 0,05$

The physical parameters of measured in ham and loin (Tab. 2) did not show no significant influence of breed on the technological quality. The pH was measured 45 minutes after the slaughter in ham was in Pulawska breed and the Landrace breeds accordingly 6.15 and the 6.12. In the case of loin means lower values was observed, accordingly 6.06 and the 6.00. With the passage of time, and progressive biochemical processes there was a decrease the concentration of hydrogen ions. The loin of Polish Landrace characterized by the lowest pH_{24} (5.40), the ham Pulawska breed characterized by the highest value pH_{24} (5.63). Analysing the results the percentage of water loose recorded statistically significant differences ($P \leq 0.01$) between the ham gilts of Pulawska breed (15.70%) and the ham Polish Landrace (19.30%). Also observed that with the decrease in the concentration of hydrogen ions in the sample was an increase the percentage of loose water. This kind of relationship between the values of pH, natural leakage and brightness of color have also demonstrated Prevolnik *et al.* [2009].

The values recorded within the meat of Polish Landrace breed, are consistent with the Orzechowska *et al.* [2012] and Tyra and Zak [2013], who showed that pH_{45} is about 6.36 ± 0.34 , and 24 hours after slaughter this value decreased to 5.62 ± 0.16 . Parameters characterizing elements obtained from Pulawska pigs and the relationship between them (a lower pH in the *longissimus dorsi muscle* and the increase the percentage of water together with pH) are consistent with their own reports [Babicz *et al.* 2009, Kropiwek *et al.* 2012].

Table 2. The physical properties of ham and loin obtained from carcasses porkers Polish Landrace and Pulawska breed

Tabela 2. Właściwości fizyczne szynki oraz połówicy pozyskanych z tusz tuczników rasy polskiej białej zwisłouchiej i puławskiej

Element Element	Breed Rasa	pH ₄₅		pH ₂₄		% of free water % wody luźnej	
		\bar{x}	SD	\bar{x}	SD	\bar{x}	SD
Ham Szynka	Pulawska breed puławska	6.15	0.55	5.63	0.42	15.70 ^A	1.90
	PL pbz	6.12	0.63	5.51	0.57	19.30 ^B	1.60
Loin Połówica	Pulawska breed puławska	6.06	0.57	5.54	0.52	22.00	2.20
	PL pbz	6.00	0.48	5.40	0.58	24.40	2.30

A, B – The values in the lines marked with various letters differ significantly at $P \leq 0.01$

A, B – Wartości w wierszach oznaczone różnymi literami różnią się istotnie przy $P \leq 0,01$

Important to obtain a better sensory attractiveness of the meat is contents in its the basic chemical components. The percentage of protein content in meat samples tested did not differ significantly among themselves, and were comparable to the values obtained by Florowski [2006], which has shown that the mean content of protein in meat Polish Landrace fatteners were 21.8%.

As is clear from the values shown in Table 3 breed gilts influenced ($P \leq 0.05$) in the fat content of valuable elements recipes. In both of the analyzed cases, the elements obtained from carcass Pulawska breed had higher fat content than the same elements cut from the carcasses of Polish Landrace gilts. Results of fat content of loin Polish Landrace i.e. 1.58% is compatible with the results shown by Orzechowska et al. [2010] which reports that the mean fat content in loin Polish Landrace pigs was 1.72 (is in the range from 1.01 to 2.89%).

Ash content in all the elements was on a similar level and its percentage is in the range from 1.12 to 1.2% (Tab. 3). The average results of the evaluation of color, smell, tastiness, juiciness and tenderness of meat from the loin and the ham obtained from carcasses of Pulawska breed and the Polish Landrace (Table 4) show that the higher sensory quality has the meat obtained from pigs of Pulawska breed. The intensity of color of the two breed loin was at the same level (4.87 points). Although the same mark color intensity better its desirability of characterized by Pulawska breed loin. The intensity and the desirability of smell loin taken from the Pulawska breed fatteners been evaluated at 4.73 points. Which was respectively 0.83 and 0.63 points more as compared to the same parameters obtain from Polish Landrace loin. Also, higher reviews have been evaluated parameters directly related to the taste feelings associated with the consumption of meat products (juiciness, tenderness). The intensity and the desirability of tastiness the loin from a fatteners Pulawska breed rated respectively 4.67 points and the 4.93 points, and Polish Landrace breeds at the 4.07 points and the 3.87 points.

Table 3. The chemical properties of ham and loin obtained from carcasses porkers Polish Landrace and Pulawska breed

Tabela 3. Właściwości chemiczne szynki oraz polędwicy pozyskanych z tusz tuczników rasy polskiej białej zwisłouchej i puławskiej

Element Element	Breed Rasa	Protein (%) Białko (%)		Fat (%) Tłuszcz (%)		Ash (%) Popiół (%)	
		\bar{x}	SD	\bar{x}	SD	\bar{x}	SD
Ham Szynka	Pulawska breed puławska	22.24	1.93	1.97 ^b	0.21	1.12	0.09
	PL pbz	22.30	1.85	1.64 ^a	0.19	1.10	0.10
Loin Polędwica	Pulawska breed puławska	23.37	1.81	2.41 ^b	0.62	1.13	0.19
	PL pbz	23.12	1.90	1.58 ^a	0.51	1.20	0.10

a, b – The values in the lines marked with various letters differ significantly at $P \leq 0.05$

a, b – Wartości w wierszach oznaczone różnymi literami różnią się istotnie przy $P \leq 0,05$

Table 4. Mean results evaluation of the consumption quality meat obtained from carcasses porkers Polish Landrace and Pulawska breed

Tabela 4. Średnie wyniki oceny jakości konsumenckiej mięsa pochodzącego z tusz tuczników rasy polskiej białej zwisłouchej i puławskiej

Specification Wyszczególnienie		Loin Polędwica				Ham Szynka			
		Pulawska breed puławska		PL pbz		Pulawska breed puławska		PL pbz	
		\bar{x}	SD	\bar{x}	SD	\bar{x}	SD	\bar{x}	SD
Colour Barwa	intensity natężenie	4.87	0.16	4.87	0.10	4.67	0.21	4.77	0.15
	desirability pożądalność	5.00	0.00	4.77	0.08	4.57	0.23	4.70	0.16
Smell Zapach	intensity natężenie	4.73	0.21	3.90	0.30	4.07	0.21	3.80	0.25
	desirability pożądalność	4.73	0.10	4.10	0.33	4.30	0.17	4.03	0.23
Tastiness Smakowitość	intensity natężenie	4.67	0.16	4.07	0.10	4.33	0.10	4.07	0.10
	desirability pożądalność	4.93	0.10	3.87	0.10	4.87	0.10	3.83	0.15
Juiciness Soczystość		4.87	0.10	3.53	0.24	4.60	0.33	3.43	0.15
Tenderness Kruchość		4.83	0.15	4.03	0.29	4.27	0.21	4.00	0.25

The mean results the organoleptic assessment of meat samples obtained from ham (Tab. 4) showed that fatteners of Landrace breed has a good intensity of and the desirability of color. Samples from carcasses of gilts of Pulawska breed were assessed higher intensity and desirability of smell and tasty. In the case of smell, these differences were both the intensity and the desirability 0.27 pts. While the intensity of tastiness 0.26 points. Desirability of tastiness ham obtained from carcasses of Pulawska breed rated more than one point higher (4.87 – desirability of tastiness ham from Pulawska breed; 3.83 – desirability of tastiness ham from Landrace breed). The large difference in the general assessment may result from the the data presented in Table 3. This may be caused by the fact that the evaluation juiciness and tenderness of meat influences different content of fat and protein. Better juiciness (4.60 points) and tenderness (4.27 points), characterized by a meat of ham Pulawska fatteners.

CONCLUSIONS

1. The breed of fatteners influenced on tissue composition loin and neck.
2. The test elements were no defects in quality of meat
3. The breed of fatteners doesn't influence on pH (45 minuts and 24 hours after slaughter) in the same pork elements. The significant differences were observed in the percentage of water loose only in ham.
4. The genetic factors such as breed and type of utility (meat or fat) significantly affected the percentage of fat in ham and loin.
5. The organoleptic tests showed that better sensory quality characterized by meat obtained from carcasses of Pulawska breed fatteners.
6. The research and analysis shows that the slaughter material from family farms can have a good technological and sensory quality.

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Streszczenie. Celem badań była analiza fizykochemiczna i sensoryczna jakości mięsa wieprzowego. Materiał badawczy stanowiło 40 tusz tuczników rasy puławskiej oraz polskiej białej zwisłouchy utrzymywanych w gospodarstwie rodzinnym na terenie Lubelszczyzny. W badaniach określono wpływ rasy na skład tkankowy szynki, polędwicy oraz karkówki. Do badań laboratoryjnych pobrano próby szynki oraz polędwicy, które poddano ocenie jakości technologicznej oraz sensorycznej. Uzyskane wyniki dowodzą, że mięso tuczników obu ras charakteryzuje się wysoką jakością technologiczną. Natomiast lepszą jakością sensoryczną cechuje się mięso pozyskane z tusz tuczników rasy puławskiej.

Słowa kluczowe: wieprzowina, jakość technologiczna, jakość sensoryczna, puławska, polska biała zwisłoucha