

## Comparison of carcass and meat quality traits of Black Slavonian pigs regarding the duration of fattening period

Gvozdanovic, K.; Margeta, V.; Djurkin Kušec, I.; Margeta, P.; Radišić, Ž. and Kušec, G.

Faculty of agriculture in Osijek. Josip Juraj Strossmayer University of Osijek. Osijek. Croatia.

### ADDITIONAL KEYWORDS

Black Slavonian swine.  
Fattening period.  
Carcass traits.  
Meat quality.

### SUMMARY

The aim of the study was to estimate the possibility of shortening the fattening period of Black Slavonian pig without deteriorating their meat quality. The research was carried out on 30 Black Slavonian pigs divided into two equal groups, A and B, according to the duration of fattening period: 18 and 12 months, respectively. Pigs from both groups were reared in extensive system (pastures, woods). During the year pigs were fed cereal mixture (50% corn, 30% barley, 10% oats, 10% soybean) which was supplemented with alfalfa during the vegetation period; during the winter pigs were fed alfalfa hay. At the end of their respective fattening period pigs were slaughtered at a commercial abattoir. Carcass and meat quality traits were collected: carcass weight, carcass length, muscle and backfat thickness, as well as ham length and circumference, pH45 in *semimembranosus* and *longissimus dorsi* muscle, meat colour (CIE L\*a\*b\*), drip loss by EZ drip and WB shear force. Pigs from group B had significantly lighter and shorter carcasses characterised by thinner backfat than pigs from group A. The ham length and circumference were not affected by duration of fattening period. On the other hand, the results showed that shortening of fattening period significantly deteriorated some important meat quality traits, most of all drip loss and CIE L\* values of the meat in group B. The meat of pigs from this group was also tougher than meat of pigs from group A as shown by significantly higher WB shear force (N).

### Comparação das características de carcaça e qualidade da carne de suínos Black Slavonian em função da duração do período de engorda

### RESUMO

O objetivo deste estudo foi analisar a possibilidade de encurtar o período de engorda do porco Black Slavonian sem deteriorar a qualidade da carne. A pesquisa foi realizada em 30 porcos Black Slavonian divididos em dois grupos iguais, A e B, de acordo com a duração do período de engorda: 18 e 12 meses, respectivamente. Os porcos foram criados em sistema extensivo (pastagens, bosques). Durante o ano, os porcos foram alimentados com uma mistura de cereais (50% de milho, 30% de cevada, 10% de aveia, 10% de soja) que foi suplementada com alfafa durante o período de crescimento vegetal; durante o inverno, os porcos foram alimentados com feno de alfafa. No final do período de engorda, os porcos foram abatidos num matadouro comercial. Foram obtidos dados de carcaça e qualidade da carne: peso da carcaça, comprimento da carcaça, espessura muscular e de gordura subcutânea dorsal, bem como comprimento e circunferência do presunto, pH45 dos músculos *semimembranoso* e *longissimus dorsi*, cor da carne (CIE L\*a\*b\*) e perda por gotejamento pelo método EZ drip. Os porcos do grupo B apresentaram carcaças significativamente mais leves e mais curtas, caracterizadas por uma gordura subcutânea dorsal menos espessa que os porcos do grupo A. O comprimento e a circunferência do presunto não foram afetados pela duração do período de engorda. Por outro lado, os resultados mostraram que o encurtamento do período de engorda deteriorou significativamente alguns traços importantes da qualidade da carne, sobretudo a perda por gotejamento e os valores CIE L\* da carne no grupo B. A carne dos porcos deste grupo também se apresentou menos tenra do que a carne dos porcos do grupo A, como mostrado por valores de força de cisalhamento WB (N) significativamente maiores.

### PALAVRAS CHAVE ADICIONAIS

Suínos Black Slavonian  
Engorda.  
Características de carcaça.  
Qualidade da carne.

### INFORMATION

Cronología del artículo.  
Recibido/Received: 15.01.2016  
Aceptado/Accepted: 06.07.2017  
On-line: 15.01.2018  
Correspondencia a los autores/Contact e-mail:  
vmargeta@pfos.hr

### INTRODUCTION

Black Slavonian pig is an autochthonous pig bred from Croatia. It is an old breed with very good productivity traits, excellent meat quality and high intramuscular fat content (Karolyi et al. 2007). This breed has been traditionally raised in extensive (pastures, woods) and semi-extensive conditions (pens with some free space) (Margeta, 2013). Considering that the Black Slavonian pig resulted from the crossbreeding of

the Lasasta Mangulica and Berkshire breeds, housing condition and feeding are main factors which affect the ratio of muscle and fat in the carcass. Extensive housing conditions allow complete use of its genetic potential in terms of fertility and conformation, as well as protection of health and welfare of the pigs (Karolyi 2010). Meat quality represents the sum of all sensory, nutritional, hygienic - toxicological and technological properties of meat. Intramuscular fat content, water holding capacity, pH values of meat and meat colour

are the most important parameters that influence selection procedures in pig production (Russo 1987). Black Slavonian pig has excellent meat quality, suitable for production of traditional meat products. Few studies have confirmed that intramuscular fat content can reach 7% (Petričević et al. 1988; Kralik et al. 1988). Meat colour mainly depends on myoglobin content, its distribution and chemical composition of meat. Meat from Black Slavonian pig is darker and redder than meat from other pig breeds (Margeta et al. 2016). Water-holding capacity is the ability of muscle *post mortem* to withhold its natural water content. If water loss is greater than 5% it leads to lower processing capacity of meat and reduction of its nutritional value. In this study, 30 Black Slavonian pigs were kept under a similar rearing system, but during a different time period, 12 and 18 months. The aim was to estimate the most favourable duration of the fattening period without deteriorating their meat quality.

## MATERIAL AND METHODS

### ANIMALS

The study was carried out on 30 Black Slavonian pigs (BS); 15 barrows and 15 gilts. Pigs were divided into groups (A and B) according to the duration of fattening period (18 and 12 months, respectively). During the fattening period pigs were kept under extensive conditions and fed *ad libitum*. During the vegetation period feeding was based on green alfalfa with the addition of a mixture of cereals (50% corn, 30% barley, 10% oats, 10% soy) and during the non-vegetation period pigs were fed diets based on the mixture of grains with the addition of alfalfa hay. The pigs were slaughtered at the age of 550 and 365 days, with an average live weight of 140 and 115 kg, respectively.

### CARCASS AND MEAT QUALITY MEASUREMENTS

After reaching the investigated age pigs were slaughtered at a commercial slaughterhouse and hot carcass weight, carcass lengths (a and b), muscle and backfat thicknesses, as well as ham length and circumference were measured. Carcass length "a" was measured from the first rib to the *os pubis* and length "b" was measured from *os pubis* to atlas of the carcass. Muscle thickness is defined as the shortest connection between the cranial end of the *gluteus medius* muscle and the dorsal edge of the vertebral canal. Backfat thickness was measured as the minimum thickness of subcutaneous fat (with skin) above *gluteus medius* muscle at the split of the carcass. Ham length was measured from the anterior edge of the *symphysis pubis* to the hock joint and ham circumference at the widest point of the thigh. Initial and ultimate pH were measured 45 minutes (pH<sub>45</sub>) and 24 hours (pH<sub>24</sub>) *post mortem*, respectively, in *musculus semimembranosus* and *musculus longissimus dorsi* between 13<sup>th</sup> and 14<sup>th</sup> ribs by Mettler Toledo" MP120-B pH meter. Meat colour was measured by Minolta CR 300 chromameter (Minolta Camera Co. Ltd., Osaka Japan) using CIE L\*a\*b\* system (Commission Internationale del'Eclairage 1976). Drip loss was determined by EZ\_drip method as described by Christensen (2003).

## RESULTS AND DISCUSSION

Statistical indicators of carcass composition are shown in **Table I**. The mean value of carcass weight was 77.81 kg. Between investigated groups of pigs, significant differences were found, ranging from 115.16 kg to 97.81 kg. Karolyi et al. (2007) found that live weight of Black Slavonian pigs reared 18 months was 154 ± 20 kg. According to Franco et al. (2016), carcass weights of

**Table I.** Statistical indicators of carcass properties (Indicadores estatísticos das características de carcaça).

Statistical Indicator Trait	1 <sup>st</sup> Group (18 months)			2 <sup>nd</sup> Group (12 months)			Statistical significance
	Mean value	SD	SE	Mean value	SD	SE	
Carcass weight, kg	115.16	22.15	4.12	97.81	24.05	4.46	***
Fat thickness S (mm)	26.11	15.43	3.15	21.66	17.62	3.21	***
Muscle thickness M(mm)	56.90	6.96	1.38	57.70	8.00	1.46	*
Leanness, %	44.20	7.11	0.98	43.80	9.10	1.51	n.s.
Carcass length (a), (cm)	91.36	6.11	1.09	88.89	5.72	1.06	n.s.
Carcass length (b), (cm)	107.28	7.02	1.22	106.93	6.63	1.21	n.s.
Ham length, cm	41.15	2.71	0.52	35.66	2.51	0.46	**
Ham circumference (cm)	70.90	6.21	1.146	65.30	6.44	1.18	*

1<sup>st</sup> Group – fattening period 18 months; 2<sup>nd</sup> Group – fattening period 12 months

\*P< 0.05; \*\*P< 0.01; \*\*\*P< 0.001

Celta pigs slaughtered at the age of 12 and 16 months were 108.41 and 135.42 kg, respectively, which is noticeably higher than live weights of the pigs investigated. Rodriguez-Sanchez et al. (2010) reported 130 kg average carcass weight of Iberian pig at the slaughter age of 18 months. In the present study, statistically significant differences were determined in the fat thickness. Mean back fat thicknesses of the pigs from group A and B were 26.11 and 21.66 mm, respectively. Muscle thickness of the pigs from group A was 56.9 mm, while pigs from group B had muscle thickness of 57.7 mm. Luković et al. (2007) reported measures for the fat thickness of 50.5 mm which is markedly higher than the results obtained in the present study, while the muscle thickness was similar as in investigated pigs. Higher values of fat thickness than those found in the present study were reported by Rodriguez-Sanchez et al. (2010) for Iberian pig reared for 12 and 18 months, which were 60.6 and 64.8 mm respectively. Muscle thicknesses were 56.2 and 53.1 mm, which is lower than in the present study. There were no significant differences ( $P>0.05$ ) in lean meat percentage, nor in carcass lengths (a and b) between the groups. Mean value of ham length in group A of pigs was 41.15 cm and in group B 35.66 cm; the difference between groups was statistically significant. Furthermore, ham circumference of the pigs from investigated groups also differed significantly; 70.9 cm in group A vs. 65.3 cm in group B.

Meat quality parameters are shown in **Table II**. Value of  $pH_{45}$  measured in *m. semimembranosus* and *m. longissimus dorsi* for the first group was 6.51 and 6.41,

respectively, while for the second group were 6.48 and 6.32, respectively. Obtained results are consistent with the expected values and do not exceed desirable limits. In a study of Karolyi et al. (2007) initial pH ranged from 6.11 to 6.78 for pigs reared for 18 months. Results on  $pH_{45}$  values reported by Rodriguez-Sanchez et al. (2010) for Iberian pigs slaughtered at the age of 12 and 18 months were 6.26 and 6.22, respectively. In the study of Franco et al. (2016), pH values were lower for both groups of pigs (6.07 and 6.03, respectively). EZ drip values determined by bag method were 1.68 % for group A and 1.58 % for group B, which is in agreement with the results of Uremović et al. (2006). Franco et al. (2016) reported EZ drip of 4.65% for Celta pigs slaughtered at the age of 12 months and 1.77% at the age of 16 months. Optimal values for meat colour are in the range of 43.11-50, due to that we can conclude that the values obtained by our research are consistent with the expected optimal values. Meat colour (CIE\*) values for the group A were:  $L^*$  45.21,  $a^*$  19.46,  $b^*$  3.06; and for the group B:  $L^*$  43.11,  $a^*$  18.61,  $b^*$  3.01. Karolyi et al. (2007) reported slightly higher values of  $L^*$ : 48.11. Robina et al. (2013) conducted a study on Iberian pig breed and found that meat colour values were  $L^*$  39.1,  $a^*$  9.2 and  $b^*$  2.1. Value  $L^*$  and  $a^*$  were markedly different from the values obtained in our study, while  $b^*$  was compatible with the values measured on samples of Black Slavonian pigs. Rodriguez-Sanchez et al. (2010) reported meat colour parameters for 18 months old Iberian pigs as  $L^*$  37.2,  $a^*$  8.5,  $b^*$  16.7 and for 12 months old pigs were  $L^*$  39.2,  $a^*$  6.8, and  $b^*$  17.3, which were noticeably different than our results. The results

**Table II.** Statistical indicators of meat quality (Indicadores estatísticos da qualidade da carne).

Statistical indicator	1 <sup>st</sup> Group (18 months)			2 <sup>nd</sup> Group (12 months)			Statistical significance
	Mean value	SD	SE	Mean value	SD	SE	
$pH_{45}$ ham	6.51	0.14	0.03	6.48	0.14	0.02	n.s.
$pH_{45}$ MLD	6.41	0.17	0.03	6.32	0.17	0.03	n.s.
$pH_{24}$ ham	5.69	0.13	0.02	5.68	0.12	0.031	n.s.
$pH_{24}$ MLD	5.78	0.18	0.03	5.70	0.17	0.03	n.s.
EZ – drip (%)	1.68	1.74	0.31	1.58	1.55	0.28	n.s.
CIE $L^*$	45.21	3.62	0.66	43.11	4.01	0.67	n.s.
CIE $a^*$	19.46	1.67	0.30	18.61	1.63	0.32	n.s.
CIE $b^*$	3.06	0.89	0.16	3.01	0.92	0.16	n.s.
Cooking loss, %	31.38	2.25	0.41	33.16	2.12	0.49	**
WBSF, N	53.83	9.59	1.75	51.98	8.56	1.55	**

1<sup>st</sup> Group – fattening period 18 months; 2<sup>nd</sup> Group – fattening period 12 months  
\* $P<0.05$ ; \*\* $P<0.01$ ; \*\*\*  $P<0.001$ .

of the present study show that shortening of fattening period have negative influence on drip loss and CIE L\* values, as well on the WB shear force. Cooking loss was significantly lower in the first group of pigs. Also, carcasses from group B were significantly lighter than those from group A. Considering the fact that shortening of fattening period have negative influence on some important carcass and meat quality traits, it can be concluded that 18 months fattening period is the most suitable for raising of Black Slavonian pigs.

## ACKNOWLEDGMENTS

This work has been fully supported by Croatian Science Foundation under the project number 3396.

## BIBLIOGRAPHY

- Christensen, LB 2003, 'Drip loss sampling in porcine *m. longissimus dorsi*', *Meat Science*, vol. 63, no. 4, pp. 469-77.
- Commission Internationale de l'Eclairage 1976, 'CIE Colorimetry - Part 4: L\*a\*b\* Colour Space', Joint ISO/CIE Standard
- Franco, D, Carballo, J, Bermúdez, R & Lorenzo, JM 2016, 'Effect of genotype and slaughter age on carcass traits and meat quality of the Celta pig breed in extensive system', *Annals of Animal Science*, vol. 16, no 1, pp. 259-73.
- Karolyi, D, Lukovic, Z & Salajpal, K, 2007, 'Production traits of Black Slavonian pigs', *In Proceedings of 6th International Symposium on the Mediterranean Pig*, pp. 11-13.
- Karolyi, D, Luković, Z & Salajpal, K 2010, 'Crna slavonska svinja', *Meso*, vol. 12, no. 4, pp. 222-30.
- Kralik, G, Petričević, A & Levaković, F 1988, 'Slaughter value of pigs of different production types', *Proceedings 34th international congress of meat science and technology*, 29. kolovoza – 2. rujna, Brisbane, pp. 88-90.
- Luković, Z, Uremović, M, Konjačić, M, Uremović, Z, Vnućec, I, Prpić, Z & Kos, I 2007, 'Proizvodna svojstva tovljenika crne slavonske pasmine i križanaca s durokom' *Book of abstracts 42nd Croatian & 2nd International Symposium on Agriculture*, Zagreb: Agronomski fakultet Sveučilišta u Zagrebu, pp. 220-221.
- Margeta, V 2013, 'Perspektive uzgoja crne slavonske svinje u Hrvatskoj u kontekstu pristupanja Europske unije' *48th Croatian and 8th International Symposium on Agriculture*. Dubrovnik. Croatia.
- Margeta, V, Gvozdanić, K, Galović, D, Grčević, M, Radišić & Ž 2016, 'Proizvodna i klaonička svojstva Crne slavonske svinje u tovu do visokih završnih tjelesnih težina' 23. *Međunarodno savjetovanje KRMIVA 2016*, 1.-3. Lipanj 2016., Opatija.
- Petričević, A, Kralik, G & Petrović, D 1988, 'Participation and quality of some tissue in pig carcasses of different production' *Proceedings 34th international congress of meat science and technology*, 29. kolovoza – 2. rujna, Brisbane, pp. 68-70.
- Rodríguez-Sánchez, J A, Ripoll, G & Latorre MA 2010, 'The influence of age at the beginning of Montanera period on meat characteristics and fat quality of outdoor Iberian pigs', *Animal*, vol. 4, no. 2, pp. 289-94.
- Robina, A, Viguera, J, Perez-Palacios, T, Mayoral, AI, Vivo, JM, Guillen, MT & Ruiz, J 2013, 'Carcass and meat quality traits of Iberian pig as affected by sex and crossbreeding with different Duroc genetic lines', *Spanish Journal of Agricultural Research*, vol. 11, no. 4, pp. 1057-67.
- Russo, V, Bosi, P & Nanni Costa, L 1987, 'In Evaluation and Control of Meat Quality in Pigs' ed. P. V. Tarrant, G. Eikelenboom & G. Monin. Martinus Nijhoff, Dordrecht, pp. 211.
- Uremović, M., Uremović, Z. & Luković, Z 2006, 'Utjecaj genotipa i načina hranidbe na rezultate u tovu svinja' *In Proceedings 41st Croatian & 1st International Symposium on Agriculture*, 13th-17th February, pp. 667-668.