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VARIATION IN CARCASS, MEAT AND FAT QUALITY OF AUTOCHTHONOUS BREED IN CONVENTIONAL AND ORGANIC PRODUCTION SYSTEM

Bojana Savić[1], Martin Škrlep[1], Klavdija Poklukar[1], Nina Batorek Lukač[1], Marjeta Čandek-Potokar[1,2]

[1] Agricultural Institute of Slovenia, Ljubljana SI-1000, Slovenia
[2] University of Maribor, Faculty of Agriculture and Life Sciences, Hoče SI-2311, Slovenia
Corresponding author: Marjeta Čandek-Potokar, meta.candek-potokar@kis.si

Abstract: The Krškopolje pig, a local Slovenian pig breed, is raised in various housing conditions (indoor, outdoor or combined) and often in organic farming. The aim of the present study was to compare carcass, meat and fat quality of surgically castrated Krškopolje male pigs reared in conventional (CON, n=108) and organic (ECO, n=136) production systems on data continuously collected from 2015 till present. Krškopolje pigs in ECO system were on average older and heavier at slaughter than CON pigs (355 vs. 299 days; 162 vs. 151 kg, respectively). Considering carcass characteristics, ECO pigs exhibited greater carcass length, thicker backfat (at the level of the last rib and at withers) and larger loin eye area (P<0.01). There was a significant difference in meat quality regarding colour parameters (L*, a*, b* and hue) and shear force, indicating that ECO pigs had darker, redder and less yellow meat colour, and more tender meat than CON pigs (P<0.05). The ECO group had also lower saturated and larger n-6 and n-3 polyunsaturated fatty acid contents of backfat than CON group (P<0.001). *Longissimus dorsi* muscle of ECO pigs exhibited lower vitamin E and larger magnesium contents (P<0.05). To conclude, the present study showed that ECO Krškopolje male pigs deposit more fat, which is further reflected in a different fatty acid composition. Although the ECO pigs were older and there was no significant difference in IMF content, their meat was less tough than the meat of CON pigs.

Key words: Krškopolje pig, production systems, carcass traits, meat quality, fatty acid composition

Introduction

Krškopolje pig is the only indigenous Slovenian pig breed with a specific white belt across the shoulders and forelegs *(Batorek Lukač et al., 2019)*.

Krškopolje pig is considered to be more robust and better adapted to local feed resources and to more extensive rearing conditions. This pig breed is also reputed for its high-quality meat and meat products, including salami, sausages, dry-cured hams and pancetta compared to modern breeds such as Large White, Landrace and Pietrain.

The production systems can be divided in two main groups: conventional and organic. The organic system differs from the conventional system in a holistic paradigm that combines best environmental and climate action practices, a high level of biodiversity, preservation of natural resources and application of high animal welfare standards and high production standards *(Regulation (EU) 2018/848)*. Livestock should be fed materials produced in accordance with the rules of organic production, preferably originating from the farmer's own holding. In the choice of breed, high degree of genetic diversity, the capacity to adapt to local conditions and disease resistance, should be encouraged. The organic pig production thus often uses local pig breeds. Housing conditions and husbandry practices should ensure a high level of animal welfare respecting species-specific needs and animals should have permanent access to open-air areas for exercise. Any suffering, pain or distress should be avoided. Feed should be of organic origin, without feed additives and processing aids and obligatory additional feeding with voluminous feed on an ad libitum basis *(Regulation (EU) 2018/848)*. Furthermore, genetically modified organisms, animal by-products, and chemical fertilizers should be strictly avoided.

As for Krškopolje pigs, they are raised in numerous production systems of conventional and organic nature *(Batorek Lukač et al., 2019),* and generally in more welfare-friendly housing conditions *(Čandek-Potokar et al.,* 2022*)*. The variability in farming practices in both organic and conventional systems leads to a wide range of obtained results *(Prache et al., 2022)*. Other than organic production standards, the pork quality attributes depend more on the on-farm factors (pig genotype, feeding, housing conditions, etc.) that farmers use to meet the specification, as stated by *Lebret and Čandek-Potokar (2022).* Also, the quality attributes of organic animal products generally show greater variability compared to conventional products *(Lebret and Čandek-Potokar., 2022)*. Therefore, the objective of this study was twofold, to evaluate the variability of carcass, meat and fat pork quality of Krškopolje pigs in conventional and organic production systems and to evaluate if overall important differences in meat quality exist with respect to these two production systems.

Materials and Methods

Data (on 244 surgically castrated male Krškopolje pigs) were collected continuously from 2015 to the present in conventional and organic farms. Pigs in the conventional system (CON) were reared either indoors on deep litter or in indoor pens with solid floor, straw bedding and outdoor access area. Pigs from the organic production systems (ECO) for which data were collected were reared either completely outdoors with a shelter, or indoors with outdoor access area. The feeds and/or diets used varied from farm to farm and, apart from the general status (organic or conventional), were not specifically monitored and/or registered and also varied according to the season and year.

The pigs involved in the study were slaughtered in different slaughterhouses in Slovenia. The left half of the carcass was used for measurements. Carcass length was measured as a distance from *atlas* to *os pubis*. The backfat thickness was evaluated on split carcasses at the level of withers, the level of last rib and above the cranial edge of *gluteus medius* muscle. Loin eye area was assessed on a picture of a carcass cross section taken at the level of the last rib.

The pH was assessed in *longissimus dorsi* muscle (LD) using a pH meter (Mettler-Toledo, GmbH, Schwarzenbach, Switzerland) at two central locations in the central part of the LD muscle. Instrumental color parameters (CIE L*, a*, b*) were measured in triplicate with a Minolta Chroma Meter CR-300 (Minolta Co. Ltd, Osaka, Japan). Hue angle (hº) and chroma (C*) parameters were calculated according to the formulas described by *Beltrán-Cotta et al. (2023).* Drip loss was determined by the EZ method *(Christensen, 2003)* and expressed as the difference (%) from the initial sample weight. To determine cooking loss and shear force, the LD samples (4 x 5 x 8 cm) were thawed, weighed and cooked in a thermostatic water bath (ONE 7-45, Memmert GmbH, Schwabach, Germany). Shear force was measured on 3-4 half inch thick cylindrical cores excised from cooked LD sample using a TA Plus texture analyser (Ametek Lloyd Instruments Ltd., Fareham, UK).

The intramuscular fat (IMF) content of LD muscle and fatty acid composition of backfat were estimated by near-infrared spectral analysis (NIR Systems 6500, Foss NIR System, Silver Spring, MD, USA) using in-house calibrations developed in our laboratory.

The vitamin and mineral content of LD muscle was determined by ISO 17025 method in an accredited laboratory (Nutricontrol, Veghel, The Netherlands) using the LC-MS/MS (liquid chromatography combined mass spectrometry) for vitamin and ICP-OES and ICP-MS (Inductively Coupled Plasma Optical Emission Spectrometry) for mineral determinations.

The statistical analysis was conducted with the SPPS Version 23.0 (IBM Corp., Armonk, NY, USA). Carcass traits, meat quality and fatty acids measurements were analysed using linear mixed model with the fixed effects of treatment group and farm (nested within the treatment group):

$$X_{ij} = \mu + \alpha i + \beta j_{(i)} + \varepsilon k_{(ij)}$$

μ - represents the overall mean, αi - represents the effect of factor A (treatment group, i.e. rearing system), βj(i) - represents the effect of factor B within the factor A (farm nested within treatment group), ε k(ij) - the random error.

Since samples used for the analysis of vitamins and minerals were not individually chemically analysed (analyses made on pooled samples per farm), one-way ANOVA with production system as fixed effect was used for the analysis.

Partial eta squared was calculated to measure the effect size of the treatment (organic vs. conventional). Levels for significant differences were set at $P < 0.05$. All results were expressed as mean (estimated marginal means) ± S.E. (standard error).

Results and Discussion

A total of 244 surgically castrated male Krškopolje pigs (conventionally reared, n=108; organically reared, n=136) were slaughtered at an average age of 355 and 299 days for ECO and CON pigs, respectively. The obtained values showed no significant difference between the two production systems in live weight, carcass weight, average daily gain, *gluteus medius* muscle thickness and backfat thickness above the *gluteus medius* muscle (P>0.05). However, it should be noted that slaughter weight and consequently carcass weight were a bit higher in organic system (11.4 kg; P=0.07 and 7.5 kg; P=0.13, respectively).

Other carcass quality traits (Table 1) showed that pigs in the ECO groups had significantly greater carcass length (P<0.001), thicker backfat at withers and at the level of the last rib (P<0.05), and greater loin eye area (P<0.01). The differences in carcass length can be explained with the fact that ECO pigs were older at slaughter (i.e. 56 days on average), while growth rate was similar in ECO and CON pigs. As it was shown and concluded in *Pugliese et al. (2003),* greater length of outdoor animals was related to their greater ages. The differences in backfat thickness (at the level of the last rib and at withers) may be attributable to higher age and weight of ECO pigs *(Schinckel et al., 2008)*. In line with our result, larger loin eye area of outdoor raised pigs was reported by *Gentry et al. (2002)* and *Maiorano et al. (2013),* while the opposite was observed for backfat thickness and loin eye area in a study comparing organic and conventional Krškopolje pigs *(Tomažin et al., 2019).*

Table 1. Carcass traits of conventionally (CON) and organically (ECO) reared Krškopolje pigs

	CON (n=108)	ECO (n=136)	*P*-value
	Mean ± S.E.		
Live weight (kg)	150.5±5.3	161.9±3.6	0.076
Average daily gain (g/day)	462±0.01	465±0.01	0.838
Carcass weight (kg)	124.7±4.1	132.2±2.8	0.130
Carcass length (cm)	101.2±1.0	107.2±0.7	<0.001
Backfat thickness above *GM* muscle (mm)	41.7±1.4	40.7±1.0	0.562
Backfat thickness at the level of the last rib (mm)	41.0±1.4	44.7±1.0	<0.05
Backfat thickness at withers (mm)	57.4±1.9	64.2±1.4	<0.01
BF (mm)	47.4±1.4	49.9±1.0	0.148
Gluteus medius muscle thickness (mm)	70.5±1.6	71.1±1.1	0.763
Loin eye area (cm^2)	39.6±1.7	46.7±1.2	<0.01

Mean: Estimated marginal means; S.E.=standard error; GM= *gluteus medius* muscle; BF=mean of the backfat thickness above *GM* muscle, at the level of the last rib and at withers.

The meat quality characteristics of the LD muscle are summarized in Table 2 and show significant differences between ECO and CON pigs in colour parameters (L*, a*, b* and hue), marbling score and shear force. The ECO pigs had lower L* (*P*<0.05), b* and hue (*P*<0.001), and higher a* values (*P*<0.05), denoting darker and redder muscle. The results on colour can be associated with two factors. On one side, the redder and darker colour could be due to increased muscle oxidative metabolism, which is in line with our previous study indicating more oxidative metabolism of organic Krškopolje pigs *(Fazarinc et al., 2020)*. The oxidative metabolism of muscle fibres is associated with more myoglobin (Mb) that gives a red meat colour *(Listrat et al., 2016)*. On the other hand, darker and redder colour of ECO pigs could also be due to animal's age; the older animals have more myoglobin (deoxymyoglobin - DMb and metmyoglobin – MMb) *(Yu et al., 2017)*. However, with more oxidative metabolism of ECO pigs, higher intramuscular fat would be expected *(Lebret et al., 1999)* which was not the case in the present study. With regard to water holding capacity traits, there were no difference in pH 45 min, pH 24 h, drip, thawing and cooking loss between two systems (*P*>0.05). Interestingly, the organic meat was significantly more tender than conventional one (*P*<0.05), despite the fact that ECO pigs were older and had slightly less marbling (*P*<0.05) and IMF (*P*=0.13). Nevertheless, the shear force is not necessarily related to the IMF. The explanation could be in the muscle fibres (type and size) which we did not measure, but can be related to our previous study *(Fazarinc et al., 2020)* showing that organic production system influenced the composition of the LD myofibre type (smaller myofibre cross-sectional area, a shift toward oxidative myofibre types). More oxidative muscle fibres have smaller cross-sectional area which is easier to cut through i.e. giving less resistance to cutting.

Table 2. Meat quality traits of conventionally (CON) and organically (ECO) reared Krškopolje pigs

	CON (n=108)	ECO (n=136)	*P*-value
	Mean ± S.E.		
pH 45 min LD	6.34±0.04	6.41±0.03	0.147
pH 24 h LD	5.48±0.02	5.46±0.02	0.366
CIE L*	54.9±0.7	52.9±0.5	<0.05
CIE a*	9.8±0.3	10.7±0.2	<0.05
CIE b*	6.1±0.4	4.5±0.3	<0.001
Hue	29.9±1.6	22.3±1.1	<0.001
Chroma	11.9±0.4	11.8±0.3	0.699
Drip loss after 24 h (%)	4.7±0.3	4.9±0.3	0.526
Thawing loss (%)	11.8±0.7	12.9±0.4	0.161
Cooking loss (%)	26.4±0.9	26.6±0.5	0.851
Marbling score (1 to 7)[1]	3.5±0.2	3.0±0.1	<0.05
IMF, %	5.1±0.3	4.6±0.2	0.138
WBSF (N)	54.9±2.2	48.7±1.3	<0.05

Mean=Estimated marginal means*;* S.E.=standard error; LD=*Longissimus dorsi* muscle; CIE= International Commission on Illumination; L*= lightness; a*=red/green coordinate; b*=yellow/blue coordinate*;* [1] visual assessment on a freshly cut LD muscle using a scale from 1 (extremely lean) to 7 (extremely marbled sample); IMF=intramuscular fat*;* WBSF = Warner–Bratzler shear force.

The results of fatty acid composition (Table 3) showed no differences in MUFA between the ECO and CON groups. Polyunsaturated fatty acids (PUFA), PUFA/SFA, n-6 and n-3 polyunsaturated fatty acids were significantly higher in the ECO group (P<0.001).

Table 3. Fatty acid composition* of conventionally (CON) and organically (ECO) reared Krškopolje pigs

	CON (n=108)	ECO (n=136)	*P*-value
	Mean ± S.E		
SFA	43.1±0.3	40.5±0.2	<0.001
MUFA	46.6±0.4	47.3±0.2	0.100
PUFA	10.4±0.4	12.4±0.3	<0.001
PUFA/SFA	0.24±0.01	0.31±0.01	<0.001
n-3 PUFA	0.7±0.03	0.9±0.02	<0.001
n-6 PUFA	9.5±0.3	11.2±0.2	<0.001
n6/n3 PUFA	13.7±0.4	12.7±0.3	<0.05

Mean=Estimated marginal means; S.E.=standard error, SFA=saturated fatty acids; MUFA=monounsaturated fatty acids; PUFA=polyunsaturated fatty acids. *=fatty acids are presented as g per 100g of fatty acids.

The fatty acid profile of a diet can have a huge impact on the final fatty acid composition *(Wood et al., 2008).* The higher PUFA content in ECO pigs can be attributed to the differences in the diet (the obligatory supplementation of roughage e.g. hay, which is rich in polyunsaturated fats), because PUFAs are obtained directly from the consumed food *(Wood and Enser, 1997).* On the other hand, MUFAs could be deposited either from feed or by desaturation of saturated fatty acids (SFA) (obtained by de novo SFA synthesis) *(Wood et al., 2008).* The SFA content was significantly lower in organic pork (P<0.001). The finding of lower SFA content of organic pork has also been reported by *Kim et al. (2009)* and *Wójciak et al. (2021).* Some authors found that higher physical activity in free-range pigs positively correlated with n-3 PUFA content *(Daza et al. 2009; Škrlep et al., 2019).*

When we consider the effect of farm (results not shown), the effect was significant for practically all measurements (except for CIE L* and drip loss). This reflects the effect of different conditions on farms with regard to the feeding and diets applied.

Analysis of the vitamins of the LD muscle (Table 4) showed that CON pigs had higher concentration of vitamin E (P<0.001), whereas all other vitamins showed no statistical difference. *Wójciak et al. (2021)* also showed higher vitamin E content in meat samples of pigs raised in conventional production system. The opposite was reported by *Högberg et al. (2002*) who found higher vitamin E content in organically raised castrated pigs. The possible reason for the differences in vitamin E content between the two groups is likely the diet *(Echenique, 2007),* however it is also possible that ECO pigs deposit less vitamin E due to its higher depletion for maintaining oxidative stability. Physical activity is associated with increased oxidative stress and consequently affects the need for antioxidants such as vitamin E *(Packer, 1984).*

Table 4. Vitamins composition of *LD* of conventionally (CON) and organically (ECO) reared Krškopolje pigs

	CON (N=10)	ECO (N=12)	μ^2_p	*P*-value
	Mean ± S.E.			
Vitamin A (mg/kg)	<0.1	<0.1	-	-
Vitamin A (IU/kg)	<333	<333	-	-
Vitamin D3 (μg/kg)	<20	<20	-	-
Vitamin D3 (IU/kg)	<800	<800	-	-
Vitamin E (mg/kg)	4.36±0.17	2.13±0.16	0.82	<0.001

LD= *Longissimus dorsi* muscle; Mean=Estimated Marginal Means; S.E. = standard error; η_p^2 – partial eta squared denotes effect size; 0.01 is considered a “small” effect size, 0.06 represents a “medium” effect size and 0.14 a “large” effect size.

The analysis of minerals (Table 5) showed that ECO pigs had higher Mg content (P<0.05). This could be explained by the fact that organic pigs have free access to soil and small stones, which are rich in Mg and Ca reserves *(Zhao et al., 2016)*. However, Ca content was higher in the CON system than in the ECO system (P<0.05). Commercial concentrate usually contains (is supplemented with) calcium phosphate and limestone, which could be a reason why the Ca concentration was higher in the conventional system. On the other hand, some authors argue that Ca content is stable despite different feeding regimes *(Zhu et al., 2007)*.

Table 5. Minerals composition of *LD* of conventionally (CON) and organically (ECO) reared Krškopolje pigs

	CON (N=12)	ECO (N=12)	μ^2_p	P-value
Mean ± S.E.				
Ca (g/100g)	0.004±0.001	0.003±0.001	0.176	<0.05
P (g/100g)	0.190±0.001	0.191±0.001	0.012	0.609
Fe (mg/kg)	5.542±0.223	5.667±0.223	0.007	0.695
K (g/100g)	0.371±0.004	0.368±0.004	0.013	0.598
Cu (mg/kg)	<5	<5	-	-
Mg (g/100g)	0.025±0.000	0.027±0.000	0.328	<0.05
Mn (mg/kg)	<5	<5	-	-
Na (g/100g)	0.038±0.001	0.040±0.001	0.053	0.281
Zn (mg/kg)	16.250±0.534	16.417±0.534	0.002	0.827

LD=*Longissimus dorsi* muscle; Mean= Estimated Marginal Means; S.E. = standard error; η_p^2 – partial eta squared denotes effect size; 0.01 is considered a “small” effect size, 0.06 represents a “medium” effect size and 0.14 a “large” effect size.

Conclusion

Krškopolje pigs in the organic system were older, heavier and exhibited greater *longissimus* muscle and backfat thickness. They also produced meat that was of darker and redder colour, with lower marbling, but higher tenderness, had lower vitamin E, lower Ca and higher Mg content. Their fat tissue was more unsaturated (higher PUFA, n-3, n-6 PUFA, PUFA/SFA ratio, and lower n-6/n-3 PUFA). It can be concluded that organic and conventional production systems affect the results which could be related to differences in the nutrition (e.g. amino acids balance, roughage), however the diets used on the farms were not monitored to be able to draw cause-effect conclusions.

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References

BATOREK LUKAČ N., TOMAŽIN U., ŠKRLEP M., KASTELIC A., POKLUKAR K., CANDEK-POTOKAR M. (2019): Krškopoljski prašič (Krškopolje pig). In: Candek-Potokar M, Linan RMN, editors. European Local Pig Breeds - Diversity and Performance. A Study of Project TREASURE. London, IntechOpen, 1–15.

BELTRÁN-COTTA L. A., PASSOS R. S. F. T., COSTA N. P., BARRETO B. G., VELOSO A. C., da SILVA M. C. A., da COSTA M.P., CAVALHEIRO C. P. (2023): Use of yellow mombin (Spondias mombin L.) in marination: Effect on quality properties of Boston butt pork during refrigerated storage. Meat Science, 109257.

CHRISTENSEN L.B. (2003): Drip loss sampling in porcine m. longissimus dorsi. Meat Science, 63, 469–477.

ČANDEK-POTOKAR M., BATOREK-LUKAČ N., TOMAŽIN U., ŠKRLEP M., MONTEIRO A. N. T. R. GARCIA-LAUNAY F. (2022): Welfare assessment of Krškopolje pigs reared in different production systems. Animal-Open Space, 1, 1, 100021.

DAZA A., REY A.I., OLIVARES A., CORDERO G., TOLDRA F., LOPEZ-BOTE C.J. (2009): Physical activity-induced alterations on tissue lipid composition and lipid metabolism in fattening pigs. Meat Science, 81, 641–646.

ECHENIQUE A. (2007): Efecto de la alimentación sobre la calidad de la carne y la grasa de cerdo. In Monografía conferencia IX Encuentro de Nutrición y Producción en Animales Monogástricos (pp. 55-63).

FAZARINC G., VRECL M., POKLUKAR K., ŠKRLEP M., BATOREK-LUKAČ N., BRANKOVIČ J., TOMAŽIN U., ČANDEK-POTOKAR M. (2020): Expression of myosin heavy chain and some energy metabolism-related genes in the longissimus dorsi muscle of Krškopolje pigs: effect of the production system. Frontiers in Veterinary Science, 7, 533936.

GENTRY J.G., MCGLONE J.J., MILLER M.F., BLANTON Jr. A. (2002): Diverse birth and rearing environment effects on pig growth and meat quality. Journal of Animal Science, 80, 1707/1715.

HÖGBERG A., PICKOVA J., BABOL J., ANDERSSON K., DUTTA P. C. (2002): Muscle lipids, vitamins E and A, and lipid oxidation as affected by diet and

RN genotype in female and castrated male Hampshire crossbreed pigs. Meat Science, 60, 4, 411-420.

KIM D. H., SEONG P. N., CHO S. H., KIM J. H., LEE J. M., JO C., LIM D. G. (2009): Fatty acid composition and meat quality traits of organically reared Korean native black pigs. Livestock Science, 120, 1-2, 96-102.

LEBRET B., ČANDEK-POTOKAR M. (2022): Review: Pork quality attributes from farm to fork. Part I. Carcass and fresh meat. Animal, 16 (1).

LEBRET B., LE ROY P., MONIN G., LEFAUCHEUR L., CARITEZ J. C., TALMANT A., ELSEN J. M., SELLIER, P. (1999): Influence of the three RN genotypes on chemical composition, enzyme activities, and myofiber characteristics of porcine skeletal muscle. Journal of Animal Science, 77, 6, 1482-1489.

LISTRAT A., LEBRET B., LOUVEAU I., ASTRUC T., BONNET M., LEFAUCHEUR L., BRIGITTE PICARD B., BUGEON J. (2016): How muscle structure and composition influence meat and flesh quality. The Scientific World Journal, 3182746.

MAIORANO G., KAPELAŃSKI W., BOCIAN M., PIZZUTO R., KAPELAŃSKA, J. (2013): Influence of rearing system, diet and gender on performance, carcass traits and meat quality of Polish Landrace pigs. Animal, 7, 2, 341-347.

PACKER L. (1984): Vitamin E, physical exercise and tissue damage in animals. Medical Biology, 62,105-109; 1984.

PRACHE S., LEBRET B., BAÉZA E., MARTIN B., GAUTRON J., FEIDT C., MÉDALE F., CORRAZE G., RAULET M., LEFÈVRE F., VERREZ-BAGNIS V., SANS P. (2022): Quality and authentication of organic animal products in Europe. Animal, 16, 100405.

PUGLIESE C, MADONIA G, CHIOFALO V, MARGIOTTA S, ACCIAIOLI A, GANDINI G. (2003): Comparison of the performances of Nero Siciliano pigs reared indoors and outdoors. 1. Growth and carcass composition. Meat Science, 65, 2, 825-31.

REGULATION (EU) 2018/848 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 30 May 2018 on organic production and labelling of organic products and repealing Council Regulation (EC) No 834/2007.

SCHINCKEL A. P., MAHAN D. C., WISEMAN T. G., EINSTEIN M. E (2008): Growth of protein, moisture, lipid and ash of two genetic lines of barrows and gilts from twenty to one hundred twenty five kilograms of body weight. Journal of Animal Science, 86, 460– 471.

ŠKRLEP M., ČANDEK-POTOKAR M., BATOREK-LUKAČ N., TOMAŽIN U., FLORES M. (2019): Aromatic Profile, Physicochemical and Sensory Traits of

Dry-Fermented Sausages Produced without Nitrites Using Pork from Krškopolje Pig Reared in Organic and Conventional Husbandry. Animals, 9, 2, 55.

TOMAŽIN U., BATOREK-LUKAČ N., ŠKRLEP M., PREVOLNIK-POVŠE M., ČANDEK-POTOKAR M. (2019): Meat and fat quality of Krškopolje pigs reared in conventional and organic production systems. Animal, 13, 5, 1103-1110.

WÓJCIAK K. M., HALAGARDA M., ROHN S., KĘSKA P., LATOCH A., STADNIK J. (2021): Selected nutrients determining the quality of different cuts of organic and conventional pork. European Food Research and Technology, 247, 1389-1400.

WOOD J. D., ENSER M. (1997): Factors influencing fatty acids in meat and the role of antioxidants in improving meat quality. British journal of Nutrition, 78, 1, S49-S60.

WOOD J. D., ENSER M., FISHER A. V., NUTE G. R., SHEARD P. R., RICHARDSON R. I., HUGHES S.I., WHITTINGTON F. M. (2008): Fat deposition, fatty acid composition and meat quality: A review. Meat Science, 78, 4, 343-358.

YU Q. P., FENG D. Y., XIAO J., WU F., HE X. J., XIA M. H., DONG T., LIU Y. H., TAN H. Z., ZOU S. G., ZHENG T., OU X. H., ZUO J. J. (2017): Studies on meat colour, myoglobin content, enzyme activities, and genes associated with oxidative potential of pigs slaughtered at different growth stages. Asian-Australasian Journal of Animal Sciences, 30, 12, 1739–1750.

ZHAO Y., WANG D., YANG S. (2016): Effect of organic and conventional rearing system on the mineral content of pork. Meat Science, 118, 103-107.

ZHU H. Q., WANG Q. K., YIN S. P. (2007): The comparison analysis of the boar meat and pork in nourishment composition. Acta Agriculturae Boreali-Occidentalis Sinica, 4, 828-865.