 DOI: /10.5513/JCEA01/20.1.2359

Changes in carcass composition of Black Slavonian pigs and their crossbreds with Duroc during growth

Goran KUŠEC*, Kristina GVOZDANOVIĆ, Ivona DJURKIN KUŠEC, Vladimir MARGETA, Dalida GALOVIĆ and Žarko RADIŠIĆ

Faculty of Agriculture in Osijek, Vladimira Preloga 1, HR-31000 Osijek, Croatia, *correspondence: gkusec@pfos.hr

Abstract

Present study was carried out on 32 pure Black Slavonian (BS) pigs and 32 crossbreds of Black Slavonian and Duroc (BSxDu); number of barrows and gilts was equal in both groups. Every three months, 4 barrows and 4 gilts from both groups were slaughtered for the analysis of tissue and primal parts development in the series of subsequent dissection trials covering a total fattening period of 12 months. The results showed that crossing the BS pigs with Duroc resulted in significant increase in the development of main tissues and primal parts. Significantly higher live weight, carcass weight and lean meat percentage was reported in BS pigs compared to BSxDu pigs ($P<0.001$). The exception was lean meat percentage determined at the age of 3 months ($P>0.05$). BSxDu pigs entered the experiment at significantly higher live weight ($P<0.05$) than BS pigs; this relationship continued during entire growth period. Muscle and fatty tissues followed the similar patterns of growth. Muscle tissue was produced in higher amounts than fat in case of BS pigs; in BSxDu pigs, fat overgrew muscle at the later stage of fattening. Although BS pigs exhibited lower formation of muscle tissue than BSxDu, their carcasses were significantly leaner.

Keywords: carcass traits, crossbreeding, growth, local pig breed

Introduction

Black Slavonian pig (original name: Crna slavonska) is Croatian autochthonous breed, traditionally kept outdoors. This production system is nowadays recognized as a low input, relatively cost-effective system since this breed requires no expensive accommodation facilities and their food requests are rather modest (Budimir et al., 2013; Margeta et al., 2016). Moreover, Black Slavonian (BS) pigs proved to have excellent adaptive ability to the local surrounding and climatic conditions (Karolyi et al., 2007; Baković et al., 2016). As many of other indigenous breeds such as Cinta Senese (Pugliese et al., 2009), BS pigs are found to be low productive breed, with robust immunity and ability to consume abundant quantity of voluminous food when offered (Uremović et al., 2000; Senčić et al., 2005; Margeta et al., 2017). There were

several attempts to improve the carcass traits of BS pigs by their crossing with various high productive, leaner breeds in order to increase the production of meat, preserving the well-known eating quality (Luković et al., 2007; Uremović et al., 2007). The aim of the present study was to determine the differences between BS pigs and their crossbreds with Duroc (BSxDu) in carcass composition at the same ages during growth.

Materials and methods

The experiment was carried out on 64 pigs (equal number of gilts and barrows). Half of the pigs were pure Black Slavonian (BS), while other half was crosses of Black Slavonian with Duroc (BSxDu). Both groups were reared on the pasture allowing 300 m^2 space per pig with 80 m^2 of canopy which protected the pigs from uncomfortable climate conditions. Basic diet for both groups was alfalfa *ad libitum* with the additional 2 kg of the whole grains per pig/day. Composition of additional diet was 50% corn, 25% barley, 10% triticale, and 15% extruded soybeans. Starting at the age of three months, 8 pigs from both experimental groups were sacrificed in the local slaughterhouse and fully dissected according to the "Kulmbach reference method" as described by Branscheid et al. (1990). This procedure was applied every 3 months covering a total fattening period of one year. In this way, the data needed for the analysis of growth of main tissues (muscle and fat) and primal parts (ham, shoulder, loins and belly rip part) were collected. The data obtained in present study were analyzed by Student's t-test using Dell Statistica v. 12 software (Dell Inc., 2015), while for the graphical presentation of the results, Microsoft Excel program (2013) was used.

Results

The basic carcass traits are presented in Table 1. It can be observed from Table 1 that significant differences in live weight (LW) and cold carcass weight (CCW) exist between the groups at all ages. There was no significant difference between the investigated pig breeds except for the lean meat percentage (LMP) determined at the age of 3 months. At other ages, the difference in LMP between the groups was significant. Pure Black Slavonian pigs and crossbreds of Black Slavonian and Duroc (BSxDu) entered the experiment having significantly different LW and CCW, but with similar LMP. Later on, the differences between the investigated pigs grew with the age for all of the investigated traits. Figure 1a and 1b shows the development of LW, muscle tissue and fat amount in BS pigs and their crossbreds with BSxDu, respectively. It can be observed that BSxDu pigs entered the experiment at significantly higher LW at the age of 3 months when compared to BS; this relationship was maintained during the investigated period of growth. Muscle and fatty tissues followed the similar patterns of growth. In the carcasses of BS pigs during the whole fattening period, muscle tissue was produced in higher amounts compared to the production of fat; in BSxDu pigs, fat overgrew muscle at the later stage of fattening. Although BS pigs exhibited lower formation of muscle tissue, their carcasses were significantly leaner than those of the crossbreds (BSxDu).

Table 1. Means and standard deviations (in brackets) for live weight, carcass weight and lean meat percentage of investigated pigs at different age

Age (months)	Live weight (kg)		P	Carcass weight (kg)		P	Lean meat (%)		P
	BS	BSxDu		BS	BSxDu		BS	BSxDu	
3	22.13 (1.55)	38.75 (0.89)	**	15 (1.31)	23.88 (1.36)	**	39.08 (0.52)	38.75 (2.02)	n.s.
6	29 (1.41)	55.13 (3.44)	**	21.5 (0.93)	36 (3.07)	**	40.41 (1.83)	43.52 (1.18)	**
9	46.13 (5.94)	80.38 (9.55)	**	36.13 (4.58)	61.13 (8.46)	**	43.2 (0.99)	38.73 (2.22)	**
12	66.38 (6.99)	126.88 (7.88)	**	53.88 (5.36)	98.75 (9.72)	**	43.45 (2.64)	38.39 (3.06)	***

BS – Black Slavonian pig; BSxDu – Black SlavonianxDuroc; n.s. - not significant; * P<0.05; ** P<0.01; *** P<0.001.

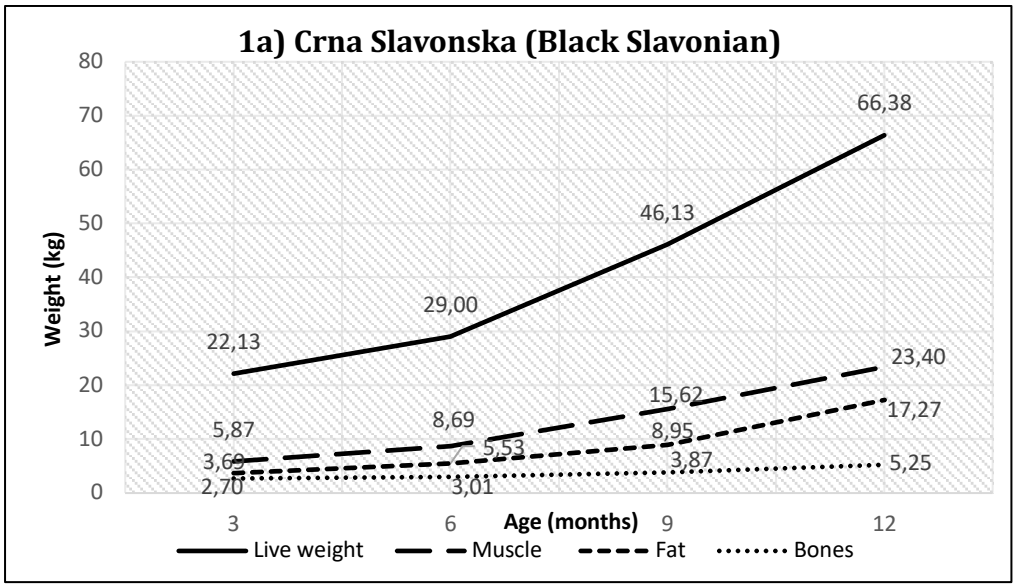

Figure 1a. Development of muscle and fat tissue in BS pigs

Changes in the weight of primal parts during the investigated fattening period of BS and BSxDu pigs are presented in Figure 2. The most pronounced differences between the investigated groups of pigs were found in the weight of belly-rib part, being almost doubled at each successive stage of growth. Similar pattern was established for the ham and shoulder, whilst the differences in loin weight between BS and BSxDu pigs were lower at the beginning of the investigated period, but they increased towards the end of experiment.

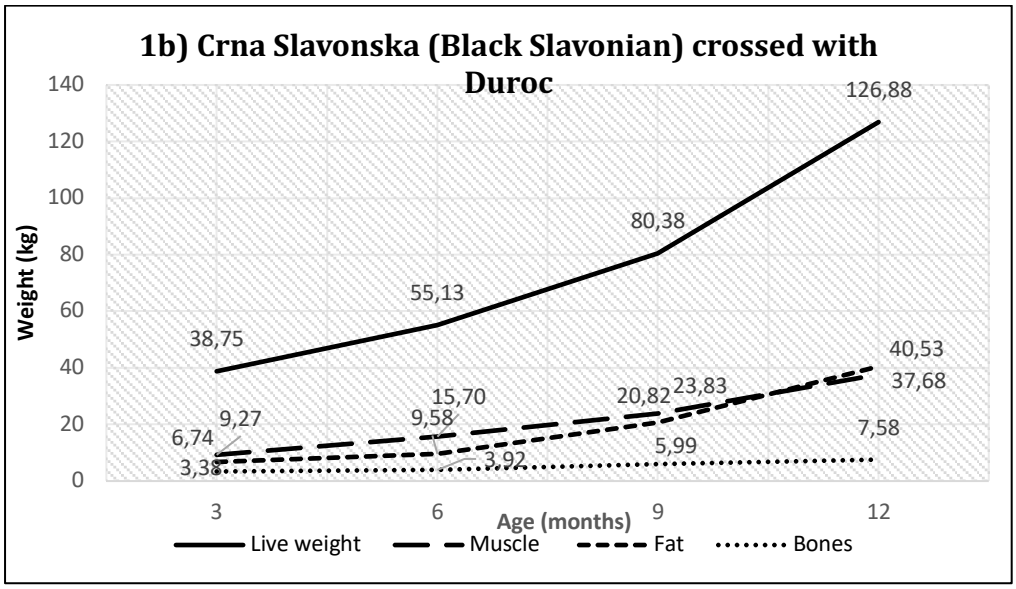

Figure 1b. Development of muscle and fat tissue in BSxDu pigs

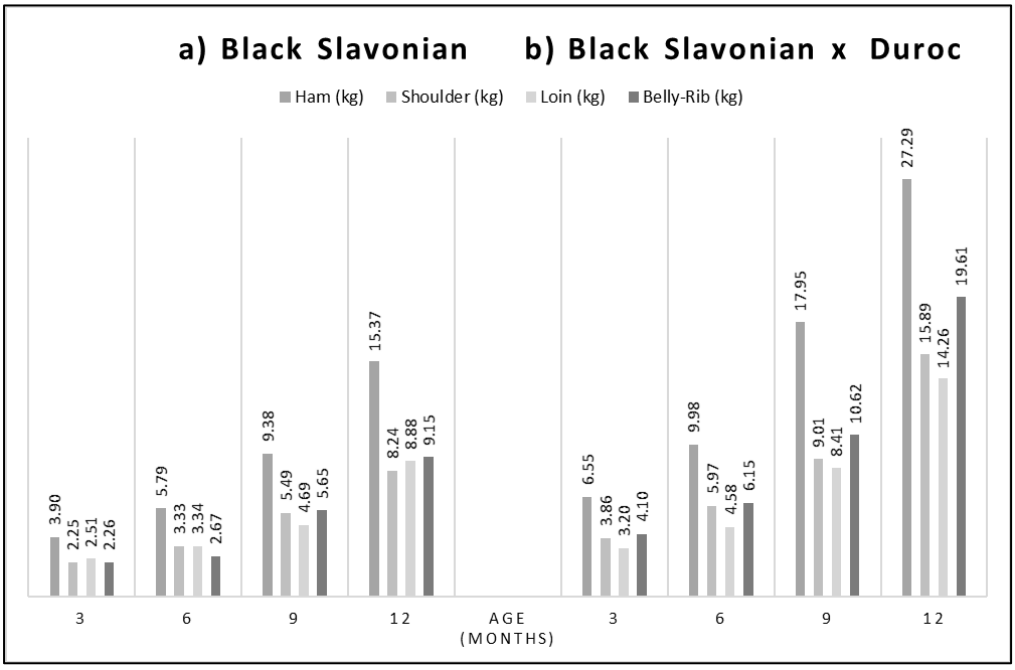

Figure 2. Growth of primal parts of: a) BS pigs, b) BSxDu pigs

Discussion

Previous studies showed that BS pigs are characterized by high percentage of fat tissue and low percentage of lean (Butko et al., 2007), especially when kept indoors (Frohlich et al., 2017). The other traditional pig breeds, such as Italian Cinta Senese have similar carcass characteristics as shown by Pugliese et al. (2009). Szulc et al. (2018) investigated effect of slaughter weight on slaughter traits and meat quality in

Zlotnicka Spotted pigs crossbred with Duroc. The obtained results were consistent with the results of present study in which the highest development of fat tissue was recorded for the pigs with live weight higher than 120 kg. The results on LW, CCW and LMP shown in Table 1 give an overview of these traits within an experimental period of present study, but it should be noted that usual outdoor rearing of BS pigs lasts 6 months longer when they achieve the final slaughter weight. This is the reason for such low LW and relatively higher LMP of BS pigs when compared to BSxDu crosses who achieved their final weight at the age of 12 months. Most of the research done so far deals with the comparison of BS pigs and their crosssbreeds with modern breeds fattened up to predetermined slaughter weight, while studies carried out on the carcass traits of these pigs at the same age are scarce. Senčić et al. (2005) observed that F1 crosssbreeds of BS and Landrace pigs had higher LMP than pure BS pigs at the predetermined slaughter weight of 135 kg. In this experiment, BS pigs were fattened outdoors for 18 months and their crossbreds with Landrace pigs reached the same LW in 12 months. Luković et al. (2007) reported significant improvements of growth and carcass traits of BS pigs crossed with Duroc and reared outdoors up to 120 kg LW, compared to pure BS pigs. The weight of ham in their study was significantly higher in BSxDu crossbreds (14.14 kg) than in pure BS pigs (13.22 kg). These results correspond to the results from present study in the case of BSxDu crossbreds, while in the case of pure BS pigs they are not comparable due to the different age at slaughter. Nevertheless, Karolyi et al. (2004) found that pure BS pigs had significantly lower utilization of hams, loins, shoulders and belly rib parts in comparison with modern white breeds, which is in agreement with the results of present study.

Conclusions

Based on the results of present study it can be concluded that crossing of Black Slavonian pigs with Duroc increases the LW and CCW within the investigated period of growth. At the age of 12 months, BS pigs had higher LMP than the crosses with Duroc, but at the significantly lower LW. Similarly, the development of main tissues and primal parts are accelerated, especially in the case of fat tissue and belly rib part, but also in other primal parts such as ham and shoulder. Low LMP of BSxDu crossbreds at the age of 12 months and 126 kg LW suggest that these pigs are prone to deposit fat and that their fattening period could be shortened. Further research on the comparison of pure BS pigs and BSxDu crossbreds are recommended, particularly in the aspects of meat quality.

Acknowledgements

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

References

Baković, M., Gvozdanović, K., Galović, D., Radišić, Ž., Margeta, V. (2016) Klaonička svojstva tovljenika crne slavonske svinje iz ekstenzivnog sustava držanja (Slaughter traits of Black Slavonian fattening pigs from extensive keeping conditions). Krmiva: časopis o hranidbi životinja, proizvodnji i tehnologiji krme, 58 (1), 3-8.

Branscheid, W., Dobrowolski, A., Sack, E. (1990) Simplification of the EC reference method for the full dissection of pig carcasses. Fleischwirtschaft, 70 (5), 565-567.

Budimir, K., Margeta, V., Margeta, P. (2013) Breeding of the Black Slavonian pig in extensive conditions. Acta Agriculturae Slovenica, 4, 93-96.

Butko, D., Senčić, Đ., Antunović, Z., Šperanda, M., Steiner, Z. (2007) Pork carcass composition and the meat quality of the Black Slavonian pig–the endangered breeds in the indoor and outdoor keeping system. Agriculture, 13 (1), 167-171.

Frohlich, M., Komlenić, M., Margeta, V., Djurkin Kušec, I., Gvozdanović, K., Margeta, P., Radišić, Ž., Kušec, G. (2017) The development in live weight, muscle and fat of Crna Slavonska pigs kept in different rearing systems. Agriculturae Conspectus Scientificus, 82 (3), 227-230.

Gvozdanović, K., Margeta, V., Kušec, I.D., Margeta, P., Radišić, Ž., Kušec, G., (2016) Comparison of carcass and meat quality traits of Black Slavonian pigs regarding the duration of fattening period. Archivos de Zootechnia, 205-208.

Luković, Z., Uremović, M., Konjačić, M., Uremović, Z., Vnučec, I., Prpić, Z., Kos, I. (2007) Proizvodna svojstva tovljenika crne slavonske pasmine i križanaca s durokom (Production traits of Black Slavonian fattening pigs and their crossbreeds with the Duroc breed). In: Proceedings of 42nd Croatian & 2nd International Symposium on Agriculture. Opatija, Croatia, 13-16 February 2007.

Karolyi, D., Salajpal, K., Sinjeri, Ž., Kovačić, D., Jurić, I., Đikić, M. (2004) Meat quality, blood stress indicators and trimmed cut yield comparison of Black Slavonian pig with modern pigs in the production of Slavonian Kulen. Acta Agriculturae Slovenica, 1, 67-72.

Karolyi, D., Luković, Z., Salajpal, K. (2007) Production traits of Black Slavonian pigs. In: Proceedings of 6th International Symposium on the Mediterranean Pig. Messina - Capo d'Orlando, Italy, 11–13 October 2007, Bologna, Italy.

Margeta, V., Gvozdanović, K., Margeta, P., Kušec, I.D., Radišić, Ž., Galović, D., Kušec, G. (2016) Low input production system suitable for Black Slavonian pig breeding. Acta Argiculturae Slovenica, 5, 122-126.

Margeta, V., Gvozdanović, K., Kušec, I.D., Margeta, P., Kušec, G., Radišić, Ž. (2017) The effect of the acorn in feeding on the production and slaughter traits of crna slavonska pig. In: Proceedings of 11th International Symposium Modern Trends in Livestock Production. Belgrade, Serbia, 11-13 October 2017, Institute for Animal Husbandry.

Pugliese, C., Sirtori, F., Ruiz, J., Martin, D., Parenti, S., Franci, O. (2009) Effect of pasture on chestnut or acorn on fatty acid composition and aromatic profile of fat of Cinta Senese dry-cured ham. Grasas y aceites, 60 (3), 271-276. DOI: https://dx.doi.org/10.3989/gya.130208

Senčić, Đ., Bukvić, Ž., Antunović, Z., Šperanda, M. (2005) Slaughter quality of Black slavonian pig – endangered breed and its cross-breeds with Swedish landrace while keeping them outdoor. Agriculture, 11 (1), 43-48.

Szulc, K., Nowaczewski, S., Skrzypczak, E., Szyndler-Nędza, M. (2018) Effect of slaughter weight and sex on slaughter traits and meat quality of Polish autochthonous Zlotnicka Spotted pigs crossbred with Duroc. Annals of Animal Science, 18 (1), 225-237. DOI: https://dx.doi.org/10.1515/aoas-2017-0020

Uremović, M., Uremović, Z., Luković, Z. (2000) Production properties of the Black Slavonian pig breed. Zbornik Biotehniške fakultete Univerze v Ljubljani, Kmetijstvo Zootehnika, 76, 131-134.

Uremović, M., Uremović, Z., Luković, Z., Konjačić, M., Nakić, S.N. (2007) The quality of meat of the Black Slavonian breed and the F1 generation with the Large White breed. In: Proceedings of 42nd Croatian & 2nd International Symposium on Agriculture. Opatija, Croatia, 13-16 February 2007.