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Black Slavonian pig – a breed for extensive husbandry (A review)

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ABSTRACT

Black Slavonian (BS) pig is local Croatian breed originated in Slavonia region in the second half of the 19th century. Until the 1950s it was the most widespread breed in Slavonia, mainly used for the production of fat and meat products. Later, its population was drastically reduced and in 1990s the survival of the breed was endangered. In order to halt breed decline the State introduced protection measures which resulted in population increase; in 2008 there were 78 boars and 669 sows. The breed is well adapted for traditional outdoor keeping which includes the utilization of pasture and woodland with supplement of a small amount of grains. Litter size is low with ~ 1.5 farrowing per year per sow. The fattening abilities are also modest, with low daily gains and high share of fat in the carcass. However, the meat quality is good, with high content of intramuscular fat and high appreciation of its meat products. As a part of current trends of support of sustainable and traditional food production systems, it becomes important to preserve the production systems of BS pigs and their products. Development of marketing of niche products could be the best way for long-term preservation of breed.
(Keywords: pigs, breeds, Black slavonian pig, production traits)

INTRODUCTION

Black Slavonian (BS) pig is local Croatian breed which originated from Berkshire and Poland China breeds crossed with Black Mangalitsa. The breed was developed in Slavonia region in the eastern Croatia by Count Pfeiffer at the end of the 19th century. In the past this was the most numerous pig breed in Slavonia commonly used for production of fat and traditional meat products. However, over time it was largely replaced by more productive imported breeds and the population of BS pigs was drastically reduced. In 1996, the size of effective population was less than 20 and survival of the breed was endangered (*Uremović et al.,* 2000). The same year, Croatia signed the Biodiversity Treaty (*CBD,* 1992) and ¨A Survey of the State of Biological and Environmental Diversity of Croatia with Strategy and Protection Plan Action¨ was elaborated (*Duzzp*, 1999), as well as ¨A Program for Breeding up of the Black slavonian breed¨(*Uremović and Janeš,* 2000). As a result of undertaken measures the breed decline was stopped. Moreover, its economical potential for the production of traditional products has been recently re-actualized (*Uremović,* 2004; *Karolyi et al.,* 2004; *Karolyi et al.,* 2007a). In recent years population of BS pigs rather increased; in 2008 it counted 78 boars, 50 young boars, 669 sows, 392 young sows and 1368 piglets (*Croatian Agricultural Agency,* 2009).

Traditional production system

Traditional BS pig production is an outdoor, grazing system which includes utilization of natural resources of pasture and oak (*Quercus robur* L.) woodland with supplement of a small amount of corn seed or some other grains (~0.15 kg per head daily). Together with pasture, pigs consume foodstuff found on stubbles after the cereals (wheat, corn, and barley) have been harvested. The sows are conventionally kept in pens for farrowing littered with straw in eaves closed on three sides, one week before farrowing and after farrowing to weaning. There are on average ~1.5 farrowing per year per sow. During low temperatures piglets may be heated (i.e. with infra-red lamps). After the weaning, sows and piglets are kept in the open with the possibility of entering eaves. Usually, there are about twenty sows per ha. During rough winter months, the animals may also be kept inside piggery in the villages. The short period of pre-slaughter fattening with concentrated feed is common. In general, the breed is well adopted for outdoor keeping in conditions of continental climate due to its pronounced resistance, dark pigmentation and ability to consume large amounts of pasture (*Uremović et al.,* 2003; *Senčić et al.,* 2005).

Production and carcass traits

As for the most of other local pig breeds, the production possibilities for BS pig are rather limited. Litter size is low with average number of live born and reared piglets per litter ranges between 6.3 and 7.4, and 5.7 and 6.6, respectively (*Uremović et al.,* 2000; *Senčić et al.,* 2001a; *Uremović et al.,* 2003). Significant improvements in litter size traits were obtained by crossing BS sows with Duroc boar (*Uremović et al.,* 2003). The fattening ability is also modest. Under the extensive production, daily gain in body mass from 27 kg to 106 kg was on average 478 g, with average share of meat in the carcass of 43% (*Uremović et al.,* 2000). At fatteners of similar finally body weight but fed with the commercial feed mixture, *Senčič et al*. (2001b) determined average carcass meatiness of 38.5%. In some previous papers, even lower meatiness in the carcasses of similar weight (~80 kg) was reported: 28.6% (*Petričević et al.,* 1988) and 28.5% (*Kralik et al.,* 1988). In general, BS pigs are characterized by high accumulation of adipose tissue in the carcass similarly to other local breeds with low genetic potential for muscle development as Alentejano in Portugal (*Freitas et al.,* 2007), Iberian in Spain (*López-Bote,* 1998), Cinta Sense in Tuscany (*Pugliese et al.,* 2004) or Corsican breed (*Coutron-Gambotti et al*., 1998). For example, in heavy BS fatteners (at the age of about 18 months and average body weight of 160 kg) used for the processing of Slavonian kulen – a traditional dry sausage, the average depth of meat and fat above *m.gluteus* were nearly the same, 64 and 63 mm, respectively. In the carcasses of crossed white pigs (Large White×Swedish Landrace sired with Duroc) of similar age and weight the average depth of meat and fat were 73 and 30 mm, respectively. As a consequence, in comparison to modern white crosses, BS pigs have significantly lower utilization of main cuts (hams, back, shoulders and neck) (32.3 vs. 26.8%, $P<0.05$) and lower utilization of carcass (19.9 vs.16.3%, $P<0.05$) for the production of traditional products like Slavonian kulen (*Karolyi et al.,* 2004). These results however, were obtained after the prolonged period of pre-slaughter fattening in the piggery when pigs weight gain is mainly due to accumulation of fat. In the same experiment, the significant reduction of back fat was obtained in progeny of BS sows and Duroc boar. Results from traditional outdoor-low input system, reported by *Senčić et al*. (2005), showed the same shares of fat and muscle tissue (41%) in the carcasses of BS pigs reared until 12 months of age and average body weight of 130 kg. In the same experiment, significant improvements in the carcass

meatiness were obtained by crossing BS sows with Swedish Landrace boars (in F1 progeny the share of fat and muscle were 36.0 and 44.6%, respectively). Significant improvements of growth and carcass traits of F1 progeny in the outdoor production system reared up to the high body weights (~170 kg) were obtained also by crossing BS and Yorkshire breed (*Uremović et al.,* 2007), as well as in crossing with Duroc breed in fattening up to 120 kg of final weight (*Luković et al.,* 2007).

Welfare in the traditional production

The knowledge about welfare issues in BS breed is limited. No research based on standard scientific measurements of animal welfare has been performed so far. However, it could be expected that in the traditional outdoor systems, both physical and mental well-being of the animals are good. The pigs are reared extensively, they spend most of their life-time outside on pastures and oak woods where they are able to exhibit foraging behavior and other natural instincts. It is well known, however, that outdoor farming is more often associated with parasite-related diseases (*Hovi et al.,* 2003). One of the recent no-drug recommendation methods of gastrointestinal nematode control in grazing animals is the consumption of plants rich in condensed tannin, as it has a direct toxic effect on parasites and/or on the parasite fecundity (*Hoskin et al.,* 2000). By grazing in oak woods, especially during season when alternative forage availability is scarce, BS pigs may consume huge amounts of tannin rich plant material. To research tannin protective ability, *Salajpal et al*. (2004) fed BS pigs three weeks before slaughter with acorn *ad libitum* (experimental group) or with concentrated feed (control). All examined pigs were reared (spring-autumn) on pasture utilizing natural resources and they naturally acquired parasite. It was found that oak acorn (*Quercus robur* L.) is a relatively tannin rich forage (65 g/kg of DM) and that its consumption can reduce total faecal egg count output (96.01%) in pigs infected with large roundworm (*Ascaris suum*) and other gastrointestinal parasites. It is concluded that the acorn grazing in the traditional BS pig production system may have a potential of aiding in the control of the gastrointestinal parasites and consequently may result in reduced need for anthelmintic treatment.

Stress resistance

Physiological responses to stress in pigs can be assessed by measuring changes in plasma cortisol, glucose, lactate and/or other parameters like activity of the cellular enzymes creatine phosphokinase (CPK), lactate dehydrogenase (LDH) and aspartate aminotransferase (AST) which are commonly used as indicators of stress affecting muscle damage (*Fàbrega,* 2002). There are some indications that the resistance to stress during pre-slaughter handling of BS pigs seems to be superior to modern pigs. In the comparison with modern white crosses, Black slavonian pigs had the lowest ($P<0.05$) serum CPK and AST activity in the blood samples collected at exsanguinations, which may indicate their lower susceptibility to pre-slaughter stress (*Karolyi et al.,* 2004). Nevertheless, this single finding needs to be investigated in the future in more detail (e.g. cortisol level).

Meat quality

Regarding the meat quality of BS pigs, in some previous papers no prominent defects were reported (*Petričević et al.,* 1988; *Kralik et al*., 1988). The average values of initial pH within 1 h post mortem (pH_1) and final pH after 24 h post mortem (pH_{24}) in longissimus muscle (LM) reported more recently were inside normal pork quality scope and ranged between 6.1 and 6.8, and 5.7 and 5.9, respectively (*Senčić et al.,* 2001b;

Senčić et al., 2005; *Karolyi et al.,* 2004; *Uremović et al.,* 2007; *Karolyi et al.,* 2007b, *Butko et al*., 2007). The meat of BS pigs is visually darker and redder than the meat of modern pigs. The lightness (Cie *L**) and redness (Cie *a**) values of LM colour measured 24 h post mortem were 49.9 and 20.0, respectively (*Karolyi et al.,* 2004). The water fixation ability assessed by compression method was between 4.0 and 4.5 cm^2 (*Senčić et al.,* 2001b, *Senčić et al.,* 2005, *Butko et al.,* 2007), while measured by drip loss method it was 1.6% (*Uremović et al.,* 2007).

In LM of BS pigs, *Salajpal et al.* (2007) found a higher ($P<0.01$) share (%) of red slow-twitch oxidative muscle fibres and fast-twitch oxidative-glycolytic muscle fibres in comparison to modern crossbred pigs of similar age, weight and keeping conditions. The authors also found lower ($P<0.05$) diameter in red slow-twitch oxidative fibres and white fast-twitch glycolytic fibres in BS pigs. These results are in accordance with findings of *Rahelić and Puać* (1981) who suggested that the diameter of LM muscle fibres in pigs increases with selection along with decrease of share of red fibres and increase of share of white fibres. The indication of lower stress susceptibility of BS pigs mentioned previously could also be related to higher muscle oxidative capacity in comparison to modern pigs.

The most distinctive characteristic of meat of BS pig in comparison to today's commercial pork is particularly high content of intramuscular fat (IMF), in average 6 to 8% (*Petričević et al.,* 1988; *Senčić et al.,* 2001b; *Senčić et al.,* 2005; *Karolyi et al.,* 2007b). Many local pig breeds in extensive production systems show similar degree of intramuscular fat accumulation. This particular ability is obviously favoured by genotype x environment interaction pointed out by *Lebret* (2007); where the slower growth rate and higher final body weight and age together with specific diet based on pasture, acorn and other natural foodstuffs allow pigs the positive expression of genetic potential for deposition of fat into the muscle. Besides this, the compensatory growth usually present during energetic abundant diet in autumn after the period of scarce diet during summer, may favour fast increase in adipose tissue mass and deposition of large amount of lipids into the muscles in breeds with low genetic potential for muscle growth (*Acciaioli et al.,* 2002; *Coutron-Gambotti et al.,* 1998). *Butko et al*. (2007) reported approximately 1% higher ($P<0.01$) share of IMF in LM of BS pigs from traditional outdoor system in comparison to animals kept inside and fed by commercial mixture. The higher share of IMF in pigs from outdoor production systems was also reported in other local breeds, e.g. Cinta Sense (*Pugliese et al.,* 2004) and Corsican pig (*Coutron-Gambotti et al.,* 1998). These findings could be related to differences in growth rate as animals raised under the extensive production usually reach the final body weight with considerably higher age and degree of development of adipose tissue (*Pugliese et al.,* 2004).

Traditional feedstufs and fatty acids

Natural resources feeds like grass are a good source of alpha linolenic acid (ALA) (*Muriel et al.,* 2002), an n-3 PUFA which is believed to confer benefits to human health. The influence of feedstuffs in the traditional production system of BS pigs, which include the pasture in spring and stubbles in late summer and autumn, on fatty acid (FA) profile of meat and back fat has been investigated by *Uremović et al.* (2007). The authors determined the average share of saturated FA (SFA), monounsaturated FA (MUFA) and PUFA in LM and back fat of 37.5, 56.9 and 5.5%, and 35.0, 47.6 and 16.7%, respectively. Investigating the effects of breed (BS vs. BS×Duroc) and rearing system (indoor vs. outdoor) on FA profile of *M. semimembranosus*, *Luković et al*. (2009) found lower SFA and MUFA and higher PUFA and ALA share in BS pigs. The share of

ALA in muscle did not differ between rearing systems probably due to fact that indoor kept pigs were also supplemented with mowed green mass. The indication of beneficial effects of traditional foodstuffs was found when BS pigs were fed with oak acorn (*Quercus robur* L.) instead of concentrate feed during finishing pre-slaughter fattening (*Karolyi et al.,* 2007b). Feeding acorn *ad libitum* three weeks before slaughter significantly increased the content of ALA in the LM in comparison to concentrate fed group (0.37 vs. 0.12, respectively; expressed as percent of total fatty acid methyl esters, $P<0.01$). These results imply that traditional feeding of BS pigs with acorn may increase the content of n-3 PUFA in meat what could be beneficial from consumer's health point of view.

CONCLUSIONS

It could be concluded that *in-situ* conservation of local BS pig so far has been successful. However, long term re-establishment of breed must be considered on economical basis by improving its traditional production system and by developing niche market products. The restoration of the traditional link between the breed and its typical products may represent a key tool to achieve these objectives. In this way, it is reasonable to start breeding the BS pigs again for the production of value added traditional products which could be, by itself, the best way for long-term preservation of breed. Additional research is needed on genetics, meat and products quality. The most interesting trait, the high IMF content, should be related, both to sensory and nutritional properties of meat and products. Influence of traditional feedstuffs on quality and FA profile of meat as well as potential benefits on consumer health should also be researched. If there are such benefits, they should be promoted in the public and in the market.

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