ISSN 1330-7142
UDK = 636.47:636.084.22

SLAUGHTER QUALITY OF BLACK SLAVONIAN PIG – ENDANGERED BREED AND ITS CROSS-BREDS WITH SWEDISH LANDRACE WHILE KEEPING THEM OUTDOOR

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Original scientific paper
Izvorni znanstveni članak

SUMMARY

Black Slavonian pig is an autochtonuous Croatian breed derived by crossing Mangulitza, Berkshire and Polandchina at the end of 19th century. It belongs to the group of endangered breeds. Because of its pronounced resistance, pigmented skin and ability of consuming high amounts of roughage (pasture), it is very convenient for keeping it outdoors, especially for organic production within low-input traditional technology. The investigation was conducted on 10 Black Slavonian pigs and 10 crossbreds between Black Slavonian pig (BS) and Swedish Landrace boars (SL). The pigs were fed until weighed approx. 135 kg. They were slaughtered at 12 months age and Black Slavonian pigs at 18 months. The pigs were kept outdoors in a natural low-lying pasture. The pasture area per animal was 0.05 ha. A traditional low- input technology was applied. Apart from pasture. the pigs consumed food found on stubbles after cereals had been harvested (wheat, barley, corn) and were given small amount of corn (0.15 kg/head/day). Dissection of cooled (+4°C) right pig carcasses was done by the modified method (Weniger et.al., 1963). The meat quality was investigated on a sample of long back muscle (Muscullus longissimus dorsi – MLD) taken between 13th and 14th rib. Outdoor keeping system and low inputs technology resulted in trunks of very significantly (P<0.01) higher meatiness (44.59% : 41.00%), higher ham share (27.78% : 24.16%), higher share of less valuable parts (7.52% : 6.53%) and lower necks share with crossbreds between Black Slavonian pig and Swedish Landrace compared to Black Slavonian pigs. As for pH1 and pH2 values, water fixation ability and meat colour, no statistically significant differences (P>0.05) were determined between analyzed pig genotypes. Crossbreds meat, compared to Black Slavonian pig meat, was known for very significantly (P<0.01) higher share of water (71.99% : 71.65%) and lower share of fat (5.30% : 5.90%).

Key-words: Black Slavonian pig, outdoor keeping, carcass quality, meat quality

INTRODUCTION

Black Slavonian pig is an autochtonous Croatian breed derived by crossing Mangulitza, Berkshire and Polandchina at the end of 19th century. Due to population density (33 boars and 375 sows – source: CLC. 2003) it belongs to the group of endangered breeds. Results of the recent investigations (Uremović et. al., 2000; Senčić et. al., 2001a, 2001b; Karolyi et.al., 2004) indicate that the Black Slavonian pig is a low-productive meaty-fat breed. Because of its pronounced resistance, pigmented skin and ability of consuming high amounts of roughage (pasture), it is very convenient for keeping it outdoors, especially for organic production within low-input traditional technology. That's why this breed is not suitable for large-scale and high-profitable true bred production. However, its resistance and good meat quality deserves further investigation for designing more productive crossbreds for outdoor keeping system and production of ecological traditional smoked products (Slavonian kulen, ham, bacon etc.).This investigation deals with slaughter quality of crossbreds between Black Slavonian pig and Swedish Landrace from outdoor keeping system.

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MATERIAL AND METHODS

The investigation was conducted on 10 Black Slavonian pigs and 10 crossbreds between Black Slavonian pig (BS) and Swedish Landrace boars (SL). Sex ratio (male castrates and gilts) was the same in each genotype. The pigs were fed until weighed approx. 135 kg. They were slaughtered at 12 months age and Black Slavonian pigs at 18 months. The pigs were kept outdoors (Figure 1) in a natural low-lying pasture. The pasture area per animal was 0.05 ha. During the night and bad weather the pigs were under eaves. A traditional low- input technology was applied. Apart from pasture, the pigs consumed food found on stubbles after cereals had been harvested (wheat, barley, corn) and were given small amount of corn (0.15 kg/head/day).

Figure 1. Black Slavonian pigs and cross-breed with Swedish Landrace on pasture (Photo: Senčić, Đ., 2004)
Slika 1. Crne slavonske svinje i križanci sa švedskim landrasom na ispaši (Foto: Senčić, Đ., 2004.)

Dissection of cooled (+4^{o}C) right pig carcasses was done by the modified method (Weniger et.al., 1963). Muscle head tissue, tail, legs and abdomen-ribbed part tailored in a "streaky bacon" (hamburg bacon) presenting less valuable parts were not included in this modification. Length of the cold pig carcasses were measured from os pubis to atlas and from os pubis to 1st rib whereas back thickness and cross-section area of *M. longissimus dorsi* –MLD between 13th and 14th rib.
Meat value pH1 was determined 45 minutes post mortem and pH2 was found out 24 hours post mortem by a contact pH-meter Mettler Toledo after meat had been cooled at +4^{o} C. The meat quality was investigated on a sample of long back muscle (*Muscullus longissimus dorsi* – MLD) taken between 13th and 14th rib. Meat water fixation ability was determined by Grau and Hamm (1952) whereas colour and marbling by the American NPPC method (National Pork Producers Council). Ratio of meat crude proteins (long back muscle-MLD) was determined by the Kjeldahl method and contains intramuscular fats by Soxhlet method. Statistic processing of the results has been made by a computer programe Statistica Stat Soft Inc (2001). Significance between the groups was determined by Student t-test.

RESULTS AND DISCUSSION

Basic quality properties of trunks in Black Slavonian pig and its crossbreds with Swedish Landrace could be seen from Table 1.

Table 1. Basic quality traits of the trunks in Black Slavonian pig (BS) and its crossbreds with Swedish Landrace (SL)
Tablica 1. Osnovne značajke kvalitete trupova crne slavonske svinje (CS) i njenih križanaca sa švedskim landrasom (ŠL)

Indicators *Pokazatelji*	**Genotype –** *Genotip*			
	Black Slavonian pig *Crna slavonska svinja*		**F_1 generation (BS x SL)** *F_1 generacija (CS x ŠL)*	
	$\bar{x}$	s	$\bar{x}$	s
Body weight, kg *Tjelesna masa, kg*	135.60	4.45	136.00	4.50
Dressing, % *Randman, %*	82.44	2.80	82.50	2.75
Weight of cooled carcasses, kg *Masa hladnih polovica, kg*	55.29	1.88	55.79	1.90
Length of the carcasses[1], cm *Dužina polovica[1], cm*	102.90	3.50	103.50	3.60
Length of the carcasses[2], cm *Dužina polovica[2], cm*	87.20	3.45	88.00	3.40
MLD area, cm^2 *Površina MLD-a, cm^2*	33.00**	3.50	38.00	3.45
Ham circumference, cm *Obujam buta, cm*	67.00**	1.50	70.00	1.45
Ham length, cm *Dužina buta, cm*	35.50	2.45	35.00	2.40
Fat thickness, cm *Debljina slanine, cm*	5.00**	0.45	4.00	0.50

[1] Os pubis-atlas; [2] Os pubis – [1st] rib Os pubis-1.rebro; ** P<0.01

Uniform pig body weights prior slaughter and uniform weights of pig carcasses enabled an accurate pig genotypes comparison. There were no statistically significant differences (P>0.05) between analyzed pig genotypes in terms of the slaughter dressing. The crossbred pig carcasses were somewhat longer but not statistically significant (P>0.05). They had very significantly (P<0.01) larger cross section area of the long back muscle, larger ham circumference and thinner back flat.
Conformation of the pig carcasses, presented in Table 2, differed between analyzed pig genotypes.
The crossbreds between Black Slavonian pig and Swedish Landrace were characterized by very significantly (P<0.01) higher absolute and relative share of hams, less valuable parts and lower share of necks. Due to the share of other carcass parts (shoulders, back, abdominal-rib part, double chin and fat), no statistically significant differences (P>0.05) were determined between the analyzed pig genotypes.
Composition of commercially valuable carcass parts (ham, back, shoulder) was better in crossbreds than in Black Slavonian pigs (Tables 3, 4, 5 and 6).

Table 2. Absolute (kg) and relative (%) shares of basic valuable parts in pig carcasses

Tablica 2. Apsolutni (kg) i relativni (%) udjeli osnovnih dijelova u svinjskim polovicama

Part of carcass *Dio polovice*	***Statistical parameters*** *Statističke veličine*	**Genotype -** *Genotip*			
		Black Slavonian pig *Crna slavonska svinja*		**F_1 generation (BS x SL)** *F_1 generacija (CS x ŠL)*	
		kg	%	kg	%
Ham *But*	$\bar{x}$	13.36**	24.16**	15.50	27.78
	s	0.82	1.49	1.30	2.09
Back part *Leđni dio*	$\bar{x}$	10.27	18.57	9.46	16.96
	s	1.04	1.67	1.17	2.10
Shoulder *Plećka*	$\bar{x}$	8.24	14.90	7.90	14.16
	s	0.77	1.42	0.74	1.35
Neck *Vrat*	$\bar{x}$	5.70**	10.31**	4.77	8.55
	s	0.60	1.18	0.50	0.98
Abdominal rib part *Trbušno-rebarni dio*	$\bar{x}$	11.53	20.85	11.11	19.91
	s	1.36	2.32	1.31	2.21
Double chin *Podbradak*	$\bar{x}$	1.66	3.00	2.00	3.58
	s	0.46	0.83	0.55	0.98
Grease *Salo*	$\bar{x}$	0.92	1.66	0.85	1.52
	s	0.24	0.41	0.18	0.37
Les valuable parts *Manje vrijedni dijelovi*	$\bar{x}$	3.61**	6.53**	4.21	7.52
	s	0.32	0.60	0.38	0.69
Weight of cooled carcasses *Masa hladnih polovica*	$\bar{x}$	55.29	100.00	55.79	100.00
	s	1.88		1.90	

*P<0.05; ** P<0.01

Table 3 Shares of tissues in ham
Tablica 3. Udjeli tkiva u butu

Kind of tissue *Vrsta tkiva*	**Statistical parameters** *Statističke veličine*	**Genotype -** *Genotip*			
		Black Slavonian pig *Crna slavonska svinja*		**F_1 generation (BS x SL)** *F_1 generacija (CS x ŠL)*	
		kg	%	kg	%
Muscle *Mišićno*	$\bar{x}$	7.44**	55.69**	9.65	62.26
	s	0.76	2.87	0.99	3.21
Fatty *Masno*	$\bar{x}$	4.11	30.76**	3.97	25.61
	s	0.49	3.70	0.53	3.16
Bones *Koštano*	$\bar{x}$	1.81	13.55	1.88	12.13
	s	0.26	2.99	0.27	2.67

** P<0.01

Table 4. Shares of tissues in back part
Tablica 4. Udjeli tkiva u leđnom dijelu

Kind of tissue *Vrsta tkiva*	**Statistical parameters** *Statističke veličine*	**Genotype -** *Genotip*			
		Black Slavonian pig *Crna slavonska svinja*		**F_1 generation (BS x SL)** *F_1 generacija (CS x ŠL)*	
		kg	%	kg	%
Muscle *Mišićno*	$\bar{x}$	4.15	40.41**	4.40	46.51
	s	0.61	3.61	0.65	4.16
Fatty *Masno*	$\bar{x}$	4.65**	45.28**	3.44	36.36
	s	0.86	5.78	0.64	4.64
Bones *Koštano*	$\bar{x}$	1.47	14.31**	1.62	17.12
	s	0.19	1.82	0.21	2.18

** P<0.01

Table 5 Shares of tissues in shoulders

Tablica 5. Udjeli tkiva u plećki

Kind of tissue *Vrsta tkiva*	**Statistical parameters** *Statističke veličine*	**Genotype -** *Genotip*			
		Black Slavonian pig *Crna slavonska svinja*		**F_1 generation (BS x SL)** *F_1 generacija (CS x ŠL)*	
		kg	%	kg	%
Muscle *Mišićno*	$\bar{x}$	4.71	57.16**	4.80	60.76
	s	0.59	2.86	0.61	3.03
Fatty *Masno*	$\bar{x}$	2.36**	28.64**	1.91	24.18
	s	0.31	3.65	0.25	3.09
Bones *Koštano*	$\bar{x}$	1.17	14.20	1.18	14.94
	s	0.11	1.44	0.12	1.51

** P<0.01

Table 6. Shares of tissues in pig carcasses
Tablica 6. Udjeli tkiva u svinjskim polovicama

Kind of tissue *Vrsta tkiva*	**Statistical parameters** *Statističke veličine*	**Genotype -** *Genotip*			
		Black Slavonian pig *Crna slavonska svinja*		**F_1 generation (BS x SL)** *F_1 generacija (CS x ŠL)*	
		kg	%	kg	%
Muscle *Mišićno*	$\bar{x}$	22.66**	41.00**	24.88	44.59
	s	1.69	2.37	1.61	2.58
Fatty *Masno*	$\bar{x}$	22.64**	40.96**	20.10	36.03
	s	2.31	4.24	2.05	3.73
Bones *Koštano*	$\bar{x}$	6.38	11.54	6.60	11.83
	s	0.49	0.86	0.50	0.88

** P<0.01

Crossbred hams were known for absolute and relative statistically very significant (P<0.01) higher muscle tissue share and lower share of fat tissue. Back part and shoulder of the crossbreds had statistically very significant (P<0.01) higher relative muscle tissue share and absolutely and relatively very lower fat tissue share. Due to the aforesaid pig carcasses of the crossbreds between Black Slavonian pig and Swedish Landrace had by 2.22 kg i.e. 3.59% statistically very significant (P<0.01) higher absolute and relative muscle tissue share and lower share of fat tissue.
From table 3, 4, 5 and 6 it is obvious that crossbreeding between Black Slavonian pig and Swedish Landrace had positive effect on pig trunks composition i.e. on their muscle tissue share increase. Literature data on slaughter quality of Black Slavonian pig are poor. Uremović et. al. (2000) stated that pig trunk meatiness at outdoor keeping pigs and their slaughter with 106.05 kg was 42.95%. Senčić et al. (2001b) reported that trunk meatiness of the Black Slavonian pigs at ad libitum feeding and slaughter with 105.00 kg body weight was 38.50%. However, there are no literature data on productive abilities of crossbreds with Black Slavonian pig.
Pork quality (table 7) did not, in terms of pH value, water fixation ability and colour, significantly differ between Black Slavonian pig and its crossbreds with Swedish Landrace. The crossbreds meat was characterized by statistically very significant (P<0.01) higher water and lower crude fat compared to Black Slavonian pig meat. Amount of intramuscular fat in the crossbreds meat was much more higher compared to fat ratio in meat of the modern meaty pig genotypes, being convenient for meat processing in traditional smoked-meat products and their organoleptic traits.

Table 7. Quality indicators of pork meat
Tablica 7. Obilježja kvalitete svinjskog mesa

Indicators *Pokazatelji*	**Genotip** - *Genotype*			
	Black Slavonian pig *Crna slavonska svinja*		**F_1 generation (BS x SL)** *F_1 generacija (CS x ŠL)*	
	$\bar{x}$	s	$\bar{x}$	s
pH_1	6.60	0.30	6.50	0.25
pH_2	5.80	0.30	5.75	0.30
Water fixation ability, cm^2 *Sposobnost vezanja vode, cm^2*	4.50	2.00	4.80	2.00
Colour (1-6) *Boja (1-6)*	4.00	1.50	4.00	1.60
Marbling (1-10) *Mramoriranost (1-10)*	4.50	0.30	4.00	0.30
Water, % *Voda, %*	71.65	0.30	71.99	0.30
Crude protein, % *Sirovi protein, %*	21.25	0.35	21.50	0.30
Crude fats, % *Sirove masti, %*	5.90	0.35	5.30	0.30
Ash, % *Pepeo, %*	1.20	0.06	1.21	0.05

*P<0.05; ** P<0.01

CONCLUSION

Outdoor keeping system and low inputs technology resulted in trunks of very significantly (P<0.01) higher meatiness (44.59% :41.00%). higher ham share (27.78% : 24.16%), higher share of less valuable parts (7.52% : 6.53%) and lower necks share with crossbreds between Black Slavonian pig and Swedish Landrace compared to Black Slavonian pigs. As for pH_1 and pH_2 values, water fixation ability and meat colour, no statistically significant differences (P>0.05) were determined between analyzed pig genotypes. Crossbreds meat, compared to Black Slavonian pig meat, was known for very significantly (P<0.01) higher share of water (71.99% : 71.65%) and lower share of fat (5.30% : 5.90%).

Aknowledgment
Special aknowledgment to Mr Adam Zvonarević from Stari Mikanovci on which farm investigation was done.

Zahvala
Zahvaljujemo gospodinu Adamu Zvonareviću iz Starih Mikanovaca, na čijem je gospodarstvu provedeno istraživanje.

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KLAONIČKA KVALITETA CRNE SLAVONSKE SVINJE - UGROŽENE PASMINE I NJENIH KRIŽANACA SA ŠVEDSKIM LANDRASOM PRI DRŽANJU NA OTVORENOM

SAŽETAK

Crna slavonska svinja je autohtona hrvatska pasmina nastala krajem 19. stoljeća planskim križanjem pasmina: mangulica, berkšir i polandkina. Spada u skupinu ugroženih pasmina. Zbog izražene otpornosti, pigmentirane kože i sposobnosti konzumacije veće količine voluminozne hrane (paše), vrlo je pogodna za držanje na otvorenom, posebice za ekološku proizvodnju, pri tradicionalnoj tehnologiji niskih ulaganja. Istraživanje je provedeno na 10 crnih slavonskih svinja i 10 križanaca između krmača crne slavonske svinje (CS) i nerastova švedskog landrasa (ŠL). Svinje su tovljene do oko 135 kg tjelesne mase. Križanci su pri klanju bili u dobi 12 mjeseci, a crne slavonske svinje u dobi od 18 mjeseci. Svinje su držane na otvoreno, na prirodnom nizinskom pašnjaku. Površina pašnjaka po životinji bila je 0,05 ha. Primjenjena je tradicionalna tehnologija niskih ulaganja. Osim paše, svinje su konzumirale pronađenu hranu na strništima nakon žetve žitarica (pšenica, ječam, kukuruz) i samo su minimalno prihranjivane kukuruzom (0,15 kg/grlo/dan). Disekcija ohlađenih (+4 ^{0}C) desnih svinjskih polovica obavljena je prema modificiranoj metodi Wenigera i sur. (1963). Kvaliteta mesa istraživana je na uzorku dugog leđnog mišića (Muscullus longissimus dorsi - MLD), uzetom u visini između 13. i 14. rebra. Pri otvorenom sustavu držanja i tehnologiji niskih ulaganja, križanci između crne slavonske svinje i švedskog landrasa, u odnosu na crne slavonske svinje, imali su statistički vrlo značajno (P<0,01) trupove veće mesnatosti (44,59% : 41,00%), veći udjel butova (27,78% : 24,16%), i veći udjel manje vrijednih dijelova (7,52% : 6,53%), a manji udjel vrata (8,55% : 10,31%). S obzirom na vrijednosti pH_1 i pH_2, sposobnost vezanja vode i boju mesa, nisu utvrđene statistički značajne razlike (P>0,05) između analiziranih genotipova svinja. Meso križanaca, u odnosu na meso crne slavonske svinje, imalo je statistički vrlo značajno (P<0,01) veći udjel vode (71,99% : 71,65%), a manji udjel masti (5,30% : 5,90%).

Ključne riječi: crna slavonska svinja, otvoreno držanje, kvaliteta polovica, kvaliteta mesa

(Received on 24 May 2005; accepted on 16 June 2005 - *Primljeno 24. svibnja 2005.; prihvaćeno 16. lipnja 2005.*)