INFLUENCE OF BREED AND SEX ON CARCASS AND MEAT QUALITY TRAITS IN PIGS

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Background

The carcass and meat quality traits of pigs considerably contribute to the profitability of pork production. The combination of favorable carcass composition characterized by superior leanness and good meat quality is constant goal of pig producers and scientists. For this purpose it is important to monitor the carcass and meat quality traits of all breeds used in the production of pork. In the composition of pigs the essential role is given to genetics (Gu et al., 1992, Wagner et al., 1999), sex (Žgur et al., 1994; Petričević et al., 1999) and nutrition as the main environmental factor (Davey and Bereskin, 1978). The meat quality traits are mainly affected by genotype and breed and less by sex (Petričević et al., 2000). The meat quality in a sense of technological usefulness is often described by pH values measured 45 minutes and 24 hours *post mortem* (pH_1 and pH_2), water holding capacity (W.H.C.) as a measure of drip loss, color (Goeffo, Goettingen fotometer) and other measurements. Special attention is given to pH_1 values because it allows quick prediction of the meat quality. Briskey et al. (1964) set the border pH_1 value of 6.0 to separate meat as normal (above 6.0) and PSE ($pH_1<6.0$), while Kallweit (1980) used less strong criterion setting 5.8 as critical value. Hoffman (1994) suggested that meat with $pH_1>6.0$ is considered as "normal", between 6.0 and 5.8 "suspicious" and $pH_1<5.8$ is PSE meat. Keeping constant attention on recording the carcass and meat quality traits for all breeds used in pork production gives the solid base of information on which important decisions can be made.

Objectives

The aim of this study is to give insight into important carcass and meat quality characteristics of three different breeds often used in Croatian pig production with special emphasize on breed and sex differences among them.

Material and methods

This study included 113 pigs divided in three groups according to breed: A = (Swedish Landrace x Large White); B = (Swedish Landrace x Large White) x Pietrain; C = Hypor hybrid; subdivided according to sex (A: 12 barrows, 13 gilts; B: 16 barrows, 19 gilts; C: 26 barrows, 27 gilts); fattened under the same production conditions to exclude the influence of environment as much as possible. Animals were fed *ad libitum* from 25-60 kg with diet ST_1 (16.5% crude proteins), and further up to around 100 kg live weight with diet ST_2 (14.5% crude proteins). After slaughter, measures of pH_{45} were taken from warm carcasses (within 45' *post mortem*) in the region between 13th and 14th rib on *m. longissimus dorsi* (MLD). Cooled right halves of the carcasses were cut (Weniger et al., 1963) into main parts (ham, back, belly-rib part, neck, shoulder), further precisely dissected on muscle tissue, fat with skin and bones. Less valuable parts included head, glands, legs, tail and kidneys. On the loin cut (between 13th and 14th rib) pH_{24} value (24 hours post mortem) and color of the meat (Göfo) were measured, and the sample was taken for determination of water holding capacity – W.H.C. (cm^2) by compression method according to Grau and Hamm (1952). Statistical analysis was performed using STATISTICA ver. 6.0 program.

Results and discussion

The analysis of dissection data of investigated pigs presented in table 1 showed little difference between the groups of pigs in the content of major tissues in the carcass. Hypor pigs had significantly lower fat percentages ($p<0.05$) while crossbreeds with Pietrain had significantly less bones in absolute and relative terms ($p<0.01$ and $p<0.05$, resp.). Other carcass traits were unaffected by breed ($p>0.05$). Although 3 way crossbreed pigs with Pietrain as terminal breed would have scored highest (S)EUROP class on average they did not significantly improve leanness of SL x LW double crossbreeds. The difference in the content of bones was statistically significant but they are not of relevance since they ranged within one kg. Similar results for carcass weight and lean percentage of 3 way crosses with Pietrain as terminal sire reported Senčić et al. (2000).

Carcass traits of barrows and gilts from investigated groups are given in table 2. The influence of sex in the 2 way crossbreeds (A) was significant only in case of cold carcass weight and fat content ($p<0.05$) while in 3 way crossbred pigs (B) it was insignificant for all investigated carcass traits. However, in Hypor pigs (C) sex had very significant effect on almost all traits of the carcass. The lean percentage was unaffected by sex, but barrows had heavier carcasses, produced more muscle in absolute terms but also more fat ($p<0.01$). The sex difference in carcass weight ($p<0.05$) was also found by Petričević et al. (1999) which is confirmed by this study and in lean percentage ($p<0.01$) which is not supported here. Similar results reported Žgur et al. (1994) who found no difference between sex regarding this factors. Significant influence of sex on fat percentage in Hypor pigs ($p<0.01$) was also reported by Petričević et al (1999).

Table 3 shows the meat quality traits of investigated groups of pigs. All of the meat quality traits (pH_1, pH_2, W.H.C. and Goeffo) were significantly affected by breed, three way crosses with Pietrain (B) and Hypor (C) pigs showed significantly poorer meat quality than SL x LW pigs (A). Hoffman (1994) proposed that lean tissue with pH_1 values above 6.0 should be considered as normal. Values of pH_1 between 5.8 and 6.0 indicate muscle suspicious on PSE, while those below 5.8 clearly indicate PSE meat. According to this classification, the meat of 3 way crosses (B) would be suspicious on PSE, while muscle tissue of Hypor pigs (C) would be on the very border between normal and suspicious meat. The values of pH_2 measured 24 hours post mortem above 6.0 indicate dark firm and dry meat (DFD). Even though this indicator differed significantly between the breeds no occurrence of DFD meat was observed. Larger surface of water compressed out of the muscle (cm^2) indicate lower W.H.C. and consequently poorer meat quality. The lowest values of water holding capacity (W.H.C.) were observed in Hypor pigs (C) and the highest in 3 way crosses (B), the difference between these two was statistically significant ($p<0.01$). On the other hand, the palest muscle color assessed by Goeffo device was found in the 3 way crosses with Pietrain (B), although all Goeffo values were normal for all breeds. Much better meat quality of the same 3 way crosses reported Senčić et al. (2000), while Kralik et al. (1998) reported similar meat quality traits as in present study for SL x LW pigs (A). The meat quality traits of Hypor pigs similar to ours found Kralik et al. (1995).

It is obvious from table 4 that there were very few significant differences between barrows and gilts in investigated groups of pigs. Only W.H.C. and Goeffo values significantly differed ($p<0.05$ and $p<0.01$, resp.) between Hypor (C) barrows and gilts, but these values were within the boundaries established for normal meat. Pietrain 3 way cross (B) barrows had the worst pH_1 values (suspicious on PSE); the gilts of the same breed had pH_1 values of normal meat. Present study supports the findings of Petričević et al. (2000) on influence of sex on meat quality traits. In their experiment the only significant difference between sexes was found for color measured by Goeffo device. Pertičević et al. (1999) found the significant effect of sex on water holding capacity in Hypor pigs which is supported in this study and no effect on Goeffo values which is in disagreement with our findings.

Pertinent literature

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Table 1. Carcass traits of investigated pigs according to breed

Trait	A (Mean ± SD)	B (Mean ± SD)	C (Mean ± SD)
Carcass weight, kg	79.89 ± 9.99	78.16 ± 5.64	80.58 ± 9.56
Lean, kg	43.56 ± 5.11	44.02 ± 4.31	45.10 ± 5.57
Lean, %	54.66 ± 3.44	56.34 ± 3.88	55.99 ± 2.50
Fat, kg	21.99 ± 5.52	20.46 ± 3.34	20.75 ± 4.79
Fat, %	27.27^{a} ±4.36	26.17^{a} ± 3.79	25.51^{b} ± 3.37
Bones, kg	8.41^{a} ±1.02	8.15^{c} ± 1.00	8.73^{a} ± 0.99
Bones, %	10.59^{a} ±1.14	10.42^{b} ± 0.84	10.96^{a} ± 1.58

SD = standard deviation; a,b p<0.05; a,c p<0.01

Table 2. Carcass traits of investigated pigs according to sex

Trait	A (Mean ± SD)		B (Mean ± SD)		C (Mean ± SD)	
	barrows	gilts	barrows	gilts	barrows	gilts
Carcass weight, kg	84.12^{a} ± 11.94	75.67^{b} ± 6.93	77.09 ± 5.56	79.22 ± 5.57	85.12^{a} ± 10.11	76.04^{c} ± 6.51
Lean, kg	44.81 ± 5.55	42.30 ± 4.72	42.81 ± 3.78	45.34 ± 4.49	47.04^{a} ± 6.30	43.15^{c} ± 4.03
Lean, %	53.46 ± 3.38	55.87 ± 3.24	55.61 ± 4.13	56.94 ± 3.65	55.22 ± 2.56	56.76 ± 2.23
Fat, kg	24.42^{a} ± 6.47	19.56^{b} ± 3.86	20.96 ± 3.78	20.09 ± 2.96	23.62^{a} ± 4.66	17.89^{c} ± 2.89
Fat, %	28.72 ± 4.57	25.82 ± 3.95	27.09 ± 3.77	25.28 ± 3.70	27.58^{a} ± 2.85	23.45^{c} ± 2.49
Bones, kg	8.69 ± 1.09	8.12 ± 0.95	8.02 ± 0.82	8.37 ± 1.13	8.49 ± 0.92	8.97 ± 1.02
Bones, %	10.41 ± 1.18	10.77 ± 1.14	10.40 ± 0.68	10.49 ± 0.97	10.07^{a} ± 1.29	11.84^{c} ±1.34

SD = standard deviation; a,b p<0.05; a,c p<0.01

Table 3. Meat quality traits of investigated pigs according to breed

Trait	A (Mean ± SD)	B (Mean ± SD)	C (Mean ± SD)
pH_1	6.29^{a} ± 0.27	5.97^{c} ± 0.35	6.04^{c} ± 0.29
pH_2	5.73^{a} ± 0.19	5.63^{b} ± 0.17	5.69^{a} ± 0.16
W.H.C., cm^2	8.60^{a} ± 1.84	9.50^{a} ± 1.74	8.04^{ac} ± 1.48
Color, Goeffo value	59.18^{a} ± 7.95	56.34^{a} ± 5.20	64.11^{bc} ± 10.45

SD = standard deviation; a,b p<0.05; a,c p<0.01

Table 4. Meat quality traits of investigated pigs according to sex

Trait	A (Mean ± SD)		B (Mean ± SD)		C (Mean ± SD)	
	barrows	gilts	barrows	gilts	barrows	gilts
pH_1	6.29 ± 0.34	6.29 ± 0.23	5.89 ± 0.36	6.05 ± 0.33	6.03 ± 0.24	6.06 ± 0.33
pH_2	5.70 ± 0.19	5.75 ± 0.20	5.68 ± 0.22	5.57 ± 0.11	5.70 ± 0.15	5.69 ± 0.17
W.H.C., cm^2	8.97 ± 1.71	8.34 ± 1.96	9.94 ± 2.03	9.06 ± 1.37	7.57^{a} ± 1.58	8.51^{b} ± 1.25
Color, Goeffo value	67.67 ± 9.07	60.23 ± 7.27	55.63 ± 6.43	57.05 ± 3.95	60.69^{a} ± 11.35	67.52^{c} ± 8.40

SD = standard deviation; a,b p<0.05; a,c p<0.01