Meat quality traits of hybrid pigs reared in eastern Croatia

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Abstract
The aim of the present study was to analyze meat quality traits of 120 carcasses originated from pigs which were divided into two groups. The first group consisted of fattened PIC C23 line pigs and in second group were hybrid PIC C23xPIC 337 pigs. All pigs were reared in eastern Croatia and slaughtered at approximately 100 kg of weight. Results showed significant differences between all colours parameters. Meat samples of hybrid PIC C23xPIC 337 pigs had significantly higher IMF content and lower Warner-Bratzler Shear Force, while their drip loss values were higher than in the meat of fattened C23 line pigs.

Key words: hybrid pigs, meat quality, meat colour, shear force, chemical composition

Introduction
Very important objective of pig breeding in Republic of Croatia is to achieve high values of lean percentage in the carcass and to preserve desirable meat quality at the same time. To achieve that goal, choosing a proper sire line with strong influence on muscle development without negative impact on the other traits such as meat quality presents a very important decision. Several authors have proven a severe decline of meat quality traits when breeding is based solely on performance traits (Brewer et al., 2002; Hermesch et al., 2003, Van Wijk et al., 2005). For this purpose, all sires and dams used in pig production should be tested on main meat quality characteristics, and the given results of these tests should be known to the pork producers (Kušec et al., 2004). Pig Improvement Company (PIC) currently conducts genetic improvement program which uses 17 populations of sires and sows with the objective to create highest quality lines (http://www.pic.com/). Frequently used sire PIC 337 has been created using Duroc, Large White and Pietrain breeds, mainly to gain muscularity without compromising meat quality traits, with emphasis on intramuscular fat content. Camborough 23 line is characterized with high fertility and excellent reproductive characteristics which is the reason of their often used in pig breeding programs worldwide. The aim of this paper was to analyze meat quality traits of carcasses originated from fattened PIC C23 line pigs and C23xPIC 337 hybrid pigs.

Material and methods
The present study was carried out on 120 PIC (Pig Improvement Company) randomly chosen carcasses equally divided into two groups according to the hybrid (C23 and C23xPIC337, respectively). The pigs were housed in the same conditions and fed the same diet during the fattening period. At approximately 100 kg of live weight pigs were slaughtered in one slaughterhouse in eastern Croatia. Initial pH values (pH45) were measured 45 minutes after the exsanguinations. After 24 hours of cooling, ultimate pH (pH24) values, drip loss and colour of m. longissimus dorsi (MLD) were taken. Drip loss was measured as described by Kauffman et al. (1992). The lightness of meat was measured by “Minolta CR-300” device at m. longissimus dorsi cut and expressed as CIE L*, a* and
b* value. The share of fat, moisture and protein were determined by standard analytical methods according to AOAC procedure for meat and meat products using FoodScan Lab NIR spectrophotometer (Foss, Denmark) (AOAC, 2007). Minced samples of *m. longissimus dorsi* were placed in a cup and positioned inside the FoodScan sample chamber and then scanned with monochromatic light in the spectral region between 850 and 1050 nm. For the measurements of instrumental tenderness, 24 hours after cooling 2.54 cm thick chops of MLD were sealed in plastic bags and frozen at -20°C. Prior to measurements, the MLD chops have been defrosted at 4°C during 24h, cooked at 80°C in a water bath until internal temperature reached 73°C and then cooled at 4°C over night. Shear force was measured on four subsamples of each chop and analyzed with the use of TA.XTplus Texture Analyzer fitted with a 1 mm thick Warner-Bratzler shear attachment. The mean value of maximal strength necessary for cutting of the sample was calculated with a Texture Exponent 4.0 Software (Stable Micro Systems Ltd., UK) and presented as Warner-Bratzler Shear Force (WBSF, N). The obtained data were subjected to one-way Analysis of Variance to determine effects of genotype on various attributes of meat quality. Means which were significantly different were identified using Fisher’s LSD test (STATISTICA 7.1 for Windows Software).

**Results and discussion**

**Table 1. Differences in meat quality and chemical traits of meat between two breeds of pigs**

<table>
<thead>
<tr>
<th>Trait</th>
<th>C23</th>
<th>C23xPIC337</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH45</td>
<td>6.28±0.26</td>
<td>6.29±0.31</td>
<td>n.s.</td>
</tr>
<tr>
<td>pH24</td>
<td>5.61±0.13</td>
<td>5.65±0.10</td>
<td>n.s.</td>
</tr>
<tr>
<td>Drip loss, (%)</td>
<td>5.93±3.19</td>
<td>7.07±2.85</td>
<td>p &lt; 0.05</td>
</tr>
<tr>
<td>CIE L*</td>
<td>51.52±3.34</td>
<td>53.06±2.64</td>
<td>p &lt; 0.01</td>
</tr>
<tr>
<td>a*</td>
<td>7.02±0.98</td>
<td>7.81±1.51</td>
<td>p &lt; 0.01</td>
</tr>
<tr>
<td>b*</td>
<td>3.15±0.87</td>
<td>4.01±1.34</td>
<td>p &lt; 0.01</td>
</tr>
<tr>
<td>Warner-Bratzler Shear Force, (N)</td>
<td>47.18±7.21</td>
<td>44.53±4.88</td>
<td>p &lt; 0.05</td>
</tr>
<tr>
<td>Water, (%)</td>
<td>73.18±0.66</td>
<td>73.05±0.76</td>
<td>n.s.</td>
</tr>
<tr>
<td>Proteins, (%)</td>
<td>23.73±0.46</td>
<td>23.57±0.56</td>
<td>n.s.</td>
</tr>
<tr>
<td>IMF, (%)</td>
<td>2.55±0.56</td>
<td>2.87±1.05</td>
<td>p &lt; 0.05</td>
</tr>
</tbody>
</table>

**Graph 1. Distribution of MLD meat samples according to pH24 values**

It can be noticed from the data presented in Table 1 that the values of both pH45 and pH24, measured for fattened C23 line pigs and C23xPIC337 hybrid pigs indicate a satisfactory
quality of examined pig carcasses; the statistical differences for these traits were not significant. Since the post mortem glycolysis in the skeletal muscle directly affects unfavourable water holding capacity and meat colour, pH values shown in Graph 1 are examined as meat quality indicators (Honikel, 2004). According to Forrest criteria (1998), hybrid PIC pigs showed slightly more improved meat quality, although in both groups normal meat quality determined (pH24>5.5). Sellier and Monin (1994) used pH45 less than 5.8 and pH34 less than 5.5 to predict pale, soft and exudative pork. Statistical results show that the investigated m. longissimus dorsi samples from fattened C23 line pigs had a relatively high value of juice release expressed as "drip loss" (5.93%) (Kauffman et al., 1992, Warner et al., 1999). Joo et al. (1999) set up limiting value for excessive drip loss to be 6%. Kušec et al. (2005) and Otto et al. (2004) gave extensive discussion about the importance of muscle ability to withhold water and its implications on meat quality. Drip loss value for PIC hybrid pigs was even higher (7.07%), which implies a reduced meat quality considering that criteria (Joo et al., 1999). Such results could be explained by intensive selection on high daily gain and meat percentage, since it is known that this can cause deterioration of meat quality (Brewer et al., 2002; Hermesch et al., 2003, Van Wijk et al., 2005). Forrest (1998) reported that pH24 value 5.5 or lower in 99% cases results with PSE meat, but the drip loss may vary. According to colour measurements, Minolta L* values indicated significantly paler meat colour of hybrid PIC pigs then in fattened C23 line pigs. Significant differences were also expressed for CIE a* and CIE b* values, which implies more redness and more yellowness in colour of meat from PIC hybrid pigs. Values of WBSF shown in Table 1 indicate significantly lower shear force for PIC hybrid pigs than those from fattened C23 line pigs. In chemical parameters such as water and protein composition there were no significant differences. Numerous studies showed that optimum intramuscular fat content values (IMF) should be between 1.5 and 3% (Daszkiewicz et al., 2005, Murray, 2002, Wood et al., 1996). Chemical analysis showed that hybrid PIC pigs had significantly higher IMF content comparing with fattened C23 line pigs. This point can be clarified as a positive effect of PIC337 boar, mainly resulted by its Duroc impact. On the other hand, the same effect could be the reason why the hybrid PIC pigs had tendered meat stated by lower shear force.

Conclusion

Considering the analyzed data, it can be concluded that PIC hybrid pigs had more desirable values of IMF content and WBSF. Values of pH were unaffected for PIC hybrid pigs and according to pH values both groups showed normal meat quality. CIE L* values indicated significantly paler meat colour of PIC hybrid pigs then in fattened C23 line pigs. Drip loss values for both groups implied reduced meat quality, which is not rare when the pigs are selected on high daily gain and meat percentage.

Acknowledgement

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References


http://www.pic.com/ (available on 23. 10. 2009.)