QUALITY PARAMETERS OF PIG *LONGISSIMUS DORSI* MUSCLE AS AFFECTED BY SLAUGHTER WEIGHT AND BREED

Keywords: pork quality, texture profile, breed, slaughter weight

M. ČANDEK-POTOKAR[1], B.ŽLENDER[2], M. BONNEAU[3].
[1]Agricultural Institute of Slovenia, Hacquetova 2, 1000 Ljubljana, Slovenia
[2]University of Ljubljana, Biotechnical faculty, Department for food science and technology, Jamnikarjeva 101, 1000 Ljubljana, Slovenia
[3]INRA, Station de Recherches Porcines St. Gilles, 35590 l'Hermitage, France

ABSTRACT

A total of 62 castrates were used to study the effect of breed and weight at slaughter on meat quality parameters in pig *longissimus dorsi* muscle. Three breeds (Duroc, Swedish Landrace and Large White) and two slaughter weights (100 and 130 kg) were compared. Results obtained show the importance of breed and weight effect on meat quality. Duroc pigs gave meat of more desired qualities (higher intramuscular fat content, better colour, more tender and aromatic meat) compared to meat of Landrace or Large White pigs. The weight effect was less pronounced. Higher intramuscular fat content was found in heavier pigs of all three breeds, but this increase was not accompanied by significantly better flavour. An important weight effect was found on texture properties. Meat of heavier pigs was less tender and less chewy in all breeds.

BACKGROUND AND OBJECTIVES

Different studies reported in literature have demonstrated a good performance results and carcass quality of Duroc pigs or its crosses (Edwards et al.1992; McGloughlin et al.,1988; Steane, 1986). It is also well established that meat quality of Duroc pigs is characterised by higher intramuscular fat content which is beneficial for meat flavour (Barton-Gade, 1988; Martel et al, 1988). Studies reported in literature show, that the effect of slaughter weight on technological quality up to 120-130 kg is limited (Monin, 1983), and is in case of texture properties even less evident. So the aim of present study was to evaluate the effect of higher slaughter weight on different meat quality parameters with special emphasis on texture and parallely to see how different breeds respond to prolonged fattening in terms of meat quality.

MATERIAL AND METHODS

Animals. Sixty-two castrated males of three different breeds (Duroc-DU, Swedish Landrace-SL and Large White-LW) were chosen to study breed and weight/age related differences in meat quality parameters. Number of pigs per breed was 20, 22 and 20 respectively. The influence of genetic background was minimised by taking two brothers from each litter, one destined to slaughter at 100 kg, the other at 130 kg of live weight. Choice of weight at slaughter was justified commercially since 100 kg is a normal slaughter weight and 130 kg is a desired slaughter weight for purposes of high quality dry ham production in Slovenia. Pigs were slaughtered in a commercial abbatoir by a routine procedure (electrically stunned 90-100V, 5 sec, chilled at 4°C).

Quality parameters. Samples were taken from *longissimus dorsi* muscle at the level of 8-14 vertebra thoracica 24 hours post-mortem. pH_u (24 hours post-mortem) was measured at the level of 13-14th rib. Intramuscular fat content was determined according to Folsch et al., 1957 and water holding capacity by press method (Grau and Hamm, 1957). Trichromatic values L, a, b were measured by Minolta chromameter and saturation value c computed as square root (a^2+b^2). Colour (1-5) and marbling (1-7) intensity were evaluated. The remaining sample was frozen and stored at -20°C until further analysis. Samples (app. 500 g) for sensory and instrumental analysis were roasted at 175°C to an internal temperature of 70 °C. We measured the thaw (%) and cook (%) weight loss. Five panellists were asked to evaluate tenderness, oral sensation, chewiness, mouth coating, juiciness, flavour and overall impression on a seven-point scale with growing intensity of appreciation. Cutting strength (N), using INSTRON Universal Testing Machine (Model 1111, 1cm cutting blade), perpendicular (cut_perp) and parallel (cut_para) to muscle fibres was measured on roasted samples (Ti=70°C).

Statistical analysis. Data were subjected to analysis of variance (GLM procedure by SAS) evaluating the effects of weight, breed and litter within the breed. Since breed weight interactions were all insignificant, the interaction was excluded from the model. Multiple comparison of means was made (GLM, MEANS, Tukey test by SAS), means, bearing different superscripts are significantly different ($P>0.05$). Significance level of effect is described as ***, **, *, + for $P<0.001$, $P<0.01$, $P<0.05$ and $P<0.1$, respectively.

RESULTS (Table 1)

Chemical, physical properties. Intramuscular fat content was significantly affected by weight at slaughter and breed. DU pigs had, as expected, the highest content of intramuscular fat, whereas LW or SL pigs did not significantly differ from each other. As reported in literature, higher intramuscular fat content was found with increasing weight at slaughter. The increase was the most important in case of DU pigs. The results obtained on chemically determined intramuscular fat content agree with marbling scoring, although for the latest, the increase was not significant ($P<0.13$). We found no effect of breed or weight on ultimate pH or water holding capacity, although the amount of expressed juice at pressing tended to be lower ($P<0.10$) in DU pigs. The cooking loss was not significantly affected by either breed or weight. The lowest thaw weight loss was accompanied by the highest cooking loss. The thaw weight loss was significantly affected by breed and weight. It was the lowest in DU pigs and the highest in SL pigs. The measurements of colour by Minolta chromameter showed that the L, a , b and c values were all breed related, while only a-value was significantly affected by weight. Colour measurements show, that DU pigs gave meat of more desirable colour (lower L and higher a, c values) compared to LW or SL pigs. Sensory evaluation of colour is in agreement with chromameter measurements. Meat colour score in DU pigs was the highest, and in Landrace pigs the lowest. The weight effect on meat colour was important. Heavier pigs had higher a-value, which reffers to higher myoglobin content, better sensory evaluation score as well as slightly more saturated colour ($P<0.10$).

Texture parameters. Only a tendency ($P<0.10$) of breed effect was found; meat of DU pigs was the most tender and that of LW the toughest. Oral sensation or mouth coating were also breed related. Meat of DU pigs gave the most coarse feeling of particles during mastication and the least mouth coating (powdery feeling). In case of breed effect, the measurements of cutting strength confirmed data observed in sensory evaluation of meat texture; namely DU pigs offering the least resistance to applied force and LW the highest. Increased weight at slaughter led to less tender and less chewy meat , but had no effect on oral sensation or mouth coating. For weight effect, lower tenderness score in heavier pigs was not accompanied by lower cutting strength.

Juiciness, flavour and overall impression. No effect of breed was found on juiciness in spite of slightly better water holding capacity and significantly higher intramuscular content of meat in DU pigs. Flavour was affected only by breed; DU pigs had the best and LW pigs the lowest flavour score. The result agrees with data on intramuscular fat content and marbling, which contribute mostly to the flavour, and show the superiority of DU pigs for concerning qualities. Finally the overall acceptability as a sum of all studied sensory properties confirms that meat of DU pigs was better accepted than meat of SL or LW pigs. No weight effect was found on juiciness, flavour and overall impression.

CONCLUSIONS

Meat quality was affected by breed in great majority of studied parameters and showed mainly the special position of DU breed which was translated to the best meat quality in terms of technological and sensory properties. The position of SL and LW pigs was varying. The weight effect was important although less pronounced. We found a beneficial effect of higher weight on colour properties and intramuscular fat content and a detrimental change of texture properties with increasing weight. Pigs of higher weight had slightly better technological quality but were less tender and less chewy than the lighter ones.

ACKNOWLEDGEMENT

Authors wish to thank the management of pig farm Emona, Farma Ihan, Slovenia for the realisation of the experiment.

REFERENCES

Barton-Gade, P.A. 1988. Proc. 34th ICMST, Brisbane, 568.

Grau, R./ R. Hamm 1957. Fleischwirts., 6, 36.

Edwards, S.A./ J.D.Wood/ C.B.Moncrieff/ S.J.Porter 1992. Anim. Prod., 54, 289.

Folch J./ M. Lee/G.H. Sloane Stanley 1957. J. Biol. Chem., 226, 497.

Martel, J./ F. Minvielle/ L.M.Poste 1988. J. Anim. Sci., 66, 41.

McGloughlin, P./ P. Allen/ P.V.Tarrent/ R.L. Joseph/ P.B. Lynch/ T.J. Hanrahan 1988. Livestock Prod. Sci., 18, 275.

Monin, G. 1983. J. Rech. Porcines, 15, 151.

Steane, D. E. 1986. Res. Develop. Agric.,3, 153.

Table 1: Meat quality parameters of *longissimus dorsi* muscle in pigs of three breeds and two weights at slaughter

Parameters	*Breed*			*Weight*		*Effects*		
	Duroc	*Landrace*	*L. White*	*100 kg*	*130 kg*	*Breed*	*Weight*	*rsd*
pH_u	5.57	5.49	5.52	5.50	5.54	NS	NS	0.14
Intramuscular fat (g/100g)	3.48^{a}	1.51^{b}	1.52^{b}	1.89	2.40	***	**	0.69
Press weight loss %	47.49	49.23	49.33	48.94	48.46	+	NS	2.92
Thaw weight loss %	1.46^{a}	5.47^{b}	3.00^{c}	4.03	2.73	***	**	1.50
Cook.weight loss %	28.34	25.17	27.38	27.73	26.74	NS	NS	4.00
Minolta values: L	50.15^{a}	54.01^{b}	51.28^{ab}	52.39	51.37	**	NS	3.84
a	10.32^{a}	8.48^{b}	8.52^{b}	8.53	9.64	**	*	1.92
b	6.26^{ab}	6.37^{a}	5.42^{b}	6.01	6.04	**	NS	1.06
Saturation value c	12.12^{a}	10.66^{ab}	10.21^{b}	10.51	11.46	**	+	1.80
Colour (1-5)	3.14^{a}	2.59^{b}	2.99^{ab}	2.75	3.04	**	*	0.51
Marbling (1-7)	3.42^{a}	2.02^{b}	1.92^{b}	2.31	2.56	***	NS	0.63
Tenderness (1-7)	5.35	5.15	5.00	5.31	5.02	+	**	0.46
Oral sensation (1-7)	5.26^{a}	5.10^{ab}	5.01^{b}	5.14	5.10	*	NS	0.28
Chewiness (1-7)	5.11	5.04	4.83	5.12	4.86	+	**	0.41
Mouth coating (1-7)	2.28^{a}	2.70^{b}	2.55^{ab}	2.58	2.44	**	NS	0.39
Juiciness (1-7)	5.09	4.98	4.92	4.98	5.01	NS	NS	0.27
Flavour (1-7)	5.57^{a}	5.26^{b}	5.07^{c}	5.27	5.32	***	NS	0.21
Overall (1-7)	5.45	5.28	5.13	5.32	5.24	+	NS	0.40
Cut_perp (N)	70.2^{a}	79.0^{ab}	85.8^{b}	80.2	76.5	***	NS	10.63
Cut_para (N)	51.7^{a}	56.8^{ab}	61.3^{b}	57.2	56.1	***	NS	6.59