THE EFFECT OF INTRAMUSCULAR FAT ON EATING QUALITY OF PORK

EIKELENBOOM G. and HOVING-BOLINK A.H.

DLO-Institute for Animal Science and Health (ID-DLO), Research Branch Zeist, The Netherlands.

S-IVB.30

SUMMARY

From 30 (out of 80) pork carcasses, loins were selected based on variation in intramuscular fat content (IMF; Foss-Let method), absence of PSE and an ultimate pH below 5.8. On the longissimus lumborum, colour, water holding capacity, shear force, sarcomere length, IMF (Soxhlet-method) and fatty acid composition of IMF were assessed. Sensory analysis of eating quality (tenderness, juiciness and flavour) at 5-8 days post mortem was determined by a 25-member taste panel.

IMF (Soxhlet) varied from 0.7 to 5.0 % (mean: 1.9 %) and was negatively correlated with the poly-unsaturated fatty acids (PUFA) linoleic acid (C18:2; r=-.60) and linolenic acid (C18:3; r= -.47) and positively with palmitic acid (C16:0; r= .53). Sensory tenderness, juiciness and flavour were moderately related to IMF (r= .30, .33 and .30, respectively), C16:0 (r= .49, .37 and .33), C18:2 (r= -.50, -.24 and -.24) and C18:3 (r= -.44, -.16 and -.22). No conclusion could be drawn as to a possible threshold for IMF, required for acceptable eating quality. With increasing carcass meat percentage, IMF decreased while PUFA increased, resulting in a significantly lower sensory tenderness (r= -.44).

The result of this experiment and the other study (Eikelenboom and Hoving-Bolink, 1994), suggest that, in preselected material, IMF is of less importance than ultimate pH for the eating quality of pork.

INTRODUCTION

Several studies have indicated a relationship between intramuscular fat content (IMF) and eating quality in pork. Bejerholm and Barton-Gade (1986) identified a threshold value of 2 % for optimal tenderness. According to a U.S.-study (De Vol et al., 1988), the threshold level was 2,5-3 %. In contrast to these papers demonstrating positive effects of IMF, a recent Swedish study (Göransson et al., 1992) did not find a relationship between IMF and eating quality. Good eating quality was maintained even at low IMF values.

Within a research project on factors determining the eating quality of pork, two experiments were conducted. In the first experiment, loins were preselected for variation in pH. Highly significant positive correlations were found for ultimate pH with shear force and sensory tenderness and juiciness (Eikelenboom and Hoving-Bolink, 1994). The purpose of the present experiment was to determine the effect of IMF on eating quality. This was conducted using material preselected for variations in IMF. A more detailed description of the experiment was published as an institute report (Hoving-Bolink et al., 1994).

MATERIAL AND METHODS

Eighty pigs (40 barrows and 40 gilts) from the institute's experimental herd were selected for the experiment. All animals were crossbred (3-way cross: Dutch Yorkshire (Y) x crossed Landrace sow (Y x LR)) and were fed at libitum. The selection (1st selection) was made visually to obtain a large variation in carcass quality and, as a consequence, varia-tion in IMF.

After slaughter, carcass meat percentage was determined with the Hennessy Grading Probe. At 20 h post mortem (pm) pH was measured in the right longissimus lumborum (LL). After cutting, 50 (out of 80) right loins were selected (2nd selection). Selected loins had an ultimate pH below 5.8. and were visually free from symptoms of PSE.

At 24 h pm ultimate pH, colour, WHC (drip loss) and sarcomere length were determined on the LL as described by Eikelenboom and Hoving-Bolink (1994). In samples obtained from the proximal end of the longissimus thoracis (LT), IMF content was analysed using the Foss-Let method (AOAC, 1980), as well as by

extraction with petroleum ether (modified Soxhlet method). After transesterification of IMF, the fatty acid composition was analysed using gas-liquid chromatography.

Based on the results of the analysis of IMF content with the faster Foss-Let method, 30 loins (from 15 barrows and 15 gilts) were ultimately selected (3rd selection) at 3 days pm, to represent the entire range of IMF content observed in both sexes. Of the selected loins, drip loss, heating loss and shear force were determined on the LL at 7 days pm (Eikelenboom and Hoving-Bolink, 1994). On the remaining part of the LL and distal part of the LT, eating quality was evaluated at 5-8 days pm, using a 25 member trained panel, as described by Eikelenboom and Hoving-Bolink (1994). Samples, originating from the same sex, were offered in series of three per time, with low, intermediate and high IMF content included.

RESULTS AND DISCUSSION

Due to the animal and loin selection procedures, there was a large variation in carcass quality and IMF content of the final group of 30 loins. Carcass meat percentage varied from 46,7 to 60,0 % (mean: 54,4 %), IMF content determined with the Foss-Let method varied from 0.70 to 4.50 % (mean 2.0 %) and with the Soxhlet method from 0.70 to 5.03 % (mean: 1.88 %). The correlation between these two methods was .95.

The mean proportion of C14:0 (myristic acid) was 1.4 %, of C16:0 (palmitic acid) 24.2 %, of C16:1 (palmitoleic acid) 3.2 %, of C18:0 (stearic acid) 13.7 %, of C18:1 (oleic acid) 47.6 %, of C18:2 (linoleic acid) 5.0 % and of C18:3 (linolenic acid) 0.4 % of total fatty acids. Thus, the total proportion of unsaturated fatty acids in IMF was 53 % and for polyunsaturated fatty acids (PUFA) it was 5.4 %.

Tenderness, assessed by shear force or by taste panel, varied less in the present study than in the previous one (Eikelenboom and Hoving, 1994). Because of the distinctly different selection procedures, ultimate pH varied in the previous study between 5.4 and 6.2 and in the present study from 5.4 to 5.7. Yet, drip and cooking losses were also significantly ($P<.05$) related to ultimate pH in this study. Unlike the previous study, no significant relationships were found for ultimate pH with colour (L^*-value), shear force, tenderness and juiciness (data not presented).

Table 1 includes the correlations between the various fat and eating quality characteristics. Only those fatty acids which were significantly related to some of the eating quality characteristics, are reported in table 1. IMF (Soxhlet) was negatively correlated with the polyunsaturated fatty acids (PUFA) linoleic acid (C18:2) and linolenic acid (C18:3) and positively with the saturated palmitic acid (C16:0) (see Table 1). Significant correlations were also found for IMF with C16:1 (palmitoleic; r= -.33) and C18:1 (oleic; r= .51) (not in Table).

Sensory tenderness, juiciness and flavour were moderately related to IMF (Soxhlet), C16:0, C18:2 and C18:3 (Table 1). For the Foss-Let method the correlations with tenderness, juiciness and flavour were of a similar magnitude (r= .34, .34 and .42, respectively). No significant relationship was found between any of the fat quality characteristics and shear force value (Table 1).

In an attempt to determine a threshold value for IMF, various classes of IMF content were arbitrarily made (< 1 %, 1 - 2 %, 2 - 3 % and > 3 %). Although trends were obvious, no significant (t-test) differences were found between adjacent IMF classes. Therefore, no treshold value for IMF, required for good eating quality could be determined with this approach.

With increasing carcass meat percentage, C16:0 decreased (r= -.53) and C18:2 and C18:3 increased (r= .64 and .56, repectively), resulting in a significantly lower sensory tenderness score (r= -.44). Because sarcomere length was not significantly related to shear force (r= .16) and tenderness score (r= -.12), it is unlikely that the lower tenderness in leaner carcasses is caused by cold shortening resulting from higher cooling rates due to the lower fat cover.

The results of this study suggest that IMF and fatty acid composition are related to the eating quality of pork. However, when comparing these results with the results of the other study (Eikelenboom and Hoving-Bolink, 1994a), we suggest that, in preselected material, IMF is of less importance than ultimate pH for the eating quality of pork.

REFERENCES

AOAC, 1980. Handbook Official Methods of Analysis of the A.O.A.C., 13th Ed., p. 376. AOAC, Washington D.C.

Bejerholm, C. and Barton-Gade, P.A., 1986. Effect of intramuscular fat level on eating quality of pig meat. Proc. 32nd Meeting of European Meat Research Workers, Gent, Belgium, p. 389-391.

De Vol, D.L., McKeith, F.K., Bechtel, P.J., Novakovski, J., Shanks, R.D. and Carr, T.R., 1988. Variations in composition and palatibility traits and relationships between muscle characteristics and palatibility in a random sample of pork carcasses. J. Anim. Sci. 66, 385-395.

Eikelenboom, G., and Hoving-Bolink, A.H., 1994. The effect of ultimate pH on eating quality of pork. Proc. 40th International Congress of Meat Science and Technology, The Hague, The Netherlands.

Göransson, A., Seth, G. von, and Tornberg, E., 1992. Influence of intramuscular fat on the eating quality of pork. Proc. 38th International Congress of Meat Science and Technology, Clermont-Ferrand, France, p. 245-248.

Hoving-Bolink, A.H., Eikelenboom, G., Vonder, G., and Vries, A.W. de, 1994. De invloed van het intramusculair vetgehalte op de eetkwaliteit van varkenskarbonade. ID-DLO, Branch Zeist, Report B-372 (with English summary).