THE EFFECT OF ULTIMATE pH ON EATING QUALITY OF PORK

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SUMMARY

Twenty pork carcasses were selected at 13 h post mortem (pm) to contain longissimus lumborum (LL) muscles that possessed a large variation in ultimate pH. On the LL ultimate pH, colour, water holding capacity, sarcomere length, percent intramuscular fat and shear force (at 3 and 7 days pm) were assessed. In addition, eating quality (tenderness, juiciness and flavour) was determined at 5-8 days p.m. by a 25-member taste panel.

Ultimate pH varied from 5.42 to 6.25 (mean: 5.71) and was, as expected, significantly related to colour and water holding capacity. The PSE condition was not observed. Shear forces, particularly at 7 days pm, were highly correlated with panel judgements of tenderness (r= -.78) and juiciness (r= -.74). No significant relationships were found for sarcomere length or intramuscular fat with shear forces and panel judgements.

Ultimate pH was positively related to sensory tenderness (r= .78) and juiciness (r= .68), but not to flavour (r= .02). Furthermore, ultimate pH appeared to be more highly related to shear force at 7 days (r= -.70) than at 3 days (r= -.43) pm. This suggests that ultimate pH had an effect on ageing rate. There was no evidence of a quadratic relationship between ultimate pH and tenderness as determined by either shear force or panel.

The results demonstrate that carcasses can be selected for eating quality (tenderness and juiciness) by using ultimate pH.

INTRODUCTION

Several studies have indicated a relationship between intramuscular fat content (IMF) and eating quality in pork (Bejerholm and Barton-Gade, 1986; De Vol et al., 1988). However, Göransson et al. (1992) could not find a significant relationship between IMF and eating quality. They found that ultimate pH affected tenderness more, even though pH did not vary to a
great extent (5.36-5.50). A lower pH-value gave more tender meat (Göransson et al., 1992).

In beef, ultimate pH is a major factor determining tenderness. There are several reports that there are linear increases in tenderness when pH increases (see Dransfield, 1981). A curvilinear relationship was found by Purchas (1990) in beef, toughness being low at the extremes of the range (5.4 and 7.4) and being the highest between 5.8 and 6.2. Dransfield et al. (1985) presented evidence that in pork, ultimate pH might be an important characteristic in determining eating quality.

A research project was initiated to determine the eating quality of pork and two experiments were conducted to include ultimate pH and IMF. The purpose of this experiment was to determine the effect of ultimate pH on eating quality. The pork was preselected to include variations in ultimate pH. A more detailed description of the experiment was previously published as an institute report (Eikelenboom et al., 1992).

MATERIAL AND METHODS

Sixty pigs (equally divided between barrows and gilts) from the institute's experimental herd were used. All animals were crossbred (Dutch Yorkshire (DY) x (DY x Dutch Landrace)) and were fed ad libitum. The animals were delivered for slaughter after a fasting period of 30 h. This fasting was employed to increase the (variation of) ultimate pH (Eikelenboom et al., 1991).

At 13 h post mortem (pm), pH was measured in the longissimus lumborum (LL) with a portable pH meter (Schott CG 818), equipped with an Ingold-electrode (type LoT 406-M6-DXK-S7). For each sex, 10 carcasses were selected which covered a wide range of pH within sexes. Of the selected carcasses, loins of both sides were transported to the laboratory.

At 20 h pm ultimate pH, colour (CIELAB-values; Hunter Labscan D65; 10° standard observer) and sarcomere length (Eikelenboom and Smulders, 1986) were determined on the left LL. In samples stored prepacked under oxygen permeable film, percent drip and (after heating for 1 h at 75 °C) heating loss and shear force were determined at 3 and 7 days p.m.. Shear force was assessed using an Adamel Lhomargy DY20B testing machine, equipped with a Warner-Bratzler shear blade (crosshead speed: 100 mm/min). Muscle samples were also taken for assessment of IMF content (modified Soxhlet method).

The right LL was sliced and prepared for sensory analysis at 5-8 days pm. The panel, consisting of 25 persons, had previously been trained for texture research. Each panel member assessed the tenderness, juiciness and flavour of each sample (offered in series of 5 samples per time) by marking on a line scaled from 0 to 100. A score of 0 (left anchor point) corresponded to very 'tough', 'dry' and 'weak flavour', whereas 100 corresponded to very 'tender', 'juicy' and 'strong flavour'. The distance from the mark to the left anchor point was identified as the score for each sample.

RESULTS AND DISCUSSION

Although the pH measured at 13 h pm tended to be slightly higher than when measured at 20 h pm (mean values: 5.82 vs 5.71; n.s.), it is likely that with both measurements the ultimate pH was clearly approximated. Thus, selection of carcasses was in fact based on ultimate pH. The ultimate pH measured at 20 h pm varied from 5.42 to 6.25.

Because of the preselection in ultimate pH, there was a considerable variation in fresh meat quality traits such as colour and water holding capacity. Two samples had an ultimate pH-value above 6.0 and were, therefore, considered to be DFD. PSE was not observed. As expected, highly significant ($P < .001$) correlations were found for ultimate pH (13 h p.m.) with drip loss, cooking loss and colour (L^*-value).

Table 1 includes the single correlations for ultimate pH and eating quality characteristics, such as shear force values and panel results. Highly significant correlations were found between shear force measurements and panel judgements of tenderness and juiciness. The correlations were somewhat lower for the shear force measurements conducted at 3 d when compared to 7 d pm. This may be explained because panel evaluations were conducted at 5 to 8 d pm. A high correlation ($r = .84$) was found between the panel judgements for tenderness and juiciness.

No significant correlations were found between eating quality characteristics and sarcomere length and IMF (not in Table). The latter is not surprising since loins were preselected based on ultimate pH. Ultimate pH, measured at 13 and 20 h p.m., were highly correlated with shear force values (day 7 pm) and with tenderness and juiciness scores, but not with flavour score (Table 1). Because correlations with pH were higher for shear force values measured at 7 as compared to 3 days pm, there may be an effect of ultimate pH on ageing rate.

Because of the curvilinear relationship between pH and tenderness described in beef (Purchas, 1990), we tested the linearity of this relationship. Using a quadratic regression, the percentage of explained variation in tenderness, assessed with shear force or panel judgement, was lower. Thus, there was little evidence that a quadratic relationship existed.

The results presented here demonstrate that carcasses can be selected for eating quality (tenderness and juiciness) of their fresh chops by using ultimate pH. In a previous study it was shown that ultimate pH can be increased by fasting before delivery (Eikelenboom et al., 1990). However, it should be realised that by increasing ultimate pH, fresh meat colour generally is darker and thus may negatively affect consumer's acceptability of the product. Also, DFD muscles are more susceptible to spoilage.

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