SUSCEPTIBILITY OF INDIVIDUAL BEEF CARCASSES TO TOUGHENING BY DIFFERENT CHILLING REGIMES.

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Keywords

Beef tenderness, chilling regimes, cold shortening, shear-force.

Background

The conflict between rapid chilling for quick shipment, low weight loss and microbiological safety on one hand, and conditions to ensure tenderness on the other hand has been known for decades (Locker and Hagyard, 1963). While abattoirs tend to focus on the weight loss, the scientists focus more often on how to achieve as tender beef as possible. All these aspects must be emphasized in order to obtain beef of high quality and safety. It is well known that toughening occurs when the cooling of carcasses is too fast (Locher and Hagyard, 1963; Dransfield *et al*, 1992). The susceptibility to rapid cooling between carcasses is probably different, but not much information about such an effect has been found.

Objectives

In this study the effects of different chilling immediately after slaughter on tenderness of beef *M. longissimus dorsi* was examined, and the individual susceptibility of carcasses to toughening by different chilling was studied.

Materials and Methods

27 bulls of Norwegian Red Cattle attending the same intensive feed research program were slaughtered at approximately equal conditional score. The average carcass weight at slaughter was 279 kg (260-313 kg). 12- 14 min after stunning the carcasses were electrical stimulated (32 sec., 90 Volt, 15 Hz). *M. longisimus dorsi* from both sides of the carcasses were deboned 1,5 h after stunning. Samples of 10 cm lenght were cut from the front of each loin, and vacuum packed in polyethylene bags. These four samples from each carcass were randomized and chilled **A**: 26 h at 4 °C, **B**: 20 h at 7-8 °C, 5 h at 4 °C, **C**: 12 h at 12-15 °C, 8 h at 7-8 °C, 5 h at 4 °C or **D**: 26 h at 15 °C. All samples were then aged at 4°C for 7 days. Temperature courses in air and meat were monitored. At the end of ageing shear-force (Warner-Bratzler) was measured on all samples on 10 replicates (Hildrum *et al*., 1994).

Results and discussion

The temperature courses in the samples chilled by different regimes are shown in Fig. 1. Chilling regime A gave significantly higher shear force values than all the others, and D gave significantly lower. B and C gave both intermediate values (Fig. 3). The shear force values indicate that A samples may be cold shortened, while B, C and D samples are not. Since sarcomere length was not measured, this was not verified. The difference in shear force between B, C and D is probably increased enzyme activity at higher temperatures. The high temperature would favour the activity of calpains and cathepsins, specially in D samples.

However, it was very clear that the toughening effect from fast chilling was very different from carcass to carcass (Fig 2). While some of the carcasses did not seem to be much influenced by the chilling regimes, other samples get much tougher when chilled fast. Samples, which are influenced by fast chilling, increase gradually in toughness when going from regime D to A. What causes this individual toughening is not clear. Fatness and weight offered little information about this variability, neither did ultimate pH (24 hours), weight loss or cooking loss. pH_{24} in the loins varied from 5.35 to 5.57, i.e. no values above 5.8. Possible causes to this individual susceptibility to chilling might be glycolytic rate, rate of muscle contraction, sarcomere length, fiber composition, sarcolemma proteins, enzyme/inhibitor activity or a combination of these factors.

Conclusion

As expected slowly chilled *M. longissimus dorsi* cuts from bulls of Norwegian Red Cattle were more tender than cuts that were rapidly chilled, based on Warner Bratzler shear -press values. Intermediate chilling regimes gave intermediate tenderness. There were substantial variations in tenderness in loin samples from 27 young bulls of Norwegian Red Cattle, - the highest variation was recorded with the fastest chilling. The susceptibility to toughening by fast chilling also varied very much from carcass to carcass. Some carcasses showed no difference in toughness between conditioned and fast chilled samples, while other carcasses exerted high susceptibility to faster chilling.

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Literature

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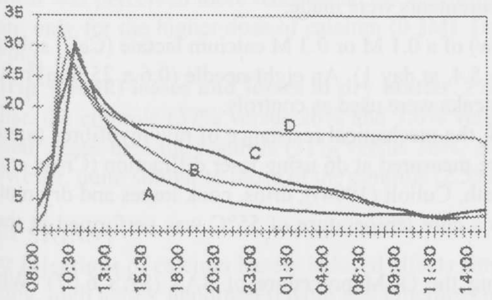

Figure 1: Temperature decline in the samples .

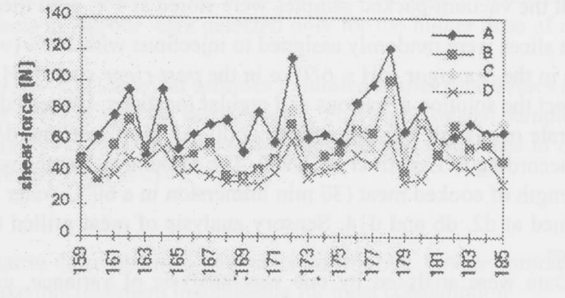

Figure 2: Shear force values at the four regimes.

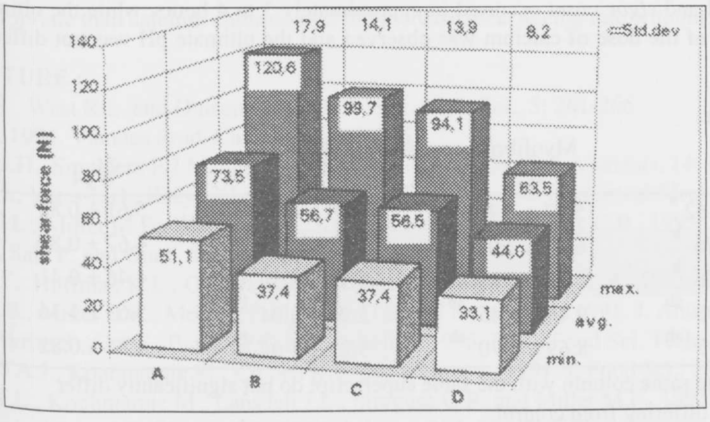

Figure 3: Shear-force values of the four chilling regimes.