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A novel cutting method to improve the Shear Force of Hot Boned Beef (#410)

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Introduction

During hot boning (HB), primals are removed from the carcase immediately prior to the onset of chilling. The advantages of HB include; ease of boning, reduced weight loss and ease of chilling, which all result in reduced processing costs. However, HB has been shown to increase toughness due to a shorter sarcomere length (Pisula & Tyburcy, 1996) when compared to conventionally hung and chilled carcasses. For this reason, HB is typically used for ungraded meat or for low quality ground beef. The aim of this study was to investigate a novel cutting method and subsequent chilling that could be applied to HB to improve shear force development in the striploin during aging. Technologies used to improve HB tenderness involve muscular restraint and stretching. We hypothesize that partially hot boning the carcase (keeping the striploin attached to the skeleton) will result in improved tenderness and increase sarcomere length compared to a fully HB striploin.

Methods

A total of 12 yearling- Droughtmaster (Bos indicus) steers were slaughtered at a commercial abattoir. The carcasses were stimulated with a low voltage nose to tail stimulation system applied for 5 seconds. The carcasses were split into sides and each side was allocated to one of 3 cutting treatments: Conventional (carcasses hung by the Achilles/chilled as normal), HB (carcase quartered at the 10th-11th rib, striploin removed pre-rigor/chilled on a rack) and Partial boning (carcase quartered at the 10th-11th rib, short loin (AusMeat 1552; AusMeat (2005)) removed pre-rigor, hung from the lumbar end/chilled as normal). The cutting treatments were distributed between the left and right side of the carcasses evenly. The pH and temperature of the loin was monitored hourly over the first 5 hours of chilling. At 72h post-slaughter the striploins were removed from all sides, and cut into 3 blocks weighing 80g each. Blocks were allocated to one of 3 aging treatments (5, 14 and 28 days), packaged in vacuum bags and stored at 2oC until the respective aging period had expired, then stored frozen. An additional 1g slice was taken for sarcomere measurement and stored at -20oC. For measurement of Warner Bratzler sheer force (WBSF), samples were first cooked for 30 minutes by sous vide where a core temperature of 70oC was reached. The samples were cooled and 5 x 1cm replicate samples were cut parallel to the fiber orientation and was measured for WBSF using a Llyod texture analyzer. Sarcomere length was determined by sectioning 5 thin subsamples parallel to muscle fibres. Sections were removed from each sample of frozen striploin. Data was analysed using a general linear models in SAS®. Cutting method and aging time were used as fixed effects, with WBSF and sarcomere length being the dependent variables.

Results

Sarcomere length did not differ between any cutting treatment, despite marked differences in their rate of pH decline. The partial cutting treatment resulted in 100% of sides reaching a pH of 6 within the temperature window of 15-35oC, compared to 75% and 50% for the Conventional and HB treatments. The WBSF decreased with aging time across all treatments ($P<0.001$). In contrast to the sarcomere length results, substantial differences in WBSF were evident between cutting treatments. The Partial cutting treatment had the lowest WBSF across all aging periods (Figure 1; $P<0.001$). The WBSF of conventional chilled loin was lower than the HB striploin after 5 days but not different at 14 and 28 days of aging.

Conclusion

The WBSF benefit in the conventional and partial cutting treatments was mostly observed during the early aging periods. Since optimized electrical stimulation creates ideal conditions for calpain activation, thus tenderization in the early aging periods (Hwang, Devine & Hopkins, 2003), this impact could be primarily due to the pH/Temp window being reached. The partial boning treatment appears to be more suited for optimized tenderness development, likely due to a greater surface to volume ratio enabling more rapid chilling, as evidenced in our results. The lack of difference in Sarcomere length between cutting treatments contradicts our expectations, which were based on previous studies where HB resulted in shorter sarcomere lengths (Pisula & Tyburcy, 1996). Although no shortening occurred in this study, the benefit of skeletal restraint cannot be ruled out. Mechanical stretching, through pre-rigor stretching and restraint, is designed to mimic skeletal restraint and to lengthen the muscle. Methods such as Tenderstretch and Tenderbound have shown increases to total muscle length but not the sarcomere length while also resulting in improved tenderness (Taylor and Hopkins, 2011). Thus, it is plausible that the WBSF benefit for the partial cutting treatments is due to a combination of skeletal restraint/stretch during rigor and a more ideal pH/temp decline. The partial HB of striploin could be used as a value adding method. Further studies to determine consumer acceptability is required.

Hwang, I. H., Devine, C. E., & Hopkins, D. L. (2003). Meat Science, 65(2), 677-691.

Pisula, A., & Tyburcy, A. (1996). Meat Science, 43, S125-S134.

Notes

Taylor, J. M., & Hopkins, D. L. (2011). Recent Patents on Food, Nutrition and Agriculture, 391-101.

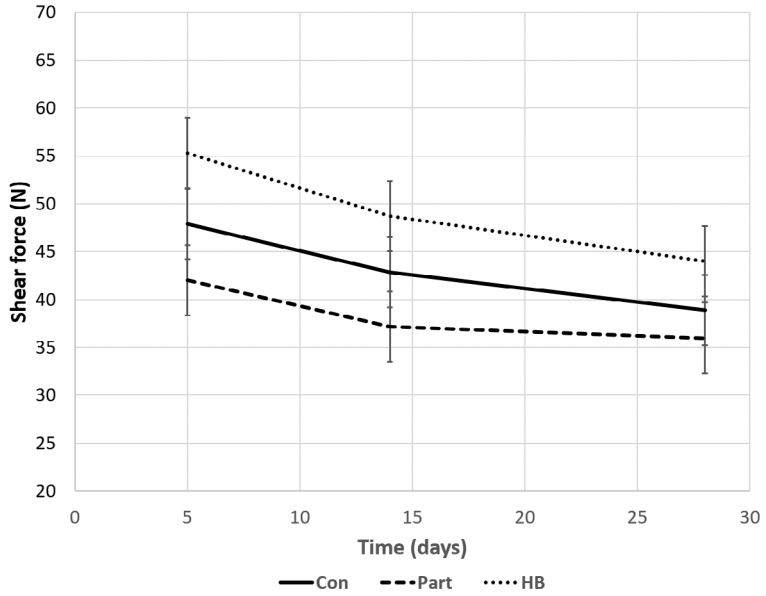

Figure 1 The Warner Bratzler shear force (N) values of beef striploin aged over 28 days from conventionally (Con) boned, partial boned (Part) and Hot boned (Hot) beef carcases. Errors are expressed as standard error of the mean.

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