



Dark Cutting Beef in the Canadian Grading System

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Objectives

In Canada, dark cutting carcasses are downgraded to a B4 grade and encounter severe price discounts. The aim of this study was to determine if different color intensities of dark cutting carcasses (B4) could be considered equivalent in quality to normal (N) carcasses of a lower marbling score.

Materials and Methods

Two hundred left beef carcass sides (100 N and 100 B4 with the American Meat Science Associations marbling levels 200 to 300, 300 to 400 and 400 to 700 equivalent to Canadian marbling standards of A, AA, and AAA respectively) were selected from a commercial slaughter plant in Alberta (Canada) following color assessment of the rib-eye between the 12th to 13th rib by certified beef graders, using visual dark cutting color chits of moderate (MD) and dark (DK) developed by the Canadian Beef Grading Agency (2010). After measuring pH and objective color at 48 h post mortem, rib-eyes were removed from the carcass, tagged, vacuum packaged, and transported under refrigerated conditions to the Lacombe Research and Development Centre (Agriculture and Agri-Food Canada, Canada). After 14 d ageing, cooking losses and shear force values were determined at the laboratory and a trained panel was conducted to evaluate meat sensory attributes. Two separate principle component analyses (PCA) and mixed model analyses (MMA) based on the quality and sensory characteristics were performed, first to determine if B4DKAA or B4MDAA have similar characteristics as NA or NAA, and second, to determine if

B4DKAAA or B4MDAAA have similar characteristics as NAA or NAAA ($n = 25$ for each group).

Results

In the first PCA, two separate clusters were identified. The first grouped most B4DKAA and B4MDAA together with limited overlap into the second cluster which contained NA and NAA samples. Similarly, in the second PCA the B4DKAAA and B4MDAAA were grouped together in a single cluster with limited overlap into the second cluster which contained NAA and NAAA samples. These groupings were associated with statistically significant differences found in the MMA of quality and sensory analyses. In all cases shear force values and off-flavor intensity in the B4DK and B4MD were significantly higher than the N, regardless of marbling level ($P < 0.05$). All B4 carcasses regardless of marbling level had lower values of $L^*a^*b^*$ than N carcasses ($P < 0.05$). The sensory perception of tenderness among the groups was not as definitive as the objective measure of shear force, which may have been influenced by the perception of juiciness.

Conclusion

These results indicate quality deficits in addition to color in all the dark cutting classes regardless of marbling level. From the point of view of eating quality, B4 carcasses suffered from increased toughness, and greater off-flavor that limits the possibility of less harsh penalties for dark cutters. Current research, including on-line technologies such as near infrared spectroscopy (NIRS) as a means of discriminating dark cutters, and packaging strategies to mitigate color differences at retail, may have future merit in reducing the impact of dark cutting.