RESEARCH

"Understanding the formation of grade B4 beef in Alberta"

UNDERSTANDING DARK CUTTERS

PROJECT NO.: 0009-018
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Background: Dark-cutting is a youthful (under 30 months) carcass condition that is severely penalized within the Canadian grading system. Carcasses that 'cut dark' are assigned a grade of Canada B4 and their value is reduced by up to $0.50/lb, meaning that up to $300 in value can be lost per head if a carcass grades B4. According to the 2010/11 Beef Quality Audit, 2.5% of youthful cattle were dark cutters, while the Canadian Beef Grading Agency reported 1.28% in 2010/2011, suggesting the audit sample contained a higher percentage of dark cutters than the Canadian population as a whole. Assuming 1.28% of Canadian cattle are dark cutters, this represents a loss in value of up to $11 million per year, depending on the level of discount.

Dark cutting carcasses are a very dark red to purple colour, contrary to the normal bright red colour of beef. This condition usually occurs after stressful events have depleted glycogen (energy) from the muscles, resulting in an elevated muscle pH of over 6.0. Dark cutting beef is visually unappealing to consumers, and the high pH stimulates the growth of spoilage bacteria, reducing its shelf life.

Bulls and heifers, due to an increase of fighting and mounting are more prone to dark cutting than steers. In addition, growth promotants have recently been recognized as a risk factor for dark cutting, perhaps contributing to the emergence of two new categories of dark cutting – borderline dark cutters that have a muscle pH between 5.8 and 6, and atypical dark cutters that have a muscle pH of less than 5.8, but still exhibit abnormally dark carcass colour.

Objectives: To determine if dark cutting is caused solely by insufficient muscle glycogen, and if all muscles are affected in the same way. A secondary objective examined whether rapid chilling of the carcass can bring on the dark cutting condition.

What they did: 179 Canada B4 carcasses were examined at a commercial packing plant over 5 visits. On each visit 6 sides were chosen based on pH for a total of 10 B4 with pH greater than 6, 10 B4 with pH less than 5.8 and 10 AA sides that were bright red and had normal pH to use as controls. Key muscles were assessed for pH, drip loss, and colour over four days of typical retail display. The 20 B4 sides along with 10 different AA sides (not selected based on pH) were also used to assess cooking loss, shear force (tenderness), colour measurements, glycogen potential, muscle fibre type, and sensory evaluation (aged steak only).

The chilling study used 10 carcasses where the rib-eye on one side was exposed to rapid chilling, while the rib-eye on the other side was treated normally. All rib-eyes were then measured for assess cooking loss, shear force (tenderness), colour measurements, glycogen potential, muscle fibre type, and sensory evaluation (aged steak only).

What they learned: Of the 179 dark cutters examined at the commercial plant, 72% were classic dark cutters (pH ≥6), 21% were borderline (pH between 5.8 and 6.0), and 7% were atypical dark cutters (pH ≤ 5.8). Classic and borderline dark cutting carcasses also weighed less with the same amount of subcutaneous fat and also had higher marbling scores than their AA counterparts. Of the 20 dark cutting carcasses studied in detail, 45% were classic, 35% were borderline, and 20% were atypical. Eighteen of the 20 carcasses were sexed by DNA analysis, revealing that heifers produced more carcasses in the borderline dark cutter category than steers did.

Glycogen levels in rib-eyes were low at the time of slaughter in the classic and borderline carcasses as expected, but although the rib-eyes from atypical carcasses had enough glycogen to produce normal, bright red beef, only one atypical carcass eventually bloomed to a normal colour. There was a high level of variation in the degree to which different muscles were affected by the dark cutting condition, but the high value cuts of the hindquarter (e.g. round, top sirloin) were most commonly dark, while the frontquarter cuts rarely cut dark. Borderline dark cutters had the highest shear force values, and were also identified as the toughest by the sensory panel, though tenderness did improve with aging.

This study was unable to identify any differences in colour between rapidly and normally chilled sides. It is possible that the chill rate was not aggressive enough, as previous research has shown the rate of chill affects muscle colour.

What it means: The survey results showed that borderline and atypical dark cutters are indeed present in the Canadian slaughter population. Heifers were more likely to produce borderline carcasses than steers, which also has an impact on tenderness. The lighter weight of the dark cutters (regardless of type) may reflect the predisposition of heifers to cut dark, but it may also indicate that smaller biological types of cattle are more prone to the condition.

The inability of atypical dark cutters to bloom, even though the amount of muscle glycogen present would mean that the carcasses should reach normal colour seems to indicate that the muscle metabolism of the cattle that produced the atypical carcasses is somehow different.

Future research on this topic funded by the 2nd Beef Industry Science Cluster and ABP will examine the protein and glycogen metabolism, and DNA sequence differences between normal and dark cutting carcasses, as well as the impact of management factors such as gender, implants, beta-agonists, melengestrol acetate, and transport practices on dark cutting.

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