The Relationship of Liver Abscess Scores and Early Postmortem Meat Tenderness

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Summary with Implications

Acidosis is one of the most common nutritional disorders found in commercial feedlots. Cattle diets with high concentrations of starch can cause rapid production of acids in the rumen, disrupting microbial fermentation, causing liver abscess formation, and lowering livestock performance. This study was conducted to evaluate the relationship between the occurrence of liver abscesses and beef tenderness early postmortem. Results showed numerically lesser shear force values (greater tenderness) in loins from animals without liver abscesses, however, this was not statistically significant for slice shear force or Warner-Bratzler shear force. Although the effects of liver abscess occurrence in relation to meat quality are still unclear, results from this study provide a conceptual foundation for additional research to be explored on meat quality.

Introduction

The use of starch-based diets during the cattle finishing stage increases production of acids and can promote acidosis, the lowering of pH within the rumen due to highly fermentable grains. This results in reduced feed intake and increased liver abscesses, costing the United States' cattle industry millions of dollars in liver condemnations. Recent studies have suggested increased ruminal biohydrogenation in high energy (*grain-based*) diets which can increase unsaturated fatty acid deposition in muscle tissue. Elevated unsaturated fatty acd content has been linked to increased tenderness in beef during early postmortem aging. Additionally, the literature has presented a decrease in carcass performance and meat quality attributes (marbling scores) in cattle with increased liver abscesses. Therefore, an investigation into high energy diets and the occurrence of liver abscesses from cattle fed with and without the inclusion of a feed additive, across beef carcasses of similar marbling scores (quality grade), may increase the understanding of meat quality as it relates to different nutritional strategies and liver abscess occurrences.

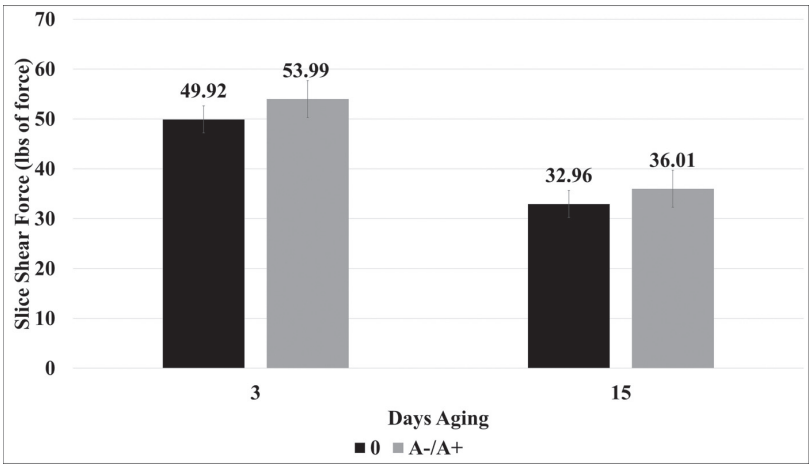

Figure 1: Analysis of Slice-Shear Force (kg on loins from carcasses with no abscesses (0) or moderate to high abscess scores (A-/A+) across 3 and 15 days of wet aging. [SEM (lbs of force): 0 = 2.706; A-/A+ = 3.718]

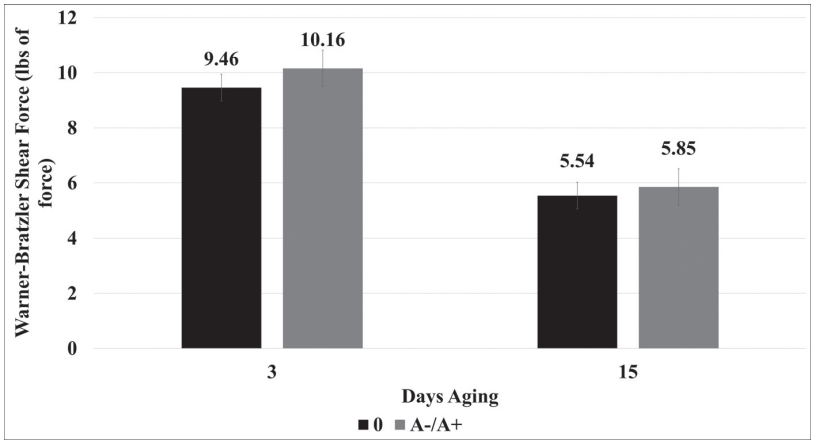

Figure 2: Analysis of Warner-Bratzler Shear Force (kg) on loins from carcasses with no abscesses (0) or moderate to high abscess scores (A-/A+) across 3 and 15 days of wet aging. [SEM (lbs of force): 0 = 0.484; A-/A+ = 0.66]

Procedure

Carcasses from cattle treated with or without Tylosin (Tylan 40®; Elanco Animal Health) were evaluated for occurrence of liver abscesses, with each carcass denoted with a score for liver abscesses. The scoring used was as follows: 0, no liver abscesses; A-, on or very few small abscesses; A, 1 large or a few small abscesses; A+, many large abscesses. Twenty-three Low Choice graded strip loins were collected, and separated based off of the following selection of No abscess occurrence (0, n = 15) or moderate to high abscess scores (A-/A+, n = 8). Abscess scores of A- defined 1 to 2 abscesses less than 2 cm in diameter and scores of A+ indicated 1 or more abscesses greater than 4 cm in diameter or greater than 4 small abscesses . Loins were split and randomly assigned to wet age for 3 or 15 days postmortem. After aging, 1 inch thick steaks were cut and measured for internal temperature and weight prior to cooking. Aged steaks were cooked to a target temperature of 160°F on a Belt Grill. After cooking, internal temperature and weight were recorded. Single cooked slices of steaks from both aging periods (n = 46) were cut parallel to the orientation of muscle fibers, and evaluated for Slice-shear force (SSF) using a Food Texture Analyzer with a Slice-shear blade. Then, steaks were individually bagged and stored overnight at 36°F for Warner-Bratzler shear force (WBSF) analysis. The following day, six ½ inch diameter cores were removed using a drill press, with each core being parallel to the orientation of the muscle fibers. Cores were sheared using a Food Texture Analyzer with a Warner-Bratzler blade. Peak WBSF values from each core were incorporated into a mean WBSF value for each steak. Slice shear force and average WBSF values for each steak were calculated for statistical analysis. Both SSF and WBSF values were analyzed as a completely randomized design with day of aging as a split-plot. Loin was considered the experimental unit (n = 23). Data were analyzed using the PROC GLIMMIX procedure of SAS 9.4 program with $\alpha \leq 0.05$ set for statistical significance.

Results

Neither SSF (Figure 1) nor WBSF values (Figure 2) were significantly different (P = 0.28 and 0.39, respectively) across treatments for both 3 and 15 days of aging. Interestingly, lower numerical values for shear force were found in loins from carcasses without liver abscesses compared to those from cattle with moderate to high liver abscess scores across both SSF and WBSF analyses. As expected, aging had an effect on SSF and WBSF, as loins aged 15 days exhibited lower shear force values ($P < 0.0001$) than loins aged 3 days. No treatment-by-aging effect was seen in either SSF ($P = 0.88$) or WBSF ($P = 0.74$). Either development of liver abscesses does not create sufficient metabolic stress to impact meat tenderness or the relatively low number of samples in this study limited the extent to which an effect could be detected.

Conclusions

Although there was a numerical trend supporting the hypothesis that metabolic changes as a consequence of liver abscess development might negatively impact meat tenderness, results were not statistically significant. There are very good reasons to control liver abscesses but it does not appear that meat quality is one of them.

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