Kansas Agricultural Experiment Station Research Reports

Volume 0
Issue 1 *Cattleman's Day (1993-2014)*

Article 242

2003

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Recommended Citation

Yancey, E.J.; Dikeman, Michael E.; Hachmeister, K.A.; Chambers, Edgar IV; Milliken, George A.; and Westcott, E. (2003) "Flavor characterization of top blade, top sirloin, and tenderloin steaks from A- and B-maturity carcasses of high and normal pH," *Kansas Agricultural Experiment Station Research Reports*: Vol. 0: Iss. 1. https://doi.org/10.4148/2378-5977.1645

Flavor characterization of top blade, top sirloin, and tenderloin steaks from A- and B-maturity carcasses of high and normal pH

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FLAVOR CHARACTERIZATION OF TOP BLADE, TOP SIRLOIN, AND TENDERLOIN STEAKS FROM A- AND B-MATURITY CARCASSES OF HIGH AND NORMAL pH

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Summary

The infraspinatus muscle (top blade steak) from the chuck clod, the gluteus medius muscle (top sirloin steak) from the sirloin, and the psoas major muscle (tenderloin steak) from the loin were obtained from A- and B-maturity carcasses with either low-Slight or Small marbling and with either normal ultimate pH (5.7 or less) or high pH (6.0 or higher) to evaluate flavor profile characteristics. Muscles were aged for 7, 14, 21, and 35 days. A highly trained flavor-profile sensory panel evaluated charbroiled steaks from these muscles. Muscles from high pH (dark cutting) carcasses had less typical beef flavor identity and less brown roasted flavor than those from carcasses with normal pH. Top blade steaks had a more intense bloody/serumy flavor than top sirloin and tenderloin steaks. Aging steaks to 21 or 35 days postmortem increased the metallic flavor sensory characteristic. Top sirloin steaks had a more intense sour flavor than top blade or tenderloin steaks, and steaks from carcasses having a high pH were found to be more rancid than those from carcasses with normal pH. In general, high pH steaks and those aged longer than 21 days had less desirable flavor profiles than normal pH steaks and those aged only 14 days.

Introduction

Consumers primarily purchase beef because of its desirable flavor and texture. Researchers have characterized the palatability of high and normal pH and A- and B-maturity longissimus muscles, but no research has evaluated the effects of pH and maturity on the flavor attributes of top sirloin, tenderloin, or top blade steaks. Therefore, our project was designed to evaluate the effects of pH, maturity, marbling, and aging time on the flavor attributes of top blade, top sirloin, and tenderloin steaks. This project was funded with Beef Checkoff dollars and coordinated by the National Cattlemen's Beef Association.

Experimental Procedures

Subprimal Selection. Beef chuck, shoulder clods; loin, top sirloin butts; and loin, full tenderloins were obtained from two commercial beef slaughter and processing facilities at six different sampling times. Carcasses were selected to fit into two groups: 1) carcasses of

[1]Appreciation is expressed to the Beef Checkoff for funding this project, National Cattlemen's Beef Association for coordination, and to Cryovac Sealed Air Corporation for providing packaging materials. The authors would like to acknowledge the assistance of J. W. Stephens, J. R. Davis, S. L. Stroda, S. Lowak, and A. Jenkins.

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A-maturity bone and 2) carcasses of B-maturity bone. These groups were further selected to be of two pH subgroups: 1) those having an ultimate pH of 5.7 or less and 2) those having an ultimate pH of 6.0 or greater (dark cutters). Ribeye muscle pH was measured at 24 to 48 hours postmortem. The carcasses also were selected to be of two marbling groups: 1) those having USDA marbling scores of Slight^{00} to Slight^{50} and 2) those having USDA marbling scores from Small^{00} to Modest^{00}. Due to the low incidence of B-maturity x high pH carcasses, we were unable to select an equal number of these carcasses. The subprimals were fabricated at 7 days postmortem, and the top blade, top sirloin, and tenderloin were excised from each of the respective subprimals. Steaks 1-inch thick were cut from the muscles, randomly assigned to an aging treatment (7, 14, 21, or 35 days), and vacuum packaged. The steaks assigned to the 7-day aging treatment were placed in a freezer at -40°F until just prior to trained flavor-profile panel evaluations. The remaining steaks were aged at 36 to 39°F until either 14, 21, or 35 days postmortem, then frozen and stored at -40°F until sensory panel evaluation.

Flavor-Profile Sensory Panel Evaluations. The **Plan** procedure of SAS was used to determine the treatments represented each day for the panel evaluations in order to reduce any order bias that might be created during panelist evaluations. Steaks were thawed at 39°F for 24 hours prior to trained flavor-profile sensory panel evaluations. The steaks were cooked on a Wells Model B-44 Electric Charbroiler, and steaks were turned every 4 minutes until an internal temperature of 158°F was reached.

The highly trained flavor profile panel used a 15-point scale for evaluations, with 15 being most intense and 0 being none. The standards for each attribute were determined by the panelists, and reference samples were used each time the panel met. Panelists used 80% lean ground chuck cooked to 160°F as the standard for both beef flavor identity and the brown roasted attribute. This standard was rated as a 10.5 for beef flavor identity and a 10.0 for brown roasted flavor. Strip loin steaks (USDA Select) were used as the standard for the bloody/serumy and metallic attributes. The steaks were cooked on the charbroiler to an internal temperature of 140°F. This standard was rated as a 5.5 for the bloody/serumy attribute and a 4.0 for the metallic attribute. Dole brand canned pineapple juice was also used for the metallic attribute and was rated as a 6.0. Crisco vegetable oil that had been heated in a microwave oven for 3 minutes and cooled was used as the rancid reference and was rated a 7.0. Two citric acid solutions were used for a sour reference; 0.015% solution and 0.025% solution were rated as 1.5 and 2.5, respectively.

After cooking, the steaks were cut into cubes measuring 1.0 x 0.5 x 0.5 inch perpendicular to the surface. Steaks were scored to the nearest 0.5 on the 15-point scale. Panelists were presented not more than 15 samples per session to minimize sensory fatigue and adaptation. The duration of each session was 1.5 hours, and panelists were allowed a 5 minute break after receiving one-half of the samples. The evaluations were conducted in an atmospherically controlled room.

Statistical Analyses. The **Mixed** procedure of SAS was used to analyze all flavor panel data. The flavor panel data were analyzed in a split-plot design structure, with carcass as the whole plot and steak as the subplot. Maturity, marbling, pH, and muscle served as whole plot fixed effects, and aging time served as the subplot fixed effect. Interactions and main effects with probability values of less than 0.05 were considered significant.

Results and Discussion

In general, carcasses with normal pH had more intense beef flavor identity than carcasses with high pH. The tenderloin had greater beef flavor identity than the top sirloin, and both had greater beef flavor identity than the top blade, especially for carcasses with high pH. When considering all muscles from carcasses with high pH, those from B-maturity had more perceptible beef flavor identity than those from A-maturity.

The tenderloin from carcasses with normal pH had a more intense ($P<0.05$) beef flavor identity than all other treatment combinations. Muscles from carcasses with high pH generally had the least beef flavor identity, especially for the top blade. The effect of aging on beef flavor identity was very inconsistent.

The tenderloin from carcasses with high pH had a more intense ($P<0.05$) brown roasted flavor than the top blade from carcasses with high pH. In general, the brown roasted flavor attribute was more intense ($P<0.05$) for muscles from carcasses with normal pH. The top blade from carcasses of high pH had the least intense brown roasted flavor, especially after the 35-day aging period. The effect of marbling was inconsistent on brown roasted flavor.

Muscle-ranked from most to least ($P<0.05$) in intense bloody/serumy flavor were: top blade, tenderloin and top sirloin. Marbling had an inconsistent effect on bloody/serumy flavor intensity. The high pH, B-maturity carcasses had more intense ($P<0.05$) bloody/serumy flavor than the other pH $\times$ maturity combinations. In general, bloody/serumy flavor intensity decreased as aging time increased. The least intense bloody/serumy flavor was for muscles from A-maturity carcasses that had been aged 35 days.

Aging muscles for 21 or 35 days generally resulted in increased metallic flavor compared to aging only 7 or 14 days, but the differences were small. pH had an inconsistent effect on metallic flavor. The top sirloin had more intense metallic flavor ($P<0.05$) than the top blade and tenderloin, but the small numerical differences are not of practical importance.

The top sirloin generally had a more intense sour flavor than the tenderloin, and the top blade had the least intense ($P<0.05$) sour flavor. Muscles from carcasses with high pH had increased sour flavor for the tenderloin but decreased sour flavor for the top sirloin. Sour flavor generally increased with longer aging, but the effect of pH on sour flavor was different for longer aging than it was for shorter aging. The sour attribute would be expected to increase over time due to the growth of lactic acid bacteria within the vacuum package. However, the magnitudes of these differences were too small to be of practical importance. Maturity had an inconsistent effect on the sour flavor attribute.

Rancid flavor was more intense ($P<0.05$) for muscles from carcasses with high pH than for muscles from carcasses with normal pH. The high pH of the muscle was probably more favorable for the growth of microorganisms that break down lipids, and these organisms could have been responsible for the higher rancid flavor scores associated with steaks from high pH carcasses. The top blade had the most intense ($P<0.05$) rancid flavor and the top sirloin had the least intense ($P<0.05$) rancid flavor. Rancid flavor was more intense for A-maturity than for B-maturity top blade, but this was not true for the top sirloin and tenderloin.

As aging time increased, rancid flavor increased ($P<0.05$) for muscles from carcasses with both normal and high pH. The combination of small marbling and high pH resulted in the most ($P<0.05$) rancid flavor and, in general, muscles from carcasses with high pH and high marbling had more rancid flavor than those from carcasses with normal pH. The polyunsaturated fatty acids and phospholipids would be expected to autoxidize over time, which could have contributed to the increase in the rancid flavor attribute detected by the sensory panelists.