

PALATABILITY OF BEEF STRIP LOIN STEAKS FROM GRASS- AND GRAIN-FINISHED BEEF REPRESENTING VARIOUS FAT LEVELS AND AGING TIMES

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Abstract – The objective of this study was to evaluate palatability of strip loin steaks from grain- and grass-fed beef across five USDA (United States Department of Agriculture) marbling score ranges and three wet aging periods. Consumer panels were conducted in four cities in the United States (US). Each steak sample was rated for tenderness, juiciness, flavor, and overall liking. In addition, each consumer was asked to rate each trait as acceptable or unacceptable. Lastly, consumers evaluated whether each sample represented unsatisfactory, everyday quality, better than everyday quality or premium quality. Age had no effect ($P > 0.05$) on flavor liking; however, tenderness increased ($P < 0.05$) as age time increased. Grass-finished Prime samples were similar ($P > 0.05$) to grass Top Choice and Low Choice for flavor liking. Juiciness increased ($P < 0.05$) as quality grade increased, and grass-fed steaks were rated higher ($P < 0.05$) for juiciness than grain-finished samples. Prime samples were characterized as premium quality and better than everyday quality more than all other treatments ($P < 0.05$). A higher ($P < 0.05$) percentage of grain-fed samples were characterized as everyday quality than grass-fed samples. Quality grade, age, and diet influenced many different sensory attributes in consumers.

Key Words – consumer, animal diet, quality

I. INTRODUCTION

Beef palatability (tenderness, flavor, and juiciness) is the main driver influencing consumer purchasing decisions [1]. It has been reported that grain-fed cattle produce carcasses with superior flavor and tenderness traits when compared with carcasses obtained from grass-fed cattle [2], but others have concluded that forage finished steers exhibit comparable or superior palatability traits when compared with grain-fed cattle [3,4]. However, consumers have not evaluated grain-fed compared to grass-fed beef from a wide range of quality grades. The majority of US consumers seem to be accustomed to the taste of domestic beef and prefer steaks from grain-fed beef. However, a portion of US consumers are becoming more interested in grass-fed beef. Most of the grass-fed beef in the US is being imported from other countries such as Australia and New Zealand, so shipping can extend aging time of beef imported. Therefore, the objective of this study was to evaluate marbling and aging impact on palatability of steaks from grain- and grass-fed beef.

II. MATERIALS AND METHODS

Beef strip loins ($n = 200$; 20 per marbling level/fed cattle type) representing five marbling levels (slightly abundant and higher, modest 00 to moderate 100, small, slight, and traces) and two fed cattle types (grass-finished and grain-finished) were used in the study. All strip loins (*longissimus lumborum*) were selected by trained Texas Tech personnel at commercial beef packing facilities in Nebraska (grain-finished) and New Zealand (grass-finished). The strip loin was equally portioned into thirds and randomly assigned to one of three aging periods (7 d, 21 d or 42 d). After aging, all strip loin portions were frozen, then fabricated (while still in the frozen state) into 2.5-cm thick steaks using a band saw, vacuum packaged individually, and stored frozen (-20°C) until subsequent analysis. All samples were thawed at $2-4^{\circ}\text{C}$ for 24 h prior to consumer evaluation, and were cooked to an internal temperature of 71°C using a clamshell grill (Cuisinart Griddler Deluxe, East Windsor, NJ). Consumer panelists ($n = 480$; 120/city) were recruited and paid for participation in Lubbock, Texas; San Francisco, California; Gainesville, Florida; and Manhattan, Kansas. Steaks were trimmed of external fat and connective tissue, then portioned into four 2.5cm by 5cm pieces and served in a random order. Attributes for all eight samples were ranked on a paper ballot with 10-cm continuous-line scales for juiciness, tenderness, flavor liking and overall liking. The zero anchors were labelled as not juicy, not tender, dislike extremely, and dislike extremely; the 10-cm anchors were labelled as very juicy, very tender, like extremely, and like extremely. Also, each consumer rated each sample as either acceptable or unacceptable for each palatability trait. Furthermore, consumers were asked to designate each sample as unsatisfactory, everyday quality, better than everyday

quality, or premium quality. Statistical analyses were conducted using the procedures of SAS (Version 9.3; SAS Inst. Inc., Cary, NC). Treatment comparisons were tested for significance using PROC GLIMMIX with $\alpha = 0.05$. Sensory data was analyzed with a split-plot arrangement of factors, with diet x QG as the main plot factor and age as the subplot factor. Acceptability data for each palatability trait and quality level was analyzed with a model that included a binomial error distribution. For all analyses, the Kenward-Roger approximation was used for estimating denominator degrees of freedom and the PDIFF option was used to separate treatment means when the F-test on the main effect or effect interaction was significant ($P < 0.05$).

III. RESULTS AND DISCUSSION

Tenderness, flavor liking and overall liking were impacted by the interaction of diet x quality grade ($P < 0.05$). In grain-finished beef, Prime was rated higher ($P < 0.05$) and Standard lower ($P < 0.05$) than all other treatments for tenderness, flavor liking and overall liking. Standard samples were rated lowest ($P < 0.05$) for tenderness, flavor liking and overall liking but similar ($P > 0.05$) to Select when finished on grass. Grass-finished Prime samples were similar ($P > 0.05$) to grass Top Choice and Low Choice for flavor liking. For overall liking, an age x diet interaction was found ($P < 0.05$). When aged for 7 and 21 days, grass-finished beef rated higher ($P < 0.05$) than grain-finished beef for overall liking. Age had no effect ($P > 0.05$) on flavor liking; however, tenderness increased ($P < 0.05$) as age time increased. Juiciness increased ($P < 0.05$) as quality grade increased and grass-fed steaks were rated higher ($P < 0.05$) for juiciness than grain-finished samples. An age x diet interaction ($P < 0.05$) and age x quality grade interaction ($P < 0.05$) was found for tenderness acceptability. A higher ($P < 0.05$) percentage of grass-finished samples were rated as acceptable for tenderness than grain-finished samples when aged for 7 and 21 days; however, no difference ($P > 0.05$) was found for samples aged 42 days. Standard samples aged 21 and 42 days were less ($P < 0.05$) acceptable for tenderness than all other 21 and 42 day aged samples, respectively. A higher ($P < 0.05$) percentage of Prime samples than other quality grades in the same aging periods were rated as acceptable for tenderness when aged 7 and 21 days. Generally, as quality grade increased, percentage of samples rated as acceptable for juiciness, flavor liking and overall liking increased. Moreover, no differences ($P > 0.05$) were found for juiciness, flavor liking or overall liking acceptability due to age. Similar to the juiciness rating, a higher ($P < 0.05$) percentage of grass-finished steaks were rated acceptable for juiciness than grain-finished steaks. An age x diet interaction was found for better than everyday and premium quality. When aged 21 days, the percentage of samples rated as better than everyday and premium quality was higher ($P < 0.05$) for grass-finished than grain-finished beef; however, no difference ($P > 0.05$) was found when aged 42 days. No QG interaction was found for perceived quality levels ($P > 0.05$). Prime samples were characterized as premium quality and better than everyday quality more than all other treatments ($P < 0.05$). The percentage of samples rated as unsatisfactory was greatest ($P < 0.05$) for Standard. A higher ($P < 0.05$) percentage of grain-fed samples were characterized as everyday quality than grass-fed samples.

IV. CONCLUSION

As expected, quality grade was the driving force for juiciness. When samples were aged 42 days, few differences in sensory attributes were discovered; however tenderness improved with age time. Additionally, diet had no impact on overall liking, tenderness acceptability, and percentage rated as better than everyday and premium quality when samples were long aged (42 days). Diet did not impact percentage of steaks rated as acceptable for flavor liking or overall liking. Recently, grass-finished beef has gained interest in the US. However, we know it lacks the intramuscular fat for the palatability to compete in the premium domestic market. This study is just the beginning of understanding how high-marbled, wet-aged, grass-fed beef ranks with the US consumer.

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