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Identifying consumer preference for beef raised with different production systems

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Objective

Objectives of this study were to evaluate meat quality characteristics and identify consumer palatability preferences for beef raised in different production systems.

Study Description

Beef striploins were collected from cattle ($n = 72$) raised using four different production systems: 1) no technology (NT; no antibiotics or growth promotants); 2) non-hormone treated cattle (ANT, fed monensin and tylosin); 3) implant (IMP, administered a series of three implants, and 4) implant plus fed a beta-agonist (BA, IMP treatment plus, fed ractopamine-HCl for the last 30 days prior to harvest). Steaks (1-inch) were fabricated from 14-day aged striploins for Warner-Bratzler shear force (WBSF) and consumer panel analysis. To determine the influence of production information on consumer preferences, untrained consumer panelists ($n = 105$) were recruited from the surrounding areas of St Paul, MN for three consecutive panels: Blind (Panel 1; samples provided with no production information); Disclosed without Meat (Panel 2; only the production description provided); and Disclosed with Meat (Panel 3; samples and production description provided). Panelists were fed repeated samples of each of the four treatments and were instructed to identify their most and least preferred sample. The relative preference of each sample was analyzed to determine percent share of preference (SOP) per treatment for comparison using a percentage scale.

Take home points

Marbling score of NT and ANT did not differ ($P > 0.05$) but were greater ($P \leq 0.05$) than IMP and BA, which were similar ($P > 0.05$). Steaks from NT and ANT treatments did not differ ($P > 0.05$) for WBSF though were more tender ($P \leq 0.05$) than IMP and BA, which were not different ($P > 0.05$). Percent cook loss was reduced ($P \leq 0.05$) for ANT versus IMP and BA which were not different ($P > 0.05$). Further, a reduction ($P \leq 0.05$) in percent cook loss was detected for NT compared to IMP but did not differ ($P > 0.05$) from BA. In Panel 1, when no information was provided, NT was most preferred ($P \leq 0.05$) and BA was least preferred ($P \leq 0.05$) while ANT and IMP were intermediate and similar ($P > 0.05$). When asked to select the most and least preferred production descriptions in Panel 2, all SOP differed ($P \leq 0.05$) with NT most preferred followed by ANT, IMP, and BA. All samples differed ($P \leq 0.05$) when information was disclosed and meat was consumed in Panel 3 but ANT was most preferred followed by NT, IMP and BA.

Pairwise comparisons between Panel 1 and 3 revealed that disclosing production information resulted in a lift ($P \leq 0.05$) in SOP for NT and ANT and a decline ($P \leq 0.05$) for IMP and BA.

Keywords: beef, consumer, meat quality, shares of preference, technology

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Abstract

The objectives of this study were to evaluate meat quality characteristics and identify consumer palatability preferences for beef raised in different production systems. Beef striploins were collected from cattle ($n = 72$) raised using four different production systems: 1) no technology (NT; no antibiotics or growth promotants; 2) non-hormone treated cattle (ANT, fed monensin and tylosin); 3) implant (IMP, administered a series of three implants, and 4) implant plus fed a beta-agonist (BA, IMP treatment plus, fed ractopamine-HCl for the last 30 days prior to harvest). Steaks (1-inch) were fabricated from 14-day aged striploins for Warner-Bratzler shear force (WBSF) and consumer panel analysis. To determine the influence of production information on consumer preferences, untrained consumer panelists ($n=105$) were recruited from the surrounding areas of St Paul, MN for three consecutive panels: Blind (Panel 1; samples provided with no production information); Disclosed without Meat (Panel 2; only the production description provided); and Disclosed with Meat (Panel 3; samples and production description provided). Panelists were fed repeated samples of each of the four treatments and were instructed to identify their most and least preferred sample. The relative preference of each sample was analyzed to determine percent share of preference (SOP) per treatment for comparison using a percentage scale. Marbling score of NT and ANT did not differ but were greater ($P \leq 0.05$) than IMP and BA, which were similar. Steaks from NT and ANT treatments did not differ for WBSF though were more tender ($P \leq 0.05$) than IMP and BA, which were not different. Percent cook loss was reduced ($P \leq 0.05$) for ANT versus IMP and BA which were not different. Further, a reduction ($P \leq 0.05$) in percent cook loss was detected for NT compared to IMP but did not differ from BA. In Panel 1, when no information was provided, NT was most preferred ($P \leq 0.05$) and BA was least preferred ($P \leq 0.05$) while ANT and IMP were intermediate and similar. When asked to select the most and least preferred production descriptions in Panel 2, all SOP differed ($P \leq 0.05$) with NT most preferred followed by ANT, IMP, and BA. All samples differed ($P \leq 0.05$) when information was disclosed, and meat was consumed in Panel 3 but ANT was most preferred followed by NT, IMP and BA. Pairwise comparisons between Panel 1 and 3 revealed that disclosing production information resulted in a lift ($P \leq 0.05$) in SOP for NT and ANT and a decline ($P \leq 0.05$) for IMP and BA.

Introduction

Growth promoting technologies (anabolic implants, ionophores, antimicrobials, and beta-agonists) are commonly used in beef production to improve efficiency. Growth-promoting technologies have been shown to mitigate NH_3 and greenhouse gas emissions (Stackhouse et al., 2012), however this is not well understood by consumers. Further, the influence of these technologies on beef tenderness and palatability is mixed (Platter et al., 2003; Harsh et al., 2015). Consumers demand credence attributes (Umberger et al., 2007) such as beef produced without growth enhancement technologies (USDA-AMS, 2015). Given this dichotomy between improving resource management and decreasing the use of technology (Mathews and Johnson, 2013) it is critical to understand the influence of production systems on measures of sustainability, meat quality and consumer preferences related to these traits. Improved

understanding of consumer preferences will increase marketing avenues and enhance producer's ability to differentially market beef. Therefore, the objective of this study was to evaluate meat quality characteristics and identify consumer palatability preferences for beef raised in different production systems.

Experimental Procedures

Striploins ($n = 72$) were collected from steers raised in one of four different production systems: 1) received no technology (NT); 2) antibiotic treated (ANT; administered therapeutic antibiotics plus 300 mg monensin [Rumensin 90, Elanco Animal Health] and 90 mg tylosin [Tylan 40, Elanco Animal Health] during the finishing phase); 3) implant treated (IMP; administered ANT technologies plus a series of three implants including a suckling calf implant [Ralgro, Merck Animal Health] at an average of 74 ± 12 d of age on June 29, a moderate-potency initial feedyard implant [Revalor-IS, Merck Animal Health] at an average of 235 ± 12 d of age on December 8, and a high potency finishing implant [Revalor-200, Merck Animal Health] at an average of 330 ± 12 d of age on March 11) and 4) beta-agonist treated (BA) administered all IMP technologies plus fed a beta-agonist (200 mg ractopamine hydrochloride/steer/day [Optaflexx 45; Elanco Animal Health]) for the last 30 days before harvest. Following harvest, marbling score was recorded and steaks (1-inch) were fabricated from 14-day aged striploins for Warner-Bratzler shear force (WBSF; an objective measure of tenderness), cook loss, and consumer panel analysis.

Consumer sensory sessions were conducted at a private consumer research and testing facility (Food Perspectives Inc., Plymouth MN). Untrained consumer panelists ($n = 105$) were recruited from the surrounding areas of St Paul, MN. Steaks were cooked on electric clamshell grill to a medium degree of doneness (160°F). Within each session, three panels were delivered in the following order: 1) Undisclosed with Meat (samples provided with no production information); 2) Disclosed without Meat (only production information provided); and 3) Disclosed with Meat (samples provided along with production information). A description of the production information provided for each treatment in Panels 2 and 3 is provided in Table 1. Within each panel, three flights of treatments were delivered in a randomized set of three samples so that the four treatments could have direct comparison and panelists could select their most and least preferred sample among the three treatments or sample options per flight. After making their most and least preferred sample selection for panels 1 and 3, panelists were asked to rate the tenderness, juiciness, beefy flavor, and overall acceptability of their most preferred sample.

Results and Discussion

Marbling score of NT and ANT did not differ but were greater ($P \leq 0.05$) than IMP and BA, which were similar. Steaks from NT and ANT treatments did not differ for WBSF though were more tender ($P \leq 0.05$) than IMP and BA, which were not different. Percent cook loss was reduced ($P \leq 0.05$) for ANT versus IMP and BA which were not different. Further, a reduction ($P \leq 0.05$) in percent cook loss was detected for NT compared to IMP but did not differ from BA.

In effort to analyze beef consumer preferences and perception of different production systems, individual panelist results were combined and SOP for each treatment were determined (Figure 1). Undisclosed with Meat panel treatment influenced ($P < 0.05$) SOP. The NT had the greatest

($P < 0.05$) SOP, ANT and IMP were similar and intermediate ($P < 0.05$) to BA, which was least preferred ($P < 0.05$). The order of preference by percentage was: 1) NT, 27.82%; 2) ANT, 26.39%; 3) IMP, 25.91%; and 4) BA, 19.88%. During the Disclosed without Meat panel, the same panelists participated and were asked to provide their preferences for production system information. Each treatment's production system information influenced ($P < 0.05$) SOP among panelists in the follow order: 1) NT (50.41%); 2) ANT (32.17%); 3) IMP (11.88%); and 4) BA (5.53%). To further investigate product palatability combined with product information, the same panelists participated in a Disclosed with Meat panel, which revealed treatment influenced ($P < 0.05$) panelists SOP for both palatability and perception. However, results of this study indicate a greater preference for ANT (36.68%) compared with NT (34.01%; $P < 0.05$), which indicates that when panelists are able to taste and evaluate production information, they preferred the ANT treatment. Further, panelists preferred IMP (19.68%) to BA (9.63%; $P < 0.05$). The order of preference differed ($P < 0.05$) among each treatment as follows: 1) ANT (36.68%); 2) NT (34.01%); 3) IMP (19.68%); and 4) BA (9.63%). In comparison to the Undisclosed without Meat panel, when panelists were provided production system information in addition to product palatability SOP for NT lifted 6.19% and ANT lifted 10.29%. Whereas, SOP for IMP decreased 6.23% and BA decreased 10.25% (Figure 1).

Panelists were asked to rate the tenderness, juiciness, beefy flavor, and overall acceptability of their most preferred sample in panels 1 and 3. Panelist ratings for tenderness reflected the WBSF results with the exception that panelists rated IMP similar to NT and ANT for tenderness ($P > 0.05$) in the Undisclosed panel. In the Disclosed with Meat panel, panelists ranked NT greater ($P < 0.05$) in overall acceptability than IMP though, ANT and BA were similar to all treatments. Beefy flavor tended ($P = 0.08$) to be influenced by treatment where NT tended to be greatest ($P < 0.10$) in beefy flavor in comparison with ANT, IMP, and BA, which were similar.

Implications

Treatments utilizing growth promoting implants with and without beta-agonist increased WBSF, which may be detectable by untrained consumer panelists as natural treatments captured greater SOP in both blind and disclosed panels. When production information was disclosed and palatability was assessed, ANT was the most preferred followed by NT, indicating that when information is provided consumers are accepting of meat from an animal that may have been treated with an antibiotic in the event of illness.

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Table 1. Production system description provided to panelists	
	Description
No technology utilized (NT)	Beef produced from cattle never receiving antibiotics, added hormones, or other growth promoting products throughout their lifetime.
Non-hormone treated (ANT)	Beef produced from cattle that never received added hormones or supplements that adjust fat to lean meat. Antibiotics and antimicrobials were used to maintain animal health and productivity.
Implanted (IMP)	Beef produced from cattle that never received supplements to adjust fat to lean meat but received other growth promoting technologies including use of antibiotics, antimicrobials, and added hormones. These technologies were used to maintain animal health and improve productivity.
Implanted plus fed a beta-agonist (BA)	Beef produced from cattle that received growth promoting technologies including antibiotics, antimicrobials, added hormones, and supplements to adjust fat to lean meat. These technologies were used to maintain animal health and improve productivity.

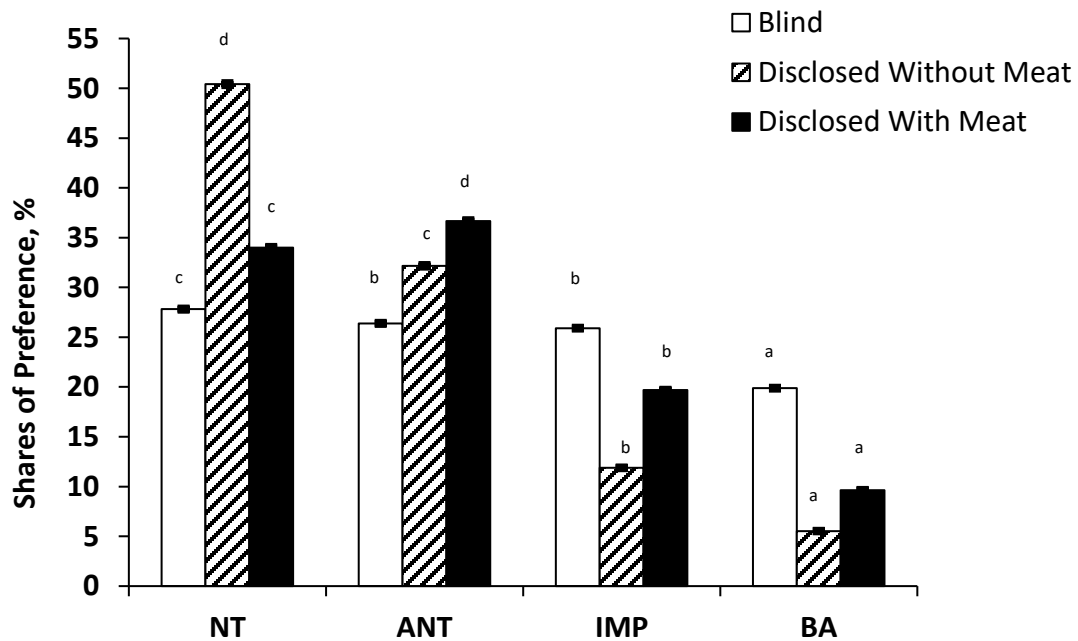


Figure 1. Comparison of consumer preferences for beef from different production systems among three consecutive panels