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The Beef-Steak Challenge: Providing Utah Beef Producers Market Insights Through Extension Programming

Abstract

The Beef-Steak Challenge was developed to give participants the opportunity to compare steak of varying quality grade and production methods in a blind-taste test. After comparing tenderness, juiciness, flavor, and overall acceptability of ribeye samples, participants, comprised of varying types of agricultural producers and consumers were able to determine significant differences between lower and higher quality grades. Wagyu and USDA-Prime samples were not statistically different in any palatability assessment, while grass-fed beef and USDA Choice finished similarly. Through the Beef-Steak Challenge, program participants can observe how carcass quality characteristics, and price premiums change depending on feeding and finishing methods combined with herd genetics.

Introduction

Consumer acceptance of beef has been associated with tenderness, juiciness, and flavor (Miller, 2020) and is increasingly influenced by their concerns about the safety,

healthfulness, quality, and nutritional content of the foods they consume (Xue et al., 2010). Prior to the 1990s, consumer preference for beef was based on tenderness, but as variation in this quality has decreased, flavor has become a more important driver for those consuming beef (Miller, 2020). Flavor intensity, as well as tenderness and juiciness, is based on meat quality, preparation methods, and animal production systems.

More than 80% of the beef produced and sold in Canada and approximately 85% of US beef is grain-finished in feedlots (McEwen et al., 2004; Umberger et al., 2009). The quality characteristics of grass-fed beef are different than those finished on grain in terms of marbling, color, meat texture, tenderness, juiciness, and flavor (Xue et al., 2010). Compared to grain finished beef, they tend to have yellower fat and lower fat thickness (Duckett et al., 2007). Feuz and Umberger (2001) found that only 23% of US consumers preferred grass-fed to corn-fed steaks while Cox et al. (2006) found that the preference difference was eliminated when grass-fed beef was prepared at home.

Wagyu (i.e., “Japanese cattle”), were originally draft animals used in agriculture, and were selected for physical endurance. This selection favored animals with more intramuscular fat cells, known as marbling (American Wagyu Association, 2023). Properly finished Wagyu beef provides a unique flavor profile, higher levels of oleic and conjugated linoleic fatty acids, and greater tenderness and marbling scores than meat from traditional beef breeds (Coleman, 2019). Wagyu cattle can take up to 25% longer to bring to market and are finished for 400-450 days on a grain diet (Farm and Dairy Staff, 2017) compared to conventional breeds that are normally finished for 120-240 days (New et al., 2020).

There are substantial differences in marbling ability across breeds of cattle, and within breeds of cattle (Herring, 2010). Heritability estimates for marbling range from .13 to .88 with a mean value of approximately .45 (Rios-Utrera et al., 2005). Marbling will respond to genetic selection in all breeds, but the amount of genetic variation is not constant within breeds (Herring, 2010). The relationship of marbling with other traits is probably not constant across all breeds. Genetically, external fat thickness does not predict

marbling because the phenotypic correlation between these two traits is close to zero (Smith et al., 2006). There is a higher, but not large genetic correlation between external fat and marbling (Herring, 2010). Simply relying on external fat thickness to predict marbling ability is ineffective and inefficient.

The Beef-Steak Challenge was designed as an activity to expose program participants to alternative beef market opportunities through their participation in a beef sensory quality panel at livestock education events. In-person education events are an integral part of traditional cooperative extension livestock education. These events expose participants to hands-on experiences for animal handling, forage estimation, and grazing practicums to promote profitable high-quality livestock production. However, it is less common to provide participants alternative livestock marketing experiences by inviting participants to taste various consumer products, in this case, a variety of market-labeled ribeye steaks. It was our assumption that participants become better informed about the beef products they make with different finishing methods (grass or grain-fed), body condition at slaughter (USDA beef grade), and animal genetics (specialty breeds).

Methods

Sample and data collection

The Beef-Steak Challenge was part of the program of activities for four Utah State University Extension hosted livestock education events held in 2020, 2021, 2022, and 2023. All participants in attendance were exposed to a beef quality sensory panel. At the same time, a paper survey was distributed to each participant. Survey completion was voluntary, and 102 individuals completed the survey during the six events. The survey consisted of three parts: (a) participant demographics, (b) beef quality, (c) product quality perception. The survey had 12 items and the panel and survey typically took 10-15 minutes to complete, depending on the number of steak samples analyzed. In 2020, 2021, 2022, and 2023, 27, 16, 24 and 36 survey responses were collected

respectively. Of these responses, seven were not fully completed for steak quality evaluation. Both incomplete and complete surveys were analyzed.

Meat selection and preparation

Beef rib roast samples were selected one day prior to the program. Samples were comprised of United State Department of Agriculture (USDA) grades Prime, Choice, Select and no-roll grain-finished beef, grain-finished Wagyu, and choice-graded, grass-finished beef. Six steaks approximately 1 inch thick were cut from 5 to 6-pound roasts, then trimmed to have <0.5 inches of subcutaneous fat around the *longissimus dorsi*. The steaks were grilled to internal temperatures that would achieve a degree of medium plate doneness after resting the samples off the grill. After cooking and resting, each sample was cut into 4 in³ portions with a three-digit numbered label for serving.

General sensory analysis and procedure

To encourage participation, the sensory panels were followed by dinner at all the events. Participation in the panel consisted of all present extension program participants. Panel participation was voluntary. Panelists were told that they would be evaluating samples of meat with different USDA beef grades and finishing methods. The panelists were not made aware of which product corresponded with the three-digit label until after the survey responses were recorded. Samples arrived in successions that were randomized with two to three minutes between samples. Beef quality was rated on a scale from 1 (no intensity, terrible) to 9 (very high intensity, exceptional) for juiciness, tenderness, flavor, and overall satisfaction. Panelists also answered questions about their level of expertise at evaluating meat, their perception of the marketability and value of each sample, their frequency of buying and consuming beef, whether they produce and consume their own beef, and any comments on the samples.

Data analysis

Data for tenderness, juiciness, flavor, and overall acceptability were analyzed by analysis of variance and Bonferroni test post hoc. Participants also determined which of

the six samples they found the highest quality, the lowest quality, and the most marketable. A chart of frequency analysis was made for participant preference 1 (no intensity, terrible) to 9 (very high intensity, exceptional) and each sensory quality attribute (Figures 1 and 2).

Results

Participants ranged in age from 7 to 73 with an average age of 34 years and a median age of 31. Of those participants who provided the information, 60% were cow/calf producers while 40% had an interest in raising cattle in a pasture setting. Average scores for tenderness, juiciness, flavor, and overall satisfaction are shown in Table 1.

Table 1: Average scores from 1 (no intensity, terrible) to 9 (high intensity, exceptional) for Tenderness, Juiciness, Flavor, and Overall Satisfaction for each of 6 ribeye samples identified by USDA Quality Grade, genetic origin, or finishing method.

Sample Classification	-----Average Score (1 to 9)-----			
	Tenderness	Juiciness	Flavor	Overall
No-Roll (n=102)	5.9 _a	6.0 _a	6.2 _{ab}	6.1 _a
Select (n=102)	6.4 _{ab}	6.3 _a	6.1 _a	6.4 _{ab}
Choice (n=79)	6.8 _{bc}	6.7 _{ab}	6.5 _{ab}	6.8 _{abc}
Prime (n=102)	7.7 _d	7.8 _c	7.2 _c	7.5 _c
Wagyu (n=54)	7.5 _{cd}	7.6 _c	7.3 _c	7.4 _c
Grass Fed (n=74)	6.7 _{abc}	7.3 _{bc}	6.8 _{bc}	6.9 _c

Note: means with the same letter are not significant ($p \geq 0.05$).

Prime and Wagyu scored higher than Select and No-Roll ($p < 0.05$) in all categories. No significant difference was observed between Prime and Wagyu in all categories. The quality of Choice and Grass-Fed beef was similar to Prime and Wagyu, but the overall satisfaction of Choice was not significantly different from Select and No-Roll beef. No-Roll and Select samples averaged the lowest scores. Over 80% of the scores given by participants were 5 or higher (Figure 1). Wagyu and Prime samples received more than 50% 8's and 9's and had a very similar pattern. Of those participants who answered the questions (n = 54), "Which sample do you think is the highest quality?", "Which sample do you think is the lowest quality?", and "Which sample do you think is the most

marketable?”, the majority found the Prime, Wagyu, and Grass-Fed samples to be the highest quality, while Choice, Prime, and Wagyu samples were found to be the most marketable (Figure 2). No-Roll, Select, and Grass-Fed had higher frequencies for lowest quality selection than Choice, Prime, and Wagyu.

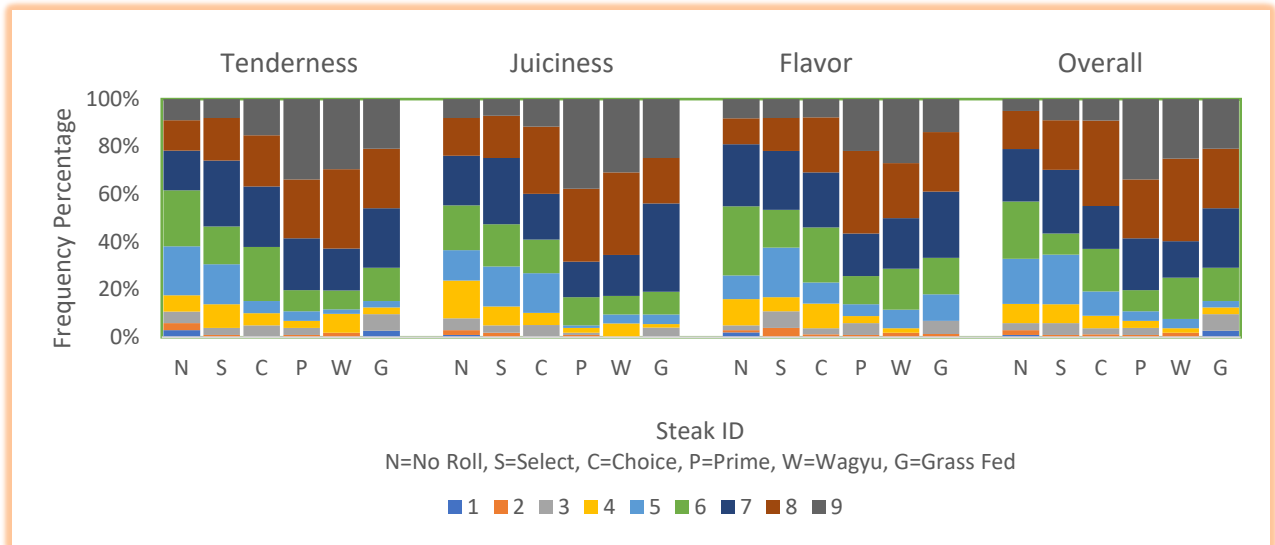


Figure 1: Frequency percentage of each score from 1-9 for each attribute and steak sample.

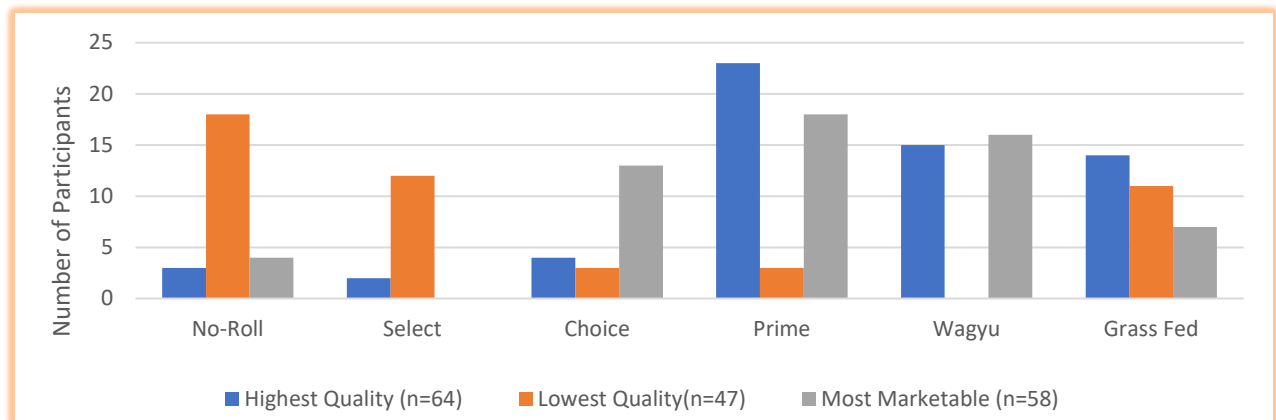


Figure 2: Participant perception of quality and marketability by number of participants.

Discussion

The purpose of the Beef-Steak Challenge was to expose participants at the extension programming, particularly beef producers and those with a desire to produce beef, to

alternative beef market opportunities through their participation in a beef sensory quality panel. The challenge was performed primarily at grazing and beef education programming. Participants were able to identify differences in quality, as measured by tenderness, juiciness, flavor, and overall satisfaction, between lower USDA graded samples (No-Roll and Select) and USDA Prime samples. They were not able to distinguish quality differences between USDA Prime samples and Wagyu ribeye. Grass finished beef was not significantly different in quality than Choice or Wagyu ribeye.

The Beef-Steak Challenge illustrates to producers that those samples with a premium price in the grocery store – Prime, Wagyu, or Grass-Fed – are also high in consumer acceptability as measured by tenderness, juiciness, and flavor. Alternative breeding such as Wagyu or Wagyu crosses or finishing cattle on forage are niche market opportunities for producers, but the quality of the product does not exceed that of raising Prime-graded beef of any breed. Although grass-fed beef was graded slightly lower on flavor, U.S. consumer demand for beef raised under alternative production systems, such as a grass-fed beef system, is rising (Mathews et al., 2013) due to consumer and producer perceptions of health and environmental benefits associated with beef raised exclusively on pasture and forage, without grain (Crandell, 2018; Sitienei et al., 2020).

Conventional cow/calf producers seek ways to improve profitability in their operations. Grass-fed carcasses sell for a premium (approximately \$5/lb more than Choice for the ribeye samples purchased in this study) and there is a growing demand for this beef (Crandell, 2018; Matthews, 2013). Such consumers also prefer organic, antibiotic-free production methods that can increase production costs (Matthews, 2013). Grass-fed production can be more expensive, as much as 25% more (Mayer, 1999), especially in parts of the country with less year-round quality forage (Mathews et al., 2010). Grass-finishing normally requires an additional seven to twelve months of feeding as compared to grain-finishing cattle. The cost savings in feeding forage versus grain could potentially be offset by the additional time required for finishing, depending on the climate, labor costs final market price.

Wagyu breeding produces beef that is highly marbled, tender, and desirable to consumers and sells for a premium (approximately \$15/lb more than Choice for the ribeye samples purchased in this study). According to a Radunz (2009) Wagyu took an average of 77 days longer on the same feedlot rations to reach slaughter weight than angus. It can take ten to eighteen months longer than traditional cattle breeds to finish to the degree of intense marbling desired by consumers. Wagyu genetics are less accessible and can be considerably more expensive than those of traditional breeds. In the Beef-Steak Challenge, USDA-graded Prime ribeye steaks were statistically the same in tenderness, juiciness, flavor, and overall quality to Wagyu samples and only differed in tenderness from Grass-Fed.

For future programming, a sous vide method of cooking will be utilized. A sous-vide cooked steak is vacuum sealed and cooked in hot water until desired internal temperature is reached then seared before serving. Utilizing this cooking method allows for extremely precise and even cooking, ensuring every participant has a steak cooked to the same temperature. It also allows for more time between serving rounds as meat can stay in the precisely heated hot water until participants are ready to taste the next sample.

Conclusions

By carefully selecting for specific genetics, cow/calf producers can increase the amount of marbling in carcasses, leading to a higher percentage of animals that will grade Prime. Genetic testing then allows producers to sell calves with a genetic predisposition for higher marbling at a premium, using the same breeding and production methods already present in the herd. By participating in and seeing results from years of steak challenge data, producers can evaluate the value consumers put on certain production practices. Understanding meat grades and consumer preferences can help determine what production practices they can employ to increase carcass quality to improve profitability in their cow/calf operation.

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