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Consumer Acceptance and Value of Beef from Various Countries of Origin

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Summary

To determine consumer acceptance and value of beef from various countries, 12 taste panels were conducted in each of two cities. Two pairs of beef strip steaks were evaluated - domestic versus Australian grass-fed and domestic versus Canadian. Consumers gave significantly higher scores for flavor, tenderness and overall acceptability to domestic steaks compared to Australian grass-fed steaks and Canadian steaks. A significantly higher value also was placed on the domestic samples compared to Australian grass-fed steaks ($3.68/lb versus $2.48/lb) and Canadian steaks ($3.95/lb versus $3.57/lb). U.S. consumers preferred and were willing to pay significantly more for domestic steaks than Australian and Canadian steaks.

Introduction

With the increasing trend of global trade, more meat products from various countries are imported into the United States. The imported fresh meat may include grain-finished or grass-finished beef, depending on the country of origin. Flavor differences may exist because of the different production systems and different lengths of cooler aging. Previous research (2001 Nebraska Beef Report, pp. 96-98) showed consumers detected sensory differences and placed greater value on steaks with moderate or modest marbling compared to steaks with slight marbling, even when tenderness was held constant. The following research was conducted to determine sensory differences and consumer value of domestic grain-fed beef steaks compared to steaks from grass-fed beef in Australia and grain-fed beef in Cananda.

Procedure

Steak Preparation

Fresh (unfrozen) Australian grass-fed and Canadian AAA beef strip loins (IMPS #180) were purchased from a beef importing company and domestic strip loins were purchased from a commercial meat plant in Nebraska. Two pairs of loins were compared by each taste panel: 1) Australian grass-fed versus domestic and 2) Canadian versus domestic. To the extent possible, steaks were paired to similar Warner-Bratzler tenderness scores and visual marbling scores to reduce variation within the pair. The aging period varied for each category, due to shipping. The aging period for this study was defined as the time from the vacuum packing date to the date the steaks were frozen for storage. The domestic strip loins were aged for 8 to 11 days to simulate the average storage time of fresh beef from the packing plant to the meat counter. The Australian grass-fed strip loins were aged the longest, for 67 to 73 days. The Canadian strip loins were aged for 24 days. Although the aging times were not consistent, they do reflect actual periods of aging available for these products in the marketplace.

The strip loins were cut into one-inch thick steaks. The first steak was used for marbling score and proximate analysis. The second steak from the anterior end of the loin was used to determine Warner-Bratzler shear value. The third and fourth steaks were evaluated by the taste panels. The remaining steaks were sold in an auction, in which the consumers could participate. After cutting, the steaks were stored in a -8°F freezer. The steaks were shipped frozen via airmail to the host facilities in Denver and Chicago.

Auction Procedures

Immediately before the panel, panelists received a $50 participation payment, which the panelists could use to bid on steaks they tasted. Panelists were not required to bid. However, if panelists chose to bid and won a non-practice auction, the panelist was required to pay for the beef. A dialogue explaining the auction procedure was read. Steaks, approximately one pound, which the panelists bought, were taken from the same strip loin as the taste sample. A reference price of $7/lb was given prior to auctions. One steak from each pair was a binding auction, although the panelists did not know which auctions were binding. The panelist tasted a pair of samples, rated them for several sensory properties, and then submitted silent, sealed bids on each steak.

A variation (the number of winners per sample was randomly assigned) of the Vickery (uniform-price) auction was utilized. An n^{th}

(Continued on next page)

price auction (n = 2, 3, or 4) determined the purchase price, or the amount the winner(s) paid, for the steak. In a 2nd price auction, the second highest bid was the purchase price the highest bidder paid for the steak. For a 3rd price auction, the third highest bid set the purchase price for the steak, and the highest and second highest bidder paid only the price of the third highest bid. The 4th price auction resulted in three winners.

Since the winners of the auctions do not pay the amount they bid, it is in the best interest of the consumer to bid the exact amount he or she is willing to pay for a sample. Consumers who underbid risk the chance of losing the auction, while consumers who overbid risk overpaying for the item. The best strategy is to bid the highest value the panelist is willing to pay for each item.

Three practice auctions were conducted to familiarize the panelists with the auction procedure. The third practice auction had a warm-up sensory sample to familiarize the panelists with the sensory evaluation process and flavor, juiciness and tenderness traits. If a panelist chose to bid "$0" for a sample, the panelist was asked to provide a written explanation of why he or she chose not to bid.

Taste Panels

Taste panel steaks were thawed in a 40°F refrigerator for 24 hours prior to taste panels. The steaks were trimmed of excess fat and cooked to an internal temperature of 158°F on Farberware Open Hearth Broilers (Farberware Co., Bronx, NY). After cooking, the steaks were cut into 0.4 x 0.4 x 1 inch cubes, wrapped in aluminum packets and labeled appropriately. Samples were held in a double broiler at approximately 104°F for 20 minutes or less until served. A single piece of steak was served to each panelist on a labeled plate. Water and unsalted saltine crackers were provided to the panelists to cleanse their palates between samples.

Samples were rated on an 8-point hedonic scale, where 1 = extremely undesirable and 8 = extremely desirable. One sample from the pair was served and evaluated for desirability of flavor, juiciness, tenderness and overall acceptability. The second sample of the pair then was served and evaluated for sensory traits. After both samples had been evaluated for

Table 1. Taste panel ratings[a] for domestic, Australian, and Canadian strip steaks matched by shear force and marbling

Pair	Flavor	Juiciness	Tenderness	Overall Acceptability
Australian	4.58	4.49	4.38	4.34
Domestic	5.67	5.20	5.17	5.37
Difference	-1.09	-0.71	-0.79	-1.03
Significance (P-value)	.01	.01	.01	.01
Canadian	5.64	5.36	5.37	5.49
Domestic	5.94	5.53	5.67	5.79
Difference	-0.30	-0.17	-0.30	-0.30
Significance (P-value)	.01	.09	.01	.01

[a]Taste panel scores (n = 273) were based on an eight-point hedonic scale, where 1 = Extremely undesirable, 2 = Very undesirable, 3 = Moderately undesirable, 4 = Slightly undesirable, 5 = Slightly desirable, 6 = Moderately desirable, 7 = Very desirable, and 8 = Extremely desirable.

Table 2. Auction data[a] for taste panel evaluations for domestic, Australian, and Canadian strip steaks matched by shear force and marbling.

Pair	Bid ($/lb)
Australian	2.48
Domestic	3.68
Difference	-1.20
Significance (P-value)	.01
Canadian	3.57
Domestic	3.95
Difference	-0.38
Significance (P-value)	.01

[a]Consumers (n = 40) who bid $0 for all samples were removed from the bid data set (n = 233).

Table 3. Bids from consumers[a] with different preferences for domestic, Australian grass-fed, and Canadian steaks.

	Preference		
	Australian ($/lb)	Domestic($/lb)	No Preference($/lb)
Australian	3.53	2.03	3.12
Domestic	2.15	4.26	3.05
Difference	1.38	-2.23	0.07
Significance (P-value)	.01	.01	.85
	Preference		
	Canadian ($/lb)	Domestic($/lb)	No Preference($/lb)
Canadian	4.57	2.85	3.67
Domestic	3.20	4.48	3.92
Difference	1.37	-1.63	-0.25
Significance (P-value)	.01	.01	.29

[a]Consumers (n=40) who bid $0 for all samples were removed from the bid data set (n = 233). Preference based on overall acceptability ratings.

sensory traits, the panelists bid on both samples at the same time. At the end of the auction, panelists were informed of the "purchase price" and whether they had won or lost the auction. This procedure was repeated for the remaining pairs of steaks.

The steaks to be sold (which auctions were binding) were announced after the entire taste panel was completed.

Statistical Analysis

All 273 panelists were included in the sensory evaluation portion of the analysis. If a panelist bid $0 per pound for all of the samples, the panelist was removed from the auction portion of the analysis, leaving 233 panelists for the analysis. Differences in sensory panel evaluation and auction data were analyzed using the PROC MIXED procedure of SAS.

Results

Consumers rated domestic beef significantly higher ($P < .01$) than Australian grass-fed beef for desirability of flavor, juiciness, tenderness and overall acceptability (Table 1), even though there were no differences in shear force. The largest sensory difference for the Australian and domestic pair was flavor. Consumers' comments frequently included reference to off-flavors and off-odors, possibly due to the longer aging periods for the Australian samples. Aging beef for 10 days in a study by Xiong et al. (Food Res. Internat., 29:27) caused frequency of off-flavors to double. Since the Australian samples were vacuum-aged for 67 to 73 days during shipping and storage, significant flavors could have developed. The diet of the animal also influences the flavor of beef. Xiong et al. also noted grassy flavors and off-flavors were significantly more pronounced in grass-fed steers than grain-supplemented steers. Higher beef flavor intensity was observed for corn-fed steers than steers finished on grass (J. Anim. Sci., 66:892). Due to the overwhelming predominance of corn-fed beef harvested in Nebraska packing plants, the domestic strip loins were assumed to be corn-fed, possibly influencing the preferred flavor of the domestic steaks. Even though marbling score was matched as closely as possible, the average percent fat for Australian samples was 2.46% less ($P < 0.01$) than the average domestic samples (8.58 versus 6.12%, respectively), which may have influenced higher juiciness scores for domestic samples.

Consumers placed a significantly higher ($P < 0.01$) value on domestic samples than Australian samples (Table 2). On average, consumers were willing to pay $3.68/lb for domestic steaks, while Australian steaks were valued at $2.68/lb. When consumer preference was defined as the highest overall acceptability score within a pair, a majority of the 273 consumers preferred domestic to Australian grass-fed samples. More consumers favored domestic (64.5%) than Australian grass-fed (19.0%) beef; however, 16.5% of the consumers did not have a preference. Consumers were willing to pay significantly for their preference, whether Australian grass-fed or domestic samples (Table 3).

More barley than corn is produced in Canada. Over 14 million metric tons of barley were produced in Canada in 2000 to 2001. Since only 8.23 million metric tons of corn were produced in Canada the same year, the beef from the Canadian supplier was assumed to be barley-fed.

Ratings for desirability of domestic beef flavor, tenderness and overall acceptability were significantly higher ($P < 0.01$) than Canadian beef (Table 1). Significant flavor differences ($P < 0.01$) between domestic and Canadian beef agrees with results from a study (Can. J. Anim. Sci., 78:271) in which barley-fed beef was rated higher for undesirable flavor compared to corn-fed beef. They also agree with results of a trained flavor profile panel that observed corn-fed beef to have slightly, but significantly, better well-balanced and well-blended flavor attributes (J. Anim. Sci., 78:1837), although the magnitude of differences were relatively small. The difference in value between domestic and Canadian samples was not as great as between domestic and Australian samples (Table 2). Consumers valued domestic beef at $3.95/lb, while $3.57/lb was the average bid for Canadian samples. When consumers were divided according to preference (Table 3), 44% of the consumers preferred the domestic samples, while 29.3% favored the Canadian samples; 26.7% of consumers had no preference. Consumers were willing to pay significantly more for their preference.

American consumers favor domestic beef compared to Australian grass-fed or Canadian beef. Overall acceptability and willingness-to-pay for domestic samples were significantly higher than Australian samples and Canadian samples. Different feeding regimes of the countries, various aging periods, or cattle breed may impact the flavor and overall acceptability for Australian grass-fed and Canadian samples. Since a steady supply of corn-fed beef is available to most consumers in the United States, consumers may have become accustomed to and prefer the flavor of corn-fed beef.

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