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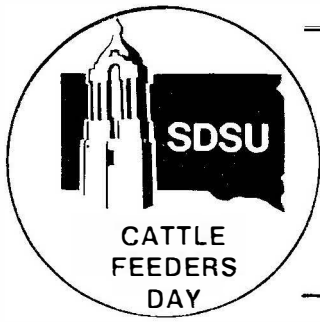
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PREDICTING BEEF PALATABILITY
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Introduction

The search for factors influencing the palatability of beef continues. The relative importance of variables in the USDA quality grading system that currently predicts acceptability and palatability of beef has been questioned. The effect of marbling on palatability is one of the more controversial aspects. Marbling is one of the prime factors in determining the quality grade of a beef carcass and researchers have shown that other variables may play an equal or more important role in influencing the eating quality of beef.

The purpose of this study was to evaluate the accuracy of commonly-used predictors of palatability and to consider the possible influence of other carcass measures as predictors of palatability. Palatability, as defined in this study, was measured by the subjective taste panel scores for flavor, juiciness and tenderness. Tenderness was measured objectively with the Warner-Bratzler shear instrument.

Procedures

Carcasses from 376 steers and heifers produced from straightbred Angus, straight bred Charolais and reciprocal cross cows born in 1970, 1971 and 1972 were the source of detailed carcass quality and yield data as well as taste panel palatability scores, Warner-Bratzler shear tenderness tests, cooking loss and chemical composition data on steaks from the 12th-13th rib of the rib eye (longissimus) muscle. All progeny in a given year were from the same sire and were raised to weaning on pasture or in drylot. Sire breeds used for each calf crop were Polled Hereford (1972, 1973, 1974), Salers (1975), Limousin (1976) and Simmental (1977).

Postweaning rations were fed individually ad libitum and are shown in table 1. Steers and heifers were switched from the starting to finishing ration at 700 and 625 pounds and fed for an additional 140 and 119 days, respectively, prior to slaughter. Upon switching diets, heifers were implanted with Synovex-H and steers with Synovex-S.

Results

Means and ranges of variables studied for their influence on palatability are given in table 2. Carcasses ranged from low Standard to low Prime and averaged high Good quality grade. Marbling score mean was 4.4 (slight). Percentages for moisture, protein and fat in the rib eye steak were 72.8, 21.1 and 4.1%, respectively. Taste panel traits measured on a scale of 1 (high score) to 8 (low score) averaged moderately tender (3.3), desirable flavor (2.9) and slightly juicy (3.9).

TABLE 1. RATIONS FOR POSTWEANING GROWTH

Ingredients	% Composition	
	Starting ration	Finishing ration
Ground shelled corn	58	85
Oats	16	
Chopped alfalfa hay	10	10
Alfalfa pellets	10	
Soybean meal (44%)	4	3
Antibiotic and vitamin A premix	2	2

Tenderness evaluation

Year, breed of dam, management system and age of dam effects were responsible for 30 and 33% of the difference in taste panel tenderness and shear tenderness, respectively. Prediction equations using all independent variables studied (table 2) were used to evaluate other possible predictors which might contribute to differences in the two measures of tenderness (table 3, a through c). The equation generated from b increased the accuracy of prediction by another 8% in both taste panel tenderness and Warner-Bratzler shear scores. Marbling explained 0.5 and 0.6% of variation alone for taste panel tenderness and Warner-Bratzler shear tenderness and was not one of the major predictors of tenderness in either case.

Four commonly-used quality grade factors (marbling, maturity, firmness of lean and color of lean) were used to assess their influence on tenderness (table 3, c). In both equations, these four predictors explained less than 1% of the differences in tenderness of beef. These results indicate that marbling plays a minor role in palatability of beef (as defined by tenderness)--far less importance than is accorded it in the beef grading industry today.

Flavor and juiciness evaluation

Similar analyses to a, b and c were performed on palatability as defined by flavor and juiciness. These are given in table 3, segments d, e and f.

Year, breed of dam and year by breed of dam interactions accounted for 44% of variation in both juiciness and flavor. Equations generated from e (table 3), which included all independent variables, increased the accuracy of predicting juiciness and flavor differences by 8 and 6%, respectively. Marbling was not a major influence as it explained less than 1% of the variation for both flavor and juiciness. As in the tenderness equation, the four quality grade factors (marbling, maturity, color and firmness) explained .5 and 1.1% of variation in flavor and juiciness. The amount of variation explained by d-f (table 3) indicates that marbling plays a minor role in palatability of beef as defined by flavor and juiciness. These results along with the tenderness evaluation indicate relatively little value for the quality grade predictors used today. Efforts to find better predictors of eating quality of beef appear worthy of increased support in order that carcass predictions in the cooler will more nearly reflect consumer acceptance.

TABLE 2. MEANS AND RANGES FOR CARCASS DATA, CHEMICAL MEASURES AND TASTE PANEL DATA

Variable	Mean	Range
Measured carcass data		
Carcass weight, lb	611.8	436-821
Rib eye area, in ²	12.1	8-17.4
Fat thickness, in	.4	.05-1.0
Kidney, pelvic, heart fat, %	2.5	1-4.5
Yield grade ^a	2.4	.1-5.2
Maturity ^b	23.4	20-24
Marbling ^c	4.4	1-11
Color of lean of rib eye ^d	4.8	2-7
Firmness of lean of rib eye ^e	5.6	4-7
Quality grade ^f	17.9	13-22
Fat trim, %	23.3	7.9-41.1
Round fat weight, side, lb	10.7	3.3-20.8
Fat weight, side, lb	68.0	22.1-114.0
Chemical analysis		
Moisture, %	72.8	67.8-76.5
Protein, %	21.1	18.5-23.1
Fat, %	4.1	.6-11.0
Slaughter age, days	430.2	350-557
Carcass hang time in cooler, days	16.7	10-34
Steak storage time in freezer, days	254.7	25-461
Cooking loss, %	24.7	11.3-37.3
Taste panel		
Tenderness score ^g	3.3	1.3-6.3
Flavor score ^h	2.9	1.6-4.5
Juiciness score ⁱ	3.9	1.8-6.3
Warner Bratzler shear, lb/in ²	13.3	6.4-26.0

^aYield grade scale: 1 to 10, where 1 = high yield and 10 = low yield.

^bMaturity scale: 13 to 24, where 13 = old and 24 = young.

^cMarbling score: 1 to 11, where 1 = devoid and 11 = very abundant.

^dColor scale: 1 to 7, where 1 = very dark red and 7 = dry pink.

^eFirmness scale: 1 to 7, where 1 = extra soft and 7 = very firm.

^fQuality grade scale: 13 to 24, where 14 = Standard, 17 = Good, 20 = Choice and 23 = Prime.

^gTenderness scale: 1 to 8 where 1 = extremely tender and 8 = extremely tough.

^hFlavor scale: 1 to 8, where 1 = desirable and 8 = undesirable.

ⁱJuiciness scale: 1 to 8, where 1 = extremely juicy and 8 = extremely dry.

TABLE 3. CARCASS QUALITY, CARCASS YIELD AND CHEMICAL COMPOSITION DATA AS PREDICTORS OF PALATABILITY OF BEEF^a

Independent variables		
Carcass weight, lb	Fat trim, %	
Rib eye area, in ²	Round fat weight, side, lb	
Fat thickness, in	Fat weight, side, lb	
Kidney, pelvic and heart fat, %	Cooking loss, %	
Yield grade ^b	Moisture content in rib eye, %	
Maturity ^c	Protein content in rib eye, %	
Marbling ^d	Fat content in rib eye, %	
Color of lean of rib eye ^e	Slaughter age, days	
Firmness of lean of rib eye ^f	Carcass hang time in cooler, days	
Quality grade ^g	Steak storage time in freezer, days	
	Accuracy (R ²) of prediction for:	
	Taste panel	Warner-Bratzler
Predicting tenderness	tenderness	shear tenderness
a. Year, breed of dam, management system and age of dam	30	33
b. a. + all independent variables	38	41
c. a. + marbling, maturity and color and firmness of lean	30	34
	Accuracy (R ²) of prediction for:	
	Taste panel	Taste panel
Predicting flavor and juiciness	flavor	juiciness
d. Year, breed of dam and year by breed of dam interaction	44	44
e. d. + all independent variables	50	52
f. d. + marbling, maturity and color and firmness of lean	44	45

^aPalatability of beef was measured by taste panel tenderness, flavor and juiciness and by Warner-Bratzler shear tenderness test.
^bYield grade scale: 1 to 10, where 1 = high yield and 10 = low yield.
^cMaturity scale: 13 to 24, where 13 = old and 24 = young.
^dMarbling score: 1 to 11, where 1 = devoid and 11 = very abundant.
^eColor scale: 1 to 7, where 1 = very dark red and 7 = very pink.
^fFirmness scale: 1 to 7, where 1 = extremely soft and 7 = very firm.
^gQuality grade scale: 13 to 24, where 14 = Standard, 17 = Good, 20 = Choice and 23 = Prime.