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ALTERNATE CARCASS LOCATIONS USED TO PREDICT PORK FOUR LEAN CUTS AT VARYING TRIM LEVELS

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INTRODUCTION

In recent years United States pork producers have concentrated on producing heavier, leaner, and more muscular pork carcasses. This is in response to consumer signals that reveal they desire a closely-trimmed and often times totally boneless product (Meeker and Sonka, 1994). As the value of heavier, leaner and more muscular carcasses increases, it is important for producers, packers, and retailers to become more familiar with the composition of their commodity. The objective of this study was to identify and utilize alternate independent variables of fat thickness and muscle area and depth from various carcass locations to develop prediction equations that most accurately and precisely predict various cutability endpoints.

MATERIALS AND METHODS

Pork carcasses (n=200) were selected at six commercial processing plants in major pork producing states based on current USDA grades for market hogs (USDA, 1984) by a trained USDA grader with a distribution as follows: 25% US #1, 37% US #2, 25% US #3, and 13% US #4. Carcasses were shipped to the Rosenthal Meat Science and Technology Center at Texas A&M University and sides were randomly assigned to two cutting procedures. Side A was stored at 0-3° C for no more than seven days and fabricated into regular trimmed, bone-in four lean cuts and belly as described by Cross et al. (1975). Side B was frozen at -40°C before being fabricated into major primals at trim levels of .64, .132, and 0 cm according to Grams (1992). Primals were then separated into knife separable fat, lean, and bone. During the fabrication of the bone-in four lean cuts side of the carcass, cross section slices were taken at the following locations: split of the 2nd rib shoulder slice (SS), 10th-11th (TEN), 12th-13th (TW) and 14th-15th (FT) rib interfaces, 90° across the femur at the approximate mid-point of the femur shank anterior slice (SA), and 4.08 cm anterior to the original femur cut for the rump anterior slice (RA). During fabrication of Side B a 1.28 cm cross section was removed from the midpoint of the posterior edge of the last lumbar vertebra and the anterior edge of the split surface of the pubic juncture (HL). Each slice was photographed before further fabrication onto 400 speed color slide film with a 30 cm ruler in the frame for scaling purposes. Each of the slides was scanned by a Nikon *Coolscan* color slide scanner (Nikon Inc., 1300 Walt Whitman Road, Melville, NY 11747-3064). Images then were analyzed using the public domain NIH image analysis program (written by Wayne Rasband at the U.S. National Institutes of Health and available from the Internet by anonymous FTP from zippy.nimh.nih.gov). SS1 and SS2 were fat depths taken at the dorsal and ventral edges of the scapula, respectively. SS3 was a muscle depth taken ventral to the scapula. SS4 was the area of the *Triceps brachii*. Measures for TEN included fat depth at the 1/4, 1/2, and 3/4 distance along the loin eye for TEN1, TEN3, and TEN5, respectively. Muscle depths (TEN2, TEN4, and TEN6) were taken from the same location as the fat depth measurements. The 10th rib loin eye area was recorded as TEN7. Measures for TW and FT were made and recorded in the same manner. RA1 and RA2 were fat depths, respectively, taken immediatly dorsal to the femur opposite the *semimembranosus* and distal to the femur at the approximate midpoint of the *Biceps femoris*. RA3 was a muscle depth taken at the same location as RA2. RA4 was the area of the large seam fat deposit between the major ham muscles. RA 5 and RA6 were respective area measures of the *Semitendinosus* and *Biceps femoris*. Measurements for SA were identical to RA. HL1 and HL2 were taken in locations analogous to RA1 and RA2. HL3 was muscle depth taken similar to RA3. HL4 was the area of the *Gluteus medius*. Statistical analysis included running stepwise regression procedures with a linear model utilizing fat and muscle measures to predict various yields of four lean cuts (SAS 1991). Best one; two; and three-variable equations were selected according to MacNeil (1983). For all equations selected intercept, b values, standard error of the b value, coefficient of determination (R^2), Mallow's C_p statistic (C_p), and root mean square error (RMSE) were reported.

RESULTS

Table 1 reported the best one; two; and three-variable equations for carcass yields of regular trimmed, bone-in four lean cuts (RTFLC). Equation 1 used the fat depth at the twelfth rib to explain 77% of the variation RTFLC. Equation 2 changed the location along the axis of the twelfth rib and added a fat measurement from the center portion of the ham,

Table 1. Best one; two; and three-variable regression equations for predicting carcass yields of regular trimmed, bone-in four lean cuts

Equation[a]	Ind. Var.	Intercept	b Values	SE	R^2	Cp[b]	RMSE[c]
1	TW5	73.69	-3.99	.48	.77	59.97	1.84
2	TW3	73.91	-3.38	.20	.77	33.61	1.86
	SA1		-1.19	.38			
3	FT2	69.02	1.00	.21	.83	23.39	1.61
	FT3		-3.63	.18			
	SA1		-1.17	.32			

[a]All equations were significant at .001.
[b]Mallows Cp.
[c]Root Mean Square Error.

Table 2. Best one; two; and three-variable regression equations for predicting carcass yields of 0 cm boneless seam fat removed four lean cuts

Equation[a]	Ind. Var.	Intercept	b Values	SE	R^2	Cp[b]	RMSE[c]
4	TW3	44.84	-4.52	.78	.74	112.0	2.41
5	TEN2	40.48	1.64	.30	.80	66.99	2.14
	TW5		-4.40	.25			
6	TEN3	41.25	-2.55	.29	.83	47.94	2.01
	SS2		-3.03	.49			
	HL3		1.03	.19			

[a]All equations were significant at .001.
[b]Mallows Cp.
[c]Root Mean Square Error.

and could not improve on the amount of variation explained by the independent variables. However, equation 3 used the same fat measure from the ham, a fat measurement from the last rib, and incorporated a muscle depth measure from the last rib to explain 83% of the variation while reducing the error of prediction. Cross et al. (1975) used a three-variable equation of average backfat, carcass length, and ham muscle score to account for 83.41% of the variation in RTFLC in a population that varied in fat and muscle. Table 2 reported equations to predict carcass yields of 0 cm, boneless, seam fat removed four lean cuts (SF4LC). Equation 4 used twelfth rib fat depth to account for 74% of the variation in SF4LC. Equation 5 changed the location of measurement on the twelfth rib and added loin muscle depth from the tenth rib to account for 6% more of the variation while lowering the error of prediction and C_p. Equation 6 used two muscle depths, one from the tenth rib and one from the ham/loin juncture, and a fat depth from the shoulder/loin juncture ventral to the scapula to predict 83% of the variation in SF4LC. Results show error of prediction increased in this population as the predicted endpoint became boneless and more closely trimmed. This is evidenced by the higher RMSE, C_p, and standard error of b values when compared between one; two; and three-variable equations predicting the two endpoints. Three-variable equations using measures of fat and muscle from locations of the carcass not typically measured to predict pork cutability can be utilized to predict composition at various compositional endpoints

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