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Estimation of Pork Trim Composition by Electromagnetic Scanning

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The value of pork trim depends on its lean content. Accurate assessment of composition is necessary for proper pricing. Procedures often used to estimate composition lack accuracy and require time, thus a rapid, accurate, non-invasive technology to determine lean content of pork trim is needed.

Electromagnetic scanning, also known as ToBEC (total body electrical conductivity), has been studied for prediction of lean in hams (see 1994 Swine Report, p. 8). The equipment consists of a stainless steel cabinet containing a large, plastic-covered coil, through which meat is conveyed. Energy is absorbed from the electromagnetic field by the sample. Because lean is more conductive than fat, the peak of the scanning curve is highly related to lean content. Prior research has demonstrated a strong relationship between electromagnetic scanning and pork carcass lean content (see 1994 Swine Report, p. 5). This study was conducted to evaluate electromagnetic scanning for estimation of pork trim composition.

Materials and Methods

Right sides from 74 carcasses were chilled and boned. Boneless pork trim from each side was allocated to plastic tubs and standardized to 70 lb (n = 51) or 40 lb (n = 23). Animal variation prevented uniform weights of trim. Temperature of trim was recorded and tubs were scanned in duplicate using an electromagnetic scanner at 2.5 MHz. Pork trim was ground to 2.5 cm in particle size and rescanned in duplicate. Oven drying and ether extraction were used to determine moisture and fat content.

Equations for prediction of fat-free lean weight and percentage were generated using peak of the scanning curve,

meat temperature and trim weight. All possible one-, two-, and three-variable equations were created, but results are presented only for those which had the highest R² with the lowest root mean square error.

Results and Discussion

Although an attempt was made to standardize trim weight, a small variation existed (Table 1). This occurred because some sides yielded less lean trim than the target weight. The pork trim was quite variable in composition, slightly more so for those allocated to a target weight of 70 pounds (Table 1). Differences in tub weight resulted in much lower peaks of the scanning curves for the 40-pound tubs (\bar{x} = 35) than the 70-pound samples (\bar{x} = 108).

Because peak of the scan curve is influenced by sample size and temperature, these variables were included in the analysis. Alone, neither sample size

or temperature accounted for much of the variation in composition (Table 2). There was a strong association between peak of the scan curve and fat-free lean content (Table 2). The magnitude of this correlation was greater for the 70-pound sample than the 40-pound sample. The manufacturer specifies a minimum sample size of 30-pounds for this scanning unit. It appears that sample sizes larger than 40 pounds are needed for maximum accuracy.

Nearly twice as much of the variation in fat-free lean content was explained in the 70-pound sample than in the 40-pound sample (Table 3). It was also apparent that grinding produces a more homogenous sample, which improved predictive accuracy in the heavier tubs. Meat temperature (for weight of fat-free lean) in conjunction with meat weight (for percentage fat-free lean) added small but significant improvements in prediction of

(Continued on next page)

Table 1. Characteristics of pork trim.

Tub weight, lb.	Trait	n	Mean	Standard deviation	Minimum	Maximum
70	Trim weight, lb.	51	69.9	0.42	67.8	70.0
	Lean trim temperature, F	51	43.2	2.49	39.0	50.0
	Ground lean temperature, F	51	43.9	2.52	41.0	52.0
	Fat-free lean weight, lb.	51	43.6	3.73	35.3	52.8
	Fat-free lean, %	51	62.4	5.38	50.5	75.5
40	Trim weight, lb.	23	40.0	0.10	39.5	40.0
	Lean trim temperature, F	23	41.8	4.16	36.9	49.0
	Ground lean temperature, F	23	44.0	3.75	39.6	51.0
	Fat-free lean weight, lb.	23	26.8	1.69	23.1	30.6
	Fat-free lean, %	23	67.0	4.25	57.6	76.4

Table 2. Correlation coefficients for pork trim and scanning characteristics to fat-free lean.

Tub weight, lb.	Particle Size	Fat-free lean weight			Fat-free lean, %		
		Meat temp.	Meat weight	Scan peak	Meat temp.	Meat weight	Scan peak
70	Lean trim	.05	.08	.83	.04	.15	.82
	Ground lean	.10	.03	.90	.11	.12	.89
40	Lean trim	.14	.20	.67	.12	.24	.67
	Ground lean	.12	.20	.60	.11	.24	.60



composition (Table 3) for the 70-pound samples. Conversely, neither grinding nor temperature nor weight improved prediction for the 40-pound samples.

Electromagnetic scanning is effective and accurate (within 2 pounds or < 3%) for prediction of fat-free lean in pork trim, presuming sample size is sufficient.

¹N. L. Meseck and B. L. Gwartney were graduate students, and C. R. Calkins is a Professor in the Animal Science Department at the University of Nebraska - Lincoln.

Table 3. Prediction of fat-free lean in pork trim.

Tub weight, lb.	Particle size	Fat-free lean weight			Fat-free lean, %		
		Model	R ²	RMSE, lb. ^a	Model	R ²	RMSE, %
70	Lean trim	Peak, temp.	.714	2.04	Peak, temp., wt.	.723	2.92
	Ground lean	Peak, temp.	.821	1.62	Peak, temp., wt.	.829	2.29
40	Lean trim	Peak	.451	1.28	Peak	.455	3.22
	Ground lean	Peak	.358	1.38	Peak	.362	3.48

^aRMSE = root mean square error.

Effect of Cooking Method on Nutrient Content of Boneless Pork Loin Roasts

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The nutritive qualities of boneless Chef's Prime™ pork loin roasts cooked by three household cooking methods to two internal temperatures were evaluated. Fresh pork loins were obtained from a vendor and prepared by UNL's Meat Laboratory according to National Pork Producers Council's specifications for the Chef's Prime™ trademarked cut with 1/8-inch fat trim. The roasts were frozen for less than two months before defrosting in the refrigerator and cooking.

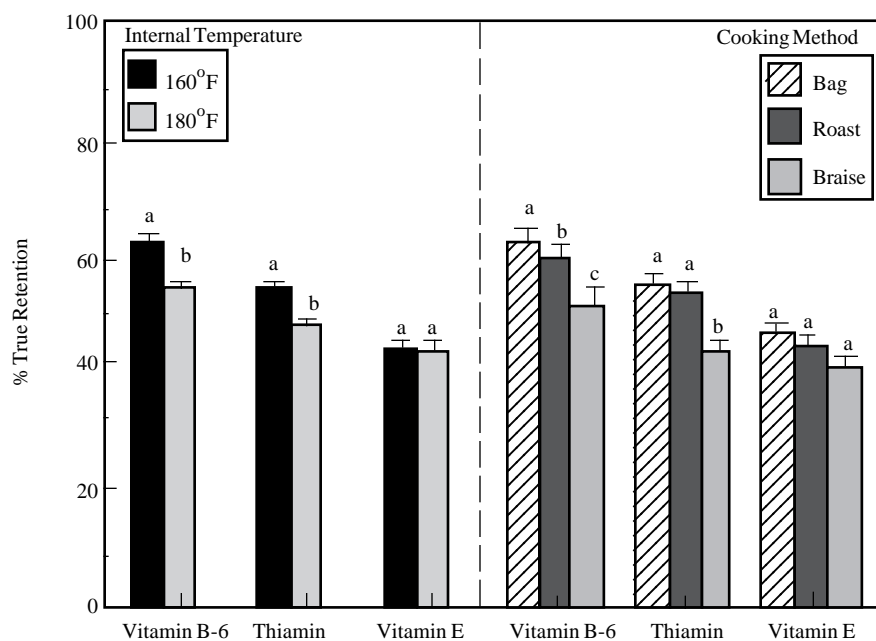
The National Pork Producers Council now recommends that pork be cooked to an endpoint internal temperature of 160° F rather than the previously recommended temperature of 180° F. This is because new swine production practices have reduced concerns about trichinosis. Roasts were cooked in a household oven at 325° F to internal temperatures of 160° F (the new recommendation) and 180° F (the former recommendation). The loins were cooked by roasting, braising, and cooking in a large (Reynolds) oven bag. The loin roasts were between 2.4 and 4 pounds. The average cooking times for the roasts are given in Table 1. Pork that was braised

Table 1. Average Cooking Time

Cooking method	Internal temperature	
	160° F	180° F
	(minutes)	
Roast	131	164
Braise	107	121
Bag	109	122

or cooked in a bag reached 160° F or 180° F internal temperature much more quickly than pork that was roasted. The cooked pork contained a mean of 68% moisture and 8% crude fat.

Pork cuts are "good" to "major" sources of many nutrients that Americans frequently consume in less than adequate quantities. These include



Values represent least squares means and standard errors.

Values for each nutrient not sharing a common superscript are significantly different at P < .01.

Figure 1. True Retention Values for Three Vitamins in Pork Roasts Prepared by Three Cooking Methods to Two Internal Temperatures