The Relationship Between Backfat and Loin Eye Area Measurements and the Weight of the Lean Cuts in Swine Carcasses

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Story in Brief

This study included the data from 190 slaughter barrows from the Ft. Reno swine breeding herd evaluated at the O.S.U. Live Animal Evaluating Center and Meat Laboratory in 1971 fall and 1972 spring. Barrows were removed from test as they weighed 220 lbs. and were evaluated for backfat thickness using the leanmeter probe and the scanogram. A Scanogram estimate of loin eye area at the tenth rib was also obtained. The whole body scintillation counter was used to obtain estimated pounds of lean cuts from the K^{40} count on the live pig. These estimates of fatness, loin area and lean cut yield were then compared to the actual carcass cutout data on the pigs.

The correlations between the various measurements of backfat thickness ranged from 0.57 to 0.69 with the scanogram backfat estimate and carcass backfat determination having the closest relationships. This would be expected since the probe backfat thickness readings were taken 1½ inches off midline while measurements for the other two methods were taken at the midline. In the first season, scanogram estimates of loin area were recalculated whenever marked differences were observed between the scanogram estimate and the carcass loin area. This insured a high correlation between the two estimates. In the second season, the two determinations of loin area were obtained independently and the correlation between the two methods was 0.49 compared to 0.80 for the first season. The average correlation between the actual weight of the lean cuts and the K^{40} estimate of lean cut yield was 0.56.

In order for a measurement to be considered a reliable predictor of lean yield, it should account for at least 90 percent of the variation in

yield. In these data, the variation in weight of lean cuts accounted for by the various measurements of backfat thickness, loin eye area or K^{40} count ranged from 13 to 41 percent. Using both backfat thickness and loin area measurements increased the predictability to a limited extent, but it was not sufficient to conclude that measures of loin area and backfat thickness on the live pig are adequate predictors of weight of lean cuts.

Introduction

Most carcass traits in swine are moderately to highly heritable. This means that one should attempt to measure the trait directly on potential breeding stock whenever possible rather than relying on the performance of relatives as an indicator of the animal's merit. For example, if a trait has a heritability of 50 percent, it takes about 100 full sibs to be equivalent to one record on the animal himself. Because performance data on relatives are not as accurate and the fact that carcass data are expensive to obtain, swine breeders are very much interested in obtaining measurements on the live animal that are reliable predictors of carcass merit.

Recently, ultrasonic estimates of backfat thickness and loin eye area have been widely used by the swine industry as indicators of carcass desirability. This study was initiated to determine the relative value of these estimates in predicting lean cut yield in swine.

Materials and Methods

A total of 190 market barrows of Duroc, Hampshire and Yorkshire breeding herds were used in this study. All pigs were self fed a 16 percent crude protein ration in confinement from weaning to 220 lbs. and were removed from test on a weekly basis as they reached 220 lbs. The data included approximately 10 purebred barrows from each of the three breeds and about 20 barrows from each two-breed cross combination (10 from each reciprocal combination). The pigs were randomly selected for evaluation each season as they completed test. The distribution by season and breed-type is shown in Table 1.

Probe backfat measurements were taken 1½ inches off the midline behind the shoulder, at the last rib and in front of the ham; and the average depth was used. The pigs were trucked to Stillwater and evaluated the next day at the O.S.U. Live Animal Evaluation Center after being held off feed and water over night. The Ithaco Scanogram Model 721 was used to obtain ultrasonic measurements of backfat thickness and loin area. This instrument combines the Branson Sonoray Animal

Table 1. Distribution of Barrows Evaluated by Year and Breeding

	Season Evaluated	
	1971	1972
Durocs	12	10
Hampshire	12	11
Yorkshire	12	10
Duroc-Hamp Crosses[1]	20	20
Duroc-York Crosses[1]	20	21
Hamp-York Crosses[1]	20	22
Total	96	94

[1] The reciprocal combinations are combined.

Tester, Model 12 with a Polaroid camera. The transducer (positioned in a guide which fits the curvature of the animal's body) and the Polaroid camera are linked together by means of a mechanically synchronized drive which moves the transducer along the animal's body at the same speed the camera is scanning the oscilloscope of the Sonoray.

When high frequency sound waves strike tissues differing in density, part of the high frequency energy passes into the second medium while the remaining energy is reflected back to the Sonoray and appears on the oscilloscope in the form of an "echo." The mechanism allows these "echoes" to be recorded on a Polaroid print from which interpretations for backfat thickness and loin eye area can be made. Readings for estimated backfat thickness were taken at the midline at three locations (the first rib, last rib and last lumbar vertebra). Loin eye area estimate was made at the tenth rib.

Each animal was evaluated in the O.S.U. K^{40} whole body scintillation counter. Five 1-minute counts were taken with background counts taken before and after the pig was confined to the chamber. The net K^{40} count was then used to predict pounds of lean cuts using the question:

$$43.876 + 0.00676\ (^{40}K\ \text{Count})$$

This equation was calculated from data on similar pigs evaluated and slaughtered in 1970 fall and reported in the 1972 Animal Sciences and Industry Research Report MP-87. This equation accounted for 55 percent of the variation in lean cut weight for the pigs evaluated in 1970.

Carcass backfat thickness was measured on each side of the carcass at the first rib, last rib, and the last lumbar vertebra; and the average depth was used. Carcass loin eye was measured between the tenth and eleventh rib before the outside fat was removed. Essentially all the out-

side fat was removed from the ham, loin, and shoulder prior to obtaining the total weight for these cuts.

The means and standard deviations for the traits evaluated each season are presented in Table 2. The 94 barrows evaluated in 1972 tended to have less backfat thickness, larger loin area, and heavier lean cut weights than the 96 barrows slaughtered the previous season, but the variability was similar for both seasons.

Results

The results obtained are presented in Tables 3, 4 and 5.

Relationship Between Different Measurements for the Same Trait

The pooled within breed group correlations for each season and the overall average are given in Table 3. Although the magnitude of the correlations between different backfat determination methods were similar, the scanogram and carcass backfat readings were in closest agreement. This would be expected since both were measured at the midline while the probe reading was taken 1½ inches off midline. The correlation between the scanogram estimate of loin eye area and the carcass loin eye measurement was considerably higher in 1971 than in 1972. Part of this discrepency was due to the fact that some scanogram pictures were recalculated the first year when a marked difference between the two estimates was obtained. This forced a high correlation between the two estimates. In order to more accurately reflect the true situation that occurs when evaluating breeding stock where the actual loin eye area is not known, all scanogram areas were obtained in 1972 without knowledge regarding the actual carcass loin eye area.

Table 2. Means and Standard Deviations by Year for Traits Evaluated

	1971		1972	
	Mean	Standard Deviation	Mean	Standard Deviation
Backfat Thickness, in.				
Probe	1.37	0.17	1.25	0.17
Scanogram	1.23	0.16	1.13	0.15
Carcass	1.24	0.15	1.19	0.14
Loin Eye Area, sq. in.	5.16	0.53	5.32	0.52
Carcass	4.84	0.57	4.92	0.67
Total Lean Cuts, lbs.				
K^{40} count estimate	82.73	4.37	81.24	4.03
Carcass cutout	85.03	4.62	88.54	4.66

Table 3. Pooled Within Breed Correlations Between Different Measurements for the Same Trait

	1971	1972	Overall Average
Backfat Thickness Measurements:			
Carcass and scanogram	.65	.69	.67
Carcass and probe	.46	.61	.53
Scanogram and probe	.57	.63	.60
Loin Eye Area Measurements:			
Carcass and scanogram	.80	.49	.65
Total Weight of Lean Cuts:			
Carcass and K^{40} count	.62	.51	.56

The K^{40} prediction equation accounted for 38 percent of the variation in lean cut weight in 1971 and only 26 percent of the variation in 1972. Although the correlation between K^{40} count and total lean cuts was rather low, it should be pointed out that a high relationship was not expected. Previous work at O.S.U. has shown that K^{40} count is a more accurate predictor of the total amount of separable lean and the total amount of fat-free lean in the carcass than it is of pounds of lean cuts.

Relationship Between Lean Cut Yield and Measurements of Backfat and Loin Area

The pooled within breed correlations for each season and the average are given in Table 4. In general, the correlations involving measures of fatness and loin area with lean cut weight were similar for both seasons with a tendency for the correlations to be somewhat lower in the second season. However, the only marked discrepancy between years was noted for the correlations involving scanogram backfat thickness with

Table 4. Pooled Within Breed Correlations Between Lean Cut Weight and Measurements of Backfat and Loin Area

	Carcass Lean Cut Weights			K^{40} Predicted Lean Cut Weights		
	1971	1972	Overall Average	1971	1972	Overall Average
Probe backfat	—.48	—.40	—.44	—.36	—.37	—.36
Scanogram backfat	—.64	—.36	—.50	—.38	—.42	—.40
Carcass backfat	—.40	—.36	—.38	—.37	—.40	—.38
Scanogram loin area	.47	.32	.39	.33	.14	.23
Carcass loin area	.59	.56	.57	.50	.41	.45

lean cuts. It accounted for 41 percent of the variation in lean cut weight in 1971 and for only 13 percent of the variation in 1972. Carcass loin eye area consistently accounted for more of the variation in lean cut yield than did the other measurements.

Relative Effectiveness of Various Measurements in Predicting Lean Cut Weight

The percentage of the variation in lean cut weight accounted for by the various measures of fatness and loin area for the two seasons is given in Table 5. The various measurements evaluated in this study accounted for more of the variation in weight of lean cuts in 1971 than in 1972. In 1971, scanogram backfat and loin area combined accounted for 45.4 percent of the variation, but they accounted for only 19.3 percent of the variation in 1972.

Over both years, carcass backfat and loin area combined accounted for the highest proportion of the variation in lean cut weight. However, in order for a measurement to be considered a reliable predictor of lean yield, it is assumed that the measurement should account for at least 90 percent of the variation in lean cut yield. Based on these data, it is concluded that none of the measurements evaluated should be considered adequate predictors. New techniques and measurements are needed in order to adequately evaluate carcass merit on the live pig.

Table 5. Effectiveness of Various Measurements in Predicting Total Weight of Lean Cuts in the Carcass

Measurement Used to Predict	% of Variation in Lean Cuts Accounted For In.	
	1971	1972
Probe backfat thickness	23.0	16.3
Scanogram backfat thickness	40.4	13.3
Carcass backfat thickness	15.9	13.0
Scanogram loin eye area	21.7	10.2
Carcass loin eye area	34.5	30.9
K^{40} prediction equation	38.4	25.8
Scanogram backfat & loin area combined	45.4	19.3
Carcass backfat & loin area combined	42.7	34.7