Predicting Carcass Retail Product in Beef Steers at Variable Fat Thickness Endpoints

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Scott P. Greiner, adjunct instructor of animal science,
Gene H. Rouse, professor of animal science,
Doyle E. Wilson, professor of animal science,
Larry V. Cundiff, U.S. Meat Animal Research Center, and
Tommy L. Wheeler, U.S. Meat Animal Research Center

Summary

Two hundred eighty-two crossbred steers were scanned with real-time ultrasound (RTU), slaughtered, and fabricated into retail cuts to determine the potential for a combination of live animal and ultrasound measures to predict carcass retail yield. Ultrasound measures of fat thickness, ribeye area, rump fat thickness, and body wall thickness, as well as live weight and visual muscle score were recorded three to five days prior to slaughter. Carcass measurements were taken, and one side of each carcass was fabricated into retail cuts with .3 inches of fat. Stepwise regression analysis was used to compare possible models for prediction of percent retail product from carcass measurements or a combination of live animal traits and ultrasound measures. Results indicate that possible prediction models for percent retail product using live animal and RTU measures were similar in their predictive power and accuracy when compared with models derived from carcass measurements across all fat thickness ranges. A larger proportion of the variation in percent retail product can be explained in steers with less than .4 inches fat cover (using either RTU and live animal measures or carcass measures) when compared with steers with greater than .4 inches fat thickness.

Introduction

Previous research (Greiner et al., 1996) has demonstrated the potential for a combination of RTU and live animal measures to predict retail product in the beef carcass. Possible models for the prediction of percent retail product using real-time ultrasound and live animal measures were similar in predictive power and accuracy when compared with models derived from carcass measurements alone.

As the beef industry moves toward producing leaner animals, external fat thickness will be less predictive of differences in retail product yield. In addition, more cattle will be fed for specification markets, thus placing emphasis on meeting certain carcass composition parameters. One such market may demand a high percentage of retail product, and therefore result in slaughter cattle with a minimal amount of fat thickness. Another specification market may target the high quality hotel/restaurant or export trade, and require a high degree of marbling. Feeding for these markets will likely result in cattle being marketed at a more specific or similar fat thickness endpoint, as compared with the large variation in fat cover that is found in the current commodity beef market.

The objective of this study is to determine the efficacy of using RTU and other live animal measures to predict retail product in the carcass of steers that have similar fat thickness endpoints. Possible prediction models derived from RTU and live animal measures can be compared to models derived using traditional yield grade parameters (carcass measures).

Materials and Methods

Two hundred eighty-two steers from Cycle V of the Germplasm Evaluation study at the U.S. Meat Animal Research Center were utilized in this study. Steers were scanned on one of four dates in the summer of 1994 (May to July), with approximately 70 animals per scanning date. Sire breeds consisted of Hereford, Angus, Brahman, Boran, Tuli, and Belgian Blue. Dam breeds were Hereford, Angus, and MARC III (Angus x Hereford x Pinzgauer x Red Poll).

Animals were measured three to five days prior to slaughter using an Aloka 500V real-time ultrasound machine with a 17 centimeter transducer. Three images per steer were collected. The first was a cross-sectional image using a wave guide taken between the 12th and 13th ribs to measure external fat thickness and ribeye area (REA). Body wall thickness was measured between the 12th and 13th ribs 1.5 inches ventral to the *longissimus*, perpendicular to the external body surface. Rump fat measurements were taken at the Aus meat P8 site over the *gluteus medius* on the rump. Visual muscle scores were assessed using a scale of 1 = light muscled to 9 = heavy muscled (system developed by Bob Long, Texas Tech. University).

Cattle were slaughtered at a commercial packing facility and routine carcass measures were taken 24 hours postmortem. One side of each carcass was transported to MARC and fabricated into boneless retail cuts trimmed to .3 inches fat thickness. Retail product was calculated and expressed as a percentage of carcass weight or as total pounds.

Statistical analyses were conducted with SAS using GLM and stepwise multiple regression procedures.

Results and Discussion

Table 1 lists the means, standard deviations, and minimum and maximum values for live animal and carcass traits for the entire sample of steers. The diversity of sire breeds used in this study resulted in a large amount of variation in carcass and live animal traits.. Carcass measures accounted for 67.6% of the variation found in percent retail product (Table 2.). A large proportion of the variation in percent retail product was accounted for by fat thickness, measured either with ultrasound or on the carcass. It was previously reported (Greiner et al., 1996) that 68% of the variation in percent retail product could be accounted for using a combination of RTU and live animal measures

When only steers with fat thicknesses from .2 to .6 inches are included in the data set, means for carcass and RTU traits are similar to those for the entire population; however, less variation is found in measures of fat cover (Table 3). Results of stepwise regression analysis for predicting percent retail product in this subset of steers are shown in Table 4. In this sample with less variation in external fat thickness, approximately 10% less of the variation in percent retail product could be explained using either RTU/live animal measures or carcass measures when compared to the entire data set (R^2 .576 vs. .680 for RTU measures, and R^2 .590 vs. .676 for carcass measures). However, the predictive power of RTU/live animal measures was similar to that found for carcass measures (R^2 .590 vs. .576). Fat thickness, measured with RTU or on the carcass, accounted for a large proportion of the variation found in percent retail product.

Table 6 shows stepwise regression results for steers with carcass backfat of less than .4 inches. Carcass measures accounted for a larger proportion of the variation found in percent retail product than a combination of RTU and live animal measures (R^2 .634 vs. .611). Muscle score was a more valuable predictor of lean product yield than RTU REA (partial R^2 .058 vs. .025). The lower R^2 values for either carcass measures or RTU/live animal measures when compared with the entire sample are reflective of the reduced amount of variation in fat thickness. Therefore, measurements of muscle content become more important in accounting for variation found in carcass percent retail product. In addition, this group tended to be heavier muscled as indicated by larger REA and higher muscle scores, while at the same time having lighter live weights and smaller carcass weights (Table 5). In lean cattle, with less variation in external fat thickness, measurements of muscle content account for a larger proportion of variation in retail product.

When all cattle with fat thicknesses greater than .4 inches are analyzed (Table 8), possible prediction models account for less of the variation in percent retail product than in the other groups previously discussed. Again, fat thickness accounts for the largest proportion of the variation in percent retail product (partial R^2 .273 for RTU fat thickness, and .231 for carcass fat thickness). The stepwise regression analysis demonstrates that measurements of fat are the most important in determining differences in percent retail product in this group. The first two variables included in each model are RTU fat thickness and rump fat thickness, and fat thickness and KPH for carcass measures. Measurements of muscle content account for less of the variation found in percent retail product for this group. Steers in this fat thickness group had smaller REA and lower muscle scores than other groups, while having heavier live and carcass weights (Table 7). Overall, RTU and live animal measures accounted for 40% of the variation, whereas carcass measures accounted for 38% of the variation in percent retail product.

These results indicate that a combination of real-time ultrasound and other live animal measures are useful in predicting beef carcass percent retail product. The possible prediction models derived from RTU/live animal measures are similar in their predictive power to those derived from carcass measures. More of the variation in percent retail product can be accounted for in cattle that have a minimal amount of backfat (less than .4 inches), as compared with those that are more advanced in their fat thickness (greater than .4 inches).

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References

Greiner, S.P., G.H. Rouse, D.E. Wilson, and L.V. Cundiff. 1996. Predicting beef carcass retail product using real-time ultrasound and live animal measures. A.S. Leaflet R1327. ISU Beef Res. Report.

Table 1. Means, standard deviations, minimum, and maximum values for live animal, carcass, and ultrasound measures for entire population of steers (n = 282).

Trait	Mean ± std. dev.	Minimum	Maximum
Live weight, lb	1206 ± 140	780	1610
Carcass weight, lb	735 ± 89	472	991
Carcass fat thickness, in	.38 ± .16	.10	1.0
Carcass REA, in^2	11.78 ± 1.24	9.1	15.5
Carcass KPH, %	2.78 ± .60	1.0	4.5
Carcass yield grade	3.04 ± .71	1.26	5.46
RTU fat thickness, in	.39 ± .14	.09	.79
RTU REA, in^2	11.94 ± 1.16	9.18	15.84
RTU rump fat thickness, in	.41 ± .13	.14	.90
RTU body wall thickness, in	2.05 ± .29	1.32	2.94
Muscle score	4.49 ± 1.5	2.0	9.0
Carcass retail product, %	70.4 ± 3.8	60.6	79.9

Table 2. Stepwise regression for prediction of percent retail product for entire population of steers (n = 282).

	Model R^2	Partial R^2	MSE
RTU/live animal measures			
RTU fat thickness	.575	.575	2.47
RTU rump fat thickness	.612	.037	2.37
Muscle score	.649	.037	2.26
Live weight	.660	.012	2.22
RTU REA	.675	.015	2.18
RTU body wall thickness	.680	.005	2.16
Carcass measures			
Carcass for thickness	.560	.560	2.52
Carcass REA	.609	.050	2.37
Carcass weight	.660	.051	2.22
Carcass KPH	.676	.016	2.17

Table 3. Means, standard deviations, minimum, and maximum values for live animal, carcass, and ultrasound measures for steers with carcass fat thickness of .2 to .6 in (n = 240).

Trait	Mean ± std. dev.	Minimum	Maximum
Live weight, lb	1203 ± 138	780	1610
Carcass weight, lb	732 ± 88	472	991
Carcass fat thickness, in	.37 ± .12	.20	.60
Carcass REA, in^2	11.80 ± 1.25	9.1	15.5
Carcass KPH, %	2.80 ± .55	1.5	4.5
Carcass yield grade	2.98 ± .56	1.26	4.32
RTU fat thickness, in	.38 ± .10	.16	.69
RTU REA, in^2	11.96 ± 1.17	9.23	15.84
RTU rump fat thickness, in	.41 ± .11	.14	.90
RTU body wall thickness, in	2.04 ± .28	1.32	2.91
Muscle score	4.44 ± 1.4	2.0	9.0
Carcass retail product, %	70.5 ± 3.3	63.2	79.1

Table 4. Stepwise regression for prediction of percent retail product for steers with carcass fat thickness of .2 to .6 in (n = 240).

	Model R^2	Partial R^2	MSE
RTU/live animal measures			
RTU fat thickness	.456	.456	2.43
RTU REA	.499	.042	2.33
Live weight	.532	.033	2.26
Muscle score	.553	.022	2.21
RTU rump fat thickness	.571	.018	2.17
RTU body wall thickness	.576	.005	2.16
Carcass measures			
Carcass fat thickness	.440	.440	2.46
Carcass REA	.516	.076	2.29
Carcass weight	.578	.062	2.15
Carcass KPH	.590	.012	2.12

Table 5. Means, standard deviations, minimum, and maximum values for live animal, carcass, and ultrasound measures for steers with carcass fat thickness of less than .4 in (n = 182).

Trait	Mean ± std. dev.	Minimum	Maximum
Live weight, lb	1187 ± 133	780	1520
Carcass weight, lb	721 ± 85	472	991
Carcass fat thickness, in	.29 ± .09	.10	.40
Carcass REA, in^2	11.86 ± 1.34	9.1	15.5
Carcass KPH, %	2.67 ± .61	1.0	4.5
Carcass yield grade	2.70 ± .53	1.26	3.84
RTU fat thickness, in	.32 ± .08	.09	.50
RTU REA, in^2	11.96 ± 1.24	9.18	15.84
RTU rump fat thickness, in	.36 ± .10	.14	.60
Muscle score	4.60 ± 1.6	2.0	8.0
Carcass retail product, %	72.0 ± 3.4	63.4	79.9

Table 6. Stepwise regression for prediction of percent retail product for steers with carcass fat thickness of less than .4 in (n = 182).

	Model R^2	Partial R^2	MSE
RTU/live animal measures			
RTU fat thickness	.481	.481	2.47
Muscle score	.540	.058	2.33
RTU rump fat thickness	.571	.031	2.26
Live weight	.586	.015	2.22
RTU REA	.611	.025	2.16
Carcass measures			
Carcass fat thickness	.492	.492	2.44
Carcass REA	.551	.059	2.30
Carcass weight	.617	.067	2.13
Carcass KPH	.634	.017	2.09

Table 7. Means, standard deviations, minimum, and maximum values for live animal, carcass, and ultrasound measures for steers with carcass fat thickness of greater than .4 in (n = 142).

Trait	Mean ± std. dev.	Minimum	Maximum
Live weight, lb	1226 ± 143	902	1610
Carcass weight, lb	749 ± 88	581	976
Carcass fat thickness, in	.51 ± .12	.40	1.0
Carcass REA, in^2	11.49 ± 1.05	9.1	15.0
Carcass KPH, %	2.92 ± .55	1.5	4.5
Carcass yield grade	3.53 ± .55	2.34	5.46
RTU fat thickness, in	.49 ± .11	.27	.79
RTU REA, in^2	11.76 ± .99	9.33	15.77
RTU rump fat thickness, in	.48 ± .12	.23	.90
Muscle score	4.24 ± 1.2	2.0	9.0
Carcass retail product, %	68.1 ± 2.7	60.6	74.9

Table 8. Stepwise regression for prediction of percent retail product for steers with carcass fat thickness of greater than .4 in (n = 142).

	Model R^2	Partial R^2	MSE
RTU/live animal measures			
RTU fat thickness	.273	.273	2.33
RTU rump fat thickness	.350	.077	2.21
RTU REA	.364	.013	2.19
Live weight	.388	.025	2.16
Muscle score	.400	.011	2.15
Carcass measures			
Carcass fat thickness	.231	.231	2.39
Carcass KPH	.277	.046	2.33
Carcass weight	.308	.031	2.29
Carcass REA	.380	.072	2.17