Comparison of Ultrasound and Carcass Measures to Predict the Percentage of Lean Beef from Four Primal Cuts

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Summary

The objective of this study was to determine how real-time ultrasound (RTU) measurements would compare with carcass measurements to predict the percentage of lean from the four primals (PERL4P). Data were collected on market ready cattle (n=265). Traditional carcass measures collected were: 1) hot carcass weight (HCW), 2) 12-13th rib fat thickness (CFAT), 3) 12-13th rib ribeye area (CREA), and 4) percentage of kidney, pelvic, and heart fat (KPH). Live animal ultrasound measures collected were: 1) scan weight (SCANWT), 2) 12-13th rib fat thickness (UFAT), 3) 12-13th rib ribeye area (UREA), 4) subcutaneous fat thickness over the termination of the *biceps femoris* in the rump (reference point) (URFAT), 5) depth of the *gluteus medius* below the reference point (URDEPTH), and 6) area of the *gluteus medius* anterior to the reference point (URAREA). A model to predict PERL4P was developed for both carcass and RTU measures. Significant measures ($p < .10$) for the carcass data were CFAT, CREA, and KPH with a model $R^2 = .38$. HCW was not a significant trait in the carcass data model ($p = .3525$). Significant measures ($p < .10$) for the RTU data were UFAT, UREA, SCANWT, URAREA, and URFAT with a model $R^2 = .43$.

Introduction

The percentage of lean in the four primals is a very economically important trait for the beef industry. However, it is also a very challenging trait to measure directly because of difficulty maintaining identity of carcasses or cuts within many of today's carcass fabrication facilities. Therefore, prediction equations such as the USDA yield grading equation are often used. The objective of this study was to determine how RTU measurements would compare to carcass measurements to predict PERL4P. With the recent interest in RTU to evaluate seedstock for body composition traits, there is interest in comparing the abilities of RTU and carcass measures for their ability to predict PERL4P. The retail product equation based on carcass traits was developed several years ago, and used cattle with large variations in fat cover. This in turn made fat thickness the driving factor for retail product equations. More recent research has indicated that feedlot operators are trying to manage external fat more efficiently, and market cattle with a more consistent fat cover. This increases the importance of muscle measurements for retail product equations. In particular, this study was interested in determining if nontraditional RTU measures in the rump can be added to increase the accuracy of prediction of PERL4P.

Materials and Methods

Source of Data

Data for this study were obtained from market cattle (n = 265) consisting of Angus bulls, Angus steers, and crossbred steers. RTU images were collected by centralized ultrasound processing (CUP) qualified technicians within one week prior to harvest. One of two ultrasound technologies were used: 1) a Classic Scanner 200 equipped with a 3.5 MHz 18 cm linear array transducer (n=176), or 2) an Aloka 500V equipped with a 3.5 MHz 17 cm linear array transducer (n=89). RTU live animal measurements taken were: 1) SCANWT, 2) UFAT, 3) UREA, 4) URFAT, 5) URDEPTH, and 6) URAREA. There were two images collected to acquire these measures: a cross-sectional image between the 12-13th ribs (Figure 1), and a longitudinal image slightly above a line from the hooks to the pins, in line with the *shaft of the ileum* (Figure 2).

Figure 1. Cross-sectional ultrasound image taken between the 12-13th ribs.

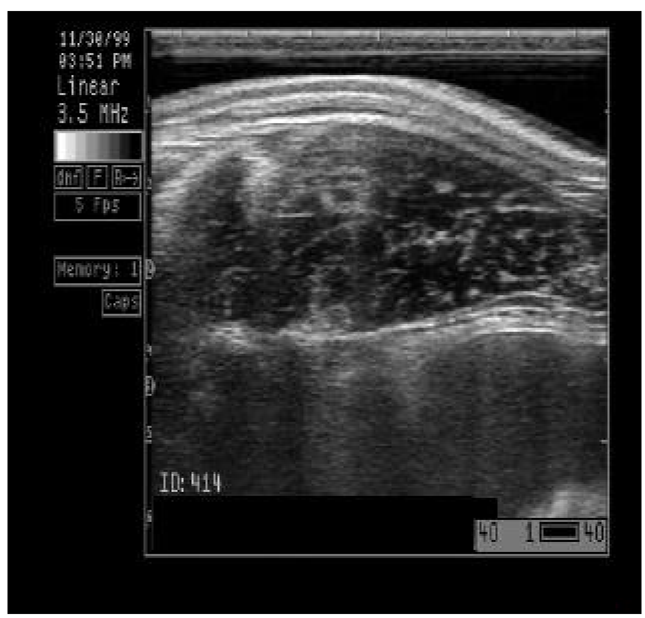

Figure 2. Longitudinal ultrasound image taken in the rump area.

Routine carcass measurements were collected at the harvesting facility approximately 48 hours post mortem by trained personnel. Carcass measurements taken were: 1) HCW, 2) CFAT, 3) CREA, and 4) KPH.

The carcasses were transported to a fabrication site, Jim's Wholesale Meats, Harlan, IA. The right side of each carcass was then fabricated into retail ready cuts, with weights recorded for bone, fat, retail cuts, and lean trim. PERL4P was calculated by adding lean weights from the closely trimmed retail cuts in the four primals and the lean trim weight from the four primals, and then expressing this as a percentage of the side weight.

Data Analysis

A prediction equation for PERL4P was developed through stepwise regression for live measures and for carcass measures. Significance level for a variable to enter the model was set at .50, and significance for a variable to remain in the model was set at .10. Means and standard deviations for each of the variables are given in Table 1. Significant measures for the carcass data were CFAT, CREA, and KPH. Significant measures for the RTU data were UFAT, UREA, SCANWT, URAREA, and URFAT. Partial R^2 and P-values for each variable in both models are given in Table 2.

Results and Discussion

This set of data indicates that RTU live measures of body composition predict PERL4P more accurately than routine carcass measures. The traditional carcass prediction equations include HCW in the percentage lean equation, and this data set did not have HCW as a significant factor for predicting PERL4P ($p = .3525$). The RTU model included the similar traits of ribeye area and fat cover over the 12-13th rib, which are the traits that ultrasound was originally used to investigate, in addition to live weight. There may be some advantage to including nontraditional RTU measures of body composition (which are not obtainable in the carcass) by scanning in the rump area because URAREA ($p = .0020$) and URFAT ($p = .0677$) were significant in the prediction of PERL4P.

Implications

Many of today's seedstock are being evaluated by RTU for body composition traits. To date the prediction of PERL4P in live animals has been based on using coefficients developed from carcass data, and then making some underlying assumptions about the cattle. Some of the assumptions under these conditions were standard dressing percentages and standard KPH values. Evidence now exists that ultrasound measures in live cattle can more accurately predict PERL4P than the carcass yield grading equation. This should allow for a more accurate prediction of PERL4P to be made on seedstock that are being selected throughout the industry.

Acknowledgments

American Angus Association, St. Joseph, MO
Jim's Wholesale Meats, Harlan, IA
ISU Rhodes Research Farm, Rhodes, IA
HPH Company, Atkinson, NE
Pioneer Hi-Bred International, Inc., Slater, IA
ISU Beef Nutrition Research Farm, Ames, IA
ISU McNay Research Farm, Chariton, IA

Table 1. Means and standard deviations of observed variables.

Variable	Mean	Std. Dev.
PERL4P(%)	51.85	1.74
SCANWT(lb.)	1217.40	95.16
UFAT(in.)	0.44	0.11
UREA(in.^{2})	13.14	1.30
URFAT(in.)	0.45	0.13
URDEPTH(in.)	3.76	0.34
URAREA(in.^{2})	10.95	1.69
HCW(lb.)	735.30	56.75
CFAT(in.)	0.44	0.18
CREA(in.^{2})	12.62	1.49
KPH(%)	1.95	0.39

Table 2. Independent variables for prediction of the percentage lean from the four primals.

Variable	Coefficient	Partial R^2	Model R^2	P-Value
CARCASS	50.6476			
CFAT(in.)	-3.0313	.2106	.2106	<.0001
CREA(in.^{2})	0.3873	.1041	.3147	<.0001
KPH(%)	-1.2054	.0673	.3821	<.0001
RTU	51.3143			
UFAT(in.)	-5.3076	.2468	.2468	<.0001
UREA(in.^{2})	0.5314	.1150	.3618	<.0001
SCANWT(lb.)	0.0042	.0336	.3953	<.0001
URAREA(in.^{2})	0.1571	.0253	.4206	.0020
URFAT(in.)	-1.4924	.0076	.4281	.0677