EVALUATION OF ULTRASOUND PREDICTION IN KOREAN BEEF CATTLE CARCASS VALUE

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Background.

Real-time ultrasound instruments have been widely used in the field for estimating back fat thickness, longissimus muscle area and intramuscular fat *(Perkins et al., 1992a; Robinson et al., 1992)*. Recently, several institutions and organizations have developed software systems, which can predict percentage of intramuscular fat or marbling from real time ultrasound images. However, limited information has been published on the accuracy or precision of these systems *(Brethour, 1994; Herring et al., 1998)*. Since 1988, the Japanese Meat Grading Association has provided a beef grading system for quantifying meat yield and quality factors by subjective evaluation *(Ozutsumi et al., 1996)*. The ability to use ultrasound to precisely and accurately estimate carcass measurements in live animals should be of benefit to the beef industry, allowing it to move away from the current practice of pricing cattle on pen averages to a value-based marketing system.

Objective.

The objective of this study was to compare and evaluate ultrasound measurements of back fat thickness, longissimus muscle area and intramuscular fat before slaughter for improvement of prediction yield grade index and marbling score.

Methods.

One hundred eighty seven progeny testing of Korean beef cattle (Hanwoo) were ultrasonically scanned by Super-eye Meat (FHK Co. Ltd., Japan) with the electric linear probe (2 MHz frequency: 27 X 147 mm) on the left side of 13th rib nearly one week before carcass for estimating back fat thickness, longissimus muscle area and intramuscular fat. Scanogram were obtained by use of video-copy machine (Mitsubishi Co. Ltd., AP-9500) and recorded videotape. A complete image was obtained by hard copy to estimate marbling score, another recorded on videotape viewed to determine both back fat thickness and longissimus muscle area estimates using computer software (SCD-150F, FHK, Japan). Prediction accuracy was assessed by two ways. The first, it was measured by means and standard deviations between scans and carcass measurements. The second, it can be increase estimate accuracy in consideration between fat thicknesses and yield grade index.

The data were analyzed for means, standard deviations and regression analyses between carcass and ultrasound measures.

Results and Discussion.

Differences in ultrasound and actual carcass measures by yield grade index of back fat thickness and longissimus muscle area are presented in Table 1. Standard deviation between carcass back fat (BFC) - ultrasound back fat (BFU) and longissimus muscle area (LMAC) - ultrasound longissimus muscle area (LMAU) were 1.71mm and 10.17cm^2. Ultrasonically measured values mean less back fat thickness with smaller longissimus muscles area. Means and standard deviations for the descriptive measures of the Hanwoo cattle by yield grade indicate that grade A cattle had much fat with smaller longissimus muscles, but grade B cattle had less fat with larger longissimus muscles. These compositional differences may account for the prediction differences.

Figure 1 presents high relationship of both BFC and BFU with Korean yield grade index (YGI). A more useful measure of the predictive capacity of a given technique is the relative frequency, which is estimated within a given range of actual carcass parameter values. In cattle larger than 69cm^2 LMAC, appearance of grade A of YGI was 93.4% at less than 7mm of BFC and 73.5% at less than 6mm of BFU.

Regressions between live and carcass weight at less than 6mm and more than 6mm BFC were indicated on Fig. 2 and 3, respectively. R-squares for predicting YGI were .92 at less than 6mm BFC and .90 at more than 6mm BFC.

Table 1 and 2 showed different measurements of BF and LMA. BF values were slightly lower but LMA values were slightly higher in Table 1. Differences between actual and corrected measure-grade accuracy are presented in Table 3. Actual method accuracy was 67.90%, whereas corrected one was 76.50%.

Table 4 shows prediction accuracy of marbling score according to Korean four grade levels was 50.8%. Error between ultrasound and actual carcass measurements of fat thickness and longissimus muscle area may be caused by placement of the transducer of near and far gains for image registration, and interpretation of the image produced by the technician. Better control of focusing and signal preprocessing along with higher gray level resolution and the ability to transfer digital data directly from the ultrasound scan converter into computer processing should enhance the accuracy.

Conclusions.

This study showed accuracy approximately 76.5% of yield grade and 50.8% of marbling score. Improved system is need for accurate and rapid measurements of yield grade and marbling in live cattle, and many analysis of carcass merit.

Pertinent literature.

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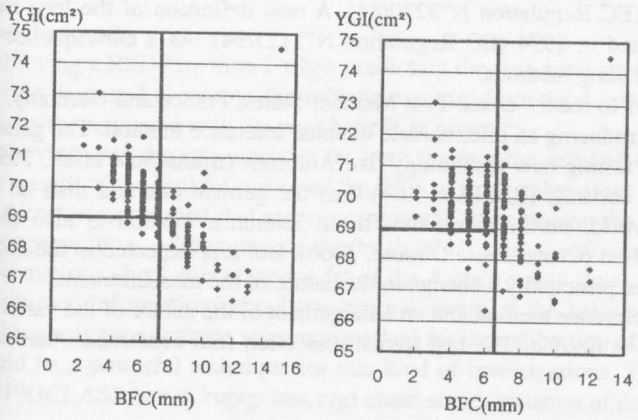

Fig 1. Relationship between BFC, BFU and YGI

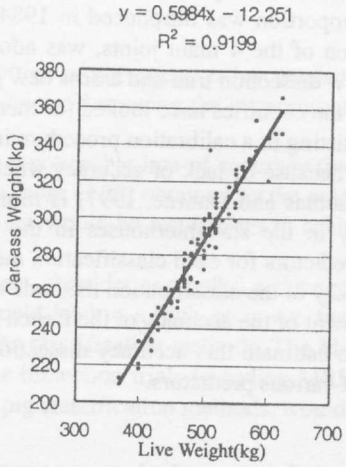

Fig 2. Regressions of live weight and carcass weight at less than 6mm BFC

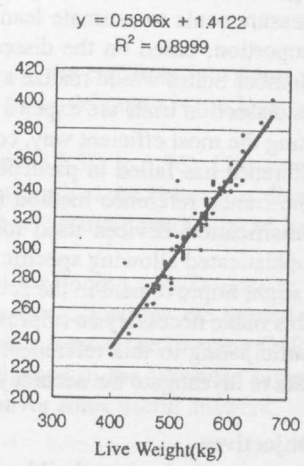

Fig 3. Regression of live weight and carcass weight at more than 6mm BFC

Table 1. Means and standard deviations between ultrasonic and carcass measures by yield grade index (YGI) of Korean beef (Hanwoo) cattle

MYC[1]	MYU[2]	BFC[3] (mm)	BFU[4] (mm)	LMAC[5] (cm²)	LMAU[6] (cm²)	STD BFC-BFU (mm)	STD LMAC-LMAU (cm²)
A	A	5.45	4.99	76.96	72.19	1.43	8.94
	B	6.19	6.51	75.42	61.81	1.58	6.61
Average		5.68	5.47	76.47	68.91	1.52	9.22
B	A	9.29	6.76	72.88	81.69	1.66	8.51
	B	8.74	7.85	70.91	64.88	1.74	8.82
Average		8.92	7.49	71.57	70.49	1.87	11.15
Total		6.57	6.02	75.13	69.34	1.71	10.17

[1] Carcass Meat Yield, [2] Ultrasonic Meat Yield, [3] Carcass Back Fat, [4] Ultrasonic Back Fat, [5] Carcass Longissimus Muscle Area, [6] Ultrasonic Longissimus Muscle Area

Table 2. Means and standard deviations with predicted grade of BF and LMA

YGIC	YGIU	BFC (mm)	BFU (mm)	LMAC (cm²)	LMAU (cm²)	STD BFC-BFU (mm)	STD LMAC-LMAU (cm²)
A	A	5.48	5.02	76.25	69.42	1.40	9.32
	B	6.81	7.95	77.67	66.10	1.46	7.65
Average		5.68	5.47	76.47	68.91	1.52	9.22
B	A	9.04	6.43	71.96	75.60	1.53	11.70
	B	8.82	8.36	71.25	66.29	1.55	9.18
Average		8.92	7.49	71.57	70.49	1.87	11.15
Total		6.57	6.02	75.13	69.34	1.71	10.17

Table 3. Accuracy between YGIC and YGIU measurements

YGIC	YGIU	Measurement Heads	Measurement Accuracy (%)	Estimate Heads	Estimate Accuracy (%)
A	A	93	68.4	115	84.6
	B	43		21	
Average		136		136	
B	A	17		23	
	B	34	66.7	28	54.9
Average		51		51	
Total		187	67.9	187	76.5

Table 4. Accuracy between MSC and MSU measurements

MSC	MSU 1+	MSU 1	MSU 2	MSU 3	Total	Accuracy (%)
1+	8	5			13	61.5
1	9	27	14	2	52	51.9
2	1	18	44	12	75	58.7
3		6	25	16	47	34.0
Total	18	56	83	30	187	50.8