PREDICTING METHOD OF YIELD GRADES FOR KOREAN NATIVE CATTLE USING REAL-TIME ULTRASOUND

Young-Han Song, Seok-Jung Kim* and Sung-Ki Lee**

Division of Animal Resource Science, Kangwon National University, Chunchon 200-701, Korea, * Institute of Animal Resources, Kangwon National University, ** Department of Animal Food Science and Technology, Kangwon National University

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Background.

Real-time ultrasound instruments have been widely used in the field for estimating back fat thickness (BFT), longissimus muscle area (LMA) (Perkins et al., 1992a; Robinson et al., 1992). Smith et al. (1992) found that correlation coefficients between live animal ultrasound and carcass measurements of BFT and LMA varied from .81 to .82 and from .43 to .63, respectively. Research has also shown that accuracy is highly dependent on the technician and level of experience that the person possesses (McLaren et al., 1991). However, limited information has been published on the accuracy or precision of these systems (Brethour, 1994; Herring et al., 1998). Since 1992, the Korean Livestock Cooperatives Federation has provided a beef grading system for quantifying meat yield and quality factors by subjective evaluation. 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 BFT and LMA before slaughter for improvement of prediction yield grade. Scanning data were evaluated yield grade index, fat compensation, regression and decision tree methods for increasing prediction rate.

Methods.

Three hundred thirty five progeny testing of Korean native 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 and longissimus muscle area. Scanogram were obtained using double frame display capabilities of the equipment, and a transducer guide was used to minimize error that might occur due to animal back line curvature and the overlapping step required to produce one complete image of the longissimus muscle. The resulting ultrasound images were recorded on MO diskette and later viewed on a display monitor to determine both BFTU and LMAU estimates. Ultrasonic estimate compare to carcass value by four predicted methods; that were yield grade index equation, fat compensation, regression and decision tree for increase prediction accuracy.

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

Results and Discussion.

Formula means and standard deviations for castrated Hanwoo traits by yield grade index of BFT and LMA are presented in Table 1. Standard deviation between carcass and ultrasound of BFT and LMAC were showed 1.34, 0.84 for yield grade A and 1.53, 0.97 for yield grade B, respectively. This could explain errors of prediction increased yield grade B rather than yield grade A. Table 2 presents correlations between predicted (BFTU, LMAU) and observed carcass measurements (BFTC, LMAC). Significant relationship ($P<0.01$) was found between BFTU and BFTC was 0.75, however LMAU and LMAC were 0.57.

Also, presented in Fig. 1 are the relationship between YG and BFT. In cattle appearance of carcasses grade A of YG was found at less than 6 mm of BFT (95.4%) and grade B of YG was founded at larger than 8 mm of BFT (91.0%). Also, ultrasonic measurements grade A showed at less than 5 mm of BFT (85.4%) and grade B showed at larger than 9 mm of BFT (71.4%). According to the Fig. 2 decision tree method was used live weight, BFTU and LMAU for target parameter, used input parameters for satisfied target parameter.

Compare of four analyze methods of prediction accuracy between ultrasonic and carcass measurements are presented in Table 3. Firstly prediction accuracy of yield grade were shown at yield grade A (77.7%) and at yield grade B (70.6%). Fat compensation methods was predicted at less than 5mm at grade A, rather than 9mm at grade B. Regression method used by corrected YGI = 70.69*** BW – 0.34787*** BFTU + 0.02808*** LMAU (*** $P < 0.001$). In this method prediction accuracy rate increased 12% point at grade A, but decreased 58.7% point at grade B. In addition, prediction accuracy was shown 85.7% at grade A, 72.5% at grade B by decision tree method.

Conclusions.

The result in the present study suggests that the decision tree method prediction accuracy of yield grade were showed 81.4%. Ultrasonic measurements made before slaughter are useful for estimating carcass BFT and LMA. 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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Table 1. Means and standard deviation between ultrasonic and carcass measures by yield grade index of Korean beef cattle (Hanwoo)

MYC[1]	BFC[2]	BFU[3]	LMAC[4]	LMAU[5]	STD BFC-BFU	STD LMAC-LMAU
A	5.32	5.08	73.80	68.30	1.34	0.84
B	8.75	7.42	69.66	68.41	1.53	0.97
Total	6.44	5.84	72.44	68.33	1.49	0.96

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

Table 2. Correlation coefficient between ultrasonic and carcass measures

	BW	BFU	LMAU	MSU	CARCASS	BFC	LMAC	MSC	YGI
BW	1.00								
BFU	0.33**	1.00							
LMAU	0.44**	0.28***	1.00						
MSU	-0.21***	-0.12*	-0.18***	1.00					
CARCASS	0.92**	0.38***	0.50***	-0.25***	1.00				
BFC	0.34**	0.75***	0.26***	-0.13*	0.38***	1.00			
LMAC	0.45**	0.16**	0.57***	-0.21***	0.57***	0.12*	1.00		
MSC	-0.26***	-0.15**	-0.19***	0.67***	-0.30***	-0.20***	-0.22***	1.00	
YGI	-0.22***	-0.61***	0.02	0.04	-0.21***	-0.84***	0.40***	0.10	1.00

*** $P < 0.001$ ** $p < 0.01$ * $p < 0.05$

Table 3. Comparative of prediction accuracy by four methods on yield grade

YGIC	YGIU	Formula Heads	Formula Accuracy	Fat compensation Heads	Fat compensation Accuracy	Regression Heads	Regression Accuracy	Decision tree Heads	Decision tree Accuracy
A	A	174	77.7%	189	84.4%	201	89.7%	192	85.7%
	B	50		35		23		32	
Average		224		224		224		224	
B	A	32		33		96		30	
	B	77	70.6%	76	69.7%	13	11.9%	79	72.5%
Average		109		109		109		109	
Total		333	75.4%	333	79.6%	333	64.3%	333	81.4%

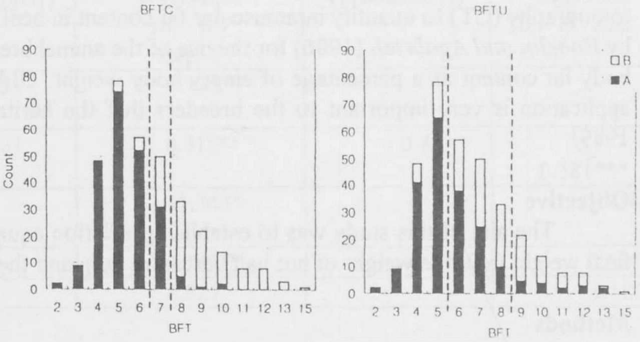

Fig. 1. Relationship between BFTU, BFTC and YGI

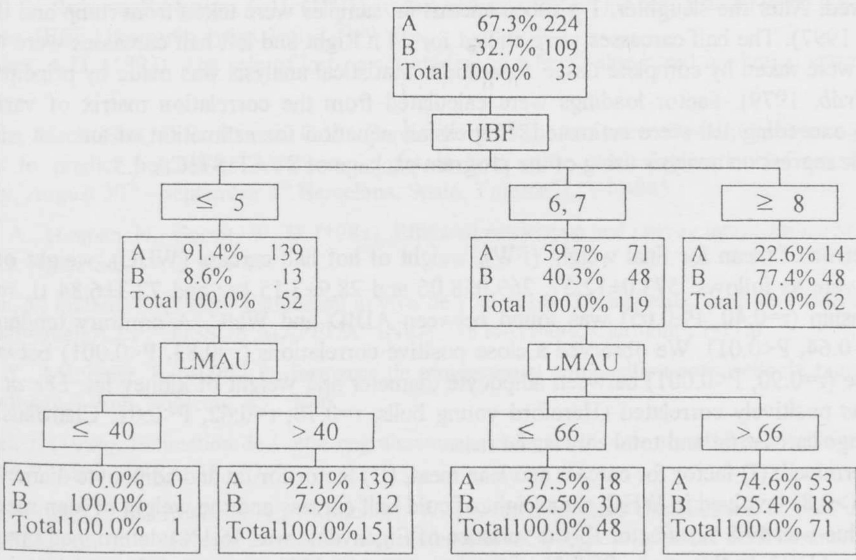

Fig. 2 Distribution pattern of yield grade index by decision tree method