REVISED EQUATION OF CARCASS YIELD GRADE FOR KOREAN NATIVE CATTLE (HANWOO)

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Background

Data from 240 cattles were used to develop new yield grading system. Accurate prediction of live animal and carcass composition is critical to all segments of the meat animal industry. Many studies of the development of beef animals have used allometric regression(AR) to examine how changes in body composition through time are affected by levels of various factors, for example breed, nutrition or weight(BERG et al., 1978; KEANE, 1994). In Korea, carcass grading system for Hanwoo(Korean native cattle) has been introduced and applied only at a few large-scaled slaughter house since its establishment in 1992. The grading system changed Korean meat production system depending on the quality as well as yield. At the beginning time, the standard of yield and quality grade in carcass grading system was mainly established based on carcass properties of bulls. However, the existing grading system may be misleading because new technology such as fattening steers or heifers was introduced as well as the factors of yield grade such as carcass weight, backfat thickness, loin areas were improved resulted from increase of market weight after the grading system was introduced. For this reason, Korean meat producers and distributors were demanded to change the old yield grade for accurate prediction of carcass yields. Therefore, this study was carried out to re-establish the Korean standard for yield grade of Hanwoo which corresponded well with ultimate end-product use and refine better reflect industry needs-sex and weight of carcass as well as percentages of lean, muscle to bone ratio and etc. This grading standard was applied extensively by industry and improve the productivity and the distribution system which are based on meat yields and marketing price for wholesalers.

Objective

The objective of this study was to establish new equation for yield index which is more practically and accurately applicable to Korean industry than the existing grade.

Methods

The animals used in these experiments were raised with ordinary feed and collected from livestock farm in various location of South Korea. A total of 240 Hanwoo cattles (cows 80, bulls 80 and steers 80) were slaughtered in the normal commercial manner at the slaughtering house of National Livestock Research Institute by 4 ranges of their live weight. The yields(%) of carcass, retail lean, bone and total fat were measured and calculated based on each fasting weights.

The estimation values were analyzed using the GLM(General Linear Model) procedure of the SAS Institute, Inc.(1996). The linear model $Yijk=\mu+Sexi+WTclassj+(Sex\times WT)ij+eijk$ was used to analyze the effects of sex and carcass weight of Hanwoo and the step-wise multiple regression by carcass factors was used to determine the grading equation for the yield index. R^2 of Regression and Residual Sandard Deviation(RSD) values were calculated from SSr/SSY and (SSr-SSY/Cn-p), respectively.

Results and Discussion

The chilled carcass weight increased as the market weight increased in cows (59.3~61.2%), bulls(61.4~62.0%) and steers(61.6~62.4%) Similar percentages of chilled carcass weight(60~63%) have been reported by YAMAZAKI et al.(1989) for Wagyu(Japanese cattle) and BARBER et al..(1981) for Herford. However, the cows had lower chilled weight values than the others in the same weight ranges. In carcass compositions of Hanwoo, there were significantly different in the yields of carcass, retail cut, bone and total fat by sex and there were significantly different in the yields of bone and total fat by slaughter weight (Table 1) ($P<0.01$). The b-values of BFT(Back-Fat Thickness) were in the range of -3.9~-5.6 which were the main factor to predict the percentages of retail cut in the prediction equation for the yield index(Table 2). MURPHEY et al.(1985) and JOHNSON & PRIYANTO (1991) reported that the fitness of the prediction equation was significantly increased when BFT values were included with carcass weight and ribeye areas as the estimation factors for yield index. In the estimated prediction equation, the fitness was increased from 0.52 to 0.56 when KPH(Kidney Pelvic & Heart fat) values were additionally included as the estimated factor (Table 2). This results were in agreement with ABRAHAM et al.(1990) reported that yields(%) of KPH was an important factor followed by BPT for the estimated prediction equation. This maybe because the fat contents in KPH were highly related with the fat accumulation amounts in the other location of carcass. However, it was concluded that three factors such as carcass weight, backfat thickness and ribeye areas except the yields(%) of KPH must be included in the new prediction equation for yield index due to its high efficiency at the slaughter house. In the analysis of differences between the actual estimated value(Ev) and prediction equation(Eq) by sex, cows and steers were higher than bulls(Table 3). KAUFFMAN et al.(1975) reported that fitness of the predicted equation was different by sex and breed. In this study, it was assumed that the fitness of yield index equation was different among sex because fat accumulation amounts and progress development of ribeye area would be different by sex. When the yields of retail cut were calculated with the existing prediction equation (Eq 1), 74.80-0.014 CW + 0.075 RA -0.2001 BFT and new predicted equation(Eq 2), 64.74 - 0.0198 CW + 0.1339 RA - 5.2264 BFT and compared the fitness of equation between two equations, the absolute difference values in variance were 9.17 for Eq 1 and 2.39 for Eq 2, respectively and the fitness of the Eq 2 was higher than that of the Eq 1 by 3.83folds in mean values of variance. This was mainly due to the increase of slaughter weight for bulls and steers up to 600kg with the increase of production technology for high quality beef in Korea.

Conclusion

The existed prediction yield equation was re-established by developing new prediction equation for yield index. The new prediction equation was applied to Korean industry due to its high accuracy when compared to those of the existing equation. The KPH% in the measurement factors was excluded for the judgment of yield grade because of its low efficiency at the industry although fitness had been increased when it was included as the carcass factor in the prediction equation.

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Table 1. Analysis of covariance for carcass traits with live body weight as a covariate

Source	Df	Carcass weight, %	Retail lean meat, %	Bone %	Total fat,%
Sex	2	176.79**	304.62**	0.0016**	0.072**
Weight class	5	2.19	4.30	0.0001**	0.004**
Sex x weight class	6	2.88	9.06	0.0000	0.001
Error	224	5.47	11.72	0.0000	0.000
R^2	-	0.34	0.34	0.51	0.59

** : P<0.01.

Table 2. Multiple regression equations for predicting yield percentages of closely trimmed retail cuts

	Independent variables	Intercept	b Value	SE of b value	Prob.> | T |	R^2	RSD**
1	Carcass weight, kg Backfat thickness,cm	69.4810	0.0016 -5.4227	0.0005 0.4970	0.726 0.001	0.38	10.8
2	Backfat thickness, kg Ribeye area, cm^2	62.6341	-5.6429 0.0987	0.4264 0.0203	0.001 0.001	0.44	10.5
3	Carcass weight,kg Backfat thickness,cm Ribeye area, cm^2	64.6526	-0.0198 -5.2264 0.1339	0.0064 0.4722 0.0256	0.003 0.001 0.001	0.52	6.2
4	Carcass weight,kg Backfat thickness,cm Ribeye area, cm^2 KPH*, %	70.7194	-0.0196 -3.9066 0.1311 -0.8636	0.0059 0.4481 0.0236 0.1214	0.001 0.0001 0.0001 0.0001	0.56	8.7

* KPH ; Kindey, pelvic and heart fat percentages to the carcass weight. ** RSD ; Residual standard deviation.

Table 3. Comparison of predicted or actual yield of boneless, closely trimmed retail cuts

Group	Carcass yield index			absolute value of difference		Correlation coefficient(r)	
	Ev	Eq_1	Eq_2	Ev-Eq_1	Ev-Eq_2	Eq_1	Eq_2
Steer	62.50	73.56	63.36	11.05	1.99	-	0.64
Bull	69.56	75.53	67.76	6.06	2.68	-	0.61
Cow	64.05	74.44	64.99	10.39	2.49	-	0.46
Over all	65.37	74.51	67.76	9.17	2.39	-	0.72

Ev : Actual estimated value of the cutability percentage.
Eq1 : The existed equation used for the Grading System in Korea
Eq2 : New predicted equation estimated from this study