PREDICTING RETAIL CUTTING YIELD OF VENEZUELAN BEEF CARCASSES

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Background

Yield of retail beef cuts defines the commercial value of the beef carcass in most South American countries. A "yield index" has been proposed by the current Venezuelan beef grading system (Decreto Presidencial 1896, 1997) in trying to predict butcher yield. This yield index lacks of scientific basis because firstly, it was developed with a subjective formula and secondly, it waits for being validated with all classes of beef cattle. The first validation study (Malaver et al., 2000) indicated that such yield index was not reliable in predicting yield of entire males (bulls), the predominant beef class in the domestic market. Most regression equations have been developed by North American workers to predict cutability of castrated males (steers) and heifers (Murphy et al., 1960; Shackelford et al., 1995 and others). However, regression equations for carcass data including bulls along with other beef classes are scarce (Reiling *et al.,* 1992). It is expected that prediction equations for multiple-class data (including bulls) are not easy to develop because relationships between yield of boneless cuts and carcass traits are not the same (in magnitude and/or sign) across beef classes due to their different muscle:fat ratios (Huerta-Leidenz, unpublished data). Given that the Venezuelan grading system for beef carcasses has not yet been applied in commercial abattoirs, it is urgent to develop a trustworthy system to predict retail cutting yield for all the classes and breed types that predominate in the Venezuelan market.

Objectives

The present study is the first in using a comprehensive data bank with Venezuelan cattle to develop prediction equations of percentages of boneless, closely trimmed (high plus medium-valued) cuts of beef carcasses.

Methods

A data bank from 1197 observations of Venezuelan cattle (738 bulls, 394 steers and 65 heifers), mostly grass-fed, with the predominance of Zebu breed types was used. The carcasses were evaluated according to the official grading system (Decreto Presidencial 1896, 1997). Leg conformation and fat covering (finish) scores, rib eye area and other linear measurements of the carcass were taken as described by Huerta et al. (1999). The carcasses were fabricated according to the official standard (COVENIN, 1982) leaving a maximum of subcutaneous fat layer of 6.4 mm on any cut. Yield of boneless, closely trimmed, retail cuts (YCB) was selected as the dependent variable. Descriptive statistics were calculated for every variable using the SAS statistical package (SAS, 1996). The degree of association between potential predictors and dependent variables was firstly determined by a correlation analysis using the Pearson´s simple correlation coefficient. The regression equations were selected through the STEPWISE procedure (SAS, 1996) using the determination coefficient, Mallow´s Cp and the residual variance as recommended by Macneill (1983).

Results and discussion

Table 1 shows descriptive statistics for the different traits of the carcass sample and corresponding r values describing their degree of association with YBC. Linear measurements showed a relatively low variation as compared to other traits. Those traits related to carcass fat estimates showed the greater variation statistics. The sex class (CLASS) explained 43% of the variation on YBC. The majority of the variation (50% or more) on YBC could not be explained by its simple linear regression over any of the 12 carcass traits under study. Variables selected for the final regression analysis were CLASS, carcass weight, back fat thickness, rib eye area, kidney, pelvic and heart fat percentage, fat covering score and leg conformation. After stepwise analyses and applying the selection criteria recommended by Macneill (1983), the best equations are described in Table 2.

Table 1. Descriptive statistics for different carcass traits of Venezuelan cattle and their correlation with the beef cutting yield.

Variables	N	Mean	SD	CV	Minimum	Maximum	r[d]
Sex class	1162				3	4	-0,659**
Hot carcass weight, kg.	1162	273,38	32,24	11,793	146,00	444,00	0,228**
Fat covering score[a]	1197	3	0,76	25,333	1	5	0,454**
Back fat thickness, mm	1160	2,84	2,22	78,169	0	19	-0,553**
Kidney, pelvic and heart fat, %.	1044	1,85	0,91	49,189	0,11	5,59	-0,644**
Rib eye area 12[a], cm²	1162	11,20	1,78	15,892	5,6	21,00	0,409**
Carcass length, cm	369	129,31	4,41	3,414	117	161	0,323**
Thoracic depth, cm	369	37,43	2,97	7,935	25	60	-0,003ns
Hind leg width, cm.	368	57,94	4,59	7,922	38	73	0,397**
Hind leg circumference, cm.	369	116,32	5,76	4,952	100	155	0,325**
Hind leg length, cm	256	70,71	3,33	4,709	46	78	0,359**
Carcass conformation score [b]	1196	2,66	0,67	25,187	2	5	0,115**
Yield of boneless retail cuts, %[c]	1109	55,11	3,29	6,969	43,86	63,03	

N: No. of observations; SD: Standard deviation; CV: Coefficient of variation;
a: 1: uniform, 4: absent; b: 1: excellent, 4: industry; c: proportion of high plus medium-valued, retail, closely trimmed cuts in relation to the chilled carcass weight. [d]: r: Pearson´s correlation coefficient; *:P < 0,05, **: P< 0,01, ns: nonsignificant.

Table 2. Regression equations selected to predict beef cutting yields

	β Coefficient										
	β_0	CLASS	HCW	FATH	REA	KPH	FINISH	LEGCON	R^{2a}	Cp^b	RV^c
1	38,580	4,550							0,452	491,65	5,96
2	46,291	3,149				-1,468			0,572	158,97	4,66
3	47,625	2,860		-0,284		-1,170			0,598	88,49	4,38
4	45,623	2,541		-0,273	0,282	-1,164			0,616	38,52	4,18
5	48,327	2,399		-0,305	0,256	-1,287		-0,615	0,625	10,47	4,07
6	47,968	2,344		-0,287	0,253	-1,237	0,209	-0,684	0,628	8,92	4,06
7	47,564	2,281	0,003	-0,302	0,211	-1,237	0,219	-0,659	0,629	8,00	4,05

[a] Coefficient of determinaton; [b] Cp= Mallows´ coefficient; [c] Residual variance; β_0 =Intercept; CLASS: Sex class (3=steers and heifers, 4= bulls); HCW= Hot Carcass Weight, Kg; FATH=Back fat thickness, mm; REA: Rib eye area at the 12ª rib interface, cm^2; KPH= Percentage of kidney, pelvic and heart fat; FINISH: External fat covering, points; LEGCON: Leg conformation score, points. All variables shown in the table were significantly related to YBC ($P<0.05$).

Conclusions

The regression analyses indicates that the best prediction equation was the number 7 (R^2 0.629; Mallow´s-Cp: 8). However, equation number 5 (even though its Cp was not the best) is strongly recommended in terms of its practical application (lesser number of predictors). All the equation set presented here in must be subjected to practical and statistical validation in Venezuelan carcasses.

Pertinent literature

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