ON FARM EFFECTS ON TENDERNESS BEEF PREDICTION

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Background

Consumers consider tenderness to be the most important component of meat quality. Knowledge of the eating quality o steaks, was therefore more important than price, which was more important than quality labels in determining choice of steak (Dransfield *et al*, 1998). Great progress has been made in the industrial processing technology (Culioli, 2000) but sourcing is still a important factor. A conceptual model that considers the pre-slaughter factors that affect tenderness was proposed by Shorthose (1996 including breed, age, carcass weight, nutrition level, and marbling.

In Argentina, these factors are more important because most beef is consumed fresh (without ageing). Although most bee comes from two year old steers of British breeds finished on good pastures, there is still a problem of a lack of consistency i tenderness of the cuts that has driven consumers to pay more for very small cuts from animals fed on concentrates, even though the have less flavour.

Objective

To determine the relative importance of pre-slaughter factors: sex, feeding system, age, breed type, and intramuscular fat i order to predict at slaughter, the on farm effects on tenderness of the *longissimus dorsi* of commercial steers .

Methods

Data of 826 commercial steers and cows from a well known source (feedlot or pasture) were collected. A record was mad before skinning of the number of adult teeth and breed type by observing the round conformation, the hump, ears, and skin colouring and finally the weight of half carcass and internal fats. After 48 hours hanging a steak was taken from the *longissimus dorsi* at th height of the 9th lumbar vertebra. 7 days ageing after slaughter, tenderness of the steak was measured by shear force (kg) by the Warner Bratzler method, according to the cooking procedure described by AMSA (1978). The percent of intramuscular fat was als determined by extraction with hexane (Soxhlet).

Statistical Analysis: The data was grouped according to Breed Type as: Pure British (BB) and Continental (CB), Bos Indicu (ZB) and Friesian (HB) crosses; and by group age, according to the number of adult teeth and the weight of the half carcass as: (0 D up to 118 kg half carcass ; (< 4 D) more than 118 kg ; (4 D) ; (6/8 D) y (gsD) worn teeth or none at all. A linear model was used fo the tenderness shear force (kg), using Sex, Feeding System, Breed Type and Age Group as fixed factors; and Half Carcass Weigh (nested in age group) and Intramuscular Chemical Fat as co-variables. The SAS-GLM procedure for unbalanced data was used. Th means were compared with the Tuckey test and the LS means were calculated. All the analysis were performed at the Computer Service Center of the Faculty of Agronomy and the fat analysis at the Biochemical Laboratory of the same Faculty. Shear force was measured at th Instituto de Tecnologias de Alimientos (INTA Castelar).

Results and Discussion

After a preliminary analysis, sex ($p = 0.27$) and chemical fat ($p = 0.17$) were excluded from the model since they were no significant in coincidence with other studies (Wheeler *et al*, 1994) . The model had a CV of 22.7 and R^2 of 0.16 and was highly singificant ($p< 0.0001$) . The effects of Feeding System and Breed Type ($p< 0.0001$), Age Group ($p< 0.006$) were also highly significant ; whereas Weight of Carcass ($p< 0.018$) was significant.

Mean tenderness of animals from feedlots was significantly different ($p < 0.05$) from grazing system, in coincidence wit other results (Van Koevering *et al*,1995), who found a linear effect with the length of feeding time . LS means for Feeding Syste appear in Table 1.

Mean tenderness of BZ differed significantly ($p < 0,05$) from all others .CB, HB, and BB means (in this order) did not diffe between them. These results coincide with Koch *et al* (1982), Gallinger *et al* (1992) and Picallo *et al* (1998). LS means for Bree Type appear in Table 2.

Mean tenderness differences between Age Groups were significant ($p < 0.05$) with the exception of < 4 D > 118 kg and 4 D and the latter with the category gsD. These differences are not great because the *longissimus dorsi* muscle has a low proportion o connective tissue, which is the most affected by age (Hernshaw *et al*, 1998) L. S Means for Age Group appears in table 3.

In Tables 4 and 5 the estimated intercepts (a) and linear regression coefficients (b) of shear force on half carcass weight ar shown between Breed Type and Age Group combinations within each Feeding System. The effect of carcass weight within eac group (b coefficient) is very low. Observing the intercepts, it is noticed a strong influence of Feeding System, Age Group, and Bree Type on shear force, confirming the differences in LS means stated before.

Conclusions

An exploratory model to predict on farm effects on shear force tenderness of *longissimus dorsi* can be used with reasonable precision by recording easily at slaughter: breed type, age group, feeding system, and carcass weight; this would help to improve processing to achiev beef quality consistency.

Pertinent Literature

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L.S. MEANS of TENDERNESS

TABLE 1 FEED SYSTEM

	n	$\bar{x}$
GRAZING	668	3,63
FEED LOT	158	3,23

TABLE 2 – BREED TYPES

	n	$\bar{x}$
BB	409	3,16
CB	189	3,35
HB	66	3,33
ZB	162	3,89

TABLE 3 - AGE GROUP

	n	$\bar{x}$
0 D <118 kg	52	3,09
<4D >118 kg	396	3,27
4 D	122	3,36
> 4 D	188	3,53
gsD	68	3,89

PREDICTIVE EQUATIONS for TENDERNESS

TABLE 4 - FEED LOT

	0 D <118 kg		<4D >118 kg		4 D		6 y 8 D		gsD	
	a	**b**	**a**	**b**	**a**	**b**	**a**	**b**	**a**	**b**
BB	1,30	-0,01	1,74	0,02	2,34	0,01	3,66	-0,01	3,80	-0,01
CB	1,49	-0,01	1,93	0,02	2,53	0,01				
HB			1,91	0,02	2,51	0,01	3,83	-0,01		
ZB			2,47	0,02	3,08	0,01	4,40	-0,01		

TABLE 5 - GRAZING SYSTEM

	0 D <118 kg		<4D >118 kg		4 D		6 y 8 D		gsD	
	a	**b**	**a**	**b**	**a**	**b**	**a**	**b**	**a**	**b**
BB	1,70	-0,01	2,14	0,02	2,75	0,01	4,06	-0,01	4,21	-0,01
CB	1,89	-0,01	2,33	0,02	2,94	0,01				
HB			2,31	0,02	2,92	0,01	4,23	-0,01		
ZB			2,88	0,02	3,48	0,01	4,80	-0,01		

BB: British Breeds, CB: Continental -British crosses, ZB Bos Indicus-British crosses, HB Friesian-British Crosses.AGE GROUP= Number of adult teeth and half carcass weight: less / more < / >. gsD: worn or no teeth; a= intercept; b = coefficient of linear regression. W.B. Shear Force (KG)