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Relationship of carcass grades with carcass composition and value of steers

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Introduction

In the EU, beef carcasses are graded for conformation and fatness as part of the carcass classification system which also includes the sex of the animal and carcass weight. Carcass conformation and fat scores were based on visual examination which is now replaced by mechanical grading in Ireland. Conformation score has a major effect on carcass price but there is considerable variation between EU countries in the price difference between the various conformation classes (Table 1). If carcass grades are to be used in genetic improvement programmes it is important to know how the grades relate to the value of the carcass. Thus, it is essential to know the relationship between the carcass grades and meat yield and meat distribution in the carcass. The importance of meat distribution is evident from the fact that following fat removal the cube roll, fillet and striploin only account for 7 to 8% of carcass weight but about 30% of carcass value. The objectives were to study the relationship between carcass conformation (CS) and carcass fat (CF) scores with (1) carcass meat, fat and bone proportions, (2) the proportion of high priced meat cuts in the carcass, (3) high priced meat cuts as a proportion of total meat and (4) carcass value.

Materials and Methods

A total of 134 steers were used, which are a subset of a more comprehensive study involving up to 500 animals. The steers were slaughtered at approximately 2 years of age in three separate batches of 44, 47 and 43 animals. Hot carcass weight was recorded and cold weight was taken as 0.98 hot carcass weight. Carcasses were visually and mechanically graded according to the EU Beef Carcasses Classification Scheme. Carcass meat, fat and bone proportions were obtained following dissection of the right side of each carcass. The right side was split into an 8 rib pistola hindquarter and the remaining forequarter. The pistola was dissected into 12 cuts (silverside, topside, knuckle, rump, tail of rump, fillet, striploin, cube roll, cap of ribs, leg, heel and salmon). The bones were removed and scraped clean. All dissectable fat was removed from each cut. The weight of each cut and total weight of fat trim, lean trim and bone were then recorded for the pistola. The forequarter was dissected into 11 cuts (front shin, brisket, chuck, neck, flat ribs (1 to 5), plate, leg of mutton cut, bladesteak, braising muscle, chuck tender and clod) and a similar procedure was undertaken as outlined for the pistola. For both quarters, lean trim was added to the fat trimmed boneless cuts to give meat yield. Total carcass yields of meat, fat and bone were the combined values for the pistola and forequarter. Carcass value was taken as twice the sum of the commercial values of the boneless, fat trimmed cuts for the half carcass with a deduction for bone. Thus, when estimating carcass value the weight of carcass fat was not taken into consideration.

Results and Discussion

Details of the animals are presented in Table 2. Their liveweights at slaughter and carcass weights were 619 and 319 kg, respectively. On a scale of 1 to15 mechanically graded carcass conformation scores (EUROP) were 5.7 and fat scores were 8.7. Carcass meat, fat and bone proportions were 672, 120 and 208 g/kg respectively. The proportions of high priced meat cuts (fillet, striploin and cube roll) in the carcass was 70g/kg.

High positive correlations (r = varied from 0.68 to 0.82) were obtained between carcass conformation score with carcass meat proportion, the proportion of high priced meat cuts and carcass value (Table 3). A high negative correlation (r = ~0.80) was obtained between carcass conformation and carcass bone proportion. The correlation between carcass conformation score and carcass fat proportion was low and negative. The only positive correlation with carcass fat score was the proportion of carcass fat (r = 0.60) and high priced cuts as a proportion of total meat (r = 0.21 to 0.34). Visual and mechanical conformation scores were highly correlated (r = 0.91) while the corresponding value for fat scores was only 0.79. The relationship with the various traits and particularly carcass value was considerably better with conformation score than with fat score.

Regression analysis were also used to quantify the relationship between carcass conformation and fat scores with carcass meat, fat and bone proportions, meat distribution and carcass value (Table 4). Using mechanical carcass grading, the effects on carcass meat proportion of a one unit increase (scale 1 to 15) in carcass conformation and fat scores was +14 and -7 g per kg respectively. The corresponding effects on carcass fat proportions were -6 and +10 g/kg while the effects of carcass bone proportions were -8 and -2 g/kg. The effect on the proportion of high priced meat cuts in the carcass of a one unit increase (scale 1 to 15) in carcass conformation and fat scores were +1.9 and -0.7 g per kg respectively. The effects of conformation and fat scores on meat in high priced cuts as a proportion of total carcass meat were both positive. The effects on carcass value of a one unit increase (scale 1 to 15) in carcass conformation and fat scores were +6.4 and -2.8 c per kg carcass. The results obtained using visual scoring of the carcasses for conformation and fatness were somewhat lower than those obtained with mechanical grading.

Conclusion

- Increased carcass conformation score increased carcass meat yield, increased the proportion of high priced cuts in the carcass, increased carcass value while decreasing carcass fat and bone proportions and had a positive effect on meat in the high value cuts expressed as a proportion of total meat.
- The results obtained with visual scoring for conformation and fatness were somewhat lower than those obtained with mechanical grading.
- Increasing carcass fat score led to a decrease in carcass meat and bone proportions, the proportion of high value cuts in the carcass and in carcass value while increasing carcass fat proportion.

Table 1: Price differences (c/kg) between carcasses grading R3 or U3 over O3 in 2005

	Ireland	GB	France	Italy	Spain	Netherlands
Steer (bull)						
R3 v O3	+10	+16	+44	(+35)	(+17)	(+16)
U3 v O3	+17	+23	+70	(+79)	(+39)	(+43)
Heifer						
R3 v O3	+13	+15	+54	+145	+45	-
U3 v O3	-	-	+98	+187	+49	-

Source: Bord Bia, Ireland

Table 2: Details of the animals used in the study

	Mean	Standard deviation	Minimum	Maximum	Coefficient of variation
Slaughter wt. (kg)	619	62.1	495	784	10.0
Cold carcass weight (kg)	319	36.3	257	450	11.3
[1]Conformation score - mechanical	5.7	2.17	2.0	11.0	38.1
- visual	6.0	2.47	2.0	11.0	41.1
[2]Fat score - mechanical	8.7	1.81	4.0	14.0	20.8
- visual	9.2	1.62	5.0	14.0	17.4
Meat (g/kg)	672	38.2	593	771	5.7
Fat (g/kg)	120	27.7	55	211	23.0
Bone (g/kg)	208	20.6	160	260	9.9
[3]High priced cuts (g/kg)	70	5.7	56	87	81
Value (c)	247	17	210	292	681

[1]Scale 1 to 15 (best conformation); [2]Scale 1 to 15 (fattest); [3]Meat in fillet, striploin and cube roll.

Table 3: Correlations between carcass conformation and fat score with carcass meat, fat and bone proportion, proportion of high priced meat cuts in the carcass, high priced meat cuts as a proportion of carcass meat and carcass value

Grading method	Meat	Fat	Bone	High priced meat cuts	High priced cuts as % meat	Carcass value	Visual conf. score	Visual fat score
Mechanical								
Conformation	0.80***	-0.49***	-0.82***	0.73***	0.59***	0.82***	0.91***	-0.06
Fat	-0.33***	0.60***	-0.20	-0.22*	0.34***	-0.28***	-0.02	0.79***
Visual								
Conformation	0.76***	-0.46***	-0.80***	0.68***	0.54***	0.79***	1.0	
Fat	-0.32***	0.60***	-0.19*	-0.25**	0.21*	-0.31***		1.0

Table 4: Regression equations using carcass conformation and fat scores (s.e.) for predicting carcass meat, fat and bone proportions (g/kg), the proportions of high priced meat cuts in the carcass, high priced cuts as a proportion of total carcass meat (g/kg) and carcass value (c/kg)

Mechanical grading	Intercept	Conformation score	Fat score	R^2
Meat proportion	656	+14.1 (0.78)***	-7.4 (0.98)***	0.74
Fat proportion	71	-6.2 (0.71)***	+9.8 (0.89)***	0.60
Bone proportion	272	-7.9 (0.44)***	-2.4 (0.56)***	0.71
Proportion of high priced cuts	65	+1.9 (0.15)***	-0.72 (0.201)***	0.57
High priced cuts as proportion meat	93	+6.1 (0.265)**	+4.4(0.82)***	0.46
Value	235	+6.4 (0.34)***	-2.8 (0.43)***	0.75
Visual grading				
Meat proportion	669	+11.7 (0.77)***	-7.2 (1.17)***	0.67
Fat proportion	58	-4.9 (0.66)***	+10.0 (1.00)***	0.54
Bone proportion	273	-6.7 (0.41)***	-2.7 (0.62)***	0.68
Proportion of high priced cuts	68	+1.5 (0.14)***	-0.8 (0.21)***	0.50
High priced cuts as proportion of meat	107	+4.9 (0.63)**	3.0 (0.96)**	0.34
Value	242	+5.3 (0.33)***	-3.0 (0.50)***	0.69