SLAUGHTER WEIGHT AND BREED GROUP EFFECTS ON CONSUMER BEEF MEAT QUALITY APPRAISAL THROUGHOUT AGEING

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Background
Consumer preferences for meat products have changed considerably in the last decade. Now there are new demands for healthier, better quality meat and an improved product image, which has even increased the purchasing price in some cases (Balling 1990). These preferences may be analysed by identifying and measuring different psychological and social conditions. Consumer testing is an essential part of this analysis as it can be used to estimate quality and, in the end, consumer acceptability.

Objectives
To assess beef meat acceptability, considering different breed types, slaughter weights and ageing times.

Material and Methods
Fifty-six entire male, yearlings, reared with concentrate after weaning, of seven local Spanish beef breeds were used (8 animals per breed): Asturiana de los Valles (a double muscled breed of North of Spain), Parda Alpina (an unimproved Brown Swiss double purpose milk-meat breed), Pirenaica and Rubia Gallega (rapid growth breeds from eastern and northwestern Spain) and Avileña Negra-Ibérica, Retinta and Morucha (unimproved breeds from central and western Spain). These breeds were grouped into four breed types according to Campo *et al.* (1999): double muscled type (DM, including Asturiana de los Valles breed), double purpose type (DP, including Brown Swiss breed), fast growth type (FG, including Pirenaica and Rubia Gallega breeds) and rustic type (RT, including the rest of breeds). Within each breed, four animals were slaughtered at 300 kg (light) and four animals at 550 kg (heavy).
Longissimus dorsi muscle of the left side carcass was remove after 24 hours of slaughter. Then it was sliced into two cm steaks, vacuum packaged, and aged 1, 3 7 and 21 days, frozen and kept at –18°C until analysis. We used a 199 consumer panel, made up of staff and workers from the University of Zaragoza, butchers, liberal professionals, members of consumer associations and staff from the catering and hotel business.

Sessions were performed under controlled conditions, in panels of 9-10 members and 11-12 samples in two comparisons per consumer and session: ageing within breed and weight and breed within ageing and weight. Samples were cooked in a double plate grill at 200°C until they reached an internal temperature of 70°C. Consumers assessed tenderness, global flavour intensity and overall appraisal. 2189 judgements were obtained, 39-40 for each breed, weight and ageing time. Data were analysed using a GLM procedure (SAS, 1993), according to model:Y=u+breed+ageing+weight+breed*ageing+breed*weight+ageing*weight+e. A Duncan test was used to identify differences between treatments.

Results and discussion
Breed effect
Breed had a bigger effect in tenderness and overall appraisal ($p<0.001$) than in global flavour ($p<0.05$) (*Table 1*). In light weight animals, DP breed type showed the lowest tenderness values at 3 and 21 days of ageing (*Table 2*), maybe because of the influence of its higher collagen composition, as it has been previously reported (Campo *et al.*, 1998). But at heavy weight, DM animals showed the lowest tenderness values at long ageing times, in both cases, related to the lowest overall appraisal. Double-muscled animals are characterised by its lower enzymatic activity and a different myofibrillar composition (Arthur, 1995) which would produce tougher meat than normal genotypes at long ageing times.
Ageing effect
Ageing had a very significant effect in all sensory attributes ($p<0.001$), as it was previously found in a taste panel with the same type of animals (Campo *et al.*, 1998). Tenderness increased in all breed types throughout ageing (*Table 2*), being especially important in light weight animals in DM and FG breed types. This increment was closely related to the better overall appraisal at long ageing times. Although global flavour intensity also rose throughout ageing, tenderness has been widely reported as the main characteristic perceived by consumers (Love, 1994).
Weight effect
Only tenderness have been significantly affected by slaughter weight ($p<0.05$) (*Table 1*). In general, consumers have considered heavy weight meat more tender than light weight meat, as it was previously reported by Boccard and Bordes (1986). This disagrees with the generalised market opinion that younger animals should be less tough. Maybe the protection effect of the marbling and the more developed enzymatic system in older animals, characteristics that do not fit in double muscled animals, could explain a higher tenderness as weight increases, up to a certain age.

Conclusions
Ageing and breed type have an important effect on consumer beef meat perception. Ageing up to 21 days increases the overall acceptability of beef meat mainly due to the increment of tenderness than to the flavour variations. Increments in carcass weight would also produce more tender and acceptable meat.

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***Table 1.** Significances of main effects (BT= breed type; W= weight group; A= ageing).*

	BT	W	A	BT x W	BT x A	W x A
Tenderness	***	*	***	***	**	n.s
Global Flavour Intensity	*	n.s.	***	n.s	n.s	n.s
Overall Appraisal	***	n.s	***	**	**	n.s

Ns=no significant;=p<0.05;**=p<0.01;***=p<0.001*

***Table 2.** Tenderness, global flavour intensity and overall appraisal average values in every breed type [double muscle (DM), fast growth (FG), double purpose (DP) and rustic type (RT)] at every ageing time (1, 3, 7 and 21 days) in animals slaughtered at light (350 kg) or heavy (550 kg) live weight*

		Tenderness[1] BREED TYPE					Global flavour[1] BREED TYPE					Overall appraisal[1] BREED TYPE				
	Ageing	**DM**	**FG**	**DP**	**RT**	**s.e.d.**	**DM**	**FG**	**DP**	**RT**	**s.e.d.**	**DM**	**FG**	**DP**	**RT**	**s.e.d.**
LIGHT	**1**	4.14 B	4.24 C	4.95 AB	5.15 C	*0.16*	5.79 A	5.87 BC	5.37 AB	5.75 B	*0.12*	5.21 B	5.25 B	5.77	5.86 B	*0.12*
	3	5.59 yA	4.82 yzC	4.40 zB	5.80 yB	*0.13*	5.62 yzAB	5.64 yzC	5.13 zB	6.28 yAB	*0.10*	6.13 yzB	5.53 zB	5.67 z	6.42 yA	*0.10*
	7	5.40 AB	6.04 B	5.43 AB	6.20 AB	*0.13*	6.49 yB	6.37 yAB	5.71 zAB	5.82 zB	*0.11*	6.15 B	6.48 A	6.29	6.39 A	*0.09*
	21	6.71 yzA	6.98 yA	5.94 zA	6.64 yzA	*0.13*	6.57 AB	6.72 A	6.35 A	6.41 A	*0.11*	7.14 yA	6.96 yA	6.13 z	6.64 yzA	*0.11*
	s.e.d.	*0.19*	*0.12*	*0.19*	*0.11*		*0.14*	*0.09*	*0.15*	*0.09*		*0.13*	*0.09*	*0.15*	*0.09*	
HEAVY	**1**	5.04	5.74 C	5.47	5.45 B	*0.14*	5.75	5.89 B	6.27	6.01 B	*0.10*	5.44	6.32 B	6.13	6.03 B	*0.11*
	3	5.81	5.68 C	5.31	5.45 B	*0.15*	5.76	6.03 B	6.44	5.95 B	*0.12*	6.27	6.08 B	5.90	6.13 B	*0.13*
	7	5.29 z	6.61 yB	5.74 yz	5.12 zB	*0.16*	6.07	6.23 B	6.06	5.98 B	*0.12*	6.14	6.67 B	6.01	5.94 B	*0.12*
	21	6.00 z	7.83 yA	6.95 yz	6.85 yzA	*0.12*	6.79	7.03 A	6.85	6.57 A	*0.10*	6.57 z	7.63 yA	7.15 yz	6.97 yzA	*0.09*
	s.e.d.	*0.20*	*0.13*	*0.12*	*0.11*		*0.14*	*0.11*	*0.09*	*0.09*		*0.16*	*0.11*	*0.09*	*0.09*	

(1) Very low(10) Very high; yz in the same row indicates significantives differences between breed type within each ageing time and live weight; ABC in the same column indicates significatives differences among ageing times within breed type an live weight.