

## THE INFLUENCE OF CATTLE BREED ON THE SENSORY MEAT QUALITY DURING AGEING.

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## ABSTRACT

The influence of the breed and ageing time on sensory quality of beef was studied. Forty-two animals were used, comprising six Brown Swiss (BS) and six animals from each of the six Spanish breeds: Asturiana de los Valles (AS), Avileña (AV), Morucha (MO), Pirenaica (PI), Retinta (RE) and Rubia Gallega (RG). AS, PI and RG are meat purpose animals and AV, MO and RE are rustic breeds. Loin steaks (*Longissimus dorsi lumborum*) from each animal were randomly selected and aged for 3, 7 and 14 days. A 10-member trained panel assessed texture, juiciness, beef flavour, abnormal flavour intensity and overall liking. No interaction effects were found between breed and ageing. Texture differed significantly among breeds ( $p < 0.001$ ). At each ageing time, BS, PI and RG meat was less tender than AS and the rustic breeds. At three days rustic breeds were more juicy ( $p < 0.05$ ) than other breeds, but did not differ at seven or fourteen days. There were no significant differences in beef flavour, although at 14 days BS had higher abnormal flavour intensity ( $p < 0.05$ ) than at 7 days. There were no significant differences in hedonic ratings of overall liking among the breeds at 3 and 7 days. However, at 14 days meat purpose breeds, apart from AS, were least liked and rustic breeds liked the most.

## INTRODUCTION

The production of beef is changing all over the world. Nowadays the main aim is to obtain a quality product produced under natural conditions. Specific Designations have been established for guaranteeing this quality to consumers, who are looking for better natural products of reliable eating quality. Several Spanish breeds already have quality labels. These animals are normally grown under intensive conditions, however their different development rates can distinguish them when fed under the same conditions. Different local methods of handling meat in each region and country has resulted in the consumption of meat at different ageing periods. Little work has been done to investigate the breed effect on ageing with a view to select ageing times that ensure good quality.

The aim of the present study assesses the breed effects on eating quality of meat aged for different periods.

## MATERIAL AND METHODS

42 animals were reared at the same time and place under intensive conditions and fed concentrates. They comprised 6 animals from Brown Swiss (BS), dual purpose animals, and 6 from each of the Spanish breeds: Asturiana de los Valles (AS), meat purpose breed of low growth rate, Pirenaica (PI) and Rubia Gallega (RG), meat purpose breeds of fast growth rate, and Avileña (AV), Morucha (MO) and Retinta (RE), which are rustic breeds. The slaughter live weights (SLW) and daily gains (DG) are shown in Table 1.

1.

Animals were slaughtered as yearlings in an E.U. licenced commercial abattoir. Carcass conformation was measured using the EUROP scale, including 15 points, and fatness was measured using a 1-15 scale, with 1 for very low fatness and 15 for a very high fatness (Table 1).

Table 1. Growth rates and carcass values.

	Breed							
	AS	AV	BS	MO	PI	RE	RG	
SLW(kg)	455.7	451.5	470.6	457.6	460.1	461.1	471.1	n.s.
DG (kg/d)	1.392bcd	1.360cd	1.707a	1.221d	1.698a	1.467bc	1.573ab	**
Conformation (1-15)	11.4a	7.7cd	9.2bc	6.9d	10.5ab	8.1cd	9.2bc	**
	U	R	R-	R+	U-	R	R+	
Fatness (1-15)	4.8c	7.0ab	6.5b	6.9ab	5.9bc	8.2a	6.2b	**

AS=Asturiana de los Valles; AV=Avileña; BS=Brown Swiss; MO=Morucha; PI=Pirenaica; RE=Retinta; RG=Rubia Gallega.

SLW=Slaughter live weight; DG=Daily gain.

Different letters in the same row indicate significant differences among breeds; n.s.=no significance; \*\*= $p < 0.01$ .

Carcasses were chilled at 4°C for 24 h after slaughter. All carcasses had normal pH. Left *Longissimus dorsi thoracis* and *lumborum* were removed from each carcass and cut into 2 cm slices, which were then vacuum packed and kept at 4°C during 3, 7 and 14 days, and then frozen at -18°C. 24 h before each taste panel session, samples were thawed at 4°C. The slices were grilled to an internal temperature of 74°C without any additive. A 10-member trained panel assessed texture, juiciness, beef flavour and abnormal flavour intensity and overall liking on 8 point category scales, where 1 stood for extremely tough, extremely dry, extremely weak flavour, extremely weak abnormal flavour and dislike extremely, and 8 stood for extremely tender, extremely juicy, extremely strong flavour, extremely strong abnormal flavour and like extremely. Unsolicited comments describing the samples were also volunteered.

Data were analysed using the GLM procedures of the SAS package (SAS, 1993). Breed was the fixed effect studied in each ageing period using the model:  $y = xb + e$ , where 'e' denotes the vector of residual effects. Differences among breeds were assessed using the Bonferroni-t-test. Unsolicited comments were analysed by Chi-squared procedures.

## RESULTS AND DISCUSSION

No significant interaction was found between breed and ageing. The biggest differences appeared in texture, where rustic breeds (AV, MO and RE) and the low growth meat breed (AS) showed the most tender meat ( $p < 0.001$ ) in each ageing period (Table 2). In juiciness, significant differences were detected only at 3 days of ageing ( $p < 0.01$ ). Rustic breeds produced the most juicy meat, and AS, which had tenderer meat, was less juicy. These differences were not significant at 7 or 14 days of ageing, showing that maturation

could decrease the genetic effect in juiciness when animals are grown in similar intensive conditions.

Table 2. Influence of breed on the eating quality of grilled loin steaks conditioned for 3, 7 and 14 days.

	n = 60	Breed							sed	
		AS	AV	BS	MO	PI	RE	RG		
Texture	3 days	3.93c	3.87c	3.18a	3.29ab	2.78a	3.77bc	2.73a	0.250	***
1, extremely tough	7 days	4.14c	4.00c	3.20a	3.74bc	3.06a	4.04c	3.45ab	0.251	***
8, extremely tender	14 days	4.83c	5.01d	3.99ab	4.40bc	3.59a	4.87cd	4.03a	0.236	***
Juiciness	3 days	4.74a	5.19ab	5.05a	5.20ab	5.06a	5.43b	4.94a	0.184	**
1, extremely dry	7 days	4.89	4.84	5.02	4.94	4.97	5.35	5.04	0.170	n.s.
8, extremely juicy	14 days	5.24	5.11	5.37	5.33	5.11	5.47	5.00	0.166	n.s.
Beef flavour intensity	3 days	2.74	2.81	2.89	3.16	2.86	2.74	2.76	0.221	n.s.
1, extremely weak	7 days	3.03	2.80	2.26	3.21	2.77	2.89	3.00	0.217	n.s.
8, extremely strong	14 days	2.92	2.75	3.10	3.05	2.86	3.05	3.03	0.214	n.s.
Abnormal flavour intensity	3 days	3.56	3.53	3.80	3.04	3.45	3.41	3.25	0.282	n.s.
1, extremely weak	7 days	3.35	3.26	3.10	3.37	3.50	3.09	3.32	0.256	n.s.
8, extremely strong	14 days	3.82b	3.75a	3.99b	3.23a	3.64ab	3.23a	3.86b	0.283	*
Overall liking	3 days	3.04	3.34	2.76	3.25	2.89	3.08	2.70	0.176	n.s.
1, dislike extremely	7 days	3.65	3.41	3.38	3.58	3.09	3.59	3.35	0.210	n.s.
8, like extremely	14 days	3.27bc	3.48cd	3.31ab	3.50cd	2.95a	3.71d	3.04ab	0.210	**

AS=Asturiana de los Valles; AV=Avileña; BS=Brown Swiss; MO=Morucha; PI=Pirenaica; RE=Retinta; RG=Rubia Gallega.

n=number of assessments by breed and ageing time.

n.s.=no significant differences; \*=p<0.05; \*\*=p<0.01; \*\*\*=p<0.001.

Different letters in the same row indicate significant differences among breeds.

No significant effects were found in beef flavour intensity. Values are low due to the age of the animals and the high energy diet. Also, the *Longissimus dorsi* muscle shows less beef-flavour intensity than other muscles (Carmack, C.F. *et al.*, 1994). As ageing time increased abnormal flavour intensity differences appeared among breeds. Thus at 14 days, MO and RE showed less intensity than AS, BS and RG, breeds with higher muscularity (p<0.05).

At 14 days there were significant differences in overall liking (p<0.01). Panellists preferred RE, MO and AV, breeds with faster growth rates and higher intramuscular fat content. PI was least preferred and tougher than other breeds. Toughness is considered the most important determinant of consumer acceptability (Love, J., 1994).

The breeds can be split into four groups based on whether they are considered rustic, fast or low growth meat and dual purposes (Table 3). A study of unsolicited comments showed that AS (low growth meat purpose breed with the best conformation and leaner meat) had a higher frequency of comments on livery flavour (p<0.001) and raw flavour (p<0.01) than other breeds. Fast growth meat breeds (PI and RG) were associated with higher frequencies of sweet (p<0.001) and off-flavours (p<0.05) comments. The presence of off-flavours may cause consumers to reject products (Love, J., 1994) and these breeds had the lowest overall liking scores.

In conclusion, this study shows that breed is an important factor in ageing meat. Therefore the optimum maturation time for each should be studied.

Table 3. Number of times that unsolicited comments were applied to the rustic breeds (AV, MO and RE), fast growth breeds (PI, RG), low growth breed (AS) and double purpose (BS).

	Rustic breeds	Fast growth breeds	Low growth breed	Double purpose	
Bitter	13	9	15	30	**
Sour	40	60	48	45	n.s.
Sweet	0	6	0	0	***
Raw	55	40	72	42	**
Off	61	91	60	78	*
No taste	10	9	0	0	***
Livery	61	50	99	66	***

AS=Asturiana de los Valles; AV=Avileña; BS=Brown Swiss; MO=Morucha; PI=Pirenaica; RE=Retinta; RG=Rubia Gallega.

n.s.=no significant differences; \*=p<0.05; \*\*=p<0.01; \*\*\*=p<0.001.

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