QUALITY OF VACUUM PACKAGED LAMB MEAT AFTER DIFFERENT AGEING TIMES.

Medel I., Sañudo C., Martínez S., Panea B., Roncalés P., Beltrán J.A.
Departamento de Producción Animal y Ciencia de los Alimentos, Facultad de Veterinaria, de Zaragoza, 50.013, Spain

Background

The extension of the storage life of lamb meat is of primary importance for the meat industry and consumers. Meat packaging techniques, like vacuum packaging, aim to maintain the optimum characteristics of this product for longer times. But long storage can affect product quality mainly in meat tenderness, which improves during ageing, and flavour, which is largely modified. Among the mechanisms involved, proteolytic degradation of the myofibrillar component and lipolysis are the most important (Roncalés *et al.*, 1995).

Objective

The purpose of the present work was to investigate the effect of different ageing times (on the carcass) and later on vacuum packaged meat (hind quarters) during 21 days, on lamb meat quality. The measurements involved were instrumental, taste panel and consumers test.

Methods

Forty half-carcasses, from 20 male lambs of the Rasa Aragonesa breed, were studied; all of them were slaughter with an age of 80+/-10 days and a carcass weight around 9-10 kg. Carcasses were conventionally cooled and after 24h shipped to a cutting plant and stored at 0ºC +/- 1ºC during 1,2,4 or 8 days of ageing (experimental groups). The hind quarters were excised from the carcass, vacuum packaged and stored at 0ºC+/-1ºC for 21 days. Then samples from the *longissimus thoracis* muscle of the right sides (8th to 12th rib) were obtained to evaluate texture: Warner-Bratzler and Compression test, with an Instron (4301). The *longissimus lumborum*, were excised and presented to a trained panel (n=7) for sensory evaluation. The *semimembranosus* (SM), *semitendinosus* (ST) and *gluteo-biceps* (GB) muscles, from each one of the hind quarters, were used for consumers test (n=80). As control group we took 8 half-carcasses with only 3 days of ageing. All the samples were vacuum packed, frozen and stored at –20ºC until required for assessment. Samples were thawed in tap water until the experimental temperature (15-17ºC). Cooking temperature, for sensory and consumers was 200ºC (grill), until the internal temperature was 70ºC. Samples were served hot and the five treatments were evaluated on each plate. Panellists were asked to score different atributes (Table 2).
For the consumers test, samples from each different ageing time group were presented to consumers at the same way than in the trained panel. Each consumer tasted 2 different muscles in different plates in the same session (See Table 3 for atributes).
The statistical analysis was performed with SPSS for Windows 98 package. Differences between treatments were analysed by ANOVA and Duncan's multiple range test.

Results and discussions

Ageing had a fundamental influence on tenderness, in agreement with Wheeler *et al.* (1994) and Sañudo *et al.* (1998). Meat progressively became more tender with a concomitant decrease in instrumental measurements of toughness (Devine et al., 1999). For the compression test at 20 % and WB shear force, we found significant differences between the different groups (Table 1). Control treatment was tougher than the others. No differences were found between experimental groups probably because long ageing times tend to homogenise texture, which is substantially finished after 14 days, in agreement with Devine *et al.* (1999). Nevertheless, neither stress at 80 % nor maximum load were different between treatments, since stress at 80% is related with collagen content, which is poorly affected by ageing (Lepetit *et al.*, 1986).
No significant differences were found by the trained panel between the treatments, except for tenderness and liver flavour intensity (Table 2). The control group less tender than the other treatments in agreement with instrumental results.
Consumers found significant differences in tenderness and overall acceptability in the three muscles (SM, ST and GB) between the different treatments (Table 3). Like the results obtained before, the control group was less tender and had lower scores than the other four treatments. Tenderness seemed to be the main attribute in determining the acceptability of lamb for consumers in agreement with Zamora *et al.* (1996). Inside the control group we found that ST was more tender than the others (Wenham M. L. *et al.*, 1973), because of its skeletal restraint but ageing tended to homogenise differences between muscles.

Conclusions

Meat from light lambs, could be aged for long periods (22 to 29 days) without modifying negatively its textural and sensory characteristics. These long periods tend to homogenise the texture of the product. A practical implication of the present study is to package the meat as soon as possible (1-2 days) if vacuum is going to be used for extending meat storage life.

Pertinent literature

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Table 1. Effect of ageing (different days on carcass + 21 days vacuum) on lamb meat texture. Means and (standard deviation).													
	Treatment (days)							Treatment (days)					
Compression	3	1+21	2+21	4+21	8+21	F	**Warner-Bratzler**	3	1+21	2+21	4+21	8+21	F
Stress 20% (N/cm^2)	7.32 b (1.02)	5.05 a (0.98)	5.24 a (0.27)	4.71 a (0.70)	5.67 a (0.66)	6.96 **	Maximum Load (kg.)	2.97 b (0.88)	1.77 ab (0.47)	1.52 a (0.59)	1.95 ab (0.66)	1.74 ab (0.82)	2.43 t
Stress 80% (N/cm^2)	34.66 a (12.06)	32.09 a (5.84)	36.95 a (10.08)	38.17 a (11.71)	42.51 a (2.13)	NS	Maximum Stress (kg/cm^2)	2.68 b (0.81)	1.44 a (0.41)	1.32 a (0.47)	1.42 a (0.56)	1.52 a (0.66)	3.30 *
Maximum Load (N)	43.16 a (15.07)	39.28 a (7.86)	48.80 a (7.00)	54.76 a (7.47)	50.54 a (4.17)	NS	Toughness (kg/cm^2)	1.10 b (0.09)	0.75 ab (0.20)	0.57 a (0.11)	0.89 ab (0.36)	0.79 ab (0.30)	2.52 t

a,b Means in the same row with different letters are significantly different; t = p≤ 0.1; * = p≤ 0.05; ** = p≤ 0.01

Table 2. Effect of carcass ageing time on sensory analysis (taste panel) of lamb meat vacuum packaged 21days. Means and (standard deviation).						
Treatment (days)	3	1+21	2+21	4+21	8+21	F
Lamb odour (1-100)	58.39 a (14.51)	57.15 a (18.47)	59.54 a (12.72)	57.89 a (18.09)	60.24 a (15.10)	NS
Tenderness (1-100)	71.13 a (14.10)	81.78 b (11.84)	80.37 b (13.53)	82.02 b (13.30)	81.70 b (12.60)	6.85 **
Juiciness (1-100)	64.39 a (12.82)	72.26 ab (14.24)	68.35 ab (16.69)	69.96 ab (15.98)	69.45 b (13.87)	2.05 t
Lamb flavour (1-100)	68.65 a (12.78)	63.31 a (15.32)	68.43 a (13.68)	66.85 a (15.35)	65.91 a (14.79)	NS
Fat flavour (1-100)	40.17 a (24.40)	38.43 a (22.50)	43.51 a (23.02)	44.10 a (25.41)	45.02 a (23.15)	NS
Liver flavour (1-100)	39.44 a (21.03)	49.91 b (22.56)	52.20 b (24.34)	52.52 b (23.42)	50.91 b (20.13)	3.19 *
Flavour quality (1-100)	60.54 a (17.48)	57.24 a (15.67)	56.17 a (16.76)	56.56 a (16.83)	55.30 a (17.29)	NS
Overall satisfaction (1-100)	63.41 a (15.47)	59.70 a (18.44)	59.19 a (19.48)	59.92 a (18.57)	58.02 a (18.77)	NS

a,b Means in the same row with different letters are significantly different: t = p≤ 0.1; * = p≤ 0.05; ** = p≤ 0.01

Table 3. Effect of ageing time on sensory quality of lamb meat (consumer test) on the *semimembranosus, semitendinosus and gluteo biceps* muscles. Means and (standard deviation).							
Treatment (days)		3	1+21	2+21	4+21	8+21	F
SM	Tenderness (1-100)	46.63 a (20.74)	73.88 b (17.39)	73.16 b (19.05)	70.76 b (21.05)	76.13 b (17.32)	32.1 **
	Taste quality (1-100)	62.13 a (19.53)	69.50 c (16.76)	68.99 bc (15.82)	63.16 ab (19.12)	66.25 ab (19.32)	2.6 *
	Overall satisfaction (1-100)	55.50 a (19.42)	71.38 b (16.74)	71.14 b (16.95)	67.09 b (19.49)	67.75 b (20.25)	9.6 **
ST	Tenderness (1-100)	57.31a (22.66)	72.69 cd (19.25)	68.75 b (20.21)	63.67 bc (19.88)	76.13 d (18.79)	10.6 **
	Taste quality (1-100)	63.21 a (19.71)	67.18 a (18.72)	68.48 a (18.88)	62.41 a (18.96)	63.25 a (21.39)	NS
	Overall satisfaction (1-100)	59.87 a (19.77)	68.33 bc (18.19)	68.63 c (19.14)	62.03 ab (18.28)	66.71 bc (21.11)	3.27 *
GB	Tenderness (1-100)	48.13 a (22.39)	75.25 b (18.28)	74.63 b (18.48)	72.13 b (19.73)	82.50 c (13.83))	39.0 **
	Taste quality (1-100)	64.56 a (19.13)	67.38 a (17.34)	72.88 a (15.69)	67.63 a (18.57)	68.38 a (20.53)	NS
	Overall satisfaction (1-100)	58.50 a (20.57)	69.75 b (17.43)	75.13 b (16.69)	70.25 b (17.50)	70.50 b (19.15)	9.0 **

a,b,c Means in the same row with different letters show significantly difference between treatment: * = p≤ 0.05; ** = p≤ 0.01