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VARIATION OF MEAT QUALITY IN LIGHT LAMB DEPENDING ON WEIGHT INCREASE OF THE CARCASS (7.4-15.4 Kg)

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INTRODUCTION

In every country and even in every region, depending on the productive peculiarities, a relatively concrete carcass weight has been achieved, in particular for the ovine species, which determine culinary traditions and consumers preferences making then reluctant to possible changes.

In this way, in European Mediterranean countries the carcass weight increase is heavily penalized, the total sale price per animal being frequently almost identical for carcasses of 8 or 16kg without well known reasons for meat quality loss existing that justified this depreciation, which became in some months of the year up to 46% of the price per kilogram of carcass when the carcass weight increase is only 36%.

On the other hand the weight is one of the factors to determine in any system of carcass classification creating commercial types or developing quality markers.

These differentiated quality products, either labelled or origin denominated, have growing importance, considered by the new community regulations, as a way to obtain better market prices.

In Spain the first denomination of Origin that has been developed, for fresh meat, was the "Ternasco de Aragón (TA)", typical ovine product that amongst other characteristics requires carcass weight between 8.5 and 11.5kg.

With the objective to make this product more versatile, the possibilities were studied for the ampliation of admitted weights, analyzing the effects that the increase or decrease of carcass weight exerts on meat quality.

MATERIAL AND METHODS

Animals

A sample of 46 male lamb carcasses (between 7.400 and 15.460kg) from Rasa Aragonesa (local breed of rustic type and medium short wool, approximately 2,176,00 heads in 1986).

These carcasses were divided, for their analysis, within three groups:

(A) 11 carcasses with a lower weight than that admitted within the "Ternasco de Aragón (TA)" denomination, being less than 8.499kg, average carcass weight of 8.068kg.

(B) 23 carcasses admitted for their carcass weight as T.A., between 8.500 and 11.500kg, average carcass weight of 10.223kg.

(C) 12 carcasses with a superior weight to the typical T.A., average carcass weight of 13.432kg.

All of the animals were weaned and submitted to the standard fattening system of T.A. production: natural lactation, weaning, ad libitum concentrate and a limited cereal straw supply (80g/day) and always stabled.

Instrumental methods

Meat instrumental quality was studied in the *m.longissimus dorsi*:

pHu: measurement at 24 hours by a penetrating electrode.

Colour: Estimated with a colorimeter reflectometer (MINOLTA CR 200b) with only white calibration system C.I.E

$L^*a^*b^*$ (1976). Steaks were displayed in a plastic tray overwrapped with P.V.C film for 24 hours at 4°C.

In the same way subjective muscle colour was evaluated by two experienced people on a scale of 5 points (1=light, 3=pink, 5=red) (Colomer, 1983).

The determination of haem pigments was made by Hornsey's method (1956).

Hardness

Evaluated with a Warner-Bratzler shear cellule on an Instron Universal Testing Machine (Type 4.300), the muscle was removed from the carcass 48 hours after sacrifice and stored at 4°C for one day, and then cooked in olive oil at 165°C, 2.5 minutes, the steaks being of 2cms thick.

Water Holding Capacity (WHC)

Modifying the GRAU-HAMM pressure method (Sañudo *et al.*, 1988).

Sensorial Analysis

Also meat palatability (*m.longissimus dorsi* at three days of aging) was evaluated by a trained panel of eight members. Tenderness, juiciness, flavour intensity and overall were determined with a width scale of 10cm (0-100 points). The meat obtained was grilled until reaching an internal temperature of 70°C.

Statistic Analysis

Descriptive statistics were calculated. Weight effect was analyzed by variance analysis and means checked by DMS

(statistic packet SPSS).

RESULTS AND DISCUSSION

Under our work conditions we have found the following results in relation with instrumental meat quality (Table 1).

pH

Significative differences ($P < 0.01$) were verified between the light carcass groups (A and B) and the heavy group (C). A and B groups had a lower pHu which could be related to differences in the marbling and with glycogen levels.

All these must be contrasted in ulterior studies since other issues (Sañudo and Sierra, 1982; Sañudo *et al.*, 1992) indicated that the pHu varies little with age in this type of animals.

Colour

The increase in carcass weight implies darkened meat, which is appreciated subjectively ($P < 0.01$) and instrumentally lightness decrease, L^* ($P < 0.08$) and red index increase, a^* ($P < 0.01$). The higher quantity of haem pigments ($P < 0.01$), especially when increasing the carcass weight from 8 to 10.2kg could be also related to older age of the animals and with a change in feed, (the end of lactation-weaning and consequent exclusive concentrate feeding (Rhodes, 1971; Renerre *et al.*, 1979).

The change of the meat from heavier carcasses to redder hues is confirmed by the decrease of the b^*/a^* ratio and for this it has less quality, since the colour is a very important aspect in choosing a local market for this type of carcasses, which must have pink hues.

Hardness

In our results the animals placed in the medium weight class showed harder meat ($P < 0.01$). Carcasses with extreme weights offered the same hardness: 3.42 and 3.44kg cm^2 for the carcasses of 8.068 and 13.423kg respectively.

These results can be influenced by a lower fattening of medium carcasses weight (Sañudo *et al.*, 1982; 1992) and they may suggest the necessity of new experiments, also analyzing the influence of connective tissue and its development in quantity and solubility depending on the age.

Water holding Capacity (W.H.C)

The weight increase does not cause significant differences in W.H.C. Although weights affects pH, this only accounts for a third of W.H.C variations when the pH is normal as in general in sheep. These results agree with other authors like Solomon *et al.*, (1980) who don't find an influence of weight increase on W.H.C., although they are in discordance with the results of Hawkins *et al.*, (1989) or Lopez (1987). These authors observe a progressive loss of W.H.C. when the carcass weight is increased.

In Table 2 the results obtained from sensorial meat properties are shown.

Tenderness

Tenderness in lamb has been less studied than in beef, therefore there are few papers dedicated to this subject, specially to light lamb carcasses. In this paper no significant differences have been found in the tenderness evaluation.

Nevertheless we observed a tendency similar to that found when evaluating toughness with the Warner-Bratzler: more tender in heavier carcasses and less in intermediate weights.

Juiciness

The only significant ($P < 0.01$) differences in sensorial quality characteristics have been in this aspect, the heavier carcass weights being juicier.

The greater marbling of these animals can exert an influence upon the further stimulation of the salivary glands at the same time it will protect muscle fibres from cooking.

Flavour Intensity

Equally the greater fattening of heavier carcasses has possibly influenced their higher flavour intensity (Crouse, 1981), although no significant differences have been found due to the relative youth of the animals (under 17 weeks), which can involve an inferior commercial quality since on the European Mediterranean lamb market a soft taste and odour is preferred. This preference is determined by consumer habits (young animals) and cooking methods (roasted and fried) that tend to preserve higher natural aromas.

On the other hand the increase of flavour intensity related to age doesn't appear as evident (Woodhams *et al.*, 1965) as other sensorial characteristics.

Overall

According to our results no significative differences exist between the three types of weights studied, when relating to the higher or lower meat acceptability, although the lighter carcasses, that had inferior juiciness, had been penalized.

CONCLUSIONS

Under similar fattening conditions the increase of carcass weight in Rasa Aragonesa breed (7.4 to 15.4kg) carries essentially, in relation to meat quality, its darkening and the consequent loss of commercial value.

On the other hand sensorial meat quality hasn't been affected except for juiciness, and for this reason this weight increase could be favouring heavy carcasses on the markets that easily accept heavier carcasses.

Lighter carcasses due to the non significance of the differences in sensorial qualities and to their lighter and more tender meat, can become a very interesting alternative for this breed.

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Table 1. Means of meat instrumental quality with weight increase in Rasa Aragonesa sheep.

n	A 11		B 23		C 12		F
	x	σ	x	σ	x	σ	
Carcass wt, kg	8.068	0.361	10.273	0.797	13.423	1.363	
pH	5.58 ^a	0.04	5.67 ^a	0.16	5.86 ^b	0.77	**
Subjective colour 1-5	2.44 ^a	0.47	2.73 ^b	0.33	3.00 ^b	0.36	**
Haem pigments mgMb/g	1.86 ^a	0.32	2.63 ^b	0.69	2.89 ^b	0.41	**
L*	48.15 ^a	1.94	47.20 ^{ab}	3.6	45.61	2.17	0.08
a*	13.94 ^a	1.31	15.66 ^b	2.25	16.95 ^b	1.49	**
b*	5.90 ^a	1.14	6.86 ^b	1.26	6.02 ^{ab}	1.06	*
Toughness, kg	3.42 ^a	0.67	4.77 ^b	1.48	3.44 ^a	0.80	**
W.H.C.	21.72	2.38	20.82	2.53	22.71	2.80	NS

^{a,b} Means in the same row with different superscripts are significantly different ($P < 0.05$).

Table 2. Means evolution of meat sensorial quality with weight increase in Rasa Aragonesa sheep.

n	A 11		B 23		C 12		F
	x	σ	x	σ	x	σ	
Carcass weight, kg	8.068	0.361	10.273	0.797	13.423	1.363	
Tenderness (0-100)	65.36	7.48	64.94	7.76	68.41	7.62	NS
Juiciness (0-100)	62.97 ^a	4.51	68.22 ^b	4.43	69.08 ^b	4.57	**
Flavour intensity (0-100)	67.60	5.81	68.56	4.83	68.73	4.79	NS
Overall (0-100)	63.18	6.30	67.25	5.61	67.61	5.47	NS

^{a,b} Means in the same row with different superscripts are significantly different ($P < 0.05$).