INFLUENCE OF CARCASS WEIGHT ON THE QUALITY OF LIGHT LAMB MEAT.

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Background: Spain has an adequate environment for the growth of sheep owing to its orographical and agroclimatic conditions as well as the tradition and training of its farmers. Within the European Union, Spain is the second most important country regarding the number of heads and the tons of meat produced. The particular characteristics of production in each region determines the type of product that is brought into the market, according to the likings, preferences and culinary traditions of the consumers. Light lamb is a traditional product of the region of Castilla-León, and consumers expect certain particular characteristics in this product. Although quality of lamb meat and the influence of carcass weight had been studied for several authors (Kemp et al., 1972, 1976; Mendelhall and Ercanbrack, 1979; Solomon et al., 1980, Sañudo et al., 1992), no information can be get about meat from very young lambs.

Objetives: The aim of this study was to estimate any variations in meat quality as carcass weight increases; within the commercial type light lamb (i.e. animals which have been fed exclusively with sheep's milk) which is a traditional lamb common in some Spanish regions.

Materials and methods:

- Animals: eighteen carcasses were studied, corresponding to three different lamb weights: 9, 10 and 11 Kg, divided into groups of six samples for each different weight. The light lambs were slaughtered following working practice commonly used in Spain and, after 24 hours under refrigeration at 4 °C, carcass conformation parameters were analysed. Then the *Longissimus dorsi* muscle was excised, quality parameters were measured and sensory analysis was carried out.

- pH: About 3 g of muscle were homogenised in 15 ml distilled water for 30 s. The measurement was carried out inmediately using a Crison pH-meter with a combined glass electrode. The pH was also measured by a glass penetrating electrode.

- Water holding capacity (WHC): was determined using two different systems: compression and cooking loss. The press method was carried out according to Grau and Hamm (1957) and cooking loss as described by Yu Bang Lee et al. (1978).
- Muscular area: Two measures were taken in the Longissimus dorsi thoracic region at 12th rib level: A (maximum width of muscle) and B (thickness of muscle).

- Instrumental texture was measured by a Texture Analyser Micro Systems XT RA whith a Warner-Bratzler probe. The initial yield force required to shear perpendicularly to the direction of the fibres, 1cm^2 cross-section samples was determined. The results are expressed in grams. Six replicates from each sample, prepared identically than for the sensory analysis, were tested.

- Sensory analysis: The lumbar region of the *Longissimus dorsi* muscle was collected for sensory analysis by a trained analytical taste panel of twenty members The muscle was cut into 10 mm slices and grilled until the internal temperature reached 70 °C. The samples were served hot and each one was evaluated on separate plates. The sensory evaluation was a quantitative descriptive test where colour, smell intensity, hardness, juiciness, swallowing difficulty and flavour intensity were scoring using 9-point scales, 9 denoted extremely high and 1 denoted extremely low.

- Statistical analysis: Data were analysed by an analysis of variance (ANOVA, f-test whith a confidence of 95%).

Results and discussion: The carcass conformation and appearance parameters improve as carcass weight increases, while other aspects, such as meat and fat colour and degree of humidity remain unchanged. In addition, another aspect that varies with an increase in weight is the amount of kidney-fat, which is higher as carcass weight increases.

Table 1 shows that parameters such as muscular area and muscle weight are higher as carcass weight increases, which proves that there is a greater muscular development with an increment in weight. In the same way, there is also an increase in the thickness of covering fat corresponding to an increased weight.

On the contrary, pH are not modified by an increase in carcass weight (table 2). Similarly, Sañudo et al. (1992) indicate that pH varies little with age in this type of animal. Water holding capacity (WHC) are not significantly influenced by carcass weight, which agrees with the results of Salomon et al. (1980) and Sañudo et al (1996). However, Kemp et al. (1972,1976), Hawkins et al. (1985) and López (1987) observed a progressive loss of WHC as carcass weight increased.
Maximum hardness corresponds to the intermediate weight samples, which agrees with the results of Sañudo et al. (1993) although carcass weights were higher. Warner-Bratzler probe is a method usually used for measuring the meat hardness, but in general meat from heavier lambs was studied (Smith et al., 1976, Hawkins et al., 1985, Sañudo et al., 1986, 1996, Devine and Graafhuis, 1995).

Regarding sensory quality, differences in several parameters can be observed depending on carcass weight (table 3). In attributes such as hardness and swallowing difficulty the highest value corresponds to the intermediate weight, the reason for this being that in the smaller animal the muscular mass is not fully developed whereas the heavier animal contains a higher amount of fat, and it is consequently less resistant to biting

Concerning to juiciness, the highest value corresponds to the higher weight -an impression that is caused by the higher amount of fat, since no significant variations can be observed in the WHC values corresponding to the different weights- and this is corroborated by the data obtained in the quality parameter analysis. This results agrees with the ones obtained by Sañudo et al. (1993). However Mendelhall and Ercanbrack (1979) reported that an increase in carcass weight of 16,4 Kg (from 19,4 to 35,8 Kg) did not result in significant differences in tenderness, flavour and juiciness in the sensory scores of lamb cuts. Solomon et al. (1980) and Hawkins et al. (1985) found similar results, but also with carcasses much heavier than those in this study. Finally, with respect to colour, smell and flavour no significant differences were found among the different weights. According to Sañudo et al. (1996) there were no differences due to carcass weight in sensory scores assigned for tenderness and flavour. However, juiciness scores were slightly higher for heavier carcasses ($p \leq 0,01$), but they worked within a wider range of lamb weight.

Table 1. Carcass conformation characteristics. Means (X) and standard desviations (SD), n=18.

LAMB WEIGHT (Kg)	CARCASS WEIGHT (Kg)		MUSCLE WEIGHT (Kg)		A AREA (mm)		B AREA (mm)		COVER FAT (mm)	
	X	SD	X	SD	X	SD	X	SD	X	SD
9	4,723 ^{a}	0,20	106,22 ^{a}	7,705	34,66 ^{a}	2.22	15,60 ^{a}	2,229	1,45 ^{a}	0,404
10	5,210 ^{a}	0,271	116,18 ^{b}	12,195	33.81 ^{a}	1,34	16,46 ^{a}	1,995	1,95 ^{a}	0,975
11	5,981 ^{a}	0,322	126,54 ^{c}	5,034	35,78 ^{a}	1,99	16,60 ^{a}	2,583	2,55 ^{a}	1,563

Values in the same column with different letters are significantly different ($p \leq 0,05$)

Table 2. Meat pH at 24 h (pH), water holding capacity (WHC) and instrumental texture (hardness). Means (X) and standard desviations (SD), n=18.

LAMB WEIGHT (Kg)	WHC % (Cooking loss)		WHC % (Compression)		pH (Homogenitation)		pH (Penetration)		HARDNESS (g)	
	X	SD	X	SD	X	SD	X	SD	X	SD
9	31,75 ^{a}	2,455	16,87 ^{a}	4,012	5,65 ^{a}	0,190	5,69 ^{a}	0,074	2152,2 ^{a}	654,768
10	30,59 ^{a}	2.995	16,59 ^{a}	3.549	5,64 ^{a}	0,130	5,67 ^{a}	0,057	2713,3 ^{a}	582,471
11	30,19 ^{a}	2,331	16,20 ^{a}	1,730	5,66 ^{a}	0,181	5,68 ^{a}	0,017	2325,6 ^{a}	556,062

Values in the same column with different letters are significantly different ($p \leq 0,05$)

Table 3. Sensory quality. Sensory parameters were scoring using 9-point scales, 9 denoted extremely high and 1 denoted extremely low. Means (X) and standard desviations (SD), n=120.

LAMB WEIGHT (Kg)	COLOUR		SMELL INTENSITY		HARDNESS		JUICINESS		FLAVOUR INTENSITY		SWALLOWING DIFFICULTY	
	X	SD	X	SD	X	SD	X	SD	X	SD	X	SD
9	3,953 ^{a}	1,673	5,203 ^{a}	1,347	3,297 ^{a}	1,469	5,203 ^{a}	1,756	4,516 ^{a}	1,357	4,337 ^{a}	1,779
10	3,611 ^{a}	1,323	5,343 ^{a}	1,414	3,704 ^{ab}	1,369	5,056 ^{a}	1,676	4,602 ^{a}	1,447	5,111 ^{b}	1,860
11	3,020 ^{b}	1,523	5,149 ^{a}	1,557	3,027 ^{a}	1,483	6,027 ^{b}	1,590	4,493 ^{a}	1,509	4,020 ^{a}	1,859

Values in the same column with different letters are significantly different ($p \leq 0,05$)

Conclusions: The quality of light lamb is different depending on the carcass weight. Consumers will choose a different weight according to their preferences, as parameters such as juiciness, hardness and swallowing difficulty vary, even with very small differences in carcass weight.

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