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Animal performance, carcass traits and meat characteristics of Assaf and Merino × Assaf growing lambs

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ABSTRACT

This study was conducted to compare the growth, carcass and meat quality of light, intensively reared Assaf and crossbred Merino × Assaf lambs. Twelve Assaf and 12 Merino × Assaf lambs of both sexes were intensively reared from weaning until they reached 20 kg live body weight (LBW). Crossbreeding improved both daily weight gain ($P<0.01$) and feed conversion ($P<0.001$), resulting in a reduction in accumulative dry matter consumption ($P<0.05$).
Carcass conformation was also improved by crossbreeding, although commercial cut category differences ($P>0.05$) were not observed. Carcass ($P<0.10$) and shoulder fat content ($P<0.01$) were breed dependent, with Assaf lambs yielding the highest values. Assaf lambs also displayed lower 24 h pH ($P<0.01$) and greater L* values ($P<0.05$) than the Merino × Assaf crossbreeds, but other, equally important parameters, such as cooking losses or shear force, were not breed dependent.
Females showed smaller weight gains ($P<0.05$) and higher feed conversion ($P<0.01$), due to differences in gain composition. Furthermore, internal ($P<0.01$) and shoulder fat ($P<0.01$) weights were higher in females. Sex dependent differences in meat quality were also related to meat fat content, with females yielding the highest values ($P<0.01$).
Raising Merino × Assaf lambs to a weight between suckling and fattening categories could avoid the seasonality problem in current suckling lamb production, by improving productive parameters such as growth or conformation.

1. Introduction

In Mediterranean countries, dairy sheep production is based on milk breeds, and lambs are normally slaughtered between 10 and 12 kg live body weight (LBW). Suckling lamb meat is a valuable commodity, which, due to its seasonal nature, can reach elevated prices during certain periods of the year.

It is well known that carcass weight is the most relevant parameter influencing the value of the carcass (Beriain et al., 2000). In fact, because of its economic importance; differences in prices between weight categories fluctuate throughout the year, and are more pronounced in certain months of the year, when lamb production is scarce. As previously reported, during these months of lamb production scarcity, it is possible to slaughter lambs heavier than 10–12 kg in order to break with seasonal lamb production, without resulting in significant economic damage (Sañudo et al., 1992).

Intensive lamb rearing after weaning is a common practice for meat breeds, but not for dairy breeds. Generally, dairy breeds mature earlier and their precocious fatness results in slaughter at lighter weights; i.e. as suckling lambs. Crossing meat breeds with dairy breeds and slaughtering at heavier weights would be an attractive alternative to both complement milk production and reduce the seasonality of farm income. These crossbreeds could also enhance the added value of the carcasses, by increasing their weight and reducing fat content. Moreover, in order to ensure a high water content and enhance juiciness, suckling lamb meat is traditionally oven-roasted (Cross et al., 1979). Raising lambs past the suckling age would allow for other cooking methods

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to be employed, while maintaining meat juiciness and tenderness; the ability to prepare lamb meat in multiple ways could broaden its marketability.

To date, studies in the literature concerning Assaf lamb feed intake, growth, carcass and meat quality have involved either suckling lambs (Landa et al., 2004; Rodríguez et al., 2008b) or 25 kg fattening lambs (Rodríguez et al., 2008a). To the best of our knowledge, very little information exists in the literature about carcass and meat quality in light, intensively reared Assaf lambs, or their crosses, at weights between suckling and fattening; i.e. the lamb weight Mediterranean area consumers prefer (Sañudo et al., 2007).

Considering these arguments, the present study was conducted to evaluate the growth, carcass and meat quality of Assaf and Merino × Assaf light lambs, when intensively reared to a weight between a suckling and fattened lamb.

2. Materials and methods

2.1. Animals and diets

Twenty-four lambs (14.4 ± 0.09 kg LBW), 12 Assaf (6 intact males and 6 females) and 12 Merino × Assaf (6 intact males and 6 females) were used. Lambs were distributed according to breed and sex in a 2 × 2 factorial design. All lambs were kept with their mothers until weaning (12 kg LBW and 6 weeks of age). After weaning they were dewormed by Ivomec (Merial Labs., Spain) administration and vaccinated against enterotoxaemia (Miloxan, Merial Labs., Spain). All animal handling practices followed the recommendations of European Council Directive 86/609/EEC for the protection of animals used for experimental and other scientific purposes, and all animals were able to see and hear other sheep.

2.2. Experimental procedures

All animals were individually housed in 1.5 × 1.5 m floor pens, in a naturally ventilated animal house and remained there until slaughter. All animals received a pellet concentrate (70% barley, 22% soybean meal, 4.8% wheat and 3.2% vitamin and mineral mixture; chemical composition: 898 g DM/kg, 166 g CP/kg DM, 163 g NDF/kg DM, 99 g ash/kg DM) and barley straw (910 g DM/kg, 35 g CP/kg DM, 813 g NDF/kg DM, 47 g ash/kg DM) for consumption *ad libitum*.

All lambs received experimental feeds *ad libitum* and separately once a day at 9:00 in the morning. The amount of feed offered permitted refusal of between 15 and 20% of the previous maximum intake. The amount of feed offered and refused was weighed daily and samples were collected for chemical analyses. LBW was recorded three times per week, before morning feeding. Lambs were slaughtered when they reached 20 kg LBW. Slaughter was carried out by stunning and desanguination via the jugular vein. Lambs were then sheared, skinned and eviscerated. The body of each lamb was separated into carcass and non-carcass parts.

2.3. Carcass and non-carcass characteristics

Weights of the different parts of the non-carcasses were recorded. Red offal contained the heart, lungs, spleen, and either udder or penis in the case of females and males, respectively. White offal comprised the empty digestive tract. Non-carcass components, aside from wool and blood, were minced, mixed and homogenised in a commercial blender, and samples were taken and stored at -30 °C, then lyophilised (FTS-Lyostar, United States) for chemical analysis.

Carcasses contained kidneys, thymus, testicles and the kidney knob and channel fat. The carcass was weighed before and after chilling at 4 °C for 24 h. The dressing percentage was calculated as the cold carcass weight (CCW), expressed as a proportion of the slaughter weight. Linear measurements were determined following the procedure of Colomer-Rocher et al. (1988). The carcass compactness index was calculated by dividing the CCW by the carcass external length and the leg compactness index was calculated by dividing the buttock width by the pelvic limb length. The left sides were separated into commercial joints as described by Colomer-Rocher et al. (1988). Legs, ribs and fore ribs comprised the higher priced joints; shoulders comprised the medium priced joints, and the lower priced joints included breasts, necks and tails. Shoulders were dissected as described by Fisher and De Boer (1994). The right sides containing the tail were minced, mixed, and homogenised as described for the non-carcass samples for chemical analysis.

2.4. Meat characteristics

Measurements for meat characteristics were conducted on the left side of the carcass. *Longissimus thoracis* muscle pH was measured at 24 h using a pH meter equipped with a penetrating glass electrode (Metrohm® 704 pHmeter, Switzerland). Muscle colour measurements were carried out using a chromatometer (Minolta® Croma Meter 2002, Germany) equipped with a D65 illuminant and 10º observer. Muscle areas at the 13th rib were drawn on a transparent film and their surface areas were measured (AreaMeter® MK2, Holland). Muscles were then removed from the carcass, vacuum packed and stored at –30 °C until analysis. *Longissimus thoracis* were allowed to thaw for 24 h at 4 °C, and then placed in plastic bags in a 75 °C water bath until they reached an internal temperature of 70 °C. Cooking loss percentages were calculated according to the initial weight. From each lamb, eight 1 × 1 × 2 cm cores along the fibre direction were used for measuring the Warner Bratzler shear force (Texture Analyser® TA.XT2, Great Britain), with a crosshead speed of 5 mm/s. *Longissimus lumborum* was lyophilised, minced and homogenised for chemical analysis.

2.5. Analytical procedures

Procedures outlined by the AOAC (2003) were used to measure dry matter (DM, method ID 934.01), ash (method ID 942.05) and Kjeldahl N (CP, method ID 976.06) in experimental feed samples. Neutral detergent fibre (NDF) was determined as described by Van Soest et al. (1991), using sodium sulphite in the neutral detergent solution. Commercial concentrate NDF was assessed using alpha-amylase.

Non-carcass, carcass and *longissimus lumborum* samples were analysed for dry matter (DM, method ID 950.46), ash (method ID 920.153), Kjeldahl N (CP, method ID 981.10) and crude fat content (method ID 960.39).