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Carcass and meat quality of Assaf milk fed lambs: Effect of rearing system and sex

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Abstract

The effect of sex and rearing system on growth and carcass and meat characteristics of milk fed Assaf lambs was studied. Thirty-six lambs, 18 males and 18 females were used. Twelve lambs remained with their mothers throughout the experiment (NR). Within 24–36 h of birth, the rest were housed individually and fed twice a day *ad libitum* (AAR) or at 70% of *ad libitum* consumption (RAR) with reconstituted cow's milk. Sex did not affect animal performance, yet females showed higher carcass and non-carcass fat deposits. NR lambs showed greater BWG than AAR fed lambs, and AAR, higher than the RAR. Differences between naturally and artificially reared lambs in CCW and killing out percentage were not significant. Empty digestive tract and mesenteric fat weights were greater for RAR than NR lambs, with the AAR lambs demonstrating intermediate values; conversely, omental fat was greater in NR lambs. Carcass ether extract content was greater for NR lambs, possibly due to the greater growth. Use of *ad libitum* cow's milk substitute in suckling lambs twice a day resulted in less body weight gain but similar killing out percentages compared to naturally raised lambs. A 70% restricted supply increased the days in suckling and reduced carcass fatness and compactness. Except for water loss, which was less in NR than artificially fed lambs, no differences were found in meat characteristics.

Keywords: Lamb; Naturally; Artificially milk feeding system; Growth; Carcass; Non-carcass; Meat quality

1. Introduction

Traditionally, in the Mediterranean countries of EU, most dairy sheep systems produce lambs aimed at 10 kg live weight. This type of lamb is a valuable product due to its organoleptic qualities. In Spain during many decades, Churra and Castellana were the most important dairy breeds and hence most milk fed lambs were from these breeds. Nevertheless, in the last 20 years the population of local dairy breeds has decreased whereas the population of foreign breeds, such as Awassi or Assaf, has increased (Ugarte, Ruiz, Gabiña, & Beltrán de Heredia, 2001). The Assaf breed is becoming the most important dairy sheep breed in a number of Spanish regions and, its population is estimated to be around 800,000 animals (Ugarte et al., 2001). As a consequence of this, lamb meat production of this breed has significantly increased.

It is well known that ewe genotype could have a significant effect on lamb performance and carcass and meat quality (Beriaín et al., 2000; Santos-Silva, Mendes, & Bessa, 2002; Sañudo et al., 1997). Different authors have analysed the growth and carcass and meat characteristics of fat-tailed lambs, and the Awassi is one of the most studied (Macit, Esenbuga, & Karaoglu, 2002; Titi, Dmour, & Abdullah, 2007).

Likewise, comparative studies of Awassi and Spanish dairy breeds have been carried out and differences in parameters such as killing out percentage, carcass conformation, meat colour and cooking losses have been reported (Sañudo et al., 1997). Nevertheless, to the best of our knowledge, there is little data on performance and carcass and meat quality of Assaf lambs.

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In addition to genotype, animal performance and meat quality can be affected by the rearing system (Napolitano, Braghieri, Cifuni, Pacelli, & Girolami, 2002a; Napolitano, Cifuni, Pacelli, Riviezzi, & Girolami, 2002b; Osorio et al., 2006). In Assaf flocks, artificial rearing with milk is commonly used either for avoiding transmission of diseases (e.g. Visna-Maedi) or to obtain a greater amount of milk, if market price of milk is high. Moreover, through artificial lactation controlling milk intake and, to a certain extent, the length of the rearing period could be made easier. It might thus be possible to get the maximal incomes from the sale of the lambs provided carcass and meat characteristics were not affected.

There are several studies comparing performance and meat quality of naturally and artificially reared lambs of local breeds (Osorio et al., 2006) but there is no information about the effect of rearing system on performance and meat quality of Assaf lambs.

The objective of this study was to evaluate the effect of sex and rearing system on growth and carcass and meat characteristics of Assaf milk fed lambs.

2. Material and methods

2.1. Experimental design and animal management

Thirty-six Assaf lambs were included in a 2 × 3 factorial design in which the effects of sex and feeding system (naturally and artificially reared at two different levels of intake) were studied in lambs from 2 days old to 10 kg live weight. Naturally reared (NR) lambs (6 males and 6 females) were raised exclusively on maternal milk from birth to slaughter and did not receive any kind of solid food. Throughout the course of the experiment NR lambs were kept with their dams. Dams were supplemented with hay and concentrate, and at second day postpartum were allowed to graze at pasture for 4 h a day.

Artificially reared lambs were removed from the ewes within 24–36 h of birth and housed in individual pens. Twelve of them (AAR) (6 males and 6 females) were fed ad libitum twice daily (09:00 and 19:00 h) with a commercial reconstituted cow's milk [18.5% dry matter (DM), 45 g of crude protein (CP)/kg and 47 g of crude fat (ether extract)/kg]. The other 12 lambs (RAR) (6 males and 6 females) were fed with the same reconstituted milk offered twice a day at 70% of the level intake of AAR group. Daily allowance of the RAR group was adjusted three times a week, according to LBW and intake of the AAR group. The milk replacer was prepared immediately before distribution and supplemented with NaCl (0.5 g/kg), Ca_2PO_4 (1 g/kg) and vitamins A (500 μg/g), D_3 (7.5 μg/g) and E (600 μg/kg). Reconstituted milk replacer was offered in clean bottles, and lambs were trained to suck the milk replacer using polythene tubes and silicone teats. Milk refusals were weighed to determine milk intake. All lambs were weighed at birth and three times a week throughout the experimental period.

2.2. Slaughter procedure and non-carcass weights

When animals reached 10 kg live body weight, they were anaesthetised using sodium pentobarbitone and slaughtered by exsanguination from the jugular vein, eviscerated and skinned. The carcass of each lamb was dissected (which included thymus, testicles, kidneys and the kidney knob and channel fat). The weights of the empty digestive tract and the digestive (omental and mesenteric) fat and kidney knob carcass fat depots were recorded.

2.3. Carcass characteristics

Carcasses were chilled at 4 °C during 24 h in a conventional chill cooler and the cold carcasses weight (CCW) was recorded (CCW). Chilling losses were estimated as the difference between cold and hot carcass weight relative to the hot carcass weight. The killing out percentage was calculated as the CCW expressed as a proportion of the slaughter weight.

The following carcass measurements, described by Colomer-Rocher, Delfa, & Sierra Alfranca, 1988) were determined to assess carcass morphology: buttock perimeter (B), buttock length (G), carcass external length (K) and pelvic limb length (F). The index for carcass conformation (cold carcass weight/carcass external length) was calculated. Right half carcasses containing the tails were minced, mixed and homogenized in a commercial blender, and samples were taken and stored at −30 °C, then lyophilized (FTS-Lyostar, United States) for chemical analysis.

2.4. Meat characteristics

Meat characteristics were evaluated in the *longissimus thoracis* and *longissimus lumborum* muscles of the left carcass. At the 6th rib, the muscle pH was measured, using a Metrohm® pH meter, equipped with a penetrating electrode. Immediately after 1 h blooming, instrumental colour CIE L^* (lightness), a^* (redness) and b^* (yellowness) (CIE, 1986) readings were taken in the longissimus thoracis muscle at 13th rib using a spectrophotometer (Minolta® Croma Meter 2002, Germany). Eye muscle area was measured in the 6th rib position by outlining on a transparency and using a plannimeter (Areameter MK2, Holland).

The *longissimus lumborum* muscle was minced, frozen (−20 °C), lyophilized (FTS-Lyostar, United States) and analysed for chemical composition. A subsample from *longissimus thoracis* muscle was taken to determine the water holding capacity using the filter paper press procedure described by Grau and Hamm (1953) and modified by Sierra (1973). The remaining portion was vacuum-packed and frozen (−20 °C) for subsequent measurements of cooking losses and instrumental hardness. *Longissimus thoracis* muscles were cooked in a water bath to an internal temperature of 70 °C. Cooking loss was expressed as a proportion of the initial weight. *Longissimus thoracis* cooked samples (10 × 10 × 20 mm portions) were used to determine War-