# Gender and slaughter weight effects on carcass quality traits of suckling lambs from four different genotypes

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**Abstract**

The effects of gender and slaughter weight on carcass quality traits were studied in 114 suckling lambs from four genotypes (Suffolk Down, Merino Precoz Aleman, Suffolk Down × Corriedale and Suffolk Down × Merino Precoz Aleman) raised to either 10 or 15 kg live weight. The characteristics of hot carcass weight, commercial dressing percent and real dressing percent (based on empty body weight), ribeye muscle area, and back fat depth were increased by higher slaughter weight; hot carcass weight, ribeye muscle area and back fat depth were higher in male suckling lambs. Different tissue components (bone, residues) varied according to slaughter weight. The commercial yield of carcass cuts and the anatomical proportions of shoulder and leg components were affected by both genotype and slaughter weight. None of the genotypes showed clearly superior carcass traits.

*Keywords:* Sheep; Suckling lambs; Carcass characteristics

## 1. Introduction

Economic advances during the last decade have increased meat demand in Chile. However, the consumption of ovine meat has steadily declined presumably due to low organoleptic quality and unattainable price (Fundación Chile, 2000). These factors have not been adequately addressed in Chile, thus affecting local consumption, product price and farmer's income (FIA, 2000; Pérez et al., 2002).

It may be possible to increase sheep meat consumption not only by improving the meat quality traits by using different breeds and feeding procedures, but also by offering different slaughter weights (Pérez et al., 2002), complemented with adequate marketing campaigns and continuous market supply (Fundación Chile, 2000).

Suckling lambs are included as marketable qualified meat in Chile. Young lambs fed only maternal milk and slaughtered at early age and low weight produce meat that is highly appreciated for its organoleptic qualities in Chile (Pérez et al., 2002) and the consumers consider this meat natural and free of substances adverse for human health (Díaz et al., 2005). Therefore, production for high value suckling lambs slaughtered at early age might complement the promising market for cheese production from Chilean sheep, as has occurred in Spain, Italy and Greece (Beriain et al., 2000; Velasco et al., 2000; Pérez et al., 2002; Díaz et al., 2005).

In the present study the effects of slaughter weight, gender and genotype on carcass quality traits from young lambs were compared.

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## 2. Materials and methods

Data were collected on 114 suckling lambs from 30 Suffolk Down, 28 Merino Precoz Aleman, 30 Suffolk Down × Merino Precoz Aleman crosses and 26 SuffolkDown × Corrriedale crosses. The meat type Suffolk Down breed represents 8.8% of the Chilean sheep production; they have a mean body weight of 4.5 kg at birth, rising to 60–90 kg for live weight mature ewes and 80–150 kg for mature males (Pérez et al., 2002). The dual-purpose wool/meat Merino Precoz Aleman breed represents 5.3% of the sheep population in Chile with a live weight increasing from a mean of 4.4 kg at birth to 70–80 kg in mature ewes and 100–130 kg in mature males (Pérez, 2003). The dual-purpose wool/meat Corriedale breed represents 63.4 % of Chilean production; their weight increases from 3.3 kg birth weight to 50–70 kg in mature females and 80–100 kg in mature males (Pérez, 2003).

The suckling lambs were born over a 30-day period from single lambing and from second and third lambing ewes from different genotypes. They were raised in permanent confinement and fed only on their mother's milk. Dams were fed ad libitum on a complete ration (NRC, 1985; Pérez et al., 2002). The lambs were assigned to four groups according to average slaughter weight (10 or 15 kg) and gender (male or female).

The slaughter weights of 10 and 15 kg were reached at 23 ± 5 and 30 ± 6 days of age, respectively. The animals were transported to a commercial slaughterhouse and fasted (only water was available) for 12 h prior to slaughter. After weighing, the lambs were electrically stunned and slaughtered according to standard commercial procedures. The weights of carcass, blood, kidney and kidney fat, feet (cut at tarsal-metatarsal and carpal-metacarpal articulations), hide, full and empty gastrointestinal tract, liver, heart, lungs (including trachea) and head (cut at the occipital-atlantoidal articulation) were determined according to procedures previously described (Gallo et al., 1996; Pérez et al., 2002). The empty body weight (EBW) was calculated by subtracting the weight of gastrointestinal contents (full minus empty gastrointestinal tract) from the live weight (Gallo et al., 1996). Commercial dressing percentage was calculated as carcass weight divided by live weight, and real dressing percentage as carcass weight divided by empty body weight (Velasco et al., 2000; Pérez et al., 2001, 2002). Three hours after slaughter, the carcasses were reweighed, then halved longitudinally with a band saw. Each carcass half was then cut between the 12th and 13th ribs. Fat depth and muscle area were measured after cutting. Fat depth was measured over the cut surface of the *Longissimus thoracic et lumborum* muscle at the level of the 12th rib, using a ruler (Gallo et al., 1996; Pérez et al., 2002). Eye muscle area was measured using a LI-COR portable area meter (LI-300 A), after tracing the transverse section of the eye muscle (*longissimus* muscle) at the 12/13th rib position (Dhanda et al., 2003). The carcass halves were then split into joints (chops, leg, thorax, shoulder and neck), according to the Chilean standard jointing procedure for lambs (Gallo et al., 1996; Pérez et al., 2002). Legs and shoulders from the left half of each carcass were packed in polyethylene bags, frozen at −20 °C and dissected 2–3 months later, as described by Cuthbertson et al. (1972). This dissection resulted in four groups of tissues: muscle, total fat (subcutaneous and intermuscular), bone and residues (lymphatic ganglia, large blood vessels and nerves, tendons and joint capsules) as well as shrink losses. Each component was weighed with a sensitivity of 0.05 g. The shrink losses were estimated as the differences between the initial and final weights of the pieces. These data were used to calculate the percentage of the tissue components of shoulder and leg cuts.

Data were analyzed as a 4 × 2 × 2 factorial experimental design, by analysis of variance using least-squres means method, the factors being genotype, gender, weight groups and interactions (genotype × weight group, genotype × gender, and weight group × gender). No interactions were significant ($p > 0.05$) (SAS, 1998). When necessary the Tukey test was used to separate means. Variables measured as percentages were transformed using an arc-sine function (Sokal and Rohlf, 1981).

## 3. Results and discussion

The main characteristics of lamb carcasses from different genotypes are presented in Table 1. There were no significant differences among the breeds and breed crosses ($p \geq 0.05$) for any of the carcass characteristics with exception of a higher dorsal fat depth in Suffolk Down × Merino Precoz Aleman crossbred. The high ribeye area of *Longissimus dorsi* among the different genotypes was remarkable considering the low slaughter weights. The hot carcass weights and proportions of commercial cuts were consistent with those reported previously in Manchega suckling lambs (Ruiz de Huidobro and Cañeque, 1993a; Sañudo et al., 1997) but lower than reported in Talaverana suckling lambs (Lauzurica et al., 1999), slaughtered at similar weights to the present study. Lambs between 24 and 28 kg of live weight from different cross breeds in the Magallanes region (Southern Chile, Díaz, 1997) have commercial dress-

Table 1
Means ± standard deviation of carcass characteristics of suckling lambs according to breed, live weight and gender

| Characteristics | Breeds | | | | Live weight (kg) | | Gender | |
|---|---|---|---|---|---|---|---|---|
| | MPA, $n = 28$ | Su, $n = 30$ | SuxMPA, $n = 30$ | SuxCo, $n = 26$ | 10, $n = 54$ | 15, $n = 60$ | Male, $n = 53$ | Female, $n = 61$ |
| Slaughter weight (kg) | 12.1 ± 3.3 | 12.2 ± 3.2 | 13.1 ± 3.5 | 12.4 ± 2.5 | 10.1 ± 2.0 b | 14.7 ± 2.2 a | 13.0 ± 3.0 a | 11.9 ± 3.2 b |
| Hot carcass weight (kg) | 6.4 ± 1.8 | 6.6 ± 2.0 | 7.1 ± 2.2 | 6.6 ± 1.4 | 5.3 ± 1.2 b | 8.0 ± 1.4 a | 7.0 ± 1.7 a | 6.4 ± 2.0 b |
| Dressing, live weight (%) | 53.3 ± 2.4 | 53.9 ± 3.0 | 54.1 ± 2.9 | 52.4 ± 3.9 | 52.6 ± 2.7 b | 54.3 ± 3.3 a | 53.7 ± 2.5 | 53.2 ± 3.5 |
| Dressing, empty body weight (%) | 54.7 ± 2.1 | 55.2 ± 3.0 | 56.0 ± 2.7 | 53.9 ± 4.4 | 54.1 ± 2.8 b | 55.9 ± 3.3 a | 55.3 ± 2.6 | 54.7 ± 3.6 |
| Ribeye muscle area ($cm^2$) | 11.7 ± 2.2 | 10.8 ± 2.5 | 11.4 ± 2.6 | 11.7 ± 2.8 | 10.2 ± 2.3 b | 12.5 ± 2.2 a | 12.0 ± 2.5 a | 10.8 ± 2.4 b |
| Fat depth over *L. dorsi* (mm) | 1.5 ± 0.6 c | 1.7 ± 0.7 bc | 2.6 ± 1.4 a | 2.2 ± 1.2 ab | 1.6 ± 1.1 b | 2.4 ± 1.0 a | 2.1 ± 0.9 | 2.0 ± 1.3 |

Different letters in the same row within main effect indicate significant difference ($p < 0.05$). There were no significant interactions ($p > 0.05$) among main effects. MPA: Merino Precoz Aleman; Su: Suffolk Down; SuxMPA: Suffolk Down × Merino Precoz Aleman crosses; SuxCo: Suffolk Down × Corriedale crosses.

ing percentages of 47.2–51, lower than values reported here.

The muscle areas were similar to those of Rodríguez et al. (1988) (10.00–13.10 $cm^2$) described in lambs with a mean carcass weight of 14.7 kg. Fat depth was similar to that found in Manchega suckling lambs at different slaughter weight and gender (Díaz et al., 1999) but higher than the 1.2 mm described in different breeds and crosses slaughtered at 30 kg live weight. (Rodríguez et al., 1988).

Studies using Corriedale, Texel, Hampshire Down and South Down males crossed with Corriedale females showed that paternal breed affects slaughter weight, tissue depth at 12th rib level, proportion of commercial cuts and tissue composition (Garibotto et al., 1999). These results suggest that crosses using meat genotypes produce heavier weight market lambs and better tissue composition than crosses using wool or dual-purpose breeds (Garibotto et al., 1999; FIA, 2000).

The main carcass characteristics (Table 1) statistically differed ($p \leq 0.05$) as live weight increased, showing higher values in lambs slaughtered at an average of 15 kg, similar to those reported by Manso et al. (1998), who suggested that higher body weight affects body composition (carcass yield, tissue composition, muscle size and fatness). Conversely, Alcalde et al. (1999), found important differences in morphology and anatomical composition but similar proportion of high value commercial cuts when 10–12.5 kg carcasses from lambs of nine different origins were compared.

Analysis of gender effects on carcass characteristics (Table 1) show differences ($p \leq 0.05$) in average live weight at slaughter, hot carcass weight and muscle area, with males having higher values than females. However, no significant differences in commercial and real carcass dressing percentages were found. The results of live slaughter weight, hot carcass weight and muscle area are consistent with those in Creole kids slaughtered at 10 kg of live weight (Pérez et al., 2001), but differ from those reported by Velasco et al. (2000) who found higher values in suckling lamb females slaughtered at 10–12 kg of live weight.

No effects of gender on dorsal fat depth ($p \geq 0.05$) were observed in the suckling lamb breeds studied here, although it has been suggested that young females have higher fatness than young males still immature at the same age (Velasco et al., 2000). Fatness in females was higher and distributed differently among tissues, particularly in omentum, kidneys and cavities from Latxa breeds (Mendizabal and Soret, 1997).

The average weights of carcass components from different suckling lamb genotypes are shown in Table 2. With the exception of liver and skin weights, differences

Table 2
Means ± standard deviation of weights of principal components of suckling lambs according to breed, live weight and gender

| Characteristics (kg) | Breeds | | | | Live weight (kg) | | Gender | |
|---|---|---|---|---|---|---|---|---|
| | MPA, $n = 28$ | Su, $n = 30$ | SuxMPA, $n = 30$ | SuxCo, $n = 26$ | 10, $n = 54$ | 15, $n = 60$ | Male, $n = 53$ | Female, $n = 61$ |
| Blood | 0.43 ± 0.14 b | 0.41 ± 0.10 b | 0.56 ± 0.15 a | 0.47 ± 0.12 b | 0.40 ± 0.11 b | 0.53 ± 0.14 a | 0.50 ± 0.16 | 0.50 ± 0.16 |
| Head | 0.60 ± 0.10 ab | 0.58 ± 0.11 b | 0.64 ± 0.13 a | 0.62 ± 0.08 ab | 0.53 ± 0.08 a | 0.68 ± 0.08 a | 0.63 ± 0.11 a | 0.61 ± 0.13 b |
| Heart | 0.08 ± 0.02 a | 0.08 ± 0.02 a | 0.07 ± 0.02 ab | 0.06 ± 0.02 b | 0.06 ± 0.02 b | 0.08 ± 0.02 a | 0.08 ± 0.02 | 0.07 ± 0.02 |
| Kidney | 0.07 ± 0.01 a | 0.06 ± 0.01 ab | 0.05 ± 0.01 c | 0.06 ± 0.01 b | 0.05 ± 0.01 b | 0.07 ± 0.01 a | 0.06 ± 0.01 a | 0.05 ± 0.02 b |
| Spleen | 0.04 ± 0.01 a | 0.04 ± 0.01 ab | 0.03 ± 0.01 bc | 0.03 ± 0.01 c | 0.03 ± 0.01 b | 0.04 ± 0.01 a | 0.04 ± 0.01 a | 0.03 ± 0.01 b |
| Liver | 0.23 ± 0.06 | 0.22 ± 0.05 | 0.20 ± 0.04 | 0.20 ± 0.04 | 0.18 ± 0.05 b | 0.24 ± 0.05 a | 0.22 ± 0.05 a | 0.21 ± 0.05 b |
| Feet | 0.54 ± 0.10 a | 0.49 ± 0.09 ab | 0.51 ± 0.11 ab | 0.46 ± 0.09 b | 0.45 ± 0.09 b | 0.55 ± 0.08 a | 0.55 ± 0.11 a | 0.50 ± 0.09 b |
| Skin | 1.58 ± 0.41 | 1.66 ± 0.40 | 1.48 ± 0.42 | 1.61 ± 0.37 | 1.29 ± 0.27 b | 1.86 ± 0.29 a | 1.56 ± 0.42 a | 1.50 ± 0.40 b |
| Full digestive tract | 1.22 ± 0.43 b | 1.27 ± 0.44 b | 1.61 ± 0.73 a | 1.41 ± 0.48 ab | 1.09 ± 0.37 b | 1.64 ± 0.57 a | 1.44 ± 0.69 | 1.39 ± 0.58 |
| Empty digestive tract | 0.86 ± 0.24 c | 0.94 ± 0.29 | 1.14 ± 0.50 a | 1.05 ± 0.22 ab | 0.81 ± 0.23 b | 1.17 ± 0.34 a | 1.03 ± 0.46 | 0.98 ± 0.36 |
| Lung and trachea | 0.31 ± 0.07 a | 0.31 ± 0.07 a | 0.24 ± 0.06 b | 0.25 ± 0.08 b | 0.24 ± 0.06 b | 0.31 ± 0.08 a | 0.28 ± 0.07 a | 0.27 ± 0.07 b |

Different letters in the same row within main effect indicate significant difference ($p < 0.05$). There were no significant interactions ($p > 0.05$) among main effects. MPA: Merino Precoz Aleman; Su: Suffolk Down; SuxMPA: Suffolk Down × Merino Precoz Aleman crosses; SuxCo: Suffolk Down × Corriedale crosses.

were found among the genotypes ($p \leq 0.05$). Higher weight values of skin, full gastrointestinal tract and empty gastrointestinal tract, in order, contributed the greatest proportion of carcass weight, consistent with values in the Corriedale breed (Osorio et al., 1998).

The effects of gender and slaughter weight on carcass components are shown in Table 2. In all of the carcass components values increased according to slaughter weight. Heavier body components were measured in males, probably due to higher slaughter weight.

Effects of genotype on proportions of commercial cuts from suckling lambs are presented in Table 3. With exception of tail yields, there were significant differences in all commercial cuts ($p \leq 0.05$) among the genotypes, but without a clear tendency of breed effect. In all of the genotypes the leg cuts constituted more than 35% of the half carcass, slightly higher than those reported for Manchega suckling lambs (Ruiz de Huidobro and Cañeque, 1993b; Cañeque et al., 1999). Previously, we reported that leg cuts constitute 27–28% of carcass from Creole kids slaughtered at live weight of 10 kg (Pérez et al., 2001).

Chop yields were higher ($p \leq 0.05$) in crossbred crosses (19%) than those from purebred suckling lambs (15%). These values are lower than the 25% previously reported in Creole kids slaughtered at 10 kg of live weight (Pérez et al., 2001).

The values of crossbred thorax meat were lower ($p \leq 0.05$) than those from purebred suckling lambs, clearly different not only from Manchega lambs slaughtered at different weights (Ruiz de Huidobro and Cañeque, 1993a), but also from those reported for Manchega suckling lambs (Cañeque et al., 1999), probably due to differences in dissection techniques.

The highest shoulder yields were obtained in Suffolk Down × Corriedale crosses (23.4%) and the lowest in the Suffolk Down breed (21.2%). These figures are slightly higher than the 20% reported by Ruiz de Huidobro and Cañeque (1993a) and Cañeque et al. (1999).

In the less commercially valuable neck and tail cuts, only neck was different ($p \leq 0.05$), with higher yields in Suffolk Down breed and lower yields in Merino Precoz Aleman breed and Suffolk Down × Corriedale crossbred suckling lambs. The results are consistent with those reported by Ruiz de Huidobro and Cañeque (1993a) and Cañeque et al. (1999).

The effect of slaughter weight on commercial cut yields in suckling lambs is presented in Table 3. Only chops and shoulder cuts show higher values ($p \leq 0.05$) in the 10 kg group, whereas 15 kg group showed higher thorax cut yield. These results are similar to those reported by Ruiz de Huidobro and Cañeque (1993a) in lambs

Table 3
Means ± standard deviation of proportions of the commercial cuts of the suckling lambs according to breed, live weight and gender

| Characteristics (as carcass percentage) | Breeds | | | | Live weight (kg) | | Gender | |
|---|---|---|---|---|---|---|---|---|
| | MPA, $n = 28$ | Su, $n = 30$ | SuxMPA, $n = 30$ | SuxCo, $n = 26$ | 10, $n = 54$ | 15, $n = 60$ | Male, $n = 53$ | Female, $n = 61$ |
| Leg | 37.71 ± 2.02 a | 37.27 ± 2.02 ab | 35.47 ± 1.55 c | 35.92 ± 2.61 bc | 36.95 ± 2.53 | 36.26 ± 1.88 | 36.74 ± 2.10 | 36.48 ± 2.36 |
| Chops | 15.00 ± 2.13 b | 15.70 ± 3.06 b | 19.67 ± 2.19 a | 18.77 ± 2.53 a | 18.05 ± 2.77a | 16.52 ± 3.39 b | 17.00 ± 3.29 | 17.51 ± 3.09 |
| Thorax | 17.79 ± 2.45 a | 18.60 ± 3.87 a | 14.90 ± 2.52 b | 15.50 ± 2.10 b | 15.13 ± 2.62b | 18.26 ± 3.00 a | 17.11 ± 3.50 | 16.38 ± 2.94 |
| Shoulder | 22.29 ± 0.98 b | 21.13 ± 2.08 c | 22.57 ± 1.28 ab | 23.42 ± 1.94 a | 22.77 ± 1.84a | 21.88 ± 1.68 b | 22.25 ± 1.75 | 22.38 ± 1.86 |
| Neck | 5.93 ± 1.61 b | 7.10 ± 1.79 a | 6.13 ± 1.80 ab | 5.42 ± 1.79 b | 6.02 ± 1.85 | 6.33 ± 1.81 | 6.15 ± 1.89 | 6.20 ± 1.80 |
| Tail | 1.11 ± 0.31 | 1.23 ± 0.43 | 1.00 ± 0.00 | 1.12 ± 0.43 | 1.14 ± 0.40 | 1.09 ± 0.28 | 1.06 ± 0.23 | 1.16 ± 0.42 |

Different letters in the same row within main effect indicate significant difference ($p < 0.05$). There were no significant interactions ($p > 0.05$) among main effects. MPA: Merino Precoz Aleman; Su: Suffolk Down; SuxMPA: Suffolk Down × Merino Precoz Aleman crosses; SuxCo: Suffolk Down × Corriedale crosses.

slaughtered at 15, 25 and 35 kg, to those obtained by Cañeque et al. (1999) for suckling lambs slaughtered at 10, 12 and 14 kg and from Osorio et al. (1998) for lambs slaughtered at 100, 130 and 150 days old.

Gender did not affect ($p \geq 0.05$) commercial cut yield for suckling lambs, in contrast to differences reported by Cañeque et al. (1999) who observed higher proportion of thorax meat and lower shoulder and neck proportions in females than males from Talaverana breeds slaughtered at 10, 12 and 14 kg.

The effects of genotype on the tissue composition of shoulder and leg cuts from suckling lambs are shown in Table 4. The greatest proportion of muscle was found in shoulder cuts of Suffolk Down × Merino Precoz Aleman crossbred suckling lambs, whereas lowest bone proportion was found in Suffolk Down × Corriedale crosses. The highest fat proportion ocurred in Suffolk Down × Corriedale crosses and Suffolk Down purebred lambs. Residues and shrink losses were higher ($p \leq 0.05$) in Merino Precoz Aleman breed and Suffolk Down × Corriedale crossbred.

The muscle proportion in leg cuts was highest of Suffolk Down × Corriedale crosses. The lowest bone proportion was found in legs of Suffolk × Corriedale suckling lambs while the highest fat proportion was found in Suffolk Down breeds. The lowest residues and shrink losses were found in legs of Suffolk Down lambs. All these leg proportions are different ($p \leq 0.05$) as shown also for the shoulder cuts.

The higher muscle and lower fat content of leg than shoulder suggest that the leg is the more valuable cut of suckling lamb carcass.

It is necessary to point out that it is difficult to compare the anatomical composition of shoulder and leg from the carcass cuts presented here with those from international reports, where the carcasses are completely dissected.

A related analysis on whole carcass by Velasco et al. (2000) found that for suckling lambs of Talaverana breeds slaughtered at 10 and 12 kg of live weight, the muscle tissue proportion varied between 54.17 and 52.63%, bone varied between 23.36 and 21.80%, fat varied between 18.47 and 21.69% and the residues varied between 3.99 and 3.88%. Also, Cañeque et al. (1999) showed for whole carcass from Manchega breeds 53% muscle, 22–24% bone, 15.85–18.25% fat and 5.19–6.34% shrink losses in suckling lambs slaughtered at weights of 10, 12 and 14 kg. Finally, Pérez et al. (1993) have also shown that for whole carcass from Manchega lambs slaughtered at about 24 kg of live weight, the proportions varied from 53.70 to 54.29% for muscle, 18.70 to 19.29% for bone, 21.17 to 22.84 % for fat, 2 to 2.42% for residues and about 2% of shrink losses. Thus, despite,

Table 4
Means ± standard deviation of anatomical composition of shoulder and leg of suckling lambs according to breeds, live weight and gender

| Characteristics (% of different tissues) | Breeds | | | | Live weight (kg) | | Gender | |
|---|---|---|---|---|---|---|---|---|
| | MPA, $n=28$ | Su, $n=30$ | SuxMPA, $n=30$ | SuxCo, $n=26$ | 10, $n=54$ | 15, $n=60$ | Male, $n=53$ | Female, $n=61$ |
| Shoulder | | | | | | | | |
| Muscle | 56.90 ± 3.52 a | 54.30 ± 3.62 b | 57.01 ± 3.33 a | 55.38 ± 3.70 ab | 56.79 ± 3.94 a | 55.19 ± 3.24 b | 56.50 ± 3.57 | 55.47 ± 3.71 |
| Bone | 22.87 ± 3.08 b | 22.71 ± 2.21 b | 24.56 ± 2.84 a | 19.40 ± 2.01 c | 23.60 ± 3.15 a | 21.37 ± 2.84 b | 23.12 ± 3.14 | 21.83 ± 3.11 |
| Fat | 12.84 ± 4.95 b | 17.40 ± 4.71 a | 13.77 ± 5.27 b | 18.67 ± 4.77 a | 13.11 ± 5.08 b | 17.80 ± 4.81 a | 14.40 ± 4.79 | 16.59 ± 5.82 |
| Residues | 3.68 ± 1.37 a | 2.25 ± 0.99 b | 2.64 ± 1.40 b | 3.52 ± 1.08 a | 3.34 ± 1.31 a | 2.76 ± 1.34 b | 3.04 ± 1.31 | 3.03 ± 1.40 |
| Losses | 3.16 ± 1.60 a | 2.61 ± 2.34 ab | 2.00 ± 1.41 b | 3.47 ± 1.11 a | 3.01 ± 1.95 | 2.61 ± 1.51 | 2.49 ± 1.36 | 3.07 ± 1.98 |
| LEG | | | | | | | | |
| Muscle | 57.62 ± 2.50 ab | 55.78 ± 2.50 b | 57.99 ± 2.60 a | 57.56 ± 3.39 ab | 57.76 ± 2.85 | 56.82 ± 2.81 | 57.23 ± 2.28 | 57.31 ± 3.29 |
| Bone | 22.98 ± 2.67 ab | 23.74 ± 2.72 ab | 24.64 ± 4.04 a | 21.93 ± 2.10 b | 24.28 ± 3.26 a | 22.28 ± 2.61 b | 23.56 ± 3.36 | 22.96 ± 2.84 |
| Fat | 11.82 ± 3.93 b | 16.62 ± 4.10 a | 13.04 ± 5.18 b | 14.58 ± 4.48 ab | 12.07 ± 4.82 b | 15.67 ± 3.97 a | 13.62 ± 4.32 | 14.21 ± 5.09 |
| Residues | 3.50 ± 1.26 a | 1.90 ± 1.26 b | 2.34 ± 0.99 b | 3.57 ± 0.55 a | 3.17 ± 1.36 a | 2.54 ± 1.11 b | 2.76 ± 1.01 | 2.92 ± 1.46 |
| Losses | 2.93 ± 1.13 a | 1.70 ± 0.77 b | 1.94 ± 1.32 b | 2.70 ± 1.06 ab | 2.32 ± 1.24 | 2.33 ± 1.17 | 2.33 ± 1.36 | 2.32 ± 1.04 |

Different letters in the same row within main effect indicate significant difference ($p<0.05$). There were no significant interactions ($p>0.05$) among main effects. MPA: Merino Precoz Aleman; Su: Suffolk Down; SuxMPA: Suffolk Down × Merino Precoz Aleman crosses; SuxCo: Suffolk Down × Corriedale crosses.

comparison difficulties, tissue composition described in international reports are closely similar to those presented here.

The effects of slaughter weight on the tissue composition for shoulder and leg suckling lamb cuts also are in Table 4. The results show significant differences ($p \leq 0.05$) in all of the tissue components of shoulder cuts, excepting shrink losses. Muscle, bone and residue proportions were greater at 10 kg and, as expected, suckling lambs slaughtered at 15 kg showed higher fat proportion. For leg cuts, significant differences ($p \leq 0.05$) were found only in bone, fat and residues as consequence of higher slaughter weight. Suckling lambs slaughtered at 15 kg showed higher bone and residues compared with 10 kg carcass.

These results are consistent with those described by Velasco et al. (2000) for Talaverana suckling lambs slaughtered at weight of 10 and 12 kg. Conversely, Cañeque et al. (1999) showed significant differences only in bone content for suckling lambs of 14 kg, when comparing the Manchega breed slaughtered at live weight of 10, 12 and 14 kg. These results suggest that carcass tissue contents change according to the animal weight variations.

Gender (Table 4) did not significantly affect tissue composition of the analyzed cuts. These results differ from those reported by Osorio et al. (1997) who showed not only differences in bone proportion for shoulder and leg cuts in Corriedale breeds slaughtered at weight between 27 and 30 kg, but also with higher values in male lambs. In addition, Cañeque et al. (1999) found differences in muscle, bone and fat composition, but higher values in muscle and bone proportions in males and greater fatness in females. Finally, Velasco et al. (2000) found lower values for bone proportions and higher values for total fat contents in females than in male suckling lambs.

## 4. Conclusions

The results described in the present study suggest that carcass quality traits are mainly modified by slaughter weight, with only few components modified by gender in the weight and age range that was measured. Commercial dressing yields and tissue composition of shoulder and leg cuts are modified by genotype and slaughter weight.


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