

# Effect of diets on carcass and meat quality characteristics of Corriedale lambs in Uruguay

R. San Julián<sup>1\*</sup>, S. Luzardo, G. Brito & F. Montossi

Meat and Wool Production National Research Program, National Institute of Agricultural Research

<sup>1</sup>INIA Tacuarembó, Ruta 5, Km. 386, Tacuarembó, Uruguay.

\*E-mail: [rsanjulian@tb.inia.org.uy](mailto:rsanjulian@tb.inia.org.uy).

## Abstract

Lamb production systems in Uruguay are based on pastures. However, more intensive systems including supplementation to grazing lambs have been increased during the last years, to improve performance and attributes of carcass and meat quality and to reduce seasonal production. One hundred and twenty Corriedale lambs grazed on an improved pasture dominated by *Lotus corniculatus* cv. INIA Draco, at a 6% of live weight (LW) allowance, under 4 treatments: T1 (pasture), T2 (pasture + concentrate 0.6%LW), T3 (pasture + concentrate 1.2%LW) and T4 (concentrate ad libitum + alfalfa hay). Lambs from T4 produced heavier carcasses and higher fat cover ( $P < 0.05$ ) than those of supplemented or non supplemented lambs grazing pasture. Also, T4 animals presented the higher value of compactness index (kg carcass weight/cm of carcass length). Meat color of the samples aged 20 days was not different ( $P > 0.05$ ) among pasture treatments. However, there is a tendency that meat from lambs of T4 presents lower intensity of red color ( $a^*$ ) and higher values yellowness ( $b^*$ ) due to high concentrate level present in the diet. Meat hardness of the 4 treatments was in the range considered as very tender meat (below 2 kgF of shear force) In general, lamb carcass and meat quality, were both improved with the inclusion of some concentrate in the diet of grazing animals.

## Introduction

The characteristics of livestock production in Uruguay, as a Natural Country, with extensive production systems, without the use of hormones and animal protein sources, with a nice sanitary condition, are important advantages to be used in marketing strategies for those consumers that privilege health, food safety and environmental sustainability. Uruguay produces about 15-20000 tons of lamb meat per year, in a very wide range of production systems, which are based mainly on direct grazing of rangelands. However, more intensive systems, including supplementation to grazing lambs, have been increased during the last years, in order to improve performance and attributes of carcass and meat quality and to reduce seasonal production (Montossi *et al.*, 2003). The objective of this trial was to evaluate the effect of different feeding strategies on carcass and meat quality of Corriedale lambs.

## Materials and methods

One hundred and twenty castrated Corriedale lambs (9 to 10 months of age, initial live weight (LW)  $28.2 \pm 0.8$  kg. and body condition (BC) score  $2.65 \pm 0.25$  units (scale 1 to 5) (Russell *et al.*, 1969)), grazed on an improved pasture dominated by *Lotus corniculatus* cv. INIA Draco, at a 6% of live weight (LW) allowance, under 4 treatments: T1: grazing pasture; T2: pasture + concentrate 0.6%LW; T3: pasture + concentrate 1.2%LW and T4: concentrate *ad libitum* + alfalfa hay. Grazing system of T1, T2 and T3 was rotational with 2 days of grazing and 30 days of resting period. The concentrate used for T2, T3 and T4, was the same and it consisted on a mixture of 72% of broken corn grain and 28% of soybean meal. Concentrate was given twice a day to each animal individually. Total fattening period was different according to the end point required by the lamb market in Uruguay (from 35 to 43 kg of LW and 3.5 to 4.5 BC units), resulting on 124 days for T1 and T2 and 84 days for T3 and T4. Lamb LW and BC were determined every 8 and 16 days, respectively. Lambs were slaughtered in a commercial abattoir. At slaughter, hot carcass weight (HCW) was recorded and cold carcass weight (CCW), carcass length (CL), GR point and boneless leg weight (BLW) were registered after 36 hours of chilling at  $2-3^{\circ}\text{C}$ . Meat measurements were done in *Longissimus thoracis* muscle samples, determining ultimate pH (24 hours after slaughter), muscle color ( $L^*$ =brightness,  $a^*$ =redness and  $b^*$ =yellowness) and shear force (Warner Bratzler) after 20 days of ageing.

It was applied a completely random experimental design. The analysis of variance was done with Proc GLM (SAS Institute Version 9.1, 2003) with treatment as a fixed effect, and the means of the treatments were compared by LSD test ( $P < 0.05$ ).

## Results and discussion

Carcass quality characteristics of the lambs from four feeding systems are presented in Table 1. It was observed a very important effect ( $P < 0.0001$ ) of the treatments on all the variables of the lamb carcass quality. It can be shown that lambs from T4 produced heavier carcasses and higher fat cover ( $p < 0.05$ ) than those of supplemented or non supplemented lambs grazing pasture. Montossi *et al.* (2002a and 2002b) working with heavy lambs grazing pastures with supplementation, found similar results. Lambs of T4 produced the higher ( $P > 0.05$ ) BLW, which is one of the most relevant cuts of the lamb, representing a very important part of the total carcass value. Also, T4 animals presented the higher value of compactness index (CCW/CL), probably due to differences in growing rate between treatments, where lambs from T4 and T3 reached the final weight earlier than those from pure pasture diet and low supplementation level (T1 and T2). Similar indexes are reported by Bianchi (2006), working with different lamb biotypes in a feed lot system.

**Table 1.** Performance of lambs under different feeding strategies

Variable	T1	T2	T3	T4	P
Days of fattening	124	124	84	84	
Hot carcass weight (HCW) (kg)	15.7c	16.5b	16.6b	17.6a	<0.0001
Cold carcass weight (CCW) (kg)	15.5c	16.3b	16.2b	17.1a	<0.0001
Carcass length (CL) (cm)	65.4a	64.8a	64.0b	61.5c	<0.0001
GR (mm)	5.2b	6.0b	5.1b	9.3a	<0.0001
Boneless leg weight (BLW) (kg)	1.66c	1.66c	1.80a	1.74b	<0.0001
Compactness index (CCW/CL) (kg/cm)	0.237	0.252	0.253	0.278	

**Note:** a, b, c = means with different letters among columns are different ( $P < 0.05$ ).

The mean values of the attributes of lamb meat produced under four feeding systems are reported in Table 2. Ultimate pH at 24 hours was strongly affected ( $P < 0.0001$ ) by treatments, being that it decreased as supplementation level increased. This result was probably due to the differences found in carcass weight and fat cover of the treatments. Meat brightness ( $L^*$ ) of the samples aged 20 days was not different ( $P > 0.05$ ) among treatments. However, there was a tendency that meat from lambs of T4 presented lower intensity of red color ( $a^*$ ) and higher values of yellowness ( $b^*$ ) due to high concentrate level in the diet. Similar tendencies are reported by Sañudo *et al.* (1998), working with lambs of lower age and carcass weight of 25 kg in a feed lot regime using concentrate plus hay ad libitum.

**Table 2.** Mean values of the attributes of lamb meat quality produced on four feeding systems

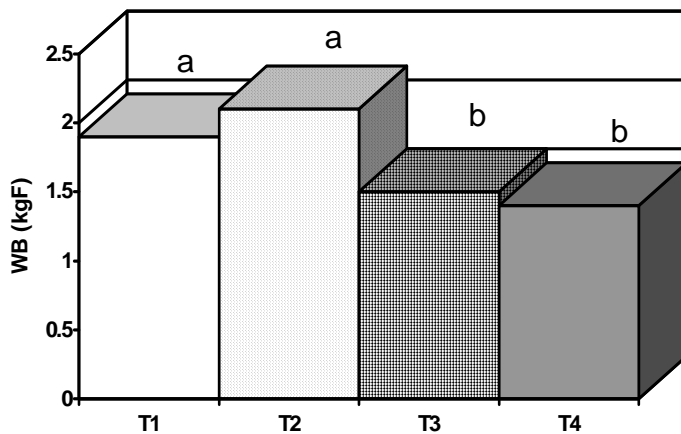
Variable	T1	T2	T3	T4	P
pH 24 hours	5.92a	5.81b	5.57d	5.63c	<0.0001
$L^*$ 20 days ageing	41.1	42.1	41.8	42.5	0.0518
$a^*$ 20 days ageing	13.5b	13.4b	15.1a	12.7b	0.0017
$b^*$ 20 days ageing	9.6b	10.1b	11.1a	11.5a	<0.0001

**Note:** a, b, c, d = means with different letters among columns are different ( $P < 0.05$ ).

$L^*$ ,  $a^*$ ,  $b^*$ : color parameters measured at 20 days of ageing.

Lamb meat hardness of the 4 feeding treatments is presented in **Figure 1**. The mean values of shear force (WB) of the meat aged for 20 days, were, for all the treatments, in the range considered as very tender meat (below 2 kgF of shear force).

a



**Note:** a, b = means with different letters are different ( $P < 0.05$ ).

**Figure 1.** Meat lamb hardness of four feeding system, after 20 days of ageing.

### Conclusions

Lambs fed mainly with concentrate resulted in heavier carcasses with higher fat cover. Additionally, these animals tended to produce boneless legs of a higher weight and higher compactness index (carcass weight/carcass length). Ultimate pH was strongly affected by treatments probably because of difference in carcass weight and fat cover. Lambs with a diet based only in a high level of concentrate (T4) tend to produce a meat with lower red and higher yellow color levels. Hardness tends to decrease as supplementation level is increased in grazing lambs, but in general all the treatments produced meat that could be considered as very tender for the lamb meat world market. In general, lamb carcass and meat quality, were both improved with the inclusion of some concentrate in the diet of grazing animals.

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### References

- Bianchi, G. 2006. Technological alternatives for quality lamb meat production in grazing systems. Editorial Hemisferio Sur. 283 pp. (In Spanish)
- Montossi, F.; Risso, D.F.; De Barbieri, I.; San Julián, R.; Cuadros, R.; Zarza, A.; Dighiero, A. and Mederos, A. 2002a. The Use of Forage Improvements: Production and quality of lamb meat - Heavy Lambs. In: Forage Improvements in the Cristalino region: fertilization, meat quality production and productive persistence. Risso, D.F., and Montossi, F. (Eds). INIA Tacuarembó, Uruguay. Serie Técnica N° 129. pp. 59 - 73. (In Spanish).
- Montossi, F.; San Julián, R.; Banchero, G.; Ganzábal, A.; Risso, D.F.; de Barbieri, I.; Dighiero, A.; de Mattos, D.; Mederos, A.; Castro, L.; Robaina, R. and Abraham, D. 2002b. Fattening systems and carcass quality for heavy lambs in Uruguay. In: Applied Research in Agro-Industrial Meat Chain: Progress achieved: Sheep Meat Quality 1998-2001. Technical Series No. 126, INIA Tacuarembó pp. 59:83. (In Spanish).
- Montossi, F.; San Julián, R.; Brito, G.; De Los Campos, G.; Ganzábal, A.; Dighiero, A.; De Barbieri, I.; Castro, L.; Robaina, R.; Pigurina, G.; De Mattos, D. Y Nolla, M. 2003. Production of quality lamb meat with the Corriedale breed: recent advances and challenges of technological innovation in the context of the Sheep Meat Chain of Uruguay. Summaries of the 12<sup>th</sup> World Corriedale Congress. Montevideo, Uruguay. pp. 74-90. (In Spanish).
- Russel, A.J.F.; Doney, J.M. and Gunn, R.G. 1969. Subjective assesment of body fat in live sheep. Journal of Agriculture Science. 72: 451 – 454.
- Sañudo, C.; Sierra, I.; Olleta, J.L.; Martin, L.; Campo, M.M.; Santolaria, P.; Word, J.D. and Nute, G.R. 1998. Influence of weaning on carcass quality, fatty acid composition and meat quality in intensive lamb production systems. Animal Science, 66: 175-187.