The influence of different pasture and supplement diet combinations on carcass and meat quality of heavy lambs in Uruguay

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Abstract

Supplementation of heavy lamb during fattening in Uruguay is growing and research studies are needed in the new scenario. One hundred and twenty eight Corriedale and Corriedale x Merino Dohne lambs were balanced by breed and randomly assigned into four treatments (T): T1, T2 and T3 (lambs grazed a dominated *Lotus corniculatus* sward at 6% liveweight-LW of forage allowance and supplemented by 0, 0.6 and 1.2% with sorghum, respectively) and T4 (lambs supplemented only with corn/soybean concentrate plus hay). After 100 days of fattening and adjusted by covariance, increasing levels of energy in the diet produced significantly (P<0.01) heavier LW (36.9, 37, 39.4 and 43.3 kg) and hot carcass weight (16.6, 16.9, 17.1, and 19.1 kg) and greater rib eye area (REA: 10.2, 10.5, 11.1, and 12.9 cm^2), REA fat cover (2.9, 3.3, 3.3, and 4.7 mm) and carcass fat cover at GR (3.2, 4.7, 5.4, and 11.7 mm) for T1, T2, T3 and T4, respectively. T affected ultimate pH (P<0.05; 5.7, 5.68, 5.7) and meat L* (P<0.01; 37.8, 37.4, 37.5, and 39), meat a* (P<0.05; 18.8, 18.4, 19.2, and 20.4) and meat hardness (P<0.01; 3.7, 3.1, 2.8, and 2.4 kgF) after 10 days of aging. The addition of supplements under grazing conditions during fattening improved lamb performance, carcass and meat quality.

Introduction

Sheep production plays a very important economical and social role in Uruguay, in particularly in rural areas where small and medium livestock producers are concentrated (Montossi *et al*., 2003). Given the lack of competitiveness of these systems historically oriented to medium fiber diameter wool production, the increase in lamb meat production or superfine wool appeared as opportunities to solve this problem. Several research studies carried out by INIA showed the potential biological and economical benefits of using different technological alternatives for fattening heavy lambs in the main intensive and extensive regions of Uruguay (Montossi *et al.,* 2003). Lamb production during summer is an important constraint for fattening lambs in these regions, where specialized and adapted summer production forages and intensive use of supplementation could contribute to improve this situation (Montossi *et al.,* 2003). The objective of this experiment is to evaluate the potential use of high nutritive value legumes like *Lotus corniculatus* cv. INIA Draco, and/or supplementation or feedloting on lamb performance and carcass and meat quality.

Materials and methods

This experiment was carried out during 97 days at the Basaltic region of Uruguay (January-March 2006) , using an improved pastures dominated by Lotus corniculatus cv. INIA Draco legume, grazed by 128 Corriedale and Corriedale x Merino Dohne lambs (approximately 10 months of age and 29.1 ± 2.6 kg of initial fasted liveweight, LW). Four treatments were applied, a) three under grazing conditions with 3 level of supplementation with uncracked sorghum (S: 0, 0.6 y 1.2 % of LW), called treatments T1, T2 and T3, respectively and b) T4 (feedlot) lambs supplemented with 20% high quality hay and 80% concentrate (72% corn and 28%/soybean) offered at 3% of LW. All animals were slaughtered at a commercial slaughterhouse. The variables measured in vivo were: fasted LW gain (LWG), fasted final live weight (FLW), rib eye area (REA) and REA fat cover (PC) estimated by ultrasound scanning. The following carcass and meat quality parameters were measured: hot carcass weight (HCW), cold carcass weight (CCW) and the weight of the most valuable meat cuts (Frenched rack and boneless leg), meat color, tenderness, and ultimate pH (pH) at 48 hours pos mortem. Color measurements were taken using a Minolta Colorimeter (model C-10). They were recorded from the approximate geometric center of the *Longissimus dorsi* muscle at the 12th rib, after 48 hours pos mortem, recording L*, a* and b* parameters on the muscle, according to the Hunter system. A portion of *Longissimus dorsi* was vacuum-packaged and aged for 10 days at 2-4oC. Tenderness was obtained after 10 days of ageing, from six transversal cuts (2.54 cm) removed from two samples using a WBSF machine (SF). The procedures and methods used are described in detail by Montossi *et al.* (2003). The information was analysed using the statistical package GLM procedure of SAS, with an analysis of variance in a model including block and treatment as main effects. Mean of the treatments were compared by test

lsmeans test (P<0.05). All data were initially tested for normality and homogeneity of variance and some variables were normalized previously to be analyzed. Also, some variables were adjusted by co-variates.

Results and discussion

Table 1 shows animal performance and carcass quality traits results. Animal performance was significantly affected by the level of supplementation used. The greater levels of energy intake achieved from T1 to T4 (Montossi *et al.,* unpublished) in general produced greater LWG, FLW, REA and PC. The extreme values were found between T1 and T4, with lower and similar values between T1 and T2 than T3 and T4 for animal performance measurements and finally similar values between T1, T2 and T3, and lower than T4 for *in vivo* measurements. In experiments with the same focus under grazing conditions or even in confinement in Uruguay, evaluating different combinations of forage and concentrates in the lamb diet, demonstrated that increasing levels of energy consumption improved animal performance and *in vivo* carcass quality (Montossi *et al.*, 2003, 2007; Montossi *et al*. in this proceeding). T4 produced heavier and fatter carcass than the treatments under grazing conditions. T3 and T2 increased GR values in compassion with T1. There were no effects of the T on high value cut weights. In comparable experimental conditions, San Julian *et al*. (in this proceeding) found similar tendencies than those reported in this trial. Montossi *et al.* (2002a and 2002b) working with heavy lambs grazing pastures with supplementation, found similar results.

Table 1. Mean values of animal performance characteristics and carcass quality traits

	Treatments				
Variable	**T1**	**T2**	T3	**T4**	**P**
LWG (g/d)	108^{c}	113^{c}	131^{b}	172^{a}	**
FLW (kg)	39.7^{c}	40.1^{c}	41.9^{b}	45.8^{a}	**
REA (cm^2) [1]	10.2^{b}	10.5^{b}	11.1^{b}	12.9^{a}	**
PC (mm) [1]	2.98^{b}	3.33^{b}	3.31^{b}	4.79^{a}	**
HCW (kg) [1]	16.6^{b}	16.9^{b}	17.1^{b}	19.1^{a}	**
CCW (kg) [1]	16.3^{b}	16.6^{b}	16.8^{b}	18.8^{a}	**
GR (mm) [2]	3.2^{c}	4.7^{b}	5.4^{b}	11.7^{a}	**
Frenched Rack (kg)[2]	409	407	421	427	ns
Boneless Leg (kg)[2]	1778	1759	1771	1723	ns

References: ns: not significant (P>0.05), *: P<0.05 and **: P<0.01; FLW: Final fasted live weight.
[a, b, c]: means with different letters among columns are significant different. (P<0.05)
[1]: adjusted by FLW. [2]: adjusted by HCW.

Table 2 reports meat quality parameters. In general, after 10 days of aging, it can be observed that growing levels of supplementation improved the values of meat tenderness. These results could be related to the high fat content of the animals under high energy diets (Montossi *et al.,* 2003). However, the effects on meat color parameters and pH had different trend, where, in general, only T4 generated better values for L* and a* with lower meat pH in relation to the grazing treatments. These results show that is needed high levels of supplements in the diet to affect the color and pH of the lamb meat and the reduced magnitude of the differences found probably do not have mayor influences in consumer decision. These results agree with those obtained by Montossi *et al*. 2007. San Julián *et al*. (in this proceeding) after 20 days of ageing observed greater differences in pH and color meat parameters when different combination of forage and concentrate regimes were compared. They found a tendency that meat lambs produced in feedlot (compared with grazing situations) presented lower intensity of red color (a*) and higher values of yellowness (b*) and L (*) due to high concentrate level in the diet. The values of pH 24 are similar to those reported by Brito *et al*. (2002) for lamb carcasses of different gender and genotypes and less than 12 months old, reared with different nutritional regimes under grazing conditions.

Table 2. Mean values of meat quality parameters

Variable	CF	Treatments				
		T1	**T2**	T3	**T4**	**P**
SF (kgF) 10 days	-	3.7 [a]	3.1 [ab]	2.8 [b]	2.4 [b]	**
pH 24 hs	1/Ln	5.70 [b]	5.68 [b]	5.70 [b]	5.56 [a]	**
L* 10 days	Ln	37.8 [b]	37.4 [b]	37.5 [b]	39.2 [a]	**
a* 10 days	√3	18.8 [b]	18.4 [b]	19.2 [ab]	20.4 [a]	*
b* 10 days	Ln	10.1	9.9	10.0	10.5	ns

References: ns: not significant (P>0.05).
[a, b,] : means with different letters among columns are significant different (P<0.05).
CF = Correction factor.

Conclusions

There are opportunities for the Uruguayan sheep industry, located mainly in the extensive regions, to be more competitive through the increase of high quality lamb meat production. This experiment and others performed by this group of researchers showed that the inclusion of moderated levels of supplementation under grazing conditions could contribute to improve lamb productivity, carcass and meat quality and consistency. This is of particular importance during the summer period given the normal climatic and natural resources constraints occurred for lamb fattening. These findings make important contributions in solving this technology demand through the complementary combination of specialised and adapted summer legumes (*Lotus corniculatus*) and supplementation.

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