Evaluation of feeding strategies on the performance and *in vivo* carcass quality of Corriedale heavy lambs in Uruguay

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Abstract

The main characteristics of Uruguayan production system are based on natural grasslands and low cost production systems. The raise in the international lamb meat demand creates new challenges for increasing lamb production and quality. The intensive use of supplements under grazing or feedlot conditions appears as an opportunity to respond to growing demand. One hundred and twenty Corriedale lambs, with an initial live weight (LW) and body condition (BC) of 28.2 ± 0.8 kg and 2.65 ± 0.25 units, respectively, were used. Lambs grazed an improved pasture dominated by *Lotus corniculatus* cv. INIA Draco, at a 6% of LW allowance, under 4 treatments (T): T1 (pasture), T2 (pasture+concentrate 0.6% LW), T3 (pasture+concentrate 1.2% LW) and T4 (concentrate *ad libitum*+alfalfa hay). Final fasted LW, BC, rib eye area (REA) and fat cover at slaughter time were: 39.4, 43.4, 41.9 and 44.5 kg ($P<0.05$), 3.0, 3.3, 3.7 and 4.0 units ($P<0.05$), 9.5, 10.8, 9.5 and 11.3 cm^2 ($P<0.05$) 2.7, 3.3, 2.6 and 3.5 mm for T1, T2, T3 and T4, respectively. The greater proportion of concentrate in the diet of supplemented animals increases energy consumption, which could explain the differences found among treatments. During fattening, considering the requirements of the European Lamb market, the addition of concentrate in the diet of grazing animals or using feedlot, increased performance and carcass quality of lambs, compared with pure lamb grazing systems.

Introduction

The sheep industry in Uruguay is the main source of income (57%) of small and medium livestock producers, with approximately 25,000 producers dedicated to the production of sheep meat and wool (Montossi *et al*., 2003). The characteristics of livestock production in Uruguay, with extensive grazing and low cost production systems, without use of hormones and without feeding ruminants with animal protein and an excellent health status, are clear advantages to be used to market meat products to those consumers which are looking for meat that promote human health, food safety and environmental sustainability. In order increase the competitiveness of the red meat in the international markets there are needs to design strategies to differentiate and adding value to the products considering the whole meat chain, to satisfy the consumer expectations and demands. In this sense, technological innovation becomes a substantial issue to achieve that goal, and then, an increasing in the use of supplements under grazing conditions or feedloting appears as an opportunity. The increase in the meat quantity and quality as well as production efficiency, are the main challenges that Uruguay has to face to consolidate its position in the international lamb market. In this article, the focus of the research is centered on the effect of different production systems on animal consumption, performance and carcass quality.

Materials and methods

This experiment was conducted at the Experimental Unit "Glencoe", belonging to the INIA Tacuarembó Experimental Station. One hundred and twenty castrated Corriedale lambs, from 9 to 10 months of age, were used. At the beginning, animal live weight (LW) was 28.2 ± 0.8 kg. and body condition score (BCS) was 2.65 ± 0.25 units (scale 1-5; Russell *et al*., 1969). These lambs were divided into 4 treatments, according to LW and BCS: Treatment 1 (T1): pasture alone, Treatment 2 (T2): pasture + concentrate (0.6% of LW), Treatment 3 (T3): pasture + concentrated (1.2% of LW) and Treatment 4 (T4): concentrate *ad libitum* (including alfalfa hay). It was used an improved pasture dominated by *Lotus corniculatus* cv. INIA Draco in a daily allowance of 6% of live weight for all the grazing treatments. It was applied a rotational grazing system with 2 days of grazing and 30 days of resting. The concentrate used was the same for T2, T3, and T4. The concentrate was a homogenous mixture of 72% of corn grain and 28% of soybean meal. It was offered individually to each animal twice a day (7 am and 6 pm) in individual boxes of 1.5 m^2. It was estimated consumption in each individual animal as the result between the different the meal offered and rejected. The adjustment of concentrate allowance was done every 8 days, coinciding with LW

determinations. Fasted LW (FLW) was determined at the beginning, every 30 days and at the end of the experiment, after 15 hours of fasting. The BCS was measured every 16 days. T4 animals were kept in individual pens of 1.5 x 1.0 m. The source of fiber in the ration of T4 was alfalfa hay (*Medicago sativa*). Hay (on a dry matter basis: DM) was expected to become 25% of the lamb diet, being the concentrate the remaining 75%. The conversion efficiency of the concentrates in the supplemented treatments was calculated as the amount of dry matter of supplement divided by the difference in weight in relation to the treatment without supplementation. All animals before slaughter were shorn, determining rib eye area (REA) and fat cover through the C point (PC) by the ultrasound technique (San Julian *et al.*, 2002). It was used a completely randomized experimental design, where the experimental unit was the animal. The analysis of variance of serial measurements (LW, BCS, REA and PC) were performed using the procedure Proc Mix (SAS Institute Version 9.1., 2003) to evaluate the effect of treatments on the variables studied, and the means of treatments were analyzed by the LSD test ($P<0.05$). For the statistical evaluation of AOB and Point C was used covariate analysis.

Results and discussion

In Table 1, is shown the effect of treatments on the evolution of LW, BCS and consumption. It is noted that BCS and initial LW did not differ between treatments ($P>0.05$). In the fist 84 days of experiment, the T4 animals had better LW gains than treatments 1, 2 and 3, being 68, 42 and 17% greater, respectively. As a result of these gain rates and the market requirements of heavy lambs in Uruguay for exportation (LW from 35 to 45 kg and BCS from 3.5 to 4.5 units), it was necessary to extend by 48% the period of fattening in the less intensive treatments (T1 and T2). According to Banchero *et al*., 2000 and Montossi *et al*., 2002a, the higher animal biological and economical response in for the use of grain supplementation under grazing conditions in heavy lamb fattening, is normally observed under restrictive conditions of forage allowance. However, even with forage allowances above of 6% of LW, the authors found positive responses to supplementation, although this practice increased substitution rates of forage consumption by concentrate and increased production costs of the meat produced.

Table 1. Animal performance, concentrate consumption and carcass characteristics

TREATMENTS	**T1**	**T2**	**T3**	**T4**
Animal performance				
Days to slaughter	124	124	84	84
Final FLW 84 days	nc	nc	38.9b	41.8a
Final FLW 124 days	36.0b	39.8a	nc	nc
BCS 84 days	2.9c	3.5b	3.7b	4.0a
BCS 124 days	3.0b	3.3a	nc	nc
Total Concentrate OMD Consumption (g/a/d)	nc	180c	370b	1178[1]a
Conversion Efficiency (84 days)	nc	7.6	6.5	6.8

Note: a, b, c and d = means with different letters among columns are significantly different ($P<0.05$). [1] = Includes 248 g OMD/a/d of hay. nc = not corresponding.

The concentrate OMD consumption increased with supplementation ($P<0.05$). The supplement conversion efficiency in extra LW obtained by supplementation ranged between 6.5 and 7.6. These values are higher than those reported by Banchero *et al* (2000), and they are closer to those obtained with levels of forage allowances from 3 to 4% of LW. The higher LW gains of the supplemented systems, managed at the same level of forage allowance (T1, T2 and T3), could be explained by the level of supplement OMD and protein consumption. The same concept would apply to the T4, which also have lower animal requirements in relation to the grazing ones due to the reduction of energy maintenance costs associated with grazing. The estimated consumption of forages ranged from 20-30%, 40-50% and 79% for T2, T3 and T4, respectively (Montossi *et at.*, 2007)

The REA and the level of fat cover (PC) determined *in vivo* increased with the growing levels of concentrate intake (Table 2). This information found agrees with other works (Montossi *et al.*, 2002a). These authors concluded that the effect of increasing the nutrition level of lambs produced greater REA and PC values, but when statistical comparisons are made after correcting these variables by their covariates the

effect become much smaller. San Julian *et al*. (2002), analyzing a database of Corriedale heavy lambs, found a positive association between AOB and PC and valuable cuts (steak and boneless leg). The PC values of T4 animals were higher than those reported by Montossi *et al*. (2002b) for carcass of similar or greater weight than those obtained in this experiment, which could be associated with the higher level of energy used in the diet of the lambs of treatments T3 and T4. These differences are related to the higher proportion of supplement consumption in relation to LW of lambs along the experiment, being 0.55, 1.09 and 3.66% of LW, for T1, T2 and T3, respectively.

Table 2. *In vivo* ultrasound measurements of heavy lambs

TREATMENTS	T1	T2	T3	T4
REA (cm^2)[1]				
Initial	5.5	5.8	5.5	5.3
REA 84 days	7.2d	8.5c	9.5b	11.3a
REA 124 days	9.5b	10.8a	nc	nc
PC (mm)[1]				
Initial	1.9	2.0	1.8	1.9
PC 84 days	2.3c	2.5bc	2.6b	3.5a
PC 124 days	2.7b	3.3a	nc	nc

Nota: a, b, c and d = means with different letters among columns are significantly different ($P<0.05$). [1] Values of REA and PC corrected by the animal LW at the moment of the measurement. nc = not corresponding.

Conclusions

The intensification of heavy lamb fattening under grazing conditions through the use of concentrates, particularly in the most intensive systems (concentrate allowance of 1.2% of LW or even with the use of confinement), decreased fattening period, improved LW gain and final LW, and carcass quality attributes as well as increase production per unit of area. The use of supplements in pastoral production systems can reduce the normal variations (in quantity and nutritional value of forages) which are normally found in these systems throughout the year and limiting animal production. This fact could lead to accelerate the process of fattening and increase the consistency of quantity and quality of meat production and increasing the carrying capacity and productivity of grazing systems.

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