EFFECT OF PROTEIN SUPPLEMENTATION ON PRODUCTION AND CARCASS QUALITY TRAITS OF LAMBS GRAZING NATURAL GRASSLANDS DURING SUMMER IN URUGUAY

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Abstract – The objective of this study was to evaluate the effect of different nutritional strategies on animal performance *in vivo* as well as carcass quality traits of crossbred lambs (88% Merino Dohne x 12% Corriedale) in Uruguay. The trial was carried out during the summer grazing on natural grasslands (NG) using an isoenergetic supplement (S; 2.9 MCal ME/kgDM) with different protein contents (PC; 12, 16 and 20%). Eighty crossbred lambs grazed on a single stocking rate (10 lambs/ha) with an initial average live weight (LW) 28.5 ± 3.6 kg. These were randomly allotted to four treatments (T) with a single supplementation level (2% LW) using three different protein content in the S, being: T1=NG (control), T2=NG + S 12% CP, T3=NG + S 16% CP and T4=NG + 20% CP. Once the experimental period was over, all animals grazed on an annual winter crop until they reached slaughter weight. At the beginning of the trial, animals presented similar LW (P>0.01). However, after the supplementation period, lambs in T1 had a lower LW (P<0.01) than the rest of the T. The same trend was observed for body score (BS) determination (P<0.01). For the rib eye area (REA), fat thickness (GR), hot carcass weight (HCW) and chilled carcass weight (CCW) measurements, lambs in T1 had lower (P>0.01) values than the rest of the supplemented T. Regardless of the protein content of S treatment, supplementation improved summer lamb rearing grazing on NG and it has a subsequent positive effect on lambs performance during the finishing period as well as carcass quality traits. Therefore, feeding rearing process with S is a key factor to improve animal performance and product quality in lams production systems.

KEYWORDS: supplement, lambs, crude protein, arcass.

I. INTRODUCTION

Over the last decades, a worldwide decrease in sheep meat supply has been registered. Nonetheless, in a literature review done by Montossi *et al*. (2013) stated that sheep meat market share will be recovered given by the stimulus of price incentives compared to other alternative meats. Traditional import markets will be grown (e.g. European Union and USA) and there will be an increase in the demand driven by developing countries (China, Saudi Arabia, Jordan, United Arab Emirates, Turkey and Qatar) due to the raise in the income of their populations (Montossi *et al*., 2013). The technological offer oriented to sheep meat production must come together with alternatives to allow productivity enhancement associated with the use of more efficient genetics and feeding systems (Montossi *et al*., 1998) as well as product quality and process certification (Montossi *et al*., 2013). During summer, throughout the Basaltic region of Uruguay, the low protein and energy levels of natural grasslands and gastrointestinal parasite infestation are the principal constraints to promote lamb LW gain before and after weaning. To overcome these restrictions, Several local research studies have been carried out to evaluate different nutritional strategies during summer on improved pastures (Montossi *et al*. 1998) and the implementation protein supplementation schemes on natural grasslands (Piaggio, 2013) on lamb rearing. However, there are few studies reported in the literature evaluating the effects of dietary protein levels needed to accomplish an efficient rearing process and to improve carcass quality. Hence, the objective of this trial was to evaluate the effect of protein supplementation on lamb rearing productivity grazing on NG during

summer and its subsequent effect during the finishing period and on carcass quality traits.

II. MATERIALS AND METHODS

This experiment was carried out at "Glencoe" Experimental Unit – INIA Tacuarembó, situated in the Basaltic Region of Uruguay. Eighty crossbred lambs, with an initial average LW of 28.5 ± 3.6 kg, grazing on NG at the same stocking rate (10 lambs/ha) were supplemented at identical level (2% LW) using an isoenergetic commercial supplement (S) which varied on its crude protein (CP) levels. The animals were randomly allotted to four treatments (T) during the summer rearing, being: T1= NG (control), T2=NG + S 12% CP, T3=NG + S 16% CP and T4= NG + 20 % CP. Animals were distributed in two repetitions per treatment. At the beginning of the experimental period, all animals had an intake adaptation period until they reached the desired level of S intake (7-10 days). After this period, animals were supplemented twice a day (7:30 – 8:30 AM and 5:30 – 6:30 PM), offering half of the total daily amount of feed on each period. Animals had free access to mineral blocks and clean water. Animal measurements were: weekly LW, fasted LW at the beginning and the end of the experiment, body score (BS) every 14 days and monthly rib eye area (REA) and fat thickness (EG). For the supplemented treatments, feed intake was adjusted every 7 days according to the average LW of each repetition. Once the experimental period was over (105 days; from January 24th to August 8th), lambs were finished during 84 days (from August 8th to July 31st) until they achieved slaughter weight and were treated exactly alike, grazing an annual Oat crop without supplementation. Lambs were slaughtered at a commercial slaughterhouse. REA was measured as well as EG at the C point (EG) by an ultrasound scanning technique (San Julian *et al.,* 2002). At slaughter, hot carcass weight (HCW) was recorded and chilled carcass weight (CCW), carcass length (CL), GR point and boneless leg weight (BLW) were registered after 36 hours of chilling at 2-3°C (San Julian *et al.,* 2002). Results were analyzed by the MIXED procedure (SAS statistical package), as repeated measurements over time. Carcass quality traits were analyzed using GLM procedure (SAS Institute 9.2 Version, 2010) while averages and differences among T were contrasted by LS means ($P<0.05$ o $P<0.01$).

III. RESULTS AND DISCUSSION

The effect of the different feeding strategies on animal performance and *in vivo* determinations are shown in Table 1. At the beginning of the trial, there were not significant differences between T in LW. By the end of the rearing period, animals of T1 had ($P<0.01$) lower final LW compared to T2, T3 and T4. The same trend was observed in other protein supplementation studies carried out on NG in the granitic region of Uruguay (Piaggio, 2013). The BS results during the summer rearing period evidenced the same trend as the final LW. These results are consistent, since the BS of an animal expresses its nutritional status and it is positively correlated to its fattening status and animal and carcass finishing (Sañudo *et al.,* 2008). Regarding to ultrasound scanning measurements (REA and EG), at the beginning of the experiment no differences were found among T, while by the end of the rearing period, T1 animals had lower ($P<0.01$) values of REA and EG compared to those of T2, T3 and T4. For the fattening period, LW, BS and REA values were lower ($P<0.01$) for T1 animals compared to those of T2, T3 and T4. EG determinations were also lower ($P<0.05$) for T1 animals compared to those of T2, T3 and T4. This proves that, even when T1 animals registered a compensatory growth during the fattening period grazing on an annual crop, but they could not achieve the same finishing weight and fat degree than supplemented animals. The effect of the different T on carcass traits is presented in Table 2. HCW, CCW and CL values were lower ($P<0.01$) for T1 animals compared to those of T2, T3 and T4. Concerning to high value cuts, where FR and Leg weights were lower ($P<0.05$) for T1 animals compared to the rest of T, without significant differences amongst T for Shoulder and Loin weights ($P>0.05$).

Table 1. Effect of different supplementation strategies on growth, fattening and ultrasound scanning traits on lambs.

Variable	T1	T2	T3	T4	P
Initial LW (January) (kg)	28.5a	28.5a	28.6a	28.4a	ns
LW (May) (kg)	30,9b	41,1a	42,1a	42,9a	**
LW (July) (kg)	41,4b	48,3a	48,9a	49,2a	**
Initial BS (January)	2,5a	2,6a	2,6a	2,6a	ns
BS (May)	2,5b	3,5a	3,5a	3,6a	**
BS (July)	4,0b	4,3a	4,4a	4,3a	**
Initial REA (January) (cm^2)	6,22a	6,30a	6,35a	6,44a	ns
REA (May) (cm^2)	7,5b	10,8a	10,8a	10,9a	**
REA (July) (cm^2)	11,0b	12,1a	12,3a	12,2a	**
Initial EG (January) (mm)	1,73a	1,63a	1,88a	1,71a	ns
EG (May) (mm)	1,7b	2,5a	2,6a	2,6a	**
EG (July) (mm)	2,7b	3,3a	3,5a	3,2a	*

Note: a, b = means with different letters among columns are significant different (*, P<0.05) and (**, P<0.01). ns= not significant.

Table 2. Effect of different supplementation strategies on *in vivo* performance of lambs.

Variable	T1	T2	T3	T4	P
HCW (kg)	18,9b	23,2a	23,7a	23,8a	**
CCW (kg)	18,6b	22,8a	23,2a	22,9a	**
GR (mm)	5,4b	10,6a	11,15a	10,5a	**
LC (cm)	68,5b	73,7a	71,5a	73,5a	**
FR (g)	387,4b	477,0a	490,3a	488,9a	**
Shoulder (g)	1948,8	1909,3	1819,1	1933,8	ns
Loin (g)	301,4	297,1	284,1	322,9	ns
Leg (g)	2356,2b	2912,1a	2934a	2952,5	**

Note: a, b = means with different letters among columns are significant different (*, P<0.05). ns= not significant.

IV. CONCLUSION

Protein supplementation after lamb weaning grazing on NG during summer improved animal performance and ultrasound scanned traits for crossbred lambs (88% Merino Dohne x 12% Corriedale) in contrast with non supplemented animals. Despite of the compensatory growth found in T1 animals, this effect was not high enough to overcome the differences achieved by supplemented T during rearing, resulting in better animal performance during fattening as well as on carcass quality traits. Protein is one of the most expensive constituents of lamb feeding supplements. Therefore, at the available energy diet content level used in this experiment (supplement plus forage) and the LW gains achieved, the use of protein supplement with more than 12 CP% is not justified to improve animal growth, carcass quality and valuable cut weights. Further research is needed since there is great variability in pasture quality between years and the definition of LW gains to achieve and finishing degree for lean carcass provide by Merino Dohne breed.

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