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Effect Of Pasture Supplemented With Methionine On Wool Growth And Selected Growth Parameters

B.J. PURCHAS, G.C. WAGHORN[1], G.A. WICKHAM

Institute of Veterinary, Animal and Medical Sciences, Massey University.

ABSTRACT

The effects of a supplemental oral drench of rumen-protected methionine (Mepron®) on wool growth and weight gain was studied in 2-3y non-mated Romney ewes during nine months from March to December. Three groups of 20 sheep received either 0, 4 or initially 8 (later 2) g of methionine daily. The ewes were rotationally grazed as a single mob on ryegrass-white clover pasture with winter restrictions. Pasture availability was monitored weekly. Mid-side wool samples were taken at two-monthly intervals and analysed for yield. Full fleece samples were collected during end of trial shearing and analysed for yield, fibre diameter, colour, staple length, crimp and style. Sheep were weighed weekly and herbage intakes estimated in August and November. Blood samples for plasma cysteine determinations were collected in June, August and November. There were no significant differences between the control and 4g/d groups in clean wool growth from mid-side patches (mean 1260 $\mu g/cm^2/d$), greasy fleece weight (4.12kg) or final live-weights (63.1kg). Average estimates of pasture intake were non-significantly lower in supplemented sheep in August but approached significance in November ($P<0.11$). There were no treatment effects on wool growth rate or wool characteristics even though Mepron increased ($P<0.05$) plasma cysteine concentrations (µmolar) (control 40.5 vs 4g/d 45.3) in June and in August (25.9 vs 31.1) but not in November. Weight-adjusted back-fats depths were lower in both supplemented groups compared to controls ($P<0.05$). We conclude that simple deficiencies in sulphur-containing amino acids were not limiting for wool production in these grazing sheep.

Keywords: methionine; wool growth; sheep; back-fat; grazing; cysteine; live-weight; supplementation; Mepron®.

INTRODUCTION

A large number of experiments have investigated the effects of adding sulphur-containing amino acids (S-AA) to the diet of sheep in attempts to increase wool growth or to alter fibre characteristics. Most of the research involved sheep kept in pens and fed at about maintenance levels. S-AA supplementation has mostly been by post-ruminal infusion or oral supplementation with methionine that has been protected from microbial action in the rumen. Improved wool growth has often been demonstrated, but large responses have been shown mainly in trials where wool growth on the basal diet was low (Reis *et al*. 1973). The objective of this trial was to study the responses of sheep grazing typical New Zealand pasture to S-AA supplementation.

MATERIALS AND METHODS

Animals

Each of 60 2-3 year old Romney non-mated ewes was randomly allocated (with a live weight restriction) to one of three treatment groups with 20 sheep/group. One group was a non-drenched control. The other two received either 4 or 8 g methionine as a daily drench. After 10 weeks the dose in the 8 g/d group was reduced to 2 g/d because of undesirable side-effects including decreases in wool growth and loss of weight (8/2g/d). The animals were rotationally-grazed as a single mob in 0.4 ha paddocks of ryegrass-white clover with restricted pasture allowance in winter to simulate normal farming conditions. Sheep were weighed weekly. Herbage availability was monitored at weekly intervals and intakes were estimated from the levels of chromium in the faeces of 10 sheep/group during two 5d collection periods in August and in November. Back-fat measurements were made at the beginning and end of the trial using a Delphi A-mode ultrasonic device (Purchas and Beach 1981).

Supplementation

Supplementation continued for nine months from March 1993 concluding in December. Immediately prior to drenching methionine (Mepron®, Degussa AG, Frankfurt, Germany) was mixed with water and guar gum (Viscol G-60, Davis Gelatine, Christchurch) was added to facilitate suspension in the drench liquor.

Wool measurements

The ewes were shorn prior to the commencement of the trial. Mid-side wool samples were clipped two-monthly and long samples collected at shearing in December. Greasy and clean scoured weights of all samples were obtained. In the long wool samples, assessment was made of fibre diameter (using the air flow method), colour, loose wool bulk, staple length (using the average of 10 staples per animal), and crimp. Visual colour, lustre, handle, cotting, and strength were graded from 1 = poor to 9 = very desirable.

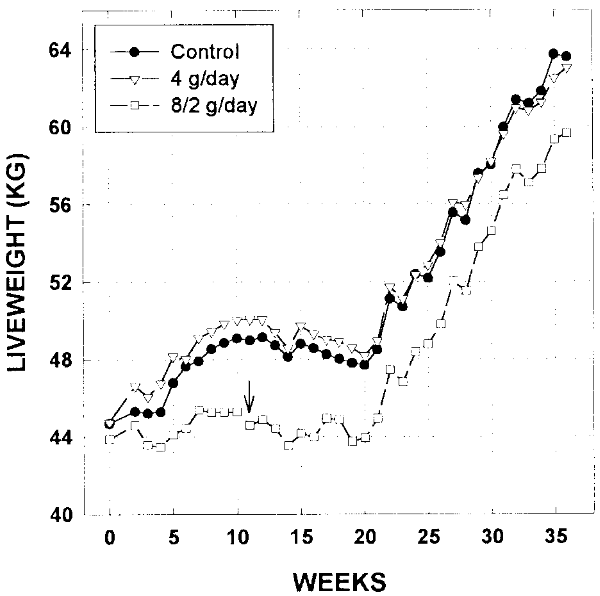
[1]AgResearch Grasslands, Private Bag 11008, Palmerston North.

RESULTS AND DISCUSSION

Liveweights

Liveweight changes are shown in Fig 1. Both the control and 4 g/d groups showed a gradual increase in their liveweights, but the average of the 8/2 g/d group did not change and some sheep in this group lost considerable weight, apparently as a consequence of methionine toxicity. From 10 weeks after the change in the dose rate for the 8/2 g/d group to the end of the supplementation period, weight gain in this group paralleled that in the other two groups. All groups had low or nil weight gains during winter (weeks 8-22) because of imposed restrictions on intake. Liveweights increased rapidly for all groups from week 21 on as a result of spring growth and increased allowances. The supplemented groups had significantly lower (P<0.05) final back-fat depths than the control group after adjustment by covariance to constant final weights and constant initial weight-adjusted fat depths (Controls 13.40mm vs 4 g/d 11.12 and 8/2 g/d 10.40).

FIGURE 1: Liveweight changes of control sheep and groups supplemented with daily drenches of 4 or 8 then 2 g/day methionine. The arrow indicates the point at which the 8 g/d supplement was reduced to 2 g/day.



Fibre Production

Fibre production from mid-side patches, adjusted for a pre-trial covariate period of 47 days is given in Table 1. There were no significant differences between the control and 4g/d groups during any of the collection periods. The 8/2 g/d group, however, did have significantly lower levels compared to the control and 4 g/d groups for the first two collection periods corresponding to the period of high dose rate. Reis (1967) also found that high levels of DL-methionine (9.84 g/d) led to a decreased rate of wool growth. Some animals in this group had very high production. This may have been due in part to sheep with genetically high potential for wool production being able to utilise more methionine/cysteine. There was a trend for winter levels of fibre production to be lower for the control group compared to the supplemented groups (888, 943 and 899 µg/cm2/d for controls, 4g/d and 8/2 g/d, respectively), but the differences were not significant.

There were no significant differences between treatment groups in greasy or clean fleece weight, scoured yield (%), bulk, resilience or style grades (Table 2). Differences between the fibre diameter of wool from the control

TABLE 1: Fibre production expressed as clean, scoured wool from mid-side patches (µg/cm2/d) adjusted for a pre-trial covariate period of 47 days.

Duration	(days)	Control	4 g/d DL M[1]	8/2 g/d M[1]	Treatment effects (P)
Number		20	20	18	
Sampling date:					
13 May	50	1718[a]	1701[a]	1431[b]	0.000
8 July	56	1150[a]	1143[a]	911[b]	0.002
2 September	56	888	943	899	0.692
28 October	56	1134	1102	1141	0.819
14 December	47	1451	1371	1436	0.554

[1] Methionine.
[a] Different superscripts indicate significant (P<0.05) treatment effects.

TABLE 2: Fleece measurements and characteristics of sheep whose grazing diet was supplemented with 0, 4 or 8 then 2 g/d methionine.

	Treatment group: Control	4 g/d M[1]	8/2 g/d M[1]	Treatment effects (P)
Measurement				
Greasy fleece (kg)	4.18	4.25	3.79	0.145
Yield (%)[a]	91.7	93.1	91.3	0.066
Fibre diameter (µ)	41.2[a]	40.6[b]	38.9[b]	0.057
Staple length (mm)	113.1	113.2	110.3	0.757
Crimp	8.3	8.6	8.3	0.818
Bulk (cm^3/g)	19.9	19.7	19.8	0.957
Resilience (cm^3/g)	7.9	7.8	7.8	0.946
Colour (reflectance units)				
X	59.6	59.6	59.7	0.930
Y	61.7	61.7	61.7	0.895
Z	58.1	57.3	57.3	0.744
Y-Z	3.6	4.4	4.4	0.880
Wool character assessments				
Visual colour	5.3	5.3	4.8	0.379
Lustre	6.2	6.0	5.5	0.202
Handle	3.2	3.5	3.6	0.321
Hand cotting	4.4	4.6	4.7	0.774
Hand strength	6.3	6.2	6.1	0.910
Final fat depths				
Adjusted final fat depths (LSMeans)	13.40[a] (0.60)	11.12[b] (0.61)	10.40[b] (0.65)	0.05

[1] Methionine.
[2] Yield estimated from the yield of a fleece sample taken during shearing at end of the trial.
[3] Fleece samples were graded from 1 (poor, undesirable) to 9 (excellent, desirable).
[a] Different superscripts for fibre diameters indicate significance (P<0.10).

group compared to that of the 4 g/d and 8/2 g/d groups approached significance (41.2 vs 40.6 and 38.9, respectively, P<0.06). Reis *et al*. (1973) found that low levels (2.5 g/d) of methionine supplementation via the abomasum decreased fibre diameter in Merinos.

Cysteine concentrations

Supplementation significantly (P<0.01) increased plasma cysteine concentrations in June and August but not in November (Table 3). The levels in the control group compared to the 4 g/d and 8/2 g/d groups were significantly different in June and August, but there were no treatment effects in November. The lower cysteine concentrations in all groups in August corresponded to lower intakes and may have been related to the feed restrictions imposed during winter. The absence of any treatment effect in November may be a consequence of improved pasture quality during spring.

TABLE 3: Digestible organic matter intakes (DOMI) of sheep fed 0, 4 or 2 g/d methionine and wool growth efficiency during August and November (10 sheep/group for feed intakes and wool growth efficiencies and 30 sheep/group for cysteine concentrations; means (SE)).

	Treatment groups			Treatment effect
	Control (0 M[1])	4 g/d M	8/2 g/d M	(P)
Intakes (g DOMI/day):				
August	746 (77.7)	704 (56.8)	690 (44.4)	0.801
November	1458 (86.7)	1217 (5.0)	1327 (90.7)	0.109
Efficiency of wool growth ((g/cm^2)/(g DOMI)):				
August	1.13 (0.14)	1.42 (0.09)	1.36 (0.12)	0.222
November	0.74 (0.06)	0.95 (0.05)	0.90 (0.07)	0.076
Plasma cysteine (µmolar):				
June	40.5^a (1.40)	45.3^b (1.46)	52.5^c (2.28)	0.0001
August	25.9^a (1.36)	31.1^b (1.44)	32.5^b (1.85)	0.0082
November	39.2 (1.73)	39.7 (1.83)	39.5 (2.44)	0.9860

[1] Methionine.

[a] Different superscripts for cysteine concentrations indicate significance (P<0.05).

Absorbed methionine is trans-sulphurated to cystine by the liver, and cystine is a major amino acid component of wool fibre. The increased blood cysteine concentrations, especially for the 8/2 g/d group in June, showed that Mepron provided additional absorbed methionine for the sheep. Whether it provided any more methionine than DL-methionine would have is another question since Mata *et al*. (1995) found that plasma levels of methionine in Merino sheep following Mepron® supplementation into the rumen were similar to those following unprotected DL-methionine. The loss of weight of some sheep in the 8/2 g/d group indicates toxicity and would be unlikely if a high proportion of the methionine had been broken down in the rumen.

Intakes

The feed restrictions imposed led all groups to have significantly lower digestible organic matter intakes (DOMI) in August compared to November (Table 3). The mean intake of the control group was non-significantly higher than that of the other two groups during both winter and spring measurement periods. Reis (1967) found abomasal administration of more than 2.46 g/d DL-methionine decreased intakes.

The efficiency of feed utilisation for wool growth (g/cm^2/g DOMI) was calculated for the August and November intake periods (Table 3). For both intake periods the controls were less efficient (wool growth/intake) than the supplemented groups, particularly in November where the differences approached significance (P<0.11). The slightly lower intakes of the supplemented groups together with similar fibre production in all groups suggest a more efficient feed utilisation in the supplemented groups.

CONCLUSION

In this trial supplementation with Mepron® in grazing ewes raised plasma cysteine concentrations demonstrating the effectiveness of the rumen-protection although there were no effects on wool growth rate or wool characteristics except for a small effect on fibre diameter. Supplemented animals tended to show an increased efficiency of wool production which was associated with slightly lower intakes.

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