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Effects of suppressed prolactin levels on wool growth in Romney ewes

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ABSTRACT

Seasonal variation in prolactin secretion has been associated with changes in the pelage of a number of mammals. The aim of this study was to ascertain whether the suppression of prolactin levels commencing in late summer, affects wool growth in sheep with a seasonal pattern of wool growth.

Twenty Romney ewes (n=10/group) received either 50 mg of bromocryptine (Parlodel LA®)/ewe, injected *im* every 4 weeks (B) or no treatment (C). Wool growth on mid-side patches (10 x 10 cm) and live weight were measured every 28 days for the duration of the 24 week study. Venous blood samples were collected for prolactin determination prior to treatment and at regular intervals during the investigation.

Plasma prolactin (mean ± SEM) was rapidly suppressed in treatment group B from a pre-treatment value of 118 ± 2 ng/ml to less than 12 ± 7 ng/ml. Prolactin levels in group C exhibited a gradual seasonal decline from 121 ± 3 ng/ml to 29 ± 2 ng/ml. A reduction in wool growth (g clean conditioned wool/100 cm^2/28 days, mean ± SEM) was observed in both treatment groups in response to season, from 5.4 ± 0.4 g to 4.2 ± 0.4 g in group B and from 4.9 ± 0.5 g to 4.0 ± 0.5 g in group C; no significant ($p<0.05$) treatment effect was evident. Liveweight (mean ± SEM) of all animals increased from 50.8 ± 0.9 kg to 55.2 ± 0.8 kg during the study.

These results indicate that reduction and suppression of prolactin secretion commencing in late summer does not reduce wool growth in the Romney sheep.

Keywords Wool growth, seasonality, prolactin, bromocryptine, sheep, Romney.

INTRODUCTION

Seasonal variation in prolactin secretion is temporally associated with changes in the pelage of a number of mammals (Lincoln, 1990a) including the blue fox (Smith *et al.*, 1987), deer (Webster & Barrell, 1985; Loudon *et al.*, 1989), goat (Deveson *et al.*, 1989), mink (Martinet *et al.*, 1984; Rose *et al.*, 1985) and sheep (Lincoln *et al.*, 1980; Rougeot *et al.*, 1984; Lincoln & Ebling, 1985; Allain *et al.*, 1986; Lincoln, 1990b). A causal relationship between prolactin secretion and seasonal changes in pelage has been established in the mink (Allain *et al.*,1981; Martinet *et al.*, 1983; Rose *et al.*, 1987), hamster (Hoffmann, 1973; Duncan & Goldman, 1984), blue fox (Smith *et al.*, 1987), deer (Bubenik *et al.*, 1986) and the goat (Webster & Barrell, 1985). In the latter studies, circulating prolactin levels were either suppressed or increased to influence hair follicle activity and thus changes in the pelage. For example, in the mink maintained under a long photoperiod, suppression of prolactin by bromocryptine led to moulting of the summer pelage and growth of a winter coat (Martinet *et al.*, 1984), while exogenous prolactin, administered to mink during the winter period, advanced the onset of the spring moult and the growth of the summer pelage (Martinet *et al.*, 1983).

Prolactin secretion is also directly correlated with wool follicle activity and thus wool growth in some sheep breeds (Lincoln and Ebling, 1985; Allain *et al.*, 1986; Lincoln, 1990b). In Soay rams, increasing prolactin concentrations were associated with spring moulting and regrowth of wool. The suppression of this increase in prolactin, by the administration of melatonin, caused a delay in the moult of the fleece (Lincoln and Ebling, 1985). Allain *et al.*, (1986) demonstrated that the hair cycle of kemp follicles in Limousine rams was synchronised with changes in the circulating levels of prolactin; prolactin secretion increased or decreased in response to artificial long (16 h L: 8 h D) or short (8 h D: 16 h L) daylength, inducing a decrease or increase respectively in the percentage of kemp follicles in anagen. In contrast, the suppression of prolactin secretion with bromocryptine in Scottish Blackface ewe in winter, eliminated the spring rise in prolactin, but had no effect on wool growth (Curlewis, 1991). These studies strongly indicate an effect of prolactin on seasonal changes in the pelage of many mammals including some primitive and less domesticated breeds of sheep, however, the effect of prolactin on wool growth in seasonal but non-shedding breeds of sheep is not clearly defined.

The aim of the present study was to determine if suppression of prolactin levels, commencing in summer, would affect wool growth in Romney sheep.

MATERIALS AND METHODS

Animals

Twenty Romney ewes, 18 months of age, were randomly divided into two groups:-Bromocryptine treated (group B, n=10) and non-treated Control (group C, n=10). Ewes were housed indoors in individual pens under natural lighting at latitude 34°S, and received a pelleted ration of 750 g/sheep/day (60:40 lucerne:oats) and water *ad libitum*.

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Experimental Procedure

The bromocryptine treated ewes (B) each received 50 mg bromocryptine (Parlodel LA®, Sandoz Ltd, Basle, Switzerland) *im*/ewe every 28days; the control ewes (C) received no treatment, commencing in late February. Wool growth was determined by clipping wool from tattooed mid-side patches (right side, 10 x 10 cm) every 4 weeks. Blood samples were collected at 1000 h, prior to the commencement of the treatment and then every fortnight for the 24 week duration of the investigation. Liveweight measurements were made prior to treatment and thence every 4 weeks during the study.

Wool Preparation

Clean conditioned wool weight (CCWW) was determined by cleaning the wool using the method described by Reis (1967) and then conditioning the wool at 20 ± 1°C and a humidity of 65 ± 2 %.

Blood Sampling

Blood samples were collected from the jugular vein using 10 ml heparinised Vacutainers®. All blood samples were immediately centrifuged for 10 min at 1200 x g (4°C) and plasma was stored at -20°C until assayed.

Hormone Determinations

Prolactin concentrations in plasma were determined by direct radioimmunoassay using the methods of Maxwell *et. al.* (1989).

Statistical Analysis

Results are expressed as means ± SEM. Mean differences and differences over time between groups were analysed via repeated measures ANOVA with Greenhouse Giesser correction (Greenhouse and Giesser, 1959) and considered significant when $P<0.05$.

RESULTS

Prolactin concentrations did not differ significantly between the treated and control group of ewes prior to the commencement of the investigation (Fig. 1). The control animals exhibited a normal seasonal decrease in prolactin during the autumn and winter from a concentration of 121 ± 3 ng/ml late in summer to 35 ± 9 ng/ml during winter (Fig. 1). Prolactin concentrations in bromocryptine treated animals were rapidly reduced following treatment, to below 12 ± 7 ng/ml throughout the investigation (Fig. 1). Although prolactin secretion was effectively suppressed, a gradual rise in levels was noted from week 14 until the end of the study.

Wool growth (g/100 cm²/28 days) did not differ significantly between treatment groups during the study (Fig. 2). Maximum wool growth of 5.3 ± 0.4 g and 5.6 ± 0.6 g respectively was recorded for groups B and C, prior to a decline in wool production of 22% during winter. Minimum wool growth of 4.2 ± 0.4 g and 4.0 ± 0.5 g respectively was measured in groups B and C during winter.

Liveweight of the ewes increased from 50.8 ± 0.9 kg to 55.2 ± 0.8 kg over the duration of the experiment; no significant differences were noted between the treatment groups.

FIGURE 1 Plasma prolactin concentrations (mean ± SEM) of bromocryptine treated (solid bar, n=10), and control (hatched bar, n=10) ewes sampled prior to, and at regular intervals during the experiment. Seasons are indicated by the divided bar, and abbreviated as SUM (summer), AUT (autumn) and WIN (winter).

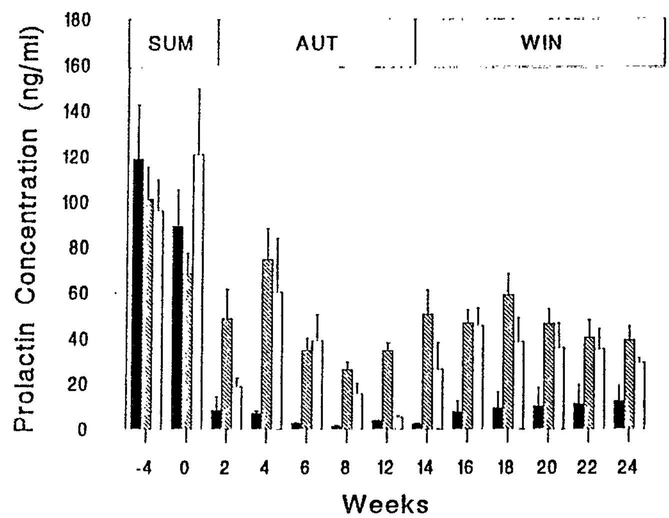
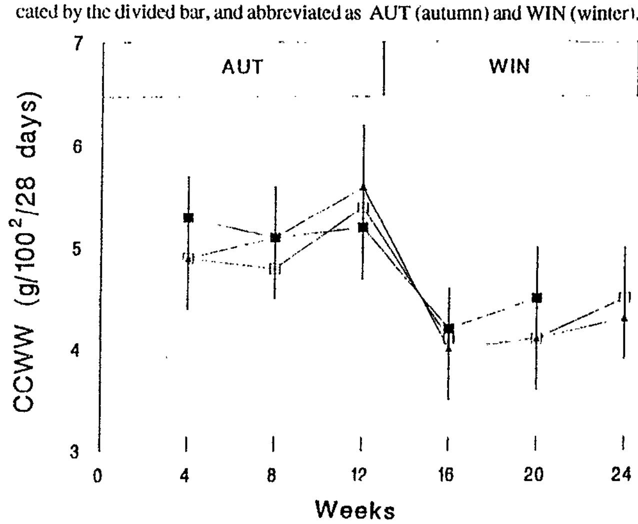


FIGURE 2 Clean conditioned wool weight (CCWW, mean ± SEM) in bromocryptine treated (■, n=10), and control (□, n=10) ewes, measured every 4 weeks following the commencement of the experiment. Seasons are indicated by the divided bar, and abbreviated as AUT (autumn) and WIN (winter).



DISCUSSION

The seasonal decline in plasma prolactin concentration observed in the present study was in agreement with that described for other sheep breeds by Lincoln (1990b). Although prolactin concentrations were effectively reduced by bromocryptine treatment and remained below 12 ± 7 ng/ml for the duration of the study, a gradual increase in prolactin was noted in the latter half of the experiment. This may reflect an inability of bromocryptine to maintain suppression of prolactin secretion for extended periods.

Wool growth declined by *c* 22% during the autumn-winter period, in both control and bromocryptine treated animals. Prolactin secretion was effectively suppressed in the bromocryptine treated group, but no significant difference in wool growth occurred between the two groups. Suppression of prolactin secretion has been shown to directly affect changes in the pelage of the mink (Martinet *et al.*, 1984), the hair cycle of kemp follicles in Limousine rams (Allain *et al.*, 1986) and the moult of the fleece in Soay rams (Lincoln and Ebling, 1985). It is uncertain why seasonal changes in prolactin secretion affect wool growth in the Soay and similar breeds of sheep (Allain *et al.*, 1986; Lincoln and Ebling, 1985), but show no effect in other domesticated breeds such as the Romney, Scottish Blackface (Curlewis *et al.*, 1991), and the Merino (Dolling *et al.*, 1986; Lincoln, 1990b). However, the reason may relate to the difference in the length of the anagen or growth phase of the hair growth cycle, between these breeds. The hair cycle of the follicles in the Soay has a short anagen phase (6 months) and is synchronised within the follicle population, resulting in a distinct annual moult of the fleece (Ryder, 1971). In contrast, the anagen phase in follicles of modern sheep breeds such as the Merino, is believed to be in excess of 8 years in length and the follicles are non-synchronised, so that the fleece is not shed as a distinct moult (Ryder and Stephenson, 1968). It is possible that the selective breeding of these sheep for increased wool production and more uniform fleeces has altered the sensitivity of the wool follicle to prolactin, perhaps by modification of prolactin receptors associated with the follicle, leading to an extension of the anagen phase of the hair cycle.

The results of this study indicate that suppression of prolactin secretion commencing in late summer does not cause a decrease in wool growth in the Romney ewe, and that although wool growth in this breed varies significantly with season, it more resembles modern breeds such as the Merino than it does the primitive breeds in which wool growth alters with plasma prolactin concentration.

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