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Goat fibre response to melatonin given in spring in two consecutive years

R.A.S. WELCH, M.P. GURNSEY, K. BETTERIDGE AND R.J. MITCHELL

DSIR Grasslands, Palmerston North.

ABSTRACT

Sustained release of melatonin from implants or microcapsules administered in October induced cashmere growth during November to March in all ten, treated, cashmere-bearing goats. The mean maximum length of the cashmere in this induced fleece ranged from 12-55 mm. Another cashmere growth cycle followed between autumn and winter. In contrast, nineteen control goats grew cashmere only during the autumn-winter period. Melatonin treatment increased total mean cashmere staple length by up to 65% for treated animals compared with the controls. The onset of growth of the autumn fleece in the treated goats was delayed as also was the time when maximum length was achieved and shedding occurred. Melatonin treatment should permit the shearing of the autumn fleece to be delayed, thus reducing the risk of post-shearing losses during inclement weather in late winter.

Keywords Melatonin; goat; fibre; cashmere.

INTRODUCTION

In reproducing cashmere-bearing feral does cashmere grows in the late summer and autumn and sheds in the late winter through mid-spring (Mitchell *et al.*, 1989). A consequence of this pattern of fibre growth is that farmers usually shear their goats in June or July. Because there is little or no growth of either cashmere or guard hair before September, many shorn goats are left with inadequate fibre cover during winter. This has led in some instances to large post-shearing losses of goats, particularly when they have been in poor condition at shearing and feed supplies and/or shelter have been inadequate (Tye, 1988).

Melatonin, an indoleamine produced by the pineal gland, is involved in the control of seasonal changes of several physiological functions in mammals, including fibre growth (Rose *et al.*, 1984; Rougeot *et al.*, 1984; McDonald and Hoey, 1987; Smith *et al.*, 1987). Sustained release of exogenous melatonin has been shown to alter the normal pattern of fibre growth by inducing cashmere to grow in the spring (Betteridge *et al.*, 1987). It appears that this is achieved by stimulating the secondary follicles to grow cashmere fibre in spring rather than the short (0.6-2.3 mm) vellus fibre (Nixon *et al.*, 1991) normally produced at that time of the year.

This paper describes the effects of two different methods of melatonin treatment of goats in the spring of two consecutive years and records the pattern of cashmere fibre growth during that time.

MATERIALS AND METHODS

Ten cashmere-bearing, reproducing, feral does were given implants impregnated with melatonin. The implants were made from medical grade silicone elastomer impregnated with melatonin (6% w/w). Implants were inserted subcutaneously in late October in year one and replaced every two months until the growth of the induced cashmere fleece stopped. At this time implants were removed. On the same date in year two the goats were injected subcutaneously with microcapsules containing melatonin. The microcapsules (formulation SRO 32/115 of Stolle Research and Development Corporation, Cincinnati, Ohio) were made from polygalactide and polylactide polymers which slowly released melatonin over more than 100 days (M.P. Gurnsey *et al.*, unpublished data). Treated goats received 1.86 mg melatonin/kg bodyweight. Nineteen untreated does acted as controls. All goats were run together on pasture in southern Hawkes Bay and received some supplementary hay in winter. Each month

the goats were treated with oral anthelmintics and foot bathed in zinc sulphate against foot infections. The does were mated in May, kidded in October and weaned in February. Cashmere and guard hair lengths were determined from a staple snipped at a new site on the mid-side each month and measured against a ruler. Goats were shorn at the end of the winter when there had been no cashmere growth over the previous month in at least 60% of the goats in a group. Data was analysed from mean fibre staple lengths on each sampling day for all goats.

The sum of mean maximum cashmere lengths of both the spring and the autumn fleeces in each group were compared using the SAS general linear model (GLM) statistical package. The difference between total mean staple cashmere length between groups within years and differences between years were compared by paired Student's t-test.

RESULTS

Melatonin treatment in October induced cashmere to grow through spring and summer (spring fleece) in all the treated goats when there was little or no growth of cashmere in the control goats (Fig. 1). The maximum mid-side cashmere staple lengths in the spring fleece ranged from 12-55 mm, in year 1, and 24-44 mm, in year 2. Both treated and control animals grew cashmere through autumn and winter (autumn fleece). The mean maximum cashmere staple lengths for both the spring-grown and autumn-grown fleeces of the treated goats were substantially less (from 9 - 30%) than those for the control animals (Table 1). However, the total cashmere length (i.e. combined lengths of both spring-grown and autumn-grown fleeces) for the treated goats exceeded the maximum cashmere length of the autumn-grown fleeces of the control animals, in years 1 and 2, by 54.0% and 65.4%, respectively.

In the treated animals the maximum cashmere staple length from the mid-side patch of the spring-grown and autumn-grown fleeces occurred in March-April and August-September, respectively. Thus, the maximum cashmere staple length for the autumn-grown fleeces occurred some 4 to 8 weeks later than in the control goats (Table 1). Cashmere growth ceased in control animals approximately 4 weeks earlier than in the treated group, hence the latter were shorn 4 weeks later than the control group (Figure 1).

Although the patterns of cashmere growth were similar for the two years, goats in both the treated and control groups grew significantly ($P<0.01$) longer cashmere staples in year 2 (treated: 84.7 ± 2.5 vs 70.1 ± 5.4 mm; controls: 51.2 ± 2.2 vs 45.5 ± 2.3 mm, respectively).

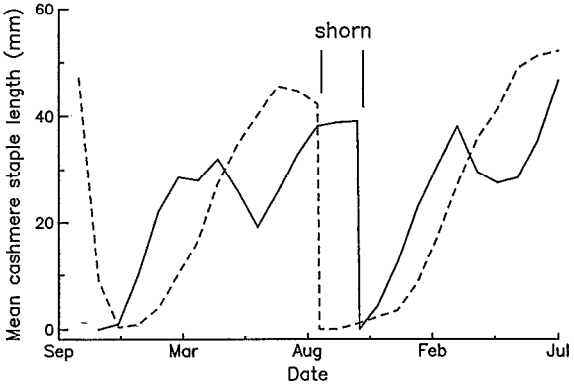

FIG 1 Mean staple cashmere length (mm) for control (solid line) and melatonin treated (broken line) goats.

The numbers of goats growing cashmere staples at least 30 mm in length (the minimum manufacturing length) are shown in Table 1. In the treated and control groups, 90 and 95%, respectively, of the goats grew autumn fleeces in which mid-side cashmere staple samples exceeded 30 mm in length. In addition, 65% of the treated goats also grew spring fleeces in which mid-side cashmere staple lengths exceeded 30 mm.

DISCUSSION

In this trial, treatment of cashmere-bearing goats with exogenous melatonin commencing in spring resulted in the growth, in 50-80% of animals, of an out-of-season (spring) cashmere fleece. The production of a spring cashmere fleece in both years of this trial, demonstrates that the result was repeatable in successive years in the same animals and also both melatonin treatments were effective. In year 1 the exogenous melatonin was administered using a silastic implant while in year 2 an injectable microcapsule formulation was given. Clearly,

Table 1 Mean maximum cashmere length, date at which maximum length was reached and the number of animals with cashmere staple lengths ≥30mm, in melatonin treated and control goats, over 2 years.

Group	n	Year 1 length (mm) ± SE (date of maximum length)		Year 2 length (mm) ± SE (date of maximum length)	
		spring	autmun	spring	autmun
Control	19	-	45.5±2.3 (4 Jul)	-	51.2±2.2 (3Jul)
no.≥30mm	0	17	-	19	
Treated	10	32.0±3.8 (12 Apr)	38.1±4.4 (27 Sep)	38.0±2.0 (14 Mar)	46.7±2.3[1] (31 Jul)
no.≥30mm		5	8	8	10

[1] Trial ended on 31 August even though maximum length may not have been reached

the silastic implant was not a practical means of administering melatonin as the implant in its present form required regular replacement. However, the injectable formulation may form the basis of a practical means of administering exogenous melatonin over a period of many weeks.

Administration of exogenous melatonin may be a practical means of increasing cashmere production. The combined mean cashmere length of mid-side staples from the spring and autumn fleeces of the treated goats were 54 and 65% higher, in years 1 and 2, respectively, than the length of cashmere staples from the autumn fleeces of control goats. The mean increase in cashmere length was even higher (63 and 70%, respectively) when treated goats with cashmere staple lengths <30 mm were excluded from consideration. Animals with cashmere lengths <30 mm were deemed to have responded poorly to the melatonin treatment and such animals may not have been worth shearing.

The maximum cashmere length of the autumn fleece and the time at which this fleece was shed was 1-2 months later in treated animals. This appears to be a consequence of the growth of a spring cashmere fleece. In untreated goats the vellus hair cycle, which occurs in spring, is of short duration (Nixon *et al.*, 1991). Melatonin treatment in spring stimulates secondary follicles to produce cashmere fibre (Betteridge *et al.*, 1987) rather than vellus hair. The duration of the cashmere growth cycle induced in spring was similar to that of the typical autumn cashmere cycle and both were of longer duration than the vellus hair cycle. As a consequence, the autumn cashmere cycle in melatonin treated goats was delayed but was also of a 'normal' duration. An implication of these results is that in melatonin treated goats the shearing of the autumn fleece may be delayed by up to 2 months, thus avoiding leaving animals with inadequate fibre cover during the worst of the winter weather. This should reduce the risk of exposure which can be high in winter shorn goats (Buddle *et al.* 1987).

These preliminary results should be checked on large numbers of goats in a variety of environments and if economically viable could aid the development of a substantial cashmere goat industry in New Zealand.

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