

THE POST NATAL DEVELOPMENT OF HAIR FOLLICLE
GROUPS IN THE SKIN OF THE AUSTRALIAN FERAL GOAT

ALTHEA LAMBERT*, B.J. RESTALL[#], B.W. NORTON* and J.D. WINTER[#]

SUMMARY

Groups of unselected feral does were fed supplements at 60 to 90, 90 to 120 and 120 to 150 days post conception and for one month after kidding; a control group was run on kikuyu grass pasture.

The density of primary and secondary follicles was measured on skin biopsies taken sequentially from 50 progeny at birth, one month and four months of age.

The results show that many primary follicles but only a few secondary follicles are present at birth. Development of the follicle population continues until four months of age but appears to be most rapid during the first month of life.

Supplementation during the last month of gestation and the first month after birth had only marginal effects on the follicle population. In contrast supplementation between 60 and 90 days pc enhanced the initiation of secondary follicles during the first month.

Single kids had higher S/P ratios than twins but the difference was small at four months of age. Male kids had higher S/P ratios than females at birth but were similar thereafter.

INTRODUCTION

Recent interest in the potential of the Australian feral goat to produce cashmere has focused attention on the biology of its skin. Published information on the development of hair follicles in the skin of the goat is limited and incomplete (Margolena 1959, 1966; Burns 1965; Dreyer and Marincowitz 1967; Ryder 1966, 1974) and there is none for the Australian feral goat.

Both primary and secondary follicles are initiated before birth in the sheep and postnatal development is concerned with secondary follicle maturation (Fraser and Short 1960) but there is no information of this type for the goat.

This paper presents preliminary results of a study of the effect of pre and post natal nutrition on follicle development in the skin of the Australian feral goat.

MATERIALS AND METHODS

The study was conducted at the Agricultural Research Centre, Wollongbar, in northern N.S.W. At 60 days post conception (pc), 168 unselected feral does were allocated to five treatment groups with equal numbers of twin and single bearing does (determined by real time scanning, Fowler and Wilkins 1982). Three groups were supplemented in individual pens at either 60 to 90, 90 to 120 or 120 to 150 (birth) days pc. The fourth group was supplemented from 120 days pc until one

* Dept of Agriculture, University of Queensland, St. Lucia, Qld 4067.

[#] N.S.W. Dept of Agriculture, Agricultural Research Centre, Wollongbar, N.S.W. 2480.

month afterkidding (180 days pc), and a control group was maintained on kikuyu grass pasture for the duration of the trial. Housed does were offered pelleted rations of cotton seed meal, barley straw and sorghum grain at varying energy and protein levels. After supplementation all animals were combined with the control group on pasture.

Skin biopsies were taken from all kids at birth, one month and four months (weaning) of age and processed by the method of Carter and Clarke (1957). Primary (P) and secondary (S) follicle densities were recorded for sequential skin samples taken at each sampling time from 50 animals. As no differences between nutritional treatments were detected, data has been pooled within each supplementation period.

RESULTS

Very little secondary follicle development was evident in any skin sample at birth, but primary follicles appeared to be well developed and were arranged in closely packed lines. Skin samples obtained at one month of age showed a marked increase in the number of S and P follicles; at four months of age the development of both follicles and their accessory structures appeared to be well advanced.

The primary and secondary follicle densities and the S/P ratio for the three sampling times for each treatment period as well as for twin and single and male and female kids are shown in Table 1.

Both P and S follicle densities increased markedly between birth and one month of age but decreased slightly between one and four months. However the S/P ratio increased sharply between birth and one month but increased more slowly thereafter.

Male kids had a higher S/P ratio than female kids at birth, due mainly to a higher density of secondary follicles, but these differences had disappeared by one month of age.

Single kids showed a consistently higher S/P ratio than twin kids at each sampling time although the difference was small at four months of age.

Differential effects of supplementation are evident at the three sampling times. Supplementation late in pregnancy (120 days +) resulted in higher S/P ratios at birth, mainly due to an increase in the density of secondary follicles. Compared to the control group, this difference was still evident at one month but not at four months of age.

Although there were no differences at birth, supplementation at 60 to 90 days pc resulted in a considerably higher density of secondary follicles at one month. However this difference was not evident at four months although the S/P ratio remained marginally higher.

DISCUSSION

Our observations indicate that in the goat postnatal follicle development involves both primary and secondary follicle initiation and maturation. The marked increase in the density of both primary and secondary follicles between birth and one month of age emphasises the importance of this period for the establishment of the adult follicle population. The slight increase in S/P ratio between one and four months shows that follicle initiation occurs in this period but at a reduced rate. This is in agreement with the limited evidence for the

TABLE 1 Skin follicle densities and S/P ratios for male, female, single and twin kids from does supplemented for varying periods after conception. Data are means for skin samples obtained sequentially at birth, one month or four months of age. Standard errors of means are given in parentheses,

Age of kid	Birth			1 month			4 months		
	No. follicles per sq. mm			No. follicles per sq. mm			No. follicles per sq. mm		
	Primary	Secondary	S/P	Primary	Secondary	S/P	Primary	Secondary	S/P
Supplementation period									
Control	2.04	0.66	0.33	5.67	24.22	4.33	4.04	26.91	6.76
n = 14	(0.103)	(0.166)	(0.082)	(0.267)	(1.774)	(0.399)	(0.169)	(1.497)	(0.412)
60-90 days pc*	1.95	0.62	0.35	6.06	32.26	5.55	3.30	24.47	7.54
n = 8	(0.156)	(0.132)	(0.098)	(0.172)	(1.720)	(0.528)	(0.257)	(1.613)	(0.475)
90-120 days pc	2.22	0.79	0.40	6.25	26.52	4.47	3.85	25.56	7.03
n = 15	(0.103)	(0.186)	(0.104)	(0.260)	(2.467)	(0.506)	(0.239)	(1.811)	(0.525)
120-150 days pc	1.93	1.11	0.68	6.09	23.82	3.92	3.68	23.20	6.56
n = 6	(0.167)	(0.206)	(0.173)	(0.436)	(3.213)	(0.422)	(0.326)	(0.698)	(0.612)
120-180 days pc	2.15	1.23	0.60	7.23	27.37	4.19	4.13	24.61	6.35
n = 7	(0.107)	(0.296)	(0.150)	(0.474)	(2.955)	(0.385)	(0.264)	(3.430)	(0.571)
Birth type									
Singles	1.84	1.10	0.66	5.37	29.54	5.60	3.20	25.31	8.02
n = 13	(0.114)	(0.173)	(0.116)	(0.262)	(2.324)	(0.511)	(0.126)	(1.691)	(0.572)
Twins	2.20	0.75	0.35	6.63	26.37	3.98	3.89	24.42	6.32
n = 23	(0.073)	(0.138)	(0.066)	(0.201)	(1.705)	(0.243)	(0.183)	(1.345)	(0.230)
Sex									
Male	1.95	1.13	0.60	5.86	27.50	4.83	3.62	25.87	7.28
n = 21	(0.083)	(0.154)	(0.084)	(0.213)	(1.793)	(0.393)	(0.188)	(1.533)	(0.416)
Female	2.23	0.55	0.30	6.61	27.53	4.19	3.67	23.16	6.45
n = 15	(0.103)	(0.111)	(0.082)	(0.309)	(2.235)	(0.336)	(0.204)	(1.228)	(0.331)
Mean	2.06	0.83	0.44	6.03	26.62	4.53	3.75	25.21	6.87
n = 50	(0.397)	(0.636)	(0.359)	(1.104)	(7.747)	(1.533)	(0.788)	(5.967)	(1.596)

Angora goat (Dreyer and Marincowitz 1967), but contrasts with the Merino sheep in which the initiation of primary and secondary follicles is completed by birth (Fraser and Short 1960).

The initiation of secondary follicles was more advanced at birth in male kids than in female kids. However this sex difference disappeared during the postnatal period when most of the follicular development occurred and the environment for both sexes was similar. The maternal environment appears to influence follicular development as single kids had higher S/P ratios at birth than did twins. The normal postnatal advantage of single kids prior to weaning was reflected in higher S/P ratios at subsequent samplings; it remains to be seen if these differences persist in the adult.

Nutritional supplementation in the last month of gestation only had small effects on the follicle population in contrast with studies on the Merino sheep (Schinckel and Short 1961). At four months of age any advantage had disappeared suggesting that supplementation in this period would have little effect on the adult follicle population.

Somewhat surprisingly, supplementation during early pregnancy (60 to 90 days pc) led to a significant increase in the density of secondary follicles at one month of age. Precisely how this nutritional effect operates is not clear from our study, but presumably involves the precursors of follicles,

These studies are being extended to monitor further development in the follicle population and adult fleece production in these animals,

ACKNOWLEDGEMENTS

We wish to thank the Kinross Cashmere Co. for financial support,

REFERENCES

- BURNS, M. (1965) Trop. Agric. Trin. 42: 243,
- CARTER, H.B. and CLARKE, W.H. (1957). Aust. J. Agric. Res. 8: 91,
- DREYER, J.H. and MARINCOWITZ, G. (1967). S. Afr. J. Agric. Sci. 10: 477.
- FOWLER, D.G. and WILKINS, J.F. (1982). Proc. Aust. Soc. Anim. Prod. 14: 491.
- FRASER, A.F. and SHORT, B.F. (1960). "The Biology of the Fleece". Animal Research Laboratories Technical Paper No. 3, CSIRO, Aust.
- MARGOLENA, L.A. (1959). Virginia J. Sci. 10: 33,
- MARGOLENA, L.A. (1966). Virginia J. Sci. 17: 32.
- RYDER, M.L. (1966). Anim. Prod. 8: 289.
- RYDER, M.L. (1974). Anim. Prod. 18: 169.
- SCHINCKEL, P.G. and SHORT, B.F. (1961). Aust. J. Agric. Res. 12: 176,