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THE OCCURRENCE OF FOETAL DWARFISM IN THE ANGORA GOAT

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Foetal dwarfism following heat stress during pregnancy has been reported previously in sheep (Yeates, 1953, 1958; Epstein & Herz, 1964; Shelton, 1964) and cattle (Bonsma, Badenhorst & Skinner, 1972) but not so far in goats. The object of the present note is to report on the occurrence of foetal dwarfing in Angora goats when introduced from a temperate region of South Africa into a more unfavourable environment.

The data presented are observations made on a flock of 27 does transferred in 1966 from the temperate Eastern Cape Province to Messina Research Station, (22°S) situated in the sub-tropical Bushveld of the Northern Transvaal; for details of the climate *vide* Bonsma, van Marle & Hofmeyr (1953). Observations on the birthweight of kids born at Onderstepoort (26°S) are also included. Onderstepoort is situated about 470 k south of Messina, verging on the sub-tropics, and about 1000 k north of the Angora farming areas in the Eastern Cape. These data are compared with the weights from kids born at Grootfontein Agricultural College (31°S) in the Cape Province. The Messina does were mated each year (1966-1970) from July, 1 and, after a summer gestation period, the kids were born in December and early January. The Onderstepoort does were mated each year (1964–1968) from April and the kids were born in September; while the Grootfontein kids (1966–1970) were born in September, following autumn mating. The birthweights of the kids are presented in Table 1 and the mean maximum temperatures and highest maximum temperatures in the three areas recorded during pregnancy are presented in Table 2.

The mean birth weights of the kids at Messina and Onderstepoort were of the same order. Three male miniature kids were born at Messina during the six years. Two weighed 1,3 kg and one 1,8 kg with a mean weight only 50,3% of that of normal males. These kids did not grow well. The first dwarf only weighed 4,0 kg at weaning at 120 days cf. 11,8 kg for normal kids at Messina (Plate 1). The kid died soon after being weaned and deprived of maternal care and nutrition. The second kid died soon after birth from unknown causes. The third dwarf died of heartwater at 60 days of age when it weighed 3,6 kg cf. 6,4 kg for two normal kids. Although one female kid weighed 1,8 kg, it grew normally. As in the Shorthorn (Bonsma *et al*, 1972) normal kids were born at the same time as dwarfs which illustrates the wide variation in individual response.

Dwarf kids born in the Onderstepoort flock usually died within a few days of birth, notwithstanding considerable efforts to save them. Of five that weighed less than 2 kg at birth and survived, only one was severely retarded at weaning on the 120th day. It then weighed 7 kg as compared to the normal weight of 14 or 15 kg. However, three other kids weighing 2,2; 2,4 and 3,1 kg at birth were dwarfs at weaning when they weighed 6,6; 7,5 and 7,5 kg.

All undersized kids in the Onderstepoort flock were born after a normal gestation period of between 143 and 153 days. Kids delivered prematurely before the 143rd day were without exception stillborn and it is therefore unlikely that the Messina dwarfs were born prematurely. It is impossible in retrospect to deduce when foetal development was affected. Shelton & Huston (1968) induced foetal dwarfing in sheep by exposing ewes in temperature control chambers for the last half of pregnancy to a temperature of 32°C for 12 hours per day, and Edey (1969) mentions that high temperatures during mid-pregnancy can cause foetal dwarfing in the sheep.

At Messina, where the incidence of dwarfing was 19% and the mean kidding percentage only 10,5% per annum, highest maximum temperatures exceeded 32°C virtually throughout pregnancy but the mean maximum temperature only exceeded 32°C in November and December. On the other hand, temperatures at Onderstepoort did not reach these extremes, and the incidence of dwarfing was still 12%. These goats had particular difficulty in adapting to stall fed hay and concentrates as they are natural browsers, preferring a short scrub and bush type of vegetation as is found in the Cape and, to a lesser extent, Messina. It would seem that there is more than one factor involved, and as the environment becomes progressively more unfavourable for the Angora, in terms of temperature and nutrition, the likelihood of dwarfism will increase.

As in the case of the dwarf Shorthorns at Messina (Bonsma *et al*, 1972) the dwarf goats at Messina were males; however, there were also female dwarfs born at Onderstepoort. It has been suggested by Bonsma *et al* (1972), that the reason for foetal dwarfing in the male could be due to a higher metabolic rate in the male foetus which in turn imposes a greater temperature strain on the dam with a low heat tolerance coefficient. It has also been surmised that there may be a nutritional deficiency affecting the developing foetus due to a reduction in uterine blood supply (Shelton, 1964). This results from the increased peripheral circulation to dissipate heat load.

Table 1

Birthweights of single Angora kids born in three areas in South Africa ± S.E.

Area	Sex	No.	Weight Mean ± S.E. (kg)	Range (kg)	% < 1,9 kg	Weight as percentage of Normal*
Messina	Male	9	2,50 ± 0,20	1,3 - 3,6	33,3	81,6
	Female	7	2,30 ± 0,20	1,8 - 3,2	42,6	87,1
	All kids	16	2,40 ± 0,05	1,3 - 3,6		
Onderstepoort	Male	44	2,52 ± 0,82	1,1 - 4,5	15,9	82,9
	Female	39	2,32 ± 0,59	1,4 - 2,9	12,8	87,9
	All kids	83	2,40 ± 0,67	1,1 - 4,5		
Grootfontein	Male	137	3,04 ± 0,04	1,9 - 4,3	0	Normal
	Female	155	2,64 ± 0,04	1,5 - 3,7	6,4	Normal
	All kids	292	2,83 ± 0,03	1,5 - 4,3		

* Normal taken as mean weight of Grootfontein kids.

Table 2

Mean maximum temperature ^{O}C and highest temperature recorded during gestation

Area	Month											
	VII		VIII		IX		X		XI		XII	
Messina	25,3	28,9;	22,4	32,5;	29,7	34,5	31,3	39,4;	32,5	40,6;	32,8	38,7;
	IV		V		VI		VII		VIII		IX	
Onderstepoort	25,8	29,4;	23,0	26,2;	20,3	24,7;	20,4	25,6;	23,2	28,1;	26,6	32,1
	IV		V		VI		VII		VIII		IX	
Grootfontein	24,0	30,7;	19,7	26,9;	16,8	21,5;	16,3	24,7;	18,9	32,5		

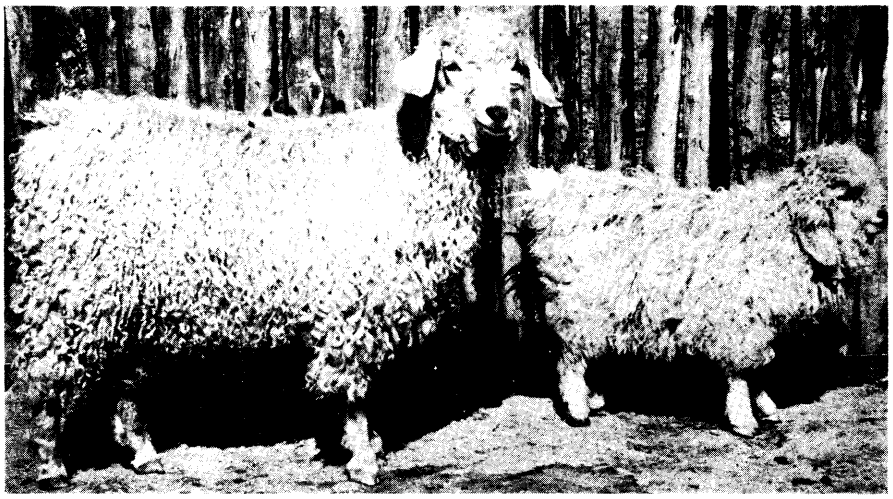

Plate 1. – *Angora kids of the same ages when 120 days old. The normal kid weighed 11,8 kg cf. 4,0 kg for the dwarf.*

Dissection studies on non-viable miniature kids at Onderstepoort revealed that such kids had very much smaller pituitaries, thyroid and adrenal glands (Van Rensburg, 1971) suggesting a state of congenital hypopituitarism. There is no question of this condition being hereditary since a high incidence was recorded among does imported from flocks in the Cape where the problem is unknown. In proportion to bodyweight, the weight of the pituitaries of dwarfs was still reduced by approximately 20%, but this state was not confined to kids which were undersized at birth. These observations are in agreement with the finding that kids with a normal birthweight may manifest as typical miniature dwarfs at four months of age. The data is also not compatible with the hypothesis that dwarfism results from an inadequate intrauterine nutritional environment, whether it is mediated via reduced uterine blood flow in order to dissipate excessive heat load peripherally, or frank nutritional deficiency.

An acceptable hypothesis could be the selective suppression of the maturation of the foetal endocrine system by abnormal levels of maternal hormones. Starvation and excessive heat are both known to markedly increase adrenocortical function. Maintained high levels of maternal glucocorticosteroids may not only suppress foetal pituitary development but could contribute to the foetal dwarfism syndrome by virtue of their anti-anabolic and hence growth suppressing actions. Under such circumstances incidental adrenal androgen secretion will also be increased and if the male foetal pituitary is indeed more receptive to androgenic suppressive effects it may account for the higher incidence of dwarfism amongst males in some species.

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