S. Afr. J. Anim. Sci. 2,19–21(1972)

THE INCIDENCE OF FOETAL DWARFISM IN SHORTHORN CATTLE IN THE SUBTROPICS

J.C. Bonsma, J.F.G. Badenhorst and J.D. Skinner*

Department of Animal Science, University of Pretoria and Research Institute of the Transvaal Region

OPSOMMING: DIE VOORKOMS VAN FETALE DWERGIES BY SHORTHORN BEESTE IN DIE SUBTROPE.

Resultate oor die voorkoms van fetale dwergies by suiwer Shorthorn beeste in die subtrope word gegee. Een-derde van die kalwers gebore het minder as 18 kg geweeg en die helfte het minder as 22,75 kg geweeg. Die dwergies het van 9,5 tot 16,4 kg geweeg. Die voorkoms van dwergies was hoër by kalwers gebore na 'n somerdragtigheid en ook in bulkalwers. Die gemiddelde geboortegewig van alle kalwers in die subtrope was 20 ± 3,2 (9,5–27,3 kg) met 'n dragtigheidsperiode van 29,0 ± 1,9 dae (281–301 dae) vergeleke met 30,0 ± 0,4 kg en 278,9 ± 1,0 dae vir Shorthorn beeste by 'n gematigde streek. Die moontlike redes vir fetale dwergies word bespreek.

SUMMARY

Results are reported on the incidence of foetal dwarfism in purebred Shorthorn cattle in the subtropics. One third of the calves born weighed less than 18 kg and half weighed less than 22,75 kg. The weight of dwarfs ranged from 9,5 tot 16,4 kg. The incidence of dwarfism was higher amongst calves following a summer gestation period and also in male calves. The mean birthweight of calves was 20,1 ± 3,2 kg (9,5–27,3 kg) with a gestation length of 290 ± 1,9 days (281–301 days) compared to 30,0 ± 0,4 kg and 278 ± 1,0 days for Shorthorn cattle in a temperate region. The possible reasons for foetal dwarfing are discussed.

The phenomenon of offspring of reduced birthweight has been referred to previously in British beef breeds in the subtropics (Bonsma, 1949), and has been reported in Angora goats in the subtropics (Skinner, van Rensburg & Badenhorst, 1971) and in sheep following heat stress (Yeates, 1958; Shelton, 1964). The object of the present note is to report on the incidence of foetal dwarfism in a Shorthorn herd imported from the temperate regions of Southern Africa to a subtropical region.

Procedure

The data presented are from the routine records kept at Messina Research Station in the subtropical Bushveld of the Northern Transvaal. Complete details of the climate are given by Bonsma, Van Marle & Hofmeyr (1953).

In 1949 a herd of 30 two-year-old Shorthorn heifers was imported from the Eastern Cape Province which is a temperate region where the breed thrives. During their active lifetime at Messina, 15 of these 30 cows produced a total of 41 calves. The other 15 cows did not produce any calves. The overall calving percentage was 43,6 per cent.

Results

At Messina normal ranching procedure involves the practice of two mating seasons per year viz. an autumn mating season (March to April), followed by winter pregnancy and summer calving season (December to January), and a spring mating season (August to September), followed by summer pregnancy and winter calving season (June to July). The birthweights for 30 calves are given in Table 1 together with some gestation periods i.e. where mating was observed. Comparative figures are supplied from Dohne Research Station in the temperate Eastern Cape Province. Over a period of 15 years seven abnormally small Shorthorn calves have been recorded at Dohne with a mean weight of 17,3 kg (range 13,6–20,4 kg) this is an incidence of 3,7 per cent.

In the Messina herd all calves with a birthweight lower than 18 kg, of which there were six, were classified as dwarfs; an incidence of 33,3 per cent. Of these only one was born following a winter gestation period, incidentally the heaviest dwarf weighing 16,4 kg. Five of the 15 calves born following summer gestation periods were miniatures. The incidence of calves under 22,75 kg, the figure given by Bonsma (1949) as indicating reduced birthweight as a result of climatic stress, was 50 per cent. Again, only one such calf (that of 16,4 kg) was born

*Present address: Mammal Research Institute, University of Pretoria.

Table 1

Comparison of birthweights and gestation lengths of Shorthorn and Shorthorn : Africander calves at Messina Research Station in the subtropics and Dohne Research Station in a temperate region

Breed	Born in	Sex	No.	Birthweight ± ± S.E. (kg)	Range (kg)	No.	Gestation length ± S.E. (days)	Range (days)
Shorthorns at Messina	Winter	Male	9	18,4 ± 2,9	9,5–27,3	6	289,6 ± 1,9	286 – 199
		Female	6	20,3 ± 10,8	9,5–27,3	2	295,5	281 & 301
	Summer	Male	1	22,7		–	–	–
		Female	4	22,8 ± 2,7	16,4–25,0	–	–	–
Messina All Shorthorns			20	20,1 ± 3,2	9,5–27,3	8	290,0 ± 1,9	281 – 301
Shorthorns at Dohne*	Autumn	Male	23	31,9 ± 0,7				
		Female	22	30,4 ± 0,7				
	Spring	Male	66	30,6 ± 0,5				
		Female	74	29,4 ± 0,4				
All Dohne Shorthorns			185	30,0 ± 0,4	–	121	278,9 ± 1,0	277 – 286
1/2 Shorthorn 1/2 Africander at Messina	Winter	Male	1	20,4	20,4	–	–	–
		Female	3	28,8 ± 3,1	22,7–31,8	2	297	293 & 301
	Summer	Male	2	29,5	25,0&34,1	–	–	–
		Female	2	27,3	25,0&29,5	2	292	283 & 301
3/4 Shorthorn: 1/4 Africander	Summer	Female	2	26,1	25,0&27,3	1	288	288
Messina All crosses			10	27,3 ± 2,6	20.4–34,1	5	293,2 ± 2,5	283–301

*Data provided by E.J.B. Bishop.

Table 2

Mean maximum temperature ^{O}C and highest maximum temperature recorded during gestation at Messina from September 1953 to June 1954

	Month											
	VIII	IX	X	XI	XII	I	II	III	IV	V	VI	VII
Mean maximum	26,6	27,3	31,8	31,4	31,8	30,7	31,8	31,1	29,5	28,9	23,5	23,0
Absolute maximum	34,5	39,5	37,2	38,2	37,8	37,4	37,7	37,7	34,8	29,6	29,6	29,8

following a winter gestation period. No cross-bred calves fell within this category, but there were too few calves born following a summer gestation period to draw definite conclusions.

Six calves less than 19 kg were born following a gestation period which extended from September 1953 to June 1954. Temperatures during this period are illustrated in Table 2. This is typical of the temperature pattern at Messina and, as it is an arid area, it is improbable in this instance that relative humidity played a significant role. Temperatures at Dohne are much lower and, although not available for the dwarf gestations, the means only exceed 28°C in January (28,5) and February (28,7).

No data were collected on embryo resorption or foetal wastage. In the pregnancies recorded the foetus was carried to term and it would seem that after implantation between day 11 to 40 (McLaren, 1962), the foetus was affected by the high environmental temperature from October to March. It is also of interest that gestation length was 12 days longer in the subtropics than in the temperate region, as demonstrated by the data in Table 1.

In the case of winter calves, monthly weight records are available for one calf with a birthweight of 9,5 kg which had an average daily gain (ADG) to 200 days of 0,2 kg, for two calves with a birthweight of 22,3 kg. ADG to 200 days 0,2 kg and for four calves of birthweight 27,3 kg ADG to 200 days 0,3 kg. Unfortunately when they were weaned and deprived of maternal care and nutrition the calves soon died. In contrast, the seven dwarfs in the Eastern Cape had an ADG of 0,6 kg (range 0,5 to 0,9 kg) to 200 days and none died.

Discussion

There are a number of interesting facts arising from this study. Maximum temperatures were apparently not sufficient to cause embryonic loss after implantation had taken place. The Shorthorn cow, unadapted to a tropical environment, was markedly influenced by temperatures above 31,0°C. It is difficult in retrospect to decide precisely when foetal development is affected or the reasons for this effect. In the ewe the effects of high temperature seem to be quantitative (Shelton & Huston, 1968). Under normal conditions, as is also illustrated in the weights from the Dohne calves, males are heavier at birth than females. In the Messina Shorthorns, however, bull calves were lighter than heifers at birth. The reason for this may be due to a higher metabolic rate of the male foetus, although this has never been demonstrated experimentally, which in turn may impose a greater temperature stress on the cow with a low heat tolerance when she is pregnant in summer.

There is a strong possibility that the adrenal is also implicated although no weights were recorded or adrenal hormone levels measured in this study. It has, for example, been shown that the foetal adrenal is strongly implicated in terminating gestation (Van Rensburg, 1967; Liggins 1968, 1969). Gestation length was moreover considerably longer in the Messina calves suggesting the possibility of some form of adrenal malfunction. Yeates (1958), found that the adrenals from heat-stressed lambs were heavier than controls and also suspected they may be implicated. On the other hand, Shelton & Huston (1968) found that in the heat-stressed ewe, gestation length is considerably reduced. This may indicate a difference in the reaction of different species to heat stress. Moreover, in the sheep the nutritional level did not appear to be of any importance. The Shorthorn in the present study were grazing in paddocks and estimates of their nutrient intake were not made, but they have been found to exhibit a marked voluntary anorexia (Bonsma & Louw, 1966). Reference has been made on occasion in the popular farming press to the results reported here, and in a review (Bonsma & Louw, 1966). A detailed report was, however, considered necessary because of the increasing interest in the effects of climate on animal production. Not only do these results emphasise how unwise it can be to introduce unadapted farm animals into areas for which they are unsuited but also that we are still unaware of the fundamentel reasons for foetal dwarfing. In this regard there is a need for more detailed research into the mechanisms involved.

Acknowledgement

We would like to thank Mr. E.J.B. Bishop of the Department of Animal Science, University of Fort Hare, Cape Province for kindly supplying the data on the Shorthorn from Dohne Research Station.

Reference

BONSMA, J.C., 1949. J. agric. Sci. Camb. 39, 204.

BONSMA, J.C. & LOUW, G.N., 1966. Proc. IIIrd int. Biomet. Congr. Pau, France. pp. 371–382.

BONSMA, J.C., VAN MARLE, J. & HOFMEYR, J.H., 1953. Empire J. exp. Agric. 21, 154.

LIGGINS, G.C., 1968. J. Endocr. 42, 323.

LIGGINS, G.C., 1969. J. Endocr. 45, 513.

McLAREN, A., 1962. Fertilization, cleavage and implantation. Ch. 7 in Reproduction in Farm Animals ed. E.S.E. Hafez Lea & Febiger: Philadelphia.

SHELTON, M., 1964. J. Anim. Sci. 23, 360.

SHELTON, M. & HUSTON, J.E., 1968. J. Anim. Sci. 27, 153.

SKINNER, J.D., VAN RENSBURG, S.J. & BADENHORST, J.F.G., 1971. S. Afr. J. Anim. Sci. 1, 69.

VAN RENSBURG, S.J., 1967. J. Endocr. 38, 83.

YEATES, N.T.M., 1958. J. agric. Sci. Camb. 51, 84.