PLASMA GROWTH HORMONE IN RAMS SELECTED FOR AND AGAINST SKIN FOLD

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Summary

Concentrations of growth hormone in the plasma of sheep with various degrees of skin folding were determined by a radio immunological method. Rams from a flock selected for a high degree of skin folding had concentrations during fasting that were twice those of rams from a flock in which selection had been for a low degree of skin folding. Relationships between growth hormone, skin folding, birthweight and scrotal thermoregulation are discussed.

I. INTRODUCTION

Several species of animals have shown an increase in the degree of skin folding after treatment with growth hormone. Intraperitoneal injections of this hormone were associated with an overgrowth and folding of the skin of Dachshund and Shepherd dogs (Evans, Meyer, Simpson and Reichert 1932; Evans, Simpson, Meyer and Reichert 1933) and rats (Evans,, Simpson and Li 1948). Similar changes in the skin were observed following injections of growth hormone into hypophysectomized rats (Simpson, Evans and Li 1949).

Increases in birthweight are another feature of the response to growth hormone. Birthweight is increased when growth hormone is administered during pregnancy in rats (Tee1 1926; Hain 1932; Engfeldt and Hultquist 1953), and it has been suggested that in humans, foetal gigantism occurring in diabetic or prediabetic mothers results from excessive maternal growth hormone production or foetal anterior pituitary overactivity (Kriss and Futcher 1948). When growth hormone is injected into incubated fertile eggs, chicks are significantly heavier at hatching (Hsieh, Wang and Blumenthal 1952).

It appeared likely that a difference in the growth hormone concentration in plasma could explain the variation in the degree of skin folding and associated differences in birthweight (Dun and Hamilton 1965) and ram fertility (Fowler 1967), among sheep selected for (Folds Plus) and against (Folds Minus) skin fold at Trangie Agricultural Research Station. Growth hormone concentration in the plasma of rams selected for and against skin fold was therefore examined.

II. MATERIALS AND METHODS

Six Folds Plus and eight Folds Minus rams, approximately four years old and from the Trangie skin fold selection flocks, were used in this experiment. The establishment and management of these flocks has been described by Dun (1964). The degree of skin folding was scored from photographic standards developed by Carter (1943). Scores from 1 (absence of skin fold) to 9 are allocated for the neck, body and breech, the scores for each body region being added to yield an estimate

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of skin folding which can range from 3 to 37. The average fold scores were 22.0 for Folds Plus rams and 3.3 for Folds Minus.

Two weeks before the experiment, rams were placed in individual pens in an animal house and fed 1 kg of chaffed lucerne hay daily. Food was withheld on one day (day 1) and samples of blood were obtained by jugular venipuncture after 26 and 30 h of fasting. Three weeks later this procedure was repeated (day 2). Plasma was separated by centrifugation at 4°C and the concentration of immuno-reactive growth hormone was estimated using a double antibody radioimmunoassay technique (Wallace and Bassett, unpublished data).

The significance of main effects and interactions were examined by analysis of variance using a split plot method.

III. RESULTS

Differences in the external appearance of rams from the two flocks are shown in Figures 1 and 2. The substantial difference in the degree of skin folding is typical of that between the two flocks.

On each day, the plasma growth hormone concentration of rams from the Folds Plus flock was greater than that of rams from the Folds Minus flock (Table 1). Variability was a feature of the results, but the mean difference between the Folds Plus and Folds Minus rams was significant ($P<0.05$). There was also a significant difference between the samples taken at approximately 1000 h after 26 h fasting and those taken 4 h later.

IV. DISCUSSION

The results support the hypothesis that there would be a difference in the plasma growth hormone concentration of the two types of rams. It is difficult to

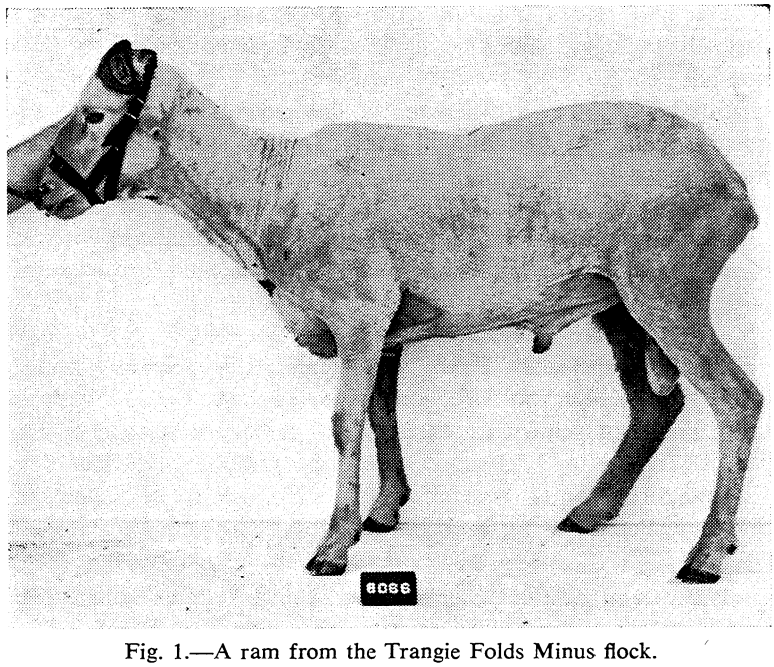

Fig. 1.—A ram from the Trangie Folds Minus flock.

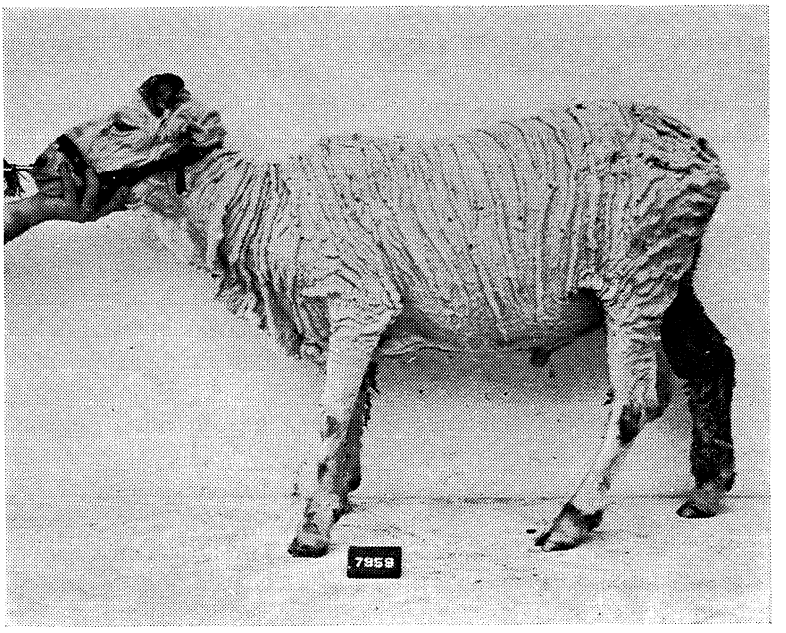

Fig. 2.—A ram from the Trangie Folds Plus flock.

explain the increase in plasma growth hormone concentration between 26 and 30 h after feeding. Daughaday and Kipnis (1966) were unable to demonstrate an increase

TABLE 1

The concentration of immuno-reactive growth hormone (mpg/ml.) in blood plasma taken on two days from Folds Plus and Folds Minus rams, 26 and 30 h after feeding

Group	Day 1 Hours after feeding		Day 2 Hours after feeding		Overall group average	Average increase between 26 and 30 h.
	26	30	26	30		
	0	33	12	35		
	0	3	3	2		
	1	8	8	31		
Folds	7	14	14	38		
Minus	11	9	9	2		
Rams	4	18	18	12		
	18	26	26	19		
	3	40	40	0		
	5.5	16.6	16.2	17.4	14	6
	22	50	20	32		
	55	44	26	42		
Folds	3	15	4	0		
Plus	14	11	13	38		
Rams	38	38	11	42		
	33	46	30	50		
	27.5	34.0	17.3	34.0	28	12

in plasma growth hormone in sheep and pigs during fasting but increases in plasma growth hormone concentration have been observed in humans during prolonged fasting (Glick *et al.* 1965). The results of the present investigation suggest that there may be a diurnal fluctuation in plasma growth hormone concentration.

Selection for increased skin fold over a period of sixteen years in the Trangie flock has led to a 90% increase in the degree of skin folding. The average birth weight of Folds Plus lambs (singles and twins) is significantly greater than that of Folds Minus lambs even though there is no difference in the length of gestation. The differences in plasma growth hormone concentration provide a possible explanation for the differences in skin folding and birthweight. A major feature of the differences between the Folds Plus and Folds Minus flocks is that Folds Plus rams are more susceptible to infertility caused by heat than Folds Minus rams because of their poor scrotal thermoregulation (Fowler 1967). The possibility that this difference is related to the difference in plasma growth hormone concentration merits consideration.

Sweating is a major channel of heat loss from the scrotum and it has been established that the scrota of Folds Minus rams sweat more than those of Folds Plus rams. Sweating is also considered to be an important thermoregulatory mechanism for cattle and an association between skin collagen and thermoregulation in cattle has been suggested. Collagen bundles form a loosely bound spongy structure in the skin of ***Bos indicus*** breeds (Hafez, Badreldin and Shafei 1955) whereas, in the skin of less heat tolerant ***Bos taurus*** breeds, collagen bundles are thick and strongly bound together (Yamane and Ono 1936). This information may be important in light of the observation that growth hormone stimulates the formation of collagen in the skin of rats (Simpson, Evans and Li 1949; Scow 1951). In acromegalic humans, collagen bundles appear grossly coarsened and tightly packed together (Gabrilove, Schwartz and Churg 1962). The higher plasma growth hormone concentration found for Folds Plus rams may thus be associated with a greater amount of collagen in the scrotal skin and thereby poorer thermoregulation.

Values for the concentration of plasma growth hormone are high in relation to values observed for other sheep (Wallace and Bassett, unpublished data), even for the Folds Minus rams. As most other values have been obtained from ewes, there may be a difference between sexes in plasma growth hormone concentration. A study involving larger numbers of rams and including ewes is in progress.

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