

*Brief Communication*

PLASMA LEVELS OF GROWTH HORMONE, INSULIN, SUGAR  
AND ACETOACETATE IN CATTLE.  
DIURNAL VARIATIONS AND RESPONSES TO FEEDING

The fundamental differences between monogastric animals and ruminants as regards the handling of dietary carbohydrates and as regards the relative importance of gluconeogenesis, rise interesting questions as to the factors regulating the secretion of growth hormone and insulin in polygastric animals.

Since little information exists on diurnal variations of the plasma components mentioned, the present investigation was undertaken in order to establish a better basis for the study of factors regulating hormone secretion.

Seven healthy, lactating cows of the Norwegian Red and White breed of varying age and stage post partum (100—190 days) were included in the study. The animals were fed concentrates and hay for periods of 2 hrs. starting at 5.30 a.m. and 2.30 p.m. Blood samples were obtained from indwelling catheters placed in the jugular vein 2 hrs. before the start of the experimental period. The blood was sampled in heparinized tubes, and the plasma transferred to plastic tubes and stored at  $-15^{\circ}\text{C}$  until analyzed.

Insulin (*Poznanski & Poznanski 1967*) and growth hormone (*Wool & Selenkow 1968*) were measured by radioimmunoassay. Free and bound hormone were separated using dextran-charcoal. Plasma sugar and acetoacetate were determined by use of Technicon autoanalyzer.

As seen from Fig. 1 which is representative for the animals studied, feeding results in a conspicuous rise in plasma insulin and acetoacetate, while plasma growth hormone levels fall; for sugar the responses are less clearcut. On the second day, the afternoon feeding was deliberately delayed 1.5 hrs., but the responses to feeding were similar to those obtained using regular feeding intervals. Statistical evaluation of the correlations be-

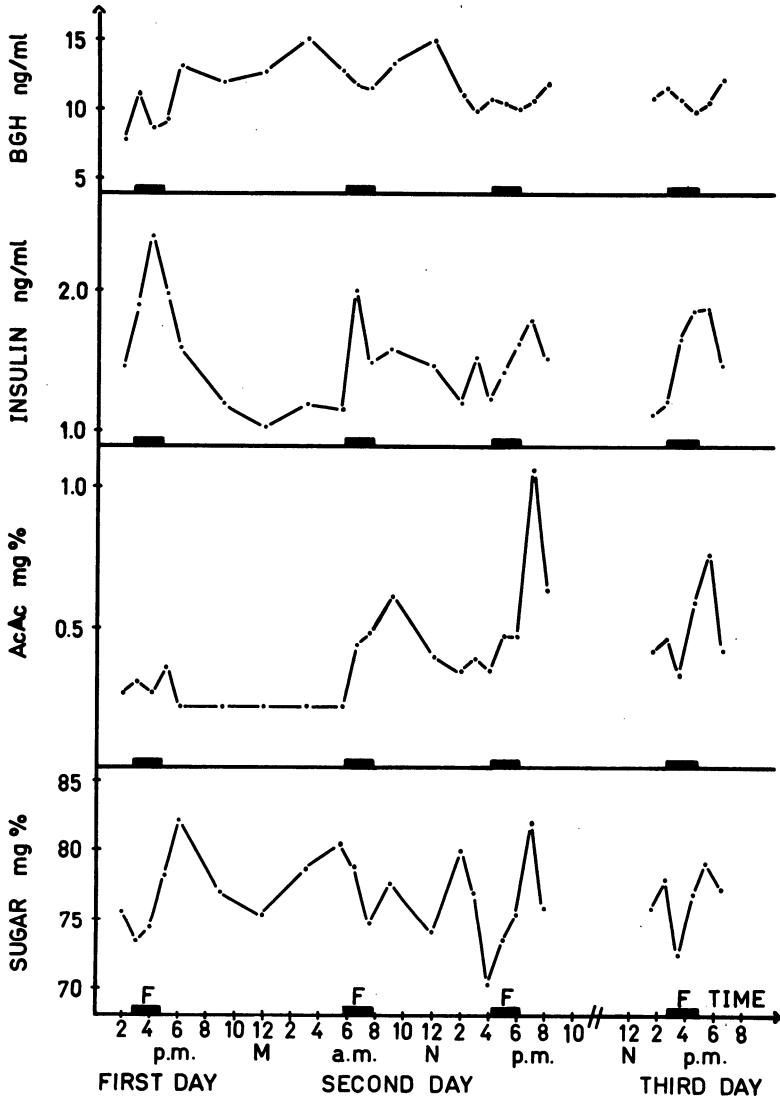


Figure 1. Diurnal variations in plasma growth hormone, insulin, acetoacetate and sugar in a lactating cow. On the second day, the afternoon feeding is delayed 1.5 hrs. Normal feeding time on the third day.

tween the measured parameters is given in Table 1.

No previous information seems to be available on plasma hormone levels in relation to feeding in cattle. The most interesting results of the present investigation seem to be the rise in

Table 1. Significance tests (P) of correlations (r) between insulin, growth hormone, sugar and acetoacetate in blood plasma of 7 cows. One hundred-and-eighty samples taken before, during and after feeding in the course of 3 consecutive days. Diurnal variations within and between animals.

	Within animals		Between animals	
	r	P	r	P
Plasma sugar/insulin	— 0.12	n. s.	— 0.59	n. s.
Plasma sugar/GH	0.22	< 0.01	— 0.55	n. s.
Plasma sugar/AcAc	— 0.12	n. s.	— 0.76	< 0.05
AcAc/insulin	0.21	< 0.01	0.34	n. s.
AcAc/GH	— 0.08	n. s.	0.76	< 0.05
Insulin/GH	— 0.25	< 0.001	0.34	n. s.

plasma insulin and the fall in plasma growth hormone in response to feeding. The delayed feeding on the second day (Fig. 1) resulting in the same responses as when normal feeding intervals were used, strengthens the concept that feed intake in some way influences the plasma levels of the hormones in question. The mechanism behind this response remains obscure. Among others, *Horino et al.* (1968) have shown that short chain fatty acids stimulate insulin secretion in ruminants. *Stern et al.* (1970) however, have recently critically analyzed previous experiments, concluding that non-physiological doses of acids have been involved. From Fig. 1 it appears that the rise in plasma insulin generally precedes the rise in plasma acetoacetate. This applies also to the other animals studied. The chemical signal releasing insulin during feeding thus remains to be defined. Another possibility is that nervous factors may be involved. Activation of the vagi caused by feeding may well influence the output of insulin and would explain the very rapid rise in plasma insulin after feeding is started. Experiments to test this possibility are under way.

As for growth hormone the explanation of the mechanisms behind the lowered plasma levels during feeding is even more remote. The highly significant negative correlation between plasma insulin and growth hormone levels within animals (Table 1) indicates that the changes are not fortuitous.

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