EFFECTS OF EXOGENOUS GROWTH HORMONE IN LACTATING COWS

G.H. McDOWELL*†, I.C. HART†, J.A. BINES† and D.B. LINDSAY§

In dairy cows, growth hormone (GH) is galactopoietic (Bines et al. 1980; Peel et al. 1981) and exerts marked effects on irreversible losses of key metabolites (Peel et al. 1982). We report responses to daily injections of GH during early and mid-lactation in cows.

Five lactating Friesian cows were housed in stalls and fed a diet of 70% commercial concentrate pellets and 30% grass hay in sufficient quantity to achieve a peak yield of ca 30 kg/d. The concentrate portion of the ration was fed using an automatic feeder and the hay in four equal portions daily. At peak (ca day 35) and mid-lactation (ca day 125) cows were given daily subcutaneous injections of saline for 6 d followed by daily injections of GH (0.06 mg = 0.084 IU/kg liveweight) for a further 6 d. During each control and treatment period, feed intake, liveweight, milk yield and milk composition were recorded and measurements were made of whole body irreversible loss rates (IL) of glucose, non-esterified fatty acids (NEFA), acetate and urea.

At peak lactation injections of GH resulted in significant liveweight loss (534 v 523 kg, $P < 0.05$) and increases in milk yield (26.8 v 28.4 kg/d, $P < 0.05$) and fat yield (1.16 v 1.27 kg/d, $P < 0.05$). Changes in feed intake (159 v 161 MJ/d), protein yield (0.79 v 0.82 kg/d) and lactose yield (1.33 v 1.35 kg/d) were not significant. There was a significant increase in glucose IL (8.48 v 10.87 mmol/min, $P < 0.01$), urea IL increased in all cows (5.34 v 7.17 mmol/min) and there was a tendency for NEFA IL to decrease (7.52 v 7.22 mmol/min) and for acetate IL to increase (71.9 v 77.6 mmol/min).

In mid-lactation, daily injections of GH resulted in significant increases in yield of milk (19.3 v 21.9 kg/d, $P < 0.05$), fat (0.77 v 0.93 kg/d, $P < 0.05$) and lactose (0.87 v 0.99 kg/d, $P < 0.05$). Liveweight (547 v 554 kg), feed intake (192 v 188 MJ/d) and protein yield (0.70 v 0.77 kg/d) remained essentially unchanged. NEFA IL increased significantly (5.14 v 6.18 mmoles/min, $P < 0.05$), acetate IL increased (75.1 v 82.8 mmoles/min), urea IL decreased (6.69 v 5.62 mmoles/min) and glucose IL was unchanged (7.89 v 8.10 mmoles/min).

Plasma GH concentrations increased from basal values of 2-4 ng/ml to peak values of 10-12 ng/ml within 2 h of injection. Concentrations remained above 10 ng/ml for 8-10 h, then declined to basal values before the next injection. Plasma insulin concentrations were higher during periods when GH was injected (ca 30 μU/ml) than during corresponding control periods (ca 15 μU/ml).

The above results show that increases in milk yield observed during GH injections are associated with changes in IL of key metabolites. These changes appear to differ depending on stage of lactation, and may be related to the heterogeneous biological activities of bovine GH (Hart 1983).

BINES, J.A., HART, I.C. and MORANT, S.V. (1980). Br. J. Nutr. 43: 179.
HART, I.C. (1983). Proc. Nutr. Soc. 42: 181.
PEEL, C.J., BAUMAN, D.E., GORWITT, R.C. and SNIFFEN, C.J. (1981). J. Nutr. 111: 1662.
PEEL, C.J., STEINHOUR, W.D., BAUMAN, D.E., TYRRELL, H.F., BROWN, A.C.G., REYNOLDS, P.J. and HAALAND, G.L. (1982). J. Dairy Sci. 65 (Suppl.1): 120.

†National Institute for Research in Dairying, Shinfield, Reading, RG2 9AT, England
§ARC Institute for Animal Physiology, Babraham, Cambridge, CB2 4AT, England
*During Special Studies Programme from Department of Animal Husbandry, University of Sydney, Camden, New South Wales 2570