

THE CORTISOL AND BETA-ENDORPHIN RESPONSE TO INSULIN INDUCED HYPOGLYCAEMIA IN CAMDEN PARK MERINO AND SAXON MERINO SHEEP

R. BEHRENDT^A and P.C. WYNN^B

^AVictorian Institute of Animal Science, 475 Mickleham Road, Attwood, Vic. 3049

^BDept of Animal Science, University of Sydney, Camden, N.S.W. 2570

The stress hormone axis participates in the mobilisation and partitioning of nutrients to maintain the function of essential tissues. Persistent selection of animals for fleece weights may have enhanced insulin sensitivity, thereby increasing the metabolic responsiveness of the modern Merino to adverse stimuli. In this study we have compared the pituitary and adrenal function of an unselected line of fine wool Merinos (from the original Camden Park flock) with a contemporary flock of Saxon Merinos of similar fibre diameter to an acute metabolic stimulus, and determined whether the stress response is modified by immunity to adrenocorticotrophin (ACTH).

Saxon Merino ewes were either immunised with an ACTH(1-24)-ovalbumin conjugate in Freund's adjuvant (ACTH-immune, n=12), or with adjuvant alone (Saxon, n=8) in weeks 1, 4, 8 and 12 of the study. Camden Park Merinos (Camden Park, n=7) were also maintained with this flock. During weeks 5 to 14 animals were housed in metabolism crates under natural lighting and temperature and offered a pelleted lucerne:oats diet (60:40, w:w) *ad libitum*. Jugular catheters were exteriorised behind a curtain to minimise disturbance to the animals. In week 14, 6 animals from each group were subjected to insulin-induced hypoglycaemia via an intravenous injection of 5U insulin/kg liveweight. Blood samples were collected at between 10 and 20 minute intervals before and after insulin treatment. Plasma was stored frozen until assayed for glucose, cortisol and beta-endorphin.

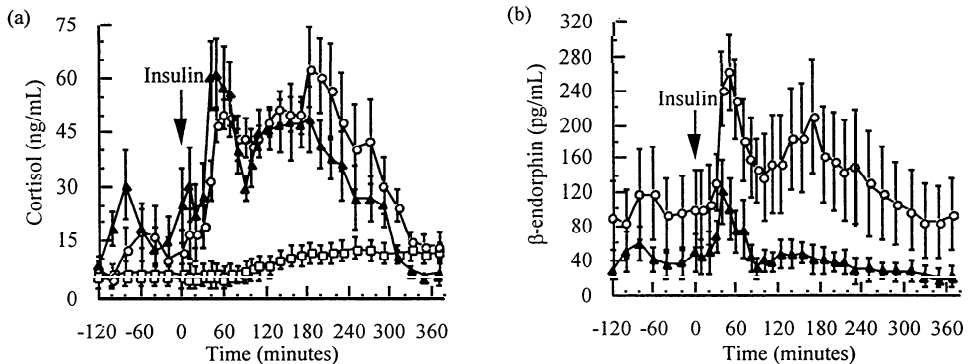


Figure 1. The influence of insulin induced hypoglycaemia on plasma (a) cortisol and (b) beta-endorphin levels in Camden Park Merinos (closed triangles), Saxon Merinos (open circles) and ACTH-immune ewes (open squares). Standard error bars are also shown.

Insulin administration resulted in circulating glucose values (mmol/L) decreasing after 40 minutes from a baseline of 3.6 ± 0.1 , 3.5 ± 0.1 and 3.4 ± 0.1 , to 1.2 ± 0.1 , 1.2 ± 0.1 , and 1.3 ± 0.2 for Camden Park, Saxon and ACTH-immune ewes respectively. Cortisol and beta-endorphin levels increased in response to insulin for both Camden Park and Saxon Merinos ($P < 0.05$, Figure 1). ACTH immunity ablated the cortisol response (Figure 1 (a)), but increased the circulating beta-endorphin levels 3 fold (from 214 ± 47 to 680 ± 145 pg/mL at 40 minutes; $P < 0.05$). This potentiation of the beta-endorphin response presumably occurs through the loss of cortisol negative feedback on the pituitary. Saxon Merinos displayed significantly ($P < 0.05$) higher basal and stress-induced beta-endorphin levels than the Camden Park Merino (Figure 1 (b)). The beta-endorphin and cortisol responses were sustained with a secondary peak of secretion in the Saxon Merino exceeding that of the Camden Park Merino. This was consistent with glucose concentrations at 155 minutes of 1.0 ± 0.1 and 1.5 ± 0.2 respectively. These results indicate that the stress hormone axis of the Saxon Merino is more sensitive to insulin induced hypoglycaemia.