THE RELATIONSHIP BETWEEN LIVE WEIGHT, BODY COMPOSITION AND ENDOCRINE FUNCTION IN BORDER LEICESTER X MERINO WETHERS

P.C. WYNN, T.W. SEARLE*, N.McC. GRAHAM*, P. BAKER*,* E. FLECK* and W. WARD*

The relationship between the weight of body components (fat, protein, water and ash) and live weight (LW) in domestic mammals can be described by a two-phase piecewise linear model, the slope in each phase being determined by the composition of weight gain. In the first phase, gain consists of similar amounts of fat and protein whereas in the second phase a much higher proportion of fat is present. The LW at which the phase change occurs differs *between* breeds, depends on mature weight and appears to be the threshold weight for puberty. The mitogenic growth factor, insulin like growth factor I (IGFI) and two hormones that regulate its synthesis, growth hormone (GB) and insulin have been implicated in the control of protein and fat synthesis in ruminants. In the present study we investigated the relationships between circulating levels of these hormones and change in the ratio of body fat and protein with increasing LW.

Border Leicester-Merino wether lambs weaned progressively to finish at 17 kg, were grown to 45-48 kg by feeding a pelleted diet (protein, 15%; energy, 11 MJ/kg DM) *ad libitum.* Body composition was estimated sequentially from 15 to 45 kg LW at 5 kg intervals by measuring tritiated water space. One group of animals (n=4) was offered *90%* of *ad libitum* feed intake in three-hourly meals for a period of 2 weeks when they had attained LW's of 25 and 45 kg. Jugular catheters were fitted each time and serial blood samples collected at 15 min intervals for 6 h. Two other groups of animals (n=5) fed similarly at either 24 or 48 kg LW were catheterised intra-arterially (IA) and intravenously (IV). Acute stimuli of GH releasing factor (GHRF) (1 pmol/kg LW) or glucose (125 mg/kg LW) were administered IA and sequential blood samples *were* collected IV for 1 h prior to and 5 h after administration of the challenge. Blood samples were analyzed for insulin, GH and IGF1 by RIA.

The relationships between body fat and protein with change in LW were described by the two phase model cited above. The phase change in favour of fat deposition occurred at a LW of 26 kg. When body protein gain was adjusted to constant DM intake, a negative correlation with LW was observed. By contrast, fat gain similarly adjusted did not change over the range of LW's used. These data show that the phase change in composition of weight gain results essentially from a decrease in protein deposition and not an increase in fat deposition, The GH *secretory* pattern of 24 kg animals was characterised by a distinct three-hourly rhythm (mean $\pm$ s.e.m. amplitude of 3.9 $\pm$ 1.2 ng/ml) entrained to the time of feeding. This rhythm was not apparent in 48 kg animals and the mean GH concentration was also lower in this heavier group (4.5$\pm$0.5 and 1.9$\pm$0.1 ng/ml for the 24 and 48 kg groups respectively, $P<0.05$). Pituitary responsiveness to GHRF stimulation did not vary between groups. Similarly in both groups a three hourly rhythm in insulin secretion was observed, the amplitude tending to be greater in the 24 kg animals (2.1$\pm$0.5 and 1.4$\pm$0.2 ng/ml for the 24 and 48 kg groups respectively). Mean plasma levels, however, did not vary between groups (1.5$\pm$0.1 and 1.8 $\pm$0.1 ng/ml for 24 and 48 kg respectively). Pancreatic responsiveness to the glucose challenge also did not vary markedly between groups. Despite the changes in circulating insulin and GH levels, plasma IGF1 levels did not vary between the 24 and 48 kg groups nor did levels change in response to feeding.

In view of the established role of insulin and GH in controlling protein synthesis we suggest that these hormones may play an important role in controlling the phase change in protein deposition during growth.

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* *CSIRO, Division of Animal Production, P.O. Box* 239, *Blacktown, N.S.W.* 2148.