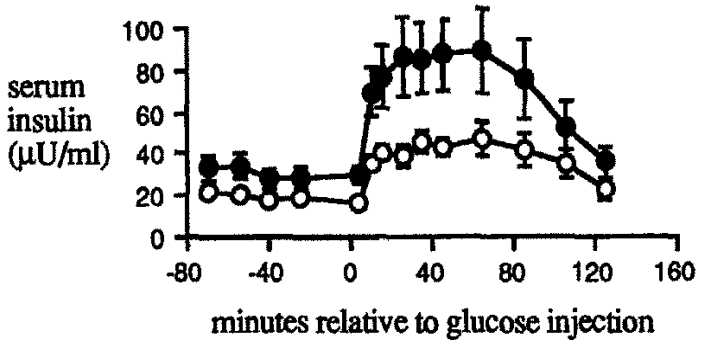
FATTER EWES RELEASE MORE INSULIN IN RESPONSE TO A GLUCOSE CHALLENGE AND PRODUCE FATTER LAMBS THAN LEAN EWES

D.M.McNEILL, R.W.KELLY* AND I.H.WILLIAMS

The sensitivity of maternal tissue to insulin is lower in ewes in late pregnancy than in non-pregnant ewes and this has been proposed as a mechanism to spare nutrients for the fetus (Hay et al. 1988). Fatness is also associated with a reduced sensitivity of the ewe to insulin but this has only been demonstrated in non-pregnant ewes. Sensitivity can be gauged by measuring the rise in insulin in response to a standard injection of glucose and then measuring the rate of removal of glucose from the blood stream. A ewe that is less sensitive to insulin is one which has a larger than expected release of insulin and a slower than expected removal of glucose (McCann et al. 1986). We hypothesised that in late pregnancy a fatter ewe would produce more insulin for a given amount of glucose injected and remove the glucose faster than a lean ewe because the maternal tissue of fatter ewes would be less sensitive to insulin than the tissue of leaner ewes.

Nutrition was manipulated so that, at mating, ewes were in medium (score 2.5) or lean condition (score 1.5) and then maintained at this fatness until day 145 of pregnancy. At day 130 the single-bearing ewes were given dextrose (440 mg/ ml saline) at 350 mg/kg of liveweight via a jugular catheter. Blood was taken via the catheter at -75, -45, -30, -15, -1, 5, 10, 20, 30, 40, 60, 80, 100, and 120 minutes relative to the dextrose injection and later assayed for glucose and insulin. Ewes were sacrificed at day 145 and the weight and chemical composition of their fetuses assessed.



The insulin response to an injection of glucose at day 130 of pregnancy in ewes that were either well fed to score 2.5 (—●—, n=8) or poorly to score 1.5 (—○—, n=8) prior to mating then fed an amount calculated to maintain their fatness at mating until day 145 of pregnancy

The ewes in medium condition gave a two-fold greater ($P < 0.05$) release of insulin (see figure), but cleared the glucose at a similar rate to the lean ewes. The fetuses of the medium ewes were fatter (127.9 ± 7.63 vs 99.8 ± 5.7 g, $P< 0.05$) but weighed the same as those of the lean ewes.

The medium ewes were less sensitive to insulin since they released more to remove the same amount of glucose compared to the lean ewes, and this supported our hypothesis. The similar removal of glucose from the blood of the medium and lean ewes suggests either that the maternal tissue of the ewes absorbed similar amounts of glucose, or that the fetuses of the medium ewes absorbed more glucose than the fetuses of the lean ewes. A greater absorbtion of glucose by the fetuses of the medium ewes could explain their higher fat content.

A greater release of insulin and a fatter fetus in the medium ewes support the concept that sensitivity to insulin is a mechanism for the partition of nutrients between the mother and fetus.

HAY, W.W., CHIN-CHU LIN and MEZNARICH, H.K. (1988). Proc. Soc. Exper. Biol. Med. 189: 275.

McCANN, J.P., ULLMAN, M.B., TEMPLE, M.R., REIMERS, T.J. and BERGMAN, E.N. (1986). J. Nutr. 116: 1287.

Animal Science Group, University of Western Australia, Nedlands, WA, 6009
* Sheep and Wool Branch, WA Department of Agriculture, South Perth, WA, 6151