

THE EFFECT OF PROTEIN AND ENERGY INTAKE ON PHYSIOLOGICAL PARAMETERS AND OVULATION RATE IN EWES

G.C. WAGHORN* and J.F. SMITH**

Two experiments were undertaken to investigate the nutritional basis for the increased ovulation and lambing percentage in ewes given protein and/or energy supplements pre mating. In the first experiment, 16 young wether sheep were fed high and low protein diets at four levels of intake and the physiological responses to treatment (Waghorn et al. 1987) were compared to the predicted ovulation rates in ewes given the same treatments (Smith 1985). The only parameter closely related to the ovulation rate predicted in the ewes, was the concentration of branched chain amino acids (BCAA) in plasma ($r = 0.95$). This relationship provided the basis for Experiment 2.

In Experiment 2, oestrus was synchronised in two groups of 20 ewes fed a low protein (LP) diet (13.3% crude protein (CP) in the DM) for 14 days. Subsequently, one group was maintained on the LP diet (control group) and the other group given a high protein (HP) diet (27.1% CP). Ovulation rates were measured by laparoscopy and blood samples taken from all ewes for amino acid (AA) determination during both periods. Blood AA concentrations were determined in samples pooled on the basis of ovulation rate for sheep in the control and HP groups.

The number of ova changed from 1.35 to 1.50/ewe in the control group, and from 1.47 to 1.89/ewe in those given the HP diet. AA concentrations were similar for both groups when the LP diet was given. The HP diet did not affect the concentrations of non essential AA, but there was an increase in the concentrations of BCAA by 58% ($P < 0.05$) and other essential AA (EAA) by 29% ($P < 0.05$).

Blood samples from the HP group were combined from ewes which had either a single ova during both periods (1 to 1); or an increased ovulation (1 to 2); or two ova (2 to 2); or an increase from 2 to 3 ova with the HP diet. There were 3 to 6 ewes in each group. The concentrations of BCAA during the LP and HP periods for the respective groups were 412 and 524; 454 and 694; 387 and 589; 502 and 1010 $\mu\text{mol/l}$ blood. The response to HP diet, as an increase in BCAA concentration was least (27%) for ewes having a single ova, intermediate for those with 2 ova (52, 50%), and greatest (101%) for the ewes producing 3 ova with the HP diet. The association between ovulation rate, dietary protein concentration and blood BCAA concentration was not evident for other AA.

In contrast to the increased concentration of BCAA in blood of ewes given the HP diet and having multiple ova, the BCAA concentrations were similar in ewes maintained on the LP diet with single ova ($421 \pm 23 \mu\text{mol/l}$) and with two ova ($440 \pm 21 \mu\text{mol/l}$). It appears that an increase in blood BCAA concentration, rather than BCAA concentration per se may be related to ovulation.

These results demonstrate an association between dietary induced increases in blood BCAA concentration and ovulation rate, in response to protein supplementation.

SMITH, J.F. (1985). In "The Genetics of Reproduction in Sheep", p.349, editors R.B. Land and D.W. Robinson. (Butterworths: London).

WAGHORN, G.C., FLUX, D.S. and ULYATT, M.J. (1987). Anim. Prod. 44: 143.

* Biotechnology Division, DSIR, Palmerston North, New Zealand.

** MAFTech, Ruakura Agricultural Centre, Hamilton, New Zealand.