

HEPATIC CONCENTRATIONS OF GLUCONEOGENIC INTERMEDIATES DURING
RUMEN DEVELOPMENT IN SHEEP

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Weaning and rumen development in sheep are accompanied by changes in glucose metabolism (Jarrett et al. 1964). Glucose flux or irreversible loss (IL) declines markedly and the hepatic activities of pyruvate carboxylase and phosphoenolpyruvate carboxykinase (PEPCK) increase after weaning (Mercer 1979). The control sites of gluconeogenesis have not been well defined in ruminants and there is no information on biochemical changes in the liver during rumen development. In this experiment glucose kinetics and the fixation of CO₂ into glucose have been determined in milk-fed and weaned lambs, and the concentrations of gluconeogenic intermediates in the liver analysed.

Fifteen lambs were bottle-fed reconstituted dried whole milk at 940 kJ ME/kg^{0.75}/d (approximately 2.5 maintenance). Experiments were conducted on groups of three lambs at 15 d intervals. After 45 d the remaining lambs were weaned on to 18% CP calf weaner pellets and lucerne chaff, 80% of the ME being supplied by the pellets and the total ME presented being 940 kJ/kg^{0.75}/d. Kinetic studies were done on animals in the post-absorptive state. Glucose IL was estimated using a single intrajugular injection of [2-³H] glucose, and CO₂ entry rate determined by a continuous intrajugular infusion of NaH¹⁴CO₃. One day after the kinetic studies the lambs were anaesthetised with sodium thiopentone and approximately 10g of the ventral lobe of the liver excised and immediately freeze-clamped. The lamb was euthanased immediately. Intermediates were assayed in the neutralised perchloric acid extracts.

The IL of glucose decreased rapidly after weaning, the mean values at each age being 810, 911, 772, 339 and 376 mg/h/kg^{0.75} at 15, 30, 45, 60 and 75 days of age respectively. The entry rate of CO₂ decreased throughout the experiment, the values being 408, 362, 339, 287 and 260 mgC/h/kgBW at 15, 30, 45, 60 and 75 days respectively. The proportion of glucose derived from CO₂ fixation increased from an average of 5% before weaning to 12.8% after weaning.

The concentrations of liver metabolites are expressed as nmol/g fresh wt. Oxaloacetate was calculated (Hawkins et al. 1973).

age(d)	lact	pyr	oaa	mal	pep	2pga	3pga	F6P	G6P	glucose
15	1392	179	5.5	160	157	135	381	68	117	5489
30	835	64	2.3	116	67	56	216	64	61	4670
45	796	35	1.7	168	47	36	135	40	53	3689
60	821	123	16.3	426	75	67	194	46	89	4458
75	837	122	11.3	344	82	60	219	90	65	4795

When the metabolite concentrations are expressed relative to those at 15d of age a reverse crossover occurred at the reaction catalysed by PEPCK after weaning. Since glucose flux (IL) declined after weaning this suggests control of gluconeogenesis at this step.

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