

HEPATIC GLUCOSE PRODUCTION IN EXERCISING SHEEP

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Exercise induces hyperglycaemia and an increase in the glucose entry rate in sheep (Judson et al. 1976). The source of increased glucose production and the period for which hyperglycaemia is maintained have not been identified.

Non-pregnant, non-lactating Merino ewes aged 3-5 years and weighing 37-46 kg were prepared surgically with chronic indwelling jugular, portal, hepatic and mesenteric venous catheters and a carotid arterial catheter according to the method of Katz and Bergman (1969). Sheep were fed 700g lucerne cubes daily in twelve equal portions at two-hourly intervals. Two weeks after surgery sheep were trained to walk on a treadmill and were subsequently exercised 4 times weekly. Experiments were conducted on exercising (walking at 4.5km/hr) and resting sheep. Para-aminohippuric acid and [U-¹⁴C]glucose were infused to determine splanchnic blood flows and glucose biokenetics respectively. Sets of simultaneous blood samples were taken from arterial, portal and hepatic catheters every 20 min for 4 hours during exercise experiments and every 15 min for 2 hours in resting sheep. Catheter positions were checked using fluoroscopy, dye-dilution and post-mortem examinations.

Glucose metabolism during exercise in sheep (Mean \pm S.E.M.; n=8)

	Rest	Exercise
Portal blood flow (ml/min)	1580 \pm 225	1220 \pm 130
Hepatic blood flow (ml/min)	1870 \pm 240	1282 \pm 140
Arterial conc. glucose : (mM)		2.91 \pm 0.18
1st hr exercise		3.92 \pm 0.17
2nd hr exercise		3.72 \pm 0.20
3rd hr exercise		3.33 \pm 0.17
4th hr exercise		2.87 \pm 0.11
Entry rate : glucose (mmole/h)	21.0 \pm 1.5	46.5 \pm 2.1
Hepatic glucose production (mmole/h)	17.4 \pm 1.4	38.2 \pm 1.6

The whole body glucose entry rate was significantly increased by exercise ($P < 0.001$). This increase was associated with hyperglycaemia at the beginning of the exercise period. However, with continued exercise the arterial concentration of glucose fell to pre-exercise levels. The hepatic contribution to the whole body glucose entry rate was substantial at 82% of the total, both during rest and exercise and like the whole body entry rate was maintained at constant levels during the four hours exercise. It is clear that after the initial hyperglycaemia associated with the onset of exercise that hepatic production of glucose is less than peripheral utilisation of glucose.

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