EFFECTS OF ADMINISTRATION OF GLUCAGON AND EPINEPHRINE IN VIVO ON THE METABOLISM OF PROPIONATE IN SUBSEQUENTLY ISOLATED CAUDAL LOBE OF SHEEP LIVER

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Propionate is the most important source of carbon for glucose synthesis in ruminants. However, the control mechanisms, in particular the role of the endocrine system, of gluconeogenesis from propionate in the ruminant liver are poorly understood. In this study, the effects of administration of glucagon and epinephrine in vivo on metabolism of propionate by subsequently isolated caudal lobe of sheep liver were examined.

Twelve merino ewe lambs weighing 24-35 kg were used. Glucagon (9.8 µg/min), epinephrine (3 µg/min) or sterile saline was infused for three hours into the jugular vein. Blood samples were taken from a contralateral jugular catheter at regular intervals before and during the infusion period. Immediately after 3 h, the infusion was stopped and sheep were anaesthetised before removal of the caudal lobe of the liver. The lobe was perfused using a non-recirculating perfusion system as described by Jois et al. (1993). The perfusion medium was Krebs-Henseleit buffer containing 0.5 mM (2-^{14}C) propionate, 2.1 mM lactate, 0.3 mM pyruvate, 0.1 mM butyrate, 1.5 mM acetate, 0.15 mM alanine, 0.2 mM glutamine, and 4.0 mM glucose. Concentration of glucose was determined in plasma. Concentration of propionate, $^{14}C02$ production, and ^{14}C-glucose synthesis were determined in the perfusate. Results (mean ± SEM) are summarised in the Table.

	Control	Glucagon	Epinephrine
Plasma Glucose (mM)			
Pre-infusion	4.05 ± 0.15	4.46 ± 0.36	4.55 ± 0.51
60 min	4.42 ± 0.27	11.48 ± 1.52**	8.42 ± 1.52**
Flow rate (ml/g wet liver/min)	5.63 ± 0.72	6.49 ± 0.54	3.35 ± 0.44*
Gluconeogenesis from propionate (nmol/g wet liver/min)	411.85 ± 29.6	555.93 ± 48.45*	348.88 ± 28.77
Release of CO_2 (nmol/g wet liver/min)	28.65 ± 2.43	30.93 ± 2.76	24.25 ± 3.75
Net uptake of propionate (µmol/g wet liver/min)	1.12 ± 0.08	1.77 ± 0.02**	0.98 ± 0.09
Extraction of propionate (%)	44.92 ± 4.15	55.17 ± 1.85*	61.50 ± 2.49*

Significant differences from control are indicated thus: * $P < 0.01$, ** $P < 0.001$

Plasma glucose was increased by both glucagon and epinephrine infusions compared with controls. Glucagon stimulated gluconeogenesis from propionate by 35% and net uptake of propionate by more than 55%. Less than 6% of propionate was released as CO_2 regardless of treatment. Epinephrine decreased the flow rate but increased the extraction of propionate by about 40%. The results show that uptake and conversion of propionate to glucose in sheep liver are controlled by hormones.

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