

THE EFFECT OF PHYSIOLOGICAL STATE ON
GLUCONEOGENESIS IN ISOLATED GUINEA-PIG HEPATOCYTES

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The caecum of the guinea pig contains short-chain fatty acids in concentrations similar to those found in the rumen (Henning and Hird 1970) and in the guinea pig liver the activity and intracellular distribution of the key gluconeogenic enzyme, phosphoenolpyruvate carboxykinase, resembles the situation in the ruminant (Hanson and Garber 1972). We are using the guinea pig as a model for the study of the regulation of gluconeogenesis in the sheep in different physiological states.

We report here some preliminary results of glucose production in non-pregnant, pregnant (45-55d) and lactating (7-14d) guinea-pig liver cells using propionate, lactate and glutamine as the glucogenic substrates. Each substrate was studied at two concentrations (2 and 10 mM) in hepatocytes from fed and 48 h starved animals. Hepatic parenchymal cells were prepared by the method of Elliott and Pogson (1977). The cells (approximately 7 mg dry wt.) were incubated for 60 min at 37°C in 2 ml of Krebs-Henseleit buffer containing 2% defatted bovine serum albumin. Incubations were terminated by the addition of 200 µL of 2 M perchloric acid. The results are shown in the table below. Glucose production rates are expressed as nmol/mg dw/h.

Substrate	mM	N-P*	Fed		Starved		
			P [†]	L [‡]	P [†]	L [‡]	
Propionate	2	93(9) ^{bc}	98(13) ^{AB}	100(10) ^I	122(9) ^{cd}	141(7) ^C	103(5) ^I
	10	129(17) ^d	117(22) ^B	107(7) ^I	111(7) ^{cd}	165(19) ^C	113(14) ^I
Lactate	2	40(7) ^a	44(8) ^A	43(10) ^{II}	51(12) ^{ab}	101(15) ^B	59(7) ^{II}
	10	43(6) ^{ab}	46(6) ^A	27(5) ^{II}	71(3) ^b	160(21) ^C	88(1) ^{II}
Glutamine	2	69(10) ^b	55(13) ^A	43(12) ^{II}	42(3) ^a	67(5) ^{AB}	52(10) ^{II}
	10	100(19) ^c	91(20) ^{AB}	51(7) ^{II}	40(3) ^a	50(1) ^A	55(15) ^{II}

* Non-pregnant; † Pregnant; ‡ Lactating

Each value (± SE) is the mean of three experiments. In any column values with different superscripts differ significantly (P < 0.05). Superscripts refer to the 3-way interaction (fed/starved, substrate and concentration of substrate) for non-pregnant and pregnant animals, and 2-way interaction (fed/starved and substrate) for lactating animals.

Propionate was the best glucogenic precursor (P < 0.05) under all conditions except in cells from starved pregnant animals in which the rate of gluconeogenesis from 10 mM lactate was similar to that from 10 mM propionate. Propionate and lactate were significantly better utilised in cells from starved animals. Glutamine at 10 mM was best utilised in cells from non-pregnant and pregnant animals in the fed state. Gluconeogenic rates in cells from starved animals were significantly higher in pregnant than in non-pregnant or lactating animals.

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