Effects of Growth Hormone on Glucose-U-C^{14} Metabolism in Dog.* (29375)

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The adenohypophysial growth hormone assumes a major role in regulation of carbohydrate and lipid metabolism in addition to its well documented protein anabolic functions. Growth hormone administration effectively antagonized insulin hypersensitivity of hypophysectomized dogs(1,2). When given to intact dogs in single doses or for a short period of time growth hormone treatment was accompanied by an increase in glucose utilization(3). In the present studies, metabolism of glucose-U-C^{14} by liver and myocardium slices obtained from growth hormone treated dogs is reported.

Material and methods. Nine healthy mongrel dogs of both sexes were maintained under conditions of constant temperature and humidity for at least 3 weeks before the beginning of an experimental period. They were fed a dry dog food diet throughout the experimental period. Growth hormone† was dissolved in physiological saline and administered to 5 dogs 1 mg/kg/day for 8 days. Four dogs served as controls receiving daily intramuscular injections of physiological saline. Each dog was anesthetized with pentobarbital sodium and sections of liver and ventricular myocardium were removed for *in vitro* studies. Liver and myocardia slices were prepared as described previously(4,5) from normal and growth hormone treated dogs and were incubated in a Ringer-bicarbonate medium equilibrated with 95% O_2 and 5% CO_2. C^{14} labeled glucose was added to the medium to give an initial concentration of 1 mg per ml. Approximately 0.5 g of wet liver or myocardium slices was incubated in 6 ml of medium containing 2.0 to 2.5 $\times$ 10^5 cpm of labeled substrate. After 90 minutes, the incubated tissues were analyzed for glycogen and protein and medium for CO_2 as $BaCO_3$. Glycogen was isolated by the procedure of Good *et al*(6). It was then hydrolyzed by 5 N H_2SO_4 and phenylglucosazone was formed by heating the hydrolysate with 100 mg of phenylhydrazine dissolved in 2 ml of 3 M acetate buffer pH 4.5. The precipitated osazone was then assayed for radioactivity. An aliquot of hydrolysate was assayed for reducing sugar by procedure of Somogyi(7). Radioactivity in protein was assayed as described previously (8). The results are given in Table I.

Results and discussion. The results clearly indicated an increase in glycogen concentration of liver and heart tissue by administration of growth hormone to dogs. These results are similar to those reported by Russell and Bloom(9) and Adrouny and Russell(10) following growth hormone administration to the rat. Whether this effect was the result of preferential deposition of glucose as glycogen or as a result of inhibition of some enzymatic process in glucose utilization is not clear. A marked increase in rate of incorporation of C^{14} from glucose into glycogen was evident in the myocardial tissue slices taken from dogs given growth hormone. The decrease in rate of incorporation of the label from glucose-U-C^{14} into CO_2 by these slices of myocardium was significant. The growth hormone administration was associated with increased glycogenesis with a simultaneous decrease in glucose oxidation in the heart. In the liver slices from growth hormone treated dogs, smaller increases in glycogenesis were accompanied by a more prominent decrease in glucose oxidation. The radioactivity in proteins was unchanged in myocardial tissues whereas proteins of liver slices from growth hormone treated dogs showed a slight increase in radioactivity over the controls. Similar results were obtained in hypophysectomized rats treated with the growth hormone as reported previously(8).

Summary. The effect of growth hormone

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TABLE I. Metabolism of Glucose-U-C^{14} by Liver and Ventricular Myocardium Slices Obtained from Normal and Growth Hormone Treated Dogs.

Tissue	Treatment	Glycogen, μM glu/g	p(t)	C.P.M. in glycogen/g tissue	p(t)	C.P.M. in CO_2/g	p(t)	C.P.M./mg protein
Heart	Control	25.2 ± 2.1*	<.001	1420 ± 50	<.01	19,056 ± 472	<.01	87
	+ Growth hormone	53.8 ± 2.4		2108 ± 97		15,500 ± 204		86
Liver	Control	248 ±21.2	<.02	1780 ±135	<.05	17,038 ±1216	<.01	83
	+ Growth hormone	350 ±22.3		2652 ±258		9,990 ± 708		113

* Each figure is an average of 4 values.

on some aspects of glucose-U-C^{14} has been studied in dog. Administration of growth hormone (1 mg/kg/day) to dogs for one week was accompanied by an increase in glycogen content of the liver and ventricular myocardium. *In vitro* studies using slices of liver and heart tissue from control and growth hormone treated dogs showed a decrease in oxidation of glucose-U-C^{14} and an increased incorporation of C^{14} into glycogen by both tissues from growth hormone treated dogs. A small increase in the radioactivity of liver proteins from growth hormone treated dogs was also observed.

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Properties of Gel Mucin of Human Gastric Juice.* (29376)

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The freshly secreted epithelial mucin which forms a cohesive protective coating on the walls of the gastric mucosa, is obtained as a gel in aspirated anacid gastric juice. In normal acid juice, it is precipitated in ropey shreds. It has been customary to define this material as "visible" or "insoluble" mucin, as distinct from the soluble gastric mucins. Due to its insolubility in neutral aqueous media it has not previously been examined in detail. Canine gastric gel mucin, obtained from Heidenhain pouches following stimulation with acetylcholine, and porcine duodenal mucin both dissolve in alkali to give a complex mixture on paper electrophoresis(1) or in the ultracentrifuge (2). In an attempt to purify the gel mucin obtained from human subjects, we have discovered that the mucin, freed by very gentle methods(3) from contamination with soluble mucoproteins and from the serum proteins which occur in anacid gastric juice, can be dissolved in 8M urea to afford a macromolecular component which acts as a single entity on paper electrophoresis or in the ultracentrifuge. The use of such a mild reagent minimizes the possibility of altering the macromolecules, other than dissociating

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