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SHORT COMMUNICATION

THE REGULATION OF α-GLYCEROLPHOSPHATE DEHYDROGENASE (α-GPDH) ACTIVITY BY HYDROCORTISONE IN RAT MAMMARY GLANDS

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Although glucocorticoid requirements for the growth and function of mammary glands are well documented, the mechanism(s) by which these steroids affect the changes is still unclear. Nandi[1] investigated the requirements for growth in ovariectomized, adrenalectomized and hypophysectomized mice and reported that oestrogens, glucocorticoids and growth hormone are required to achieve ductal development comparable to that found in pre-pubertal or early post-pubertal females. Furthermore, these hormones plus progesterone and prolactin administered in various combinations induced ductal and alveolar development such as that found in mammary glands of untreated adult virgins or animals in early pregnancy. The role played by glucocorticoids in initiation, maintenance and cessation of lactation has been known for some time. Both prolactin and glucocorticoids appear to be required for initiation and maintenance of lactation [2, 3]. Since one of the factors affecting cell growth is the amount of energy available for cell division, it is possible that glucocorticoids might be implicated in energy generation. A major proportion of the cell's energy is generated by carbohydrate utilization and therefore by investigating the effect of glucocorticoid administration on the activities of some of the key enzymes associated with intermediary metabolism, it is possible to obtain insight into the mode of action of the hormone. Korsud and Baldwin[4] examined the effects of glucocorticoids on certain key enzymes of the hexose-monophosphate pathway and reported that adrenalectomy reduced and hydrocortisone administration stimulated the activities of glucose-6-phosphate dehydrogenase and 6-phosphogluconate dehydrogenase in lactating rat mammary glands indicating that the hormone plays a key role in directing substrates into the pathways of nucleic acid synthesis. In this communication we would like to present data which indicates that hydrocortisone regulates the activity of α-GPDH which is involved in the interconversion of lipids and carbohydrates.

Randomly bred albino Sprague–Dawley rats about 10 weeks old at the time of death were used in these experiments and were housed five to a cage. The endocrine ablations were carried out under fluothane anaesthesia. Castrations were performed via a dorsal incision through the skin and body-wall. The animals were adrenalectomized through a horizontal incision ½″ below the back and last rib. Adrenalectomized animals were maintained on 5% dextrose and 0.9% sodium chloride for the remainder of the period. After surgery, the animals were allowed to recover for 24 h before starting their 10 day experimental regime during which a daily dose of 10 mg of hydrocortisone (Efcortesol, Glaxo Laboratories Ltd., Greenford, Middlesex, England) was injected subcutaneously. At the end of the treatment period the animals were killed by dislocation of the vertebrae in the neck and the left abdominal mammary glands 4 and 5 and liver were removed. The tissues were frozen immediately on solid carbon dioxide and kept at −20° until further processing. The tissues were processed within two weeks of removal. α-GPDH activity was measured as described previously [5]. DNA content of the tissues was estimated according to the procedure of Burton[6]. The enzyme activities are expressed in terms of units per milligram of DNA where a unit is defined as that amount of enzyme which will catalyse the conversion of one micromole of substrate per minute. The results are expressed as mean ± SD. Each group consists of values obtained on tissues from five animals. The means were tested for significance by a Student's *t*-test.

The effects of adrenalectomy, adrenalectomy plus ovariectomy and hydrocortisone administration to adrenalectomized animals on the activity of α-GPDH in mammary glands and liver are presented in Table 1.

The mammary glands from endocrine ablated animals showed a highly significant decrease in the activity of α-GPDH. The administration of hydrocortisone to adrenalectomized animals results in stimulation of the enzyme's activity. Neither endocrine ablation nor administration of the hormone had any effect on the enzyme's activity in the liver.

From the data presented here, it is clear that hydrocortisone can induce highly significant changes in the activity of α-GPDH. Furthermore, failure to induce similar changes in the liver indicates that this is a specific rather than a general effect. Thus apart from stimulating the

Table 1. α-GPDH activities (μmol of pyridine nucleotide oxidized/min/mg DNA) in rat mammary gland and liver

	Intact	Adrenalectomized	Ovariectomized + adrenalectomized	Adrenalectomized + hydrocortisone
Mammary gland	0.911 ± 0.226	0.109 ± 0.052*	0.508 ± 0.165†	1.780 ± 0.905‡
Liver	16.858 ± 3.432	16.258 ± 1.564	17.618 ± 1.181	16.113 ± 2.021

Each group consists of tissues from five rats. The results are expressed as mean ± SD.
* Significant differences between intact and adrenalectomized animals $P < 0.01$.
† Significant differences between intact and ovariectomized plus adrenalectomized animals $P < 0.02$.
‡ Significant differences between adrenalectomized and adrenalectomized animals treated with hydrocortisone $P < 0.02$.

transfer of substrates into the pathways of nucleic acid synthesis [4] hydrocortisone further appears to affect energy generation by regulating the entry of substrates into the pathways of lipid and carbohydrate metabolism. The mechanism by which these changes are affected simultaneously remains to be explored.

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