

Effects of prolactin *in vitro* on the metabolism of glucose by rat mammary gland

It has long been known that prolactin is concerned in the initiation of lactation. Moreover, a direct local action of prolactin on the secretory activity of mammary alveoli has been demonstrated by LYONS¹. BALMAIN AND FOLLEY² investigated the effect *in vitro* of prolactin on the metabolism of slices of rat mammary gland at different stages of lactation. Although the respiration of tissue taken at 1–5 days lactation was sensitive to the addition of prolactin to the medium they failed to find any metabolic changes, in the respiratory quotient or in the incorporation of labelled acetate into lipids, in slices of tissue from pregnant rats.

In view of the intraduct-injection results of LYONS¹ it might be expected that prolactin would have an effect *in vitro* on the metabolism of mammary tissue from pregnant rats and for this reason measurements have been made of the action of this hormone on the conversion of glucose carbons 1 and 6 to CO₂ and lipid and the relative participation of the Embden–Meyerhof and pentose phosphate pathways in the conversion of glucose to lipid by mammary-gland slices from pregnant and lactating rats. The results of these experiments are shown in Fig. 1.

The addition of prolactin to the medium caused a significant increase in the formation of ¹⁴CO₂ from both [1-¹⁴C]glucose and [6-¹⁴C]glucose and also increased the incorporation of glucose carbon into lipid by mammary-gland slices from pregnant

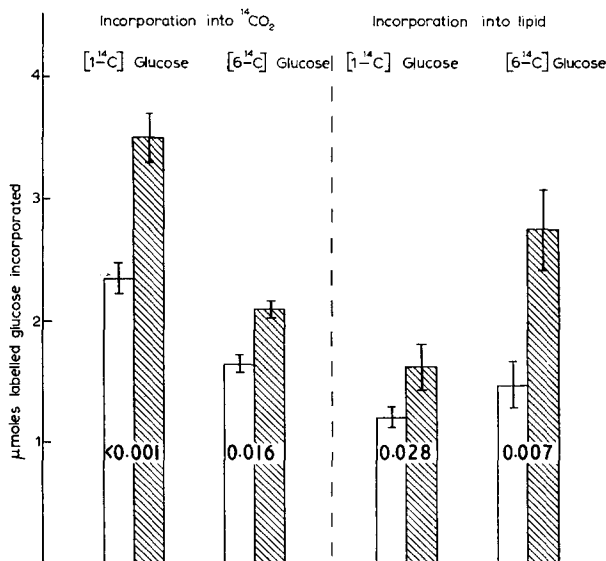


Fig. 1. Effect of prolactin on the conversion of specifically labelled glucoses to ¹⁴CO₂ and lipid by mammary-gland slices from pregnant rats. 500 mg mammary-gland slices were incubated for 1.5 h at 37° in 4.5 ml Krebs–Ringer bicarbonate solution with 100 μmoles glucose containing 0.2 μC ¹⁴C in the form of [1-¹⁴C]glucose or [6-¹⁴C]glucose. Gas phase, O₂–CO₂ (95:5). Open columns represent values for control slices, hatched columns those for slices incubated with 3 mg prolactin/flask. (Armour “Panlitar” lot S10209 15 units/mg). The vertical lines represent twice the standard error of the mean and the figures across adjacent columns are the values for Fisher’s *P* calculated using the method of corresponding pairs (number of pairs = 7). Method of incubation and isotopic procedure were as described previously⁶ except that the total lipid was extracted by the method of BLIGH AND DYER⁷ and was counted using the “infinitely thick” layer technique.

rats. The amount of ^{14}C -labelled lipid derived from added glucose arising from the Embden-Meyerhof pathway has been calculated by the method described by ABRAHAM *et al.*³. While $85 \pm 6\%$ arose from glycolysis in control experiments this value fell to $58 \pm 6\%$ in experiments in which prolactin was added to the tissue slices (Fisher's $P = 0.023$). By difference it is apparent that the contribution of the non-glycolytic route is more than doubled in the presence of prolactin.

In contrast with the above results prolactin had no consistent effect *in vitro* on the metabolism of specifically labelled glucoses by mammary-gland slices from lactating rats (11th–18th day).

WINEGRAD *et al.*⁴ have recently shown that prolactin *in vitro*, in concentrations similar to those used in the present study, increased both the oxidation of glucose carbon to $^{14}\text{CO}_2$ and the incorporation of glucose carbon into fatty acids by adipose tissue from normal-fed rats. The present results are also in accord with those of ABRAHAM *et al.*⁵ who have investigated the oxidation of glucose and acetate and lipogenesis from these substrates by mammary glands of hypophysectomised rats in which lactation was hormonally induced. These authors found that administration of prolactin and Δ^1 -hydrocortisone acetate together brought about pronounced changes in the pattern of glucose metabolism, a greater proportion of the glucose-derived fatty acids arising from the pentose phosphate pathway.

It is of interest that the effect of prolactin disappears with the onset of lactation while the action of insulin is considerably enhanced⁶, a point of contrast which suggests that these two hormones have different mechanisms of action although the general pattern, the parallel increase in the oxidation of glucose and synthesis of lipid, is apparent in both cases.

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The mode of action of actinomycin D

Actinomycin D is one of a series of polypeptide antibiotics, the first of which was reported by WAKSMAN AND WOODRUFF in 1940¹. It has powerful bacteriostatic effects on many micro-organisms, particularly Gram-positive bacteria.

Abbreviations: RNA, ribonucleic acid; DNA, deoxyribonucleic acid; d.ATP, deoxyadenosine triphosphate; d.GTP, deoxyguanosine triphosphate; d.TPP, thymidine triphosphate; d.CTP, deoxycytosine triphosphate; Tris, tris (hydroxymethyl)aminomethane.

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