Studies on Plasma Prolactin in Nursing Malnourished & Normal Mothers

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A C K N O W L E D G E M E N T

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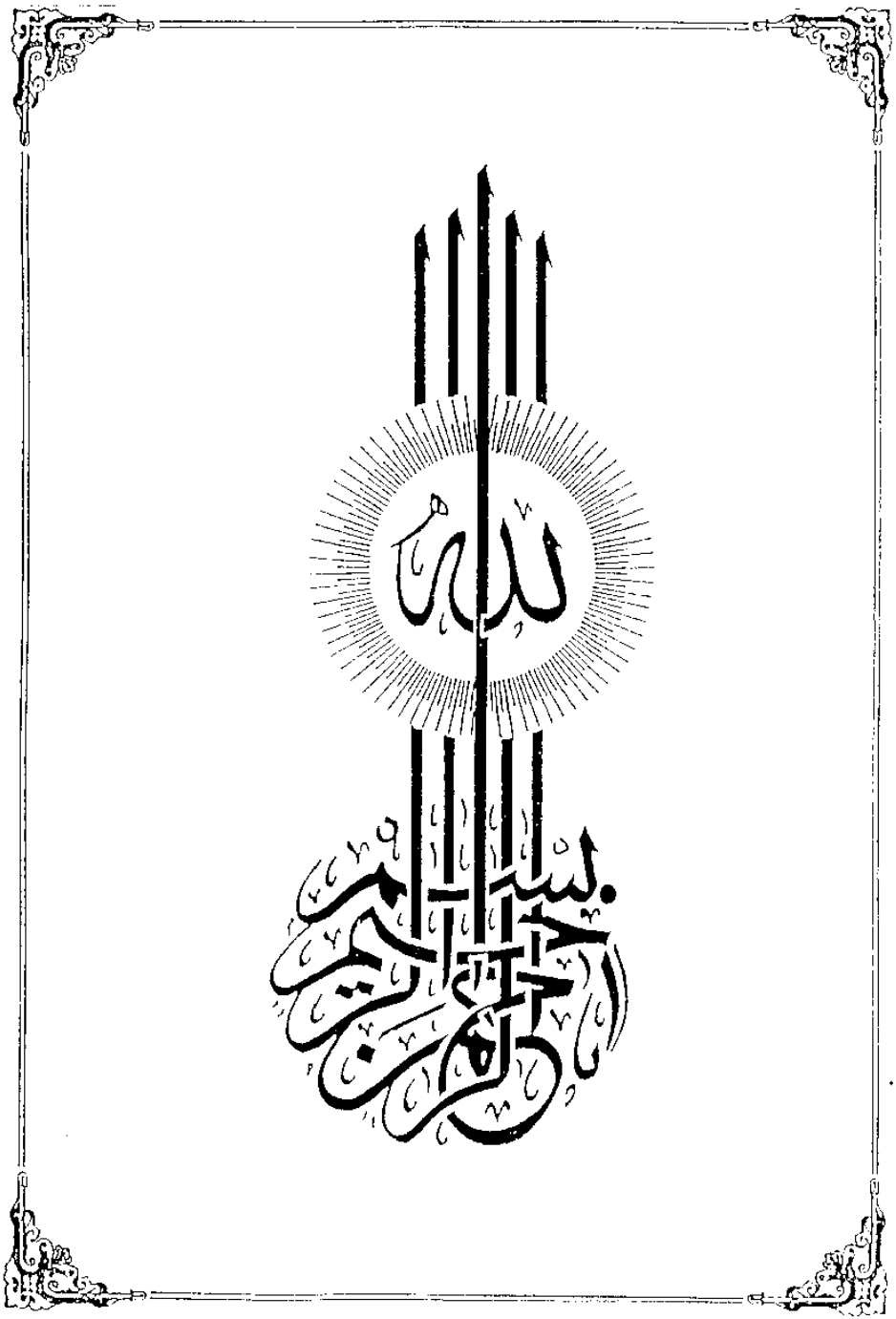


C O N T E N T S

Introduction

I N T R O D U C T I O N

Physiology of the pituitary gland as prolactin secreting gland, (Ganong 1981)[1].

The anterior, intermediate and posterior lobes of the pituitary gland are actually 3 more or less separate endocrine organs. The 6 established hormones of the anterior pituitary are thyroid stimulating hormone (TSH), adreno corticotrophic hormone (ACTH), luteinizing hormone (LH), follicle stimulating hormone (FSH), prolactin and growth hormone, All of these except growth hormone and prolactin regulate the function of other endocrine glands. Intermediate lobe secrete α and B Melanocyte-stimulating hormones (α-and-B MSH).
Posterior lobe secrete vasopressin (antidiuretic hormone ADH) and oxytocin hormone.

From these hormones prescribed before, we are interest in two hormones for our research study prolactin and oxytocin.

Prolactin (luteotrophic hormone, LTH, lactogenic hormone) stimulates secretion of milk, while oxytocin causes milk ejection.

Secretion & ejection of milk, (Ganong 1981)[1].

The breast enlarges during pregnancy in response to high circulating levels of estrogens, progesterone and

prolactin, some milk is secreted as early as the fifth month but the amounts are small compared to the surge of milk secretion that follows delivery. A similar increase in milk secretion follows abortions after the fourth month. After explusion of the placenta at parturition, there is an abrupt decline in circulating estrogens and progesterone. The drop in circulating estrogens initiates lactation. Prolactin and estrogens synergize in producing Breast growth, but estrogen antagonizes the milk producing effect of prolactin on the Breast. Indeed, in women who do not wish to nurse their babies, estrogens are adminstrated to stop lactation.

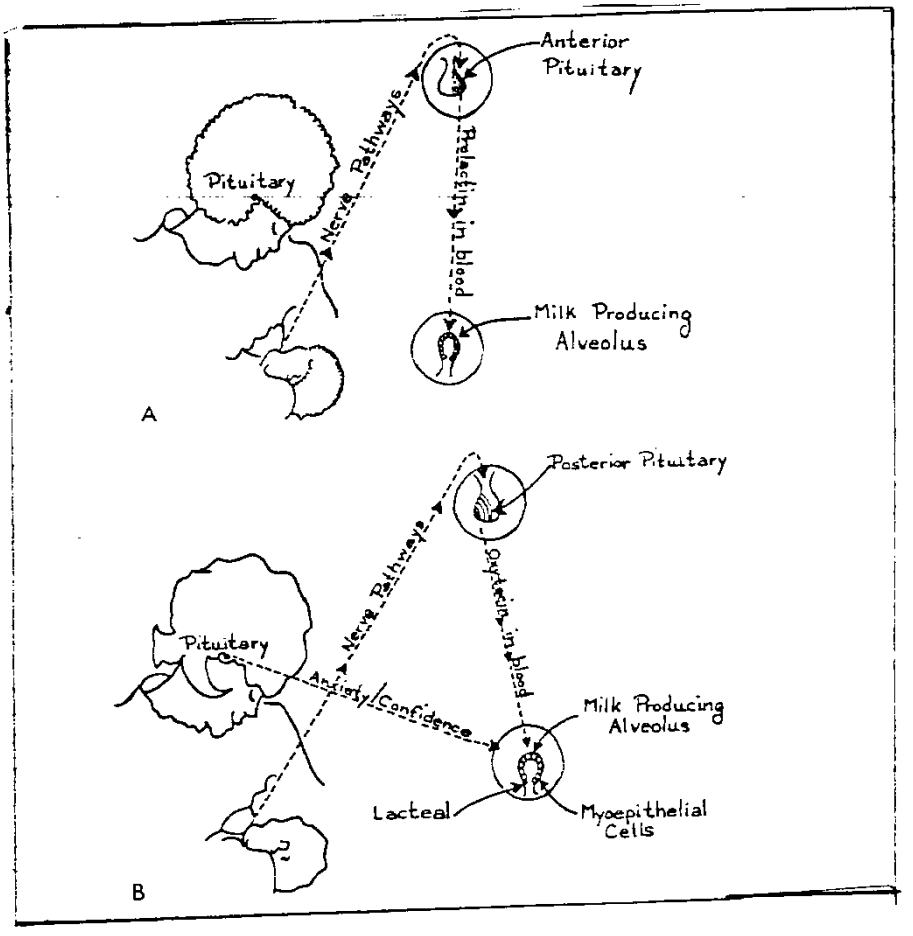
Suckling not only evokes reflex oxytocin release and milk ejection but it also maintains and augments the secretion of milk because of the stimulation of prolactin secretion.

The principal physiologic effect of oxytocin is on the myoepithelial cells, smooth muscles - like cells that line the ducts of the breast. The hormone makes these cells contract, squeezing the milk out of the alveoli of the lactating breast into the large ducts (sinuses) and thence out the nipple (milk ejection).

Milk ejection reflex, (Ganong 1981)[1].

Milk ejection is normally initiated by a neuro-endocrine reflex. The receptors involved are the touch

receptors, which are plentiful in the breast especially around the nipple. Impulses generated in these receptors are relayed from the somatic touch pathway via the bundle of schütz and mammillary peduncle to the supraoptic and supra ventricular nuclei. Discharge of the oxytocin-containing neurons causes liberation of oxytocin from the posterior pituitary. The Infant's Suckling at the breast stimulates the touch receptors, the nuclei are stimulated, oxytocin is released and the milk is expressed into the sinuses, ready to flow into the mouth of the waiting infant.

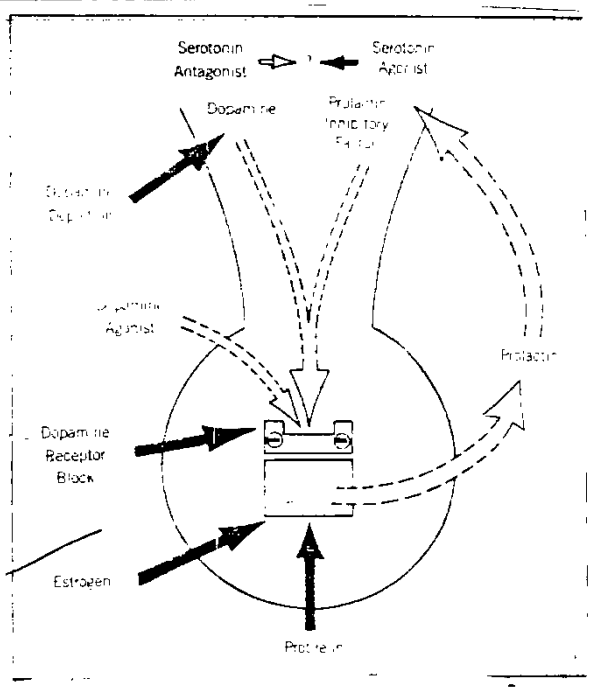


This figure show the two key reflexes in lactation:

A, The prolactin reflex, a somatic response to suckling the breast, responsible for milk secretion.

B, the "let-down" or "milk ejection" reflexes, a psycho-somatic reflex, impaired by anxiety and enhanced by confidence, responsible for moving milk from alveoli to terminal lacteals (Jelliffe and Jelliffe 1976)[2].

Factors Affecting Secretion of Prolactin



Control of prolactin secretion. Factors that result in elevated serum concentration are indicated by solid arrows. Factors that lower serum concentration are indicated by broken arrows, (Kirby et al, 1979)[3].

Unique among the pituitary hormones, prolactin secretion is controlled by a predominantly inhibitory influence from the hypothalamus. The prolactin release is controlled in part by a negative feed back system active at the hypothalamus where the result of increased prolactin is an increase in prolactin inhibitory factors (Figure). Considerable evidence suggests that dopamine is the primary, although probably not the only prolactin

inhibitory factor. Prolactin secretion by pituitary cells grown in culture is suppressed by dopamine, (Kirby et al, 1979)[3].

Dopamine neurosecretory terminals are found on the portal hypophyseal vessels and dopamine receptors have been identified on the prolactin-secreting cells, (Kirby et al, 1979)[3].

Dopamine agonists e.g. (Bromocriptine) lower serum prolactin concentration within hours. Drugs that deplete hypothalamic dopamine and drugs that block dopamine receptors on the prolactin-secreting cells induce hyperprolactinaemia (Table), (Kirby et al, 1979)[3].

Although both serotonin and histamine appear to be involved in prolactin regulation, their importance remains uncertain.

Protirelin (synthetic thyrotrophin-releasing hormone) is a potent stimulus for prolactin secretion and appears to act directly on the prolactin-secreting cells. The prolactin response to protirelin is potentiated by hypothyroidism and estrogens and is greater in women than men, (Yamaji et al, 1974)[4].

In the euthyroid state, thyrotrophin-releasing hormone (TRH) is probably not a physiologically important modulator of prolactin secretion.

Estrogens also increase prolactin release but we must remember that estrogens has a dual role on prolactin secretion and function.

First, it promotes hypertrophy of human prolactin secreting cells with a subsequent elevation in basal peripheral human prolactin concentrations. Next, it inhibits the effect of elevated human prolactin concentrations on mammary alveolar cells. It is only with the loss of significant concentrations of placental steroids that human prolactin induces human lactation, (Shearman et al, 1972)[5].

Unlike the rapid effects of drugs that act on the dopamine neurotransmitter system, the effect of estrogens is delayed several days. Estrogens appear to exert their effect by increasing mitotic activity of prolactin - producing cells of the anterior pituitary, (Kirby et al, 1979)[3].

Drugs Affecting Serum Prolactin Concentration
Drugs that lower prolactin concentration
Dopamine agonists
Ergot derivatives
Bromocriptine mesylate, bergotrile mesylate, lisuride hydrogen maleate.
Levadopa, apomorphine hydrochloride, clonidine hydrochloride.
Drugs that elevate prolactin concentration
Dopamine antagonist.
Hypothalamic dopamine depletion
Reserpine, methyl dopa.
Dopamine receptor blockade
Phenothiazines, haloperidol, metoclopamide hydrochloride.
Direct stimulation of the pituitary prolactin-secreting cell.
Protirelin
Estrogens

(Kirby et al, 1979)[3].

Beside hormones and drugs, there are other factors also effects the secretion of human prolactin as shown in this table, (Ganong 1979)[6].

I, moderate increase; I^+, marked increase; I^{++}, very marked increase; N, no change; D, moderate decrease; D^+, marked decrease.

Factor	Prolactin
Sleep	I^+
Nursing	I^{++}
Breast stimulation in non lactating women.	I
Stress	I^+
Hypoglycemia	I
Strenuous exercise	I
Sexual intercourse in women	I
Pregnancy	I^{++}
Estrogens	I
Hypothyroidism	I
TRH	I^+
Phenothiazines, butyrophenons	I^+
Opiates	I
Glucose	N
Somatostatin	N
L-Dopa	D^+
Apomorphine	D^+
Bromocriptine and related ergot derivatives	D^+

Influence of Maternal diet on plasma-prolactin levels during lactation.

The effect of maternal malnutrition may not be obvious except in extreme cases. Howevers the milk volume in poorly nourished communities is somewhat less than in well-fed women, (Jelliffe and Jelliffe, 1978)(76).

Dietary protein is probably the agent responsible for prolactin secretion induced by meals, while fat, glucose, and a non-nutrient meals had no consistent effects on serum prolactin, (Carlson et al, 1983)(7).

The mechanism of prolactin stimulation by protein is unclear. The lack of a concomitant change in serum TSH suggests that TRH does not mediate meal-induced prolactin secretion. At least two amino acids, arginine and Tryptophan, stimulate prolactin secretion when given in large doses, (Woolf et al, 1977)(17), (Vierhapper et al, 1980)(18).

It is certainly possible that the effect of protein ingestion is due to amino acids liberated by digestion. The time course of the protein effect is consistent with this interpretation.

An alternative mechanism might involve the liberation of opioid peptides (so-called exorphins) from food proteins by pepsin digestion, (Zioudrou et al,