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QUESTION: DISCUSS LACTATION AND GESTATION PERIOD IN A NORMAL FEMALE.

**Lactation** is the secretion of milk from specialized glands (mammary glands) to provide nourishment to offspring. Lactation describes the secretion of milk from the mammary glands and the period of time that a mother lactates to feed her young. The process occurs in all female mammals, although it predates the origin of mammals.

In humans the process of feeding milk is called breastfeeding or nursing.  
The chief function of lactation is to provide nutrition and immune protection to the young after birth. In almost all mammals, lactation induces a period of infertility, which serves to provide the optimal birth spacing for survival of the offspring.

In most species, milk comes out of the mother’s nipples; however, the platypus (a non-placental mammal) releases milk through ducts in its abdomen. In only one species of mammal, the dayak fruit bat, is milk production a normal male function.

In some other mammals, the male may produce milk as the result of a hormone imbalance. This phenomenon may also be observed in newborn infants as well (for instance, witch’s milk).

Galactopoiesis is the maintenance of milk production. This stage requires prolactin and oxytocin.

**Preparation for Lactation**

By the fifth or sixth month of pregnancy, the breasts are ready to produce milk. During the latter part of pregnancy, the woman’s breasts enter into the lactogenesis I stage. This is when the breasts make colostrum, a thick, sometimes yellowish fluid.

At this stage, high levels of progesterone inhibit most milk production. It is not a medical concern if a pregnant woman leaks any colostrum before her baby’s birth, nor is it an indication of future milk production.

At birth, prolactin levels remain high, while the delivery of the placenta results in a sudden drop in progesterone, estrogen, and human placental lactogen levels. This abrupt withdrawal of progesterone in the presence of high prolactin levels stimulates the copious milk production of the lactogenesis II stage.

When the breast is stimulated, prolactin levels in the blood rise and peak in about 45 minutes, then return to the pre-breastfeeding state about three hours later. The release of prolactin triggers the cells in the alveoli to make milk.

**Colostrum**

Colostrum is the first milk a breastfed baby receives. It contains higher amounts of white blood cells and antibodies than mature milk, and is especially high in immunoglobulin A (IgA), which coats the lining of the baby’s immature intestines, and helps to prevent pathogens from invading the baby’s system. Secretory IgA also helps prevent food allergies. Over the first two weeks after the birth, colostrum production slowly gives way to mature breast milk

Normal lactation involves the female breast, anterior lobe of the pituitary, and the posterior lobe of the pituitary. Their roles in lactation are discussed below

Function

The decision to breastfeed or to provide breast milk via expression is a decision that every mother must make. Clinicians must inform our patients about all the benefits that breast milk can provide to their newborn. Breast milk provides ideal nutrition for infants with vitamins, proteins, and fats that are more easily digested than formula. Breast milk contains antibodies from the mother that help babies fight off viruses and bacteria. Other anti-infective factors it provides include immunoglobulin (IgA in particular), white blood cells, whey protein (lysozyme and lactoferrin), and oligosaccharides. It also lowers the baby's risk of asthma, allergies, ear infections, respiratory illnesses, bouts of diarrhea, and the risk of diabetes and obesity.

**Pathophysiology**

Lactogenesis is the process of developing the ability to secrete milk and involves the maturation of alveolar cells. It takes place in 2 stages: secretory initiation and secretory activation.

* Stage I lactogenesis (secretory initiation) takes place during the second half of pregnancy. The placenta supplies high levels of progesterone which inhibit further differentiation. In this stage, small amounts of milk can be secreted by week 16 gestation. By late pregnancy, some women can express colostrum.
* Stage II lactogenesis (secretory activation) starts with copious milk production after delivery. With the removal of the placenta at delivery, the rapid drop in progesterone, as well as the presence of elevated levels of prolactin, cortisol, and insulin, are what stimulate this stage. Usually, at days 2 or 3 postpartum, most women experience swelling of the breast along with copious milk production. In primiparous women, the secretory activation stage is slightly delayed, and early milk volume is lower. Lower milk volume is also observed in women who had cesarean births compared with those who delivered vaginally. Late onset of milk production has also been seen in women who have had retained placental fragments, diabetes, and stressful vaginal deliveries. With retained placental fragments, lactogenesis stage II could be inhibited by the continued secretion of progesterone and would continue to be inhibited until removal of the remaining placental fragments.

Lactation is maintained by regular removal of milk and stimulation of the nipple, which triggers prolactin release from the anterior pituitary gland and oxytocin from the posterior pituitary gland. For the ongoing synthesis and secretion of milk, the mammary gland must receive hormonal signals; and although prolactin and oxytocin act independently on different cellular receptors, their combined action is essential for successful lactation.

Prolactin is a polypeptide hormone synthesized by lactotrophic cells in the anterior pituitary and is structurally similar to growth hormone and placental lactogen. Prolactin is both positively and negatively regulated, but its main control comes from hypothalamic inhibitory factors such as dopamine which act on the D2 subclass of dopamine receptors present in lactotrophs. Prolactin stimulates mammary gland ductal growth and epithelial cell proliferation and induces milk protein synthesis. Emptying of the breast by the infant's suckling is thought to be the most important factor. Prolactin concentration increases rapidly with suckling of the nipple which stimulates nerve endings located there.

Oxytocin is involved in the milk ejection or letdown reflex. The tactile stimulation of the nipple-areolar complex by suckling leads to afferent signals to the hypothalamus that trigger release of oxytocin. This results in contraction of the myoepithelial cells, forcing milk into the ducts from the alveolar lumens and out through the nipple. Oxytocin also has a psychological effect, which includes inducing a state of calm, and reducing stress. It may also enhance feelings of affection between mother and child, an important factor in bonding.

Once lactation is established and maintained, production is regulated by the interaction of both physical and biochemical factors. If milk is not removed, elevated intramammary pressure and accumulation of a feedback inhibitor of lactation reduce milk production and initiate mammary involution. If breast milk is removed, the inhibitor is also removed, and secretion will resume. The role of the feedback inhibitor of lactation is to regulate the amount of milk produced which is determined by how much the baby takes, and therefore by how much the baby needs.

**PHYSIOLOGY OF PREGNANCY**

Pregnancy in the human female is an unusual state in which virtually all maternal systems are dramatically altered to permit the sustenance and growth of the intrauterine conceptus. In very real ways, the maternal organism is life-adapted.

Although pregnancy is unique in many ways, it is particularly so in being limited in time. Pregnancy is a temporary state with a definite point of onset and an equally definite termination. The duration of pregnancy in humans, marked from the first day of the last menstrual period, is classically 280 days. Recent studies, however, using computerized day-counting techniques, show an average duration of 284.2 days.

The changes brought about in the maternal organism by the state of pregnancy are important, because in many instances they mimic pathophysiologic responses to disease. If the constellation of changes occurring normally in pregnancy are misinterpreted as signs of disease processes, the gravid or puerperal woman may be subjected to diagnostic and therapeutic interventions that are not only unnecessary but may also be dangerous to mother and fetus.

During pregnancy, your growing uterus puts pressure on your veins making it harder for the blood to flow back to your heart. This causes the blood to pool in the veins making them swell.

PHYSIOLOGIC CHANGES OF PREGNANCY

Pregnancy causes physiologic changes in all maternal organ systems; most return to normal after delivery. In general, the changes are more dramatic in multifetal than in single pregnancies

**Cardiovascular**

Cardiac output (CO) increases 30 to 50%, beginning by 6 weeks gestation and peaking between 16 and 28 weeks (usually at about 24 weeks). It remains near peak levels until after 30 weeks

Then, CO becomes sensitive to body position. Positions that cause the enlarging uterus to obstructExercise increases CO, heart rate, oxygen consumption, and respiratory volume/min more during pregnancy than at other times the vena cava the most (eg, the recumbent position) cause CO to decrease the most. On average, CO usually decreases slightly from 30 weeks until labor begins. During labor, CO increases another 30%. The hyperdynamic circulation of pregnancy increases frequency of functional murmurs and accentuates heart sounds. X-ray or ECG may show the heart displaced into a horizontal position, rotating to the left, with increased transverse diameter. Premature atrial and ventricular beats are common during pregnancy.

**Urinary**

Changes in renal function roughly parallel those in cardiac function. Glomerular filtration rate (GFR) increases 30 to 50%, peaks between 16 and 24 weeks gestation, and remains at that level until nearly term, when it may decrease slightly because uterine pressure on the vena cava often causes venous stasis in the lower extremities

Postural changes affect renal function more during pregnancy than at other times; ie, the supine position increases renal function more, and upright positions decrease renal function more. Renal function also markedly increases in the lateral position, particularly when lying on the left side; this position relieves the pressure that the enlarged uterus puts on the great vessels when pregnant women are supine. This positional increase in renal function is one reason pregnant women need to urinate frequently when trying to sleep.

**Endocrine**

Pregnancy alters the function of most endocrine glands, partly because the placenta produces hormones and partly because most hormones circulate in protein-bound forms and protein binding increases during pregnancy. The placenta produces the beta subunit of human chorionic gonadotropin (beta-hCG), a trophic hormone that, like follicle-stimulating and luteinizing hormones, maintains the corpus luteum and thereby prevents ovulation. Levels of estrogen and progesterone increase early during pregnancy because beta-hCG stimulates the ovaries to continuously produce them. After 9 to 10 weeks of pregnancy, the placenta itself produces large amounts of estrogen and progesterone to help maintain the pregnancy. Increased production of corticosteroids and increased placental production of progesterone lead to insulin resistance and an increased need for insulin, as does the stress of pregnancy and possibly the increased level of human placental lactogen. Insulinase, produced by the placenta, may also increase insulin requirements, so that many women with gestational diabetes develop more overt forms of diabetes.

**Dermatologic**

Increased levels of estrogens, progesterone, and MSH contribute to pigmentary changes, although exact pathogenesis is unknown. These changes include

* Melasma (mask of pregnancy), which is a blotchy, brownish pigment over the forehead and malar eminences.
* Darkening of the mammary areolae, axilla, and genitals.
* Linea nigra, a dark line that appears down the midabdomen.

**Respiratory**

Lung function changes partly because progesterone increases and partly because the enlarging uterus interferes with lung expansion. Progesterone signals the brain to lower carbon dioxide (CO2) levels. To lower CO2 levels, tidal and minute volume and respiratory rate increase, thus increasing plasma pH. oxygen consumption increases by about 20% to meet the increased metabolic needs of the fetus, placenta, and several maternal organs. Inspiratory and expiratory reserve, residual volume and capacity, and plasma PCO2 decrease. Vital capacity and plasma PCO2 do not change. Thoracic circumference increases by about 10 cm. Thoracic circumference increases by about 10 cm.

Considerable hyperemia and edema of the respiratory tract occur. Occasionally, symptomatic nasopharyngeal obstruction and nasal stuffiness occur, eustachian tubes are transiently blocked, and tone and quality of voice change.

**Gastrointestinal (GI) and hepatobiliary**

As pregnancy progresses, pressure from the enlarging uterus on the rectum and lower portion of the colon may cause constipation. GI motility decreases because elevated progesterone levels relax smooth muscle. Heartburn and belching are common, possibly resulting from delayed gastric emptying and gastroesophageal reflux due to relaxation of the lower esophageal sphincter and diaphragmatic hiatus. Hydrochloric acid production decreases; thus, peptic ulcer disease is uncommon during pregnancy, and preexisting ulcers often become less severe.

**Sympathetic Activity and Baroreceptors**

During a normal pregnancy, vasomotor sympathetic activity is increased, and this increase occurs very early in pregnancy.It is postulated that when sympathetic activity is excessive, then gestational hypertension or preeclampsia may ensue. Normal pregnancy appears to be associated with increased maternal baroreceptor sensitivity and an attenuated responsiveness to α-adrenergic stimulation. In pregnant rats, decreased pressor responsiveness to angiotensin II, norepinephrine, and vasopressin has been observed, and this is improved with inhibition of prostaglandin production.