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**DEPARTMENT: HUMAN NUTRITION AND DIETETICS.**

**COURSE TITLE: ENDOCRINE PHYSIOLOGY**

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**ASSIGNMENT: DISCUSS LACTATION & GESTATION PERIOD INA NORMAL FEMALE.**

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**LACTATION**

Lactation describes the secretion of [milk](https://en.wikipedia.org/wiki/Milk) from the [mammary glands](https://en.wikipedia.org/wiki/Mammary_gland) and the period of time that a [mother](https://en.wikipedia.org/wiki/Mother) lactates to feed her young. The process naturally occurs with all post-[pregnancy](https://en.wikipedia.org/wiki/Pregnancy) [female mammals](https://en.wikipedia.org/wiki/Female_mammals), although it predates mammals. In humans the process of feeding milk is also called [breastfeeding](https://en.wikipedia.org/wiki/Breastfeeding) or nursing. Newborn infants often produce some milk from their own breast tissue, known colloquially as [witch's milk](https://en.wikipedia.org/wiki/Witch%27s_milk).

In most species, milk comes out of the mother's [nipples](https://en.wikipedia.org/wiki/Nipples); however, the [monotremes](https://en.wikipedia.org/wiki/Monotremes), egg-laying mammals, lack nipples and release milk through ducts in the abdomen. In only one [species](https://en.wikipedia.org/wiki/Species) of mammal, the [Dayak fruit bat](https://en.wikipedia.org/wiki/Dayak_fruit_bat) from [Southeast Asia](https://en.wikipedia.org/wiki/Southeast_Asia), is milk production a normal male function.

Galactopoiesis is the maintenance of milk production. This stage requires [prolactin](https://en.wikipedia.org/wiki/Prolactin). [Oxytocin](https://en.wikipedia.org/wiki/Oxytocin) is critical for the milk let-down reflex in response to [suckling](https://en.wikipedia.org/wiki/Suckling). [Galactorrhea](https://en.wikipedia.org/wiki/Galactorrhea) is milk production unrelated to nursing. It can occur in males and females of many mammal species as result of hormonal imbalances such as [hyperprolactinaemia](https://en.wikipedia.org/wiki/Hyperprolactinaemia).

### Hormonal influences

From the eighteenth week of [pregnancy](https://en.wikipedia.org/wiki/Pregnancy) (the second and third [trimesters](https://en.wikipedia.org/wiki/Physiology_of_pregnancy)), a woman's body produces [hormones](https://en.wikipedia.org/wiki/Hormone) that stimulate the growth of the [milk duct](https://en.wikipedia.org/wiki/Milk_duct) system in the [breasts](https://en.wikipedia.org/wiki/Breast):

* [Progesterone](https://en.wikipedia.org/wiki/Progesterone) influences the growth in size of [alveoli](https://en.wikipedia.org/wiki/Alveolar_gland) and lobes; high levels of progesterone inhibit lactation before birth. Progesterone levels drop after birth; this triggers the onset of copious milk production.[[4]](https://en.wikipedia.org/wiki/Lactation#cite_note-Mohrbacher_2003-4)
* [Estrogen](https://en.wikipedia.org/wiki/Estrogen) stimulates the milk duct system to grow and differentiate. Like progesterone, high levels of estrogen also inhibit lactation. Estrogen levels also drop at delivery and remain low for the first several months of breastfeeding.[[4]](https://en.wikipedia.org/wiki/Lactation#cite_note-Mohrbacher_2003-4) Breastfeeding mothers should avoid estrogen-based birth control methods, as a spike in estrogen levels may reduce a mother's milk supply.
* [Prolactin](https://en.wikipedia.org/wiki/Prolactin) contributes to the increased growth and differentiation of the alveoli, and also influences differentiation of ductal structures. High levels of prolactin during pregnancy and breastfeeding also increase insulin resistance, increase growth factor levels (IGF-1) and modify lipid metabolism in preparation for breastfeeding. During lactation, prolactin is the main factor maintaining [tight junctions](https://en.wikipedia.org/wiki/Tight_junction) of the ductal epithelium and regulating milk production through osmotic balance.
* [Human placental lactogen](https://en.wikipedia.org/wiki/Human_placental_lactogen) (HPL) – from the second month of pregnancy, the [placenta](https://en.wikipedia.org/wiki/Placenta) releases large amounts of HPL. This hormone is closely associated with prolactin and appears to be instrumental in breast, nipple, and areola growth before birth.
* [Follicle stimulating hormone](https://en.wikipedia.org/wiki/Follicle_stimulating_hormone) (FSH), [luteinizing hormone](https://en.wikipedia.org/wiki/Luteinizing_hormone) (LH), and [human chorionic gonadotropin](https://en.wikipedia.org/wiki/Human_chorionic_gonadotropin) (hCG), through control of estrogen and progesterone production, and also, by extension, prolactin and growth hormone production, are essential.
* [Growth hormone](https://en.wikipedia.org/wiki/Growth_hormone) (GH) is structurally very similar to prolactin and independently contributes to its galactopoiesis.
* [Adrenocorticotropic hormone](https://en.wikipedia.org/wiki/Adrenocorticotropic_hormone) (ACTH) and [glucocorticoids](https://en.wikipedia.org/wiki/Glucocorticoid) such as [cortisol](https://en.wikipedia.org/wiki/Cortisol) have an important lactation inducing function in several animal species, including humans. Glucocorticoids play a complex regulating role in the maintenance of tight junctions.
* [Thyroid-stimulating hormone](https://en.wikipedia.org/wiki/Thyroid-stimulating_hormone) (TSH) and [thyrotropin-releasing hormone](https://en.wikipedia.org/wiki/Thyrotropin-releasing_hormone%22%20%5Co%20%22Thyrotropin-releasing%20hormone) (TRH) are very important galactopoietic hormones whose levels are naturally increased during pregnancy.
* [Oxytocin](https://en.wikipedia.org/wiki/Oxytocin) contracts the [smooth muscle](https://en.wikipedia.org/wiki/Smooth_muscle) of the [uterus](https://en.wikipedia.org/wiki/Uterus) during and after birth, and during orgasm(s). After birth, oxytocin contracts the smooth muscle layer of band-like cells surrounding the alveoli to squeeze the newly produced milk into the duct system. Oxytocin is necessary for the milk ejection reflex, or let-down, in response to suckling, to occur.

It is also possible to [induce lactation](https://en.wikipedia.org/wiki/Lactation#Lactation_without_pregnancy,_induced_lactation,_relactation) without pregnancy. Protocols for inducing lactation are called the Goldfarb protocols. Using birth control pills to mimic the hormone levels of pregnancy, then discontinuing the birth control, followed by use of a double electric breast pump for 15 minute sessions at regular 2-3 hour intervals (100+ minutes total per day) helps to induce milk production.

**GESTATION**

Gestation is the period of [development](https://en.wikipedia.org/wiki/Prenatal_development) during the carrying of an [embryo](https://en.wikipedia.org/wiki/Embryo) or [fetus](https://en.wikipedia.org/wiki/Fetus) inside [viviparous](https://en.wikipedia.org/wiki/Viviparity) [animals](https://en.wikipedia.org/wiki/Animals). It is typical for [mammals](https://en.wikipedia.org/wiki/Mammal), but also occurs for some non-mammals. [Mammals during pregnancy](https://en.wikipedia.org/wiki/Pregnancy_%28mammals%29) can have one or more gestations at the same time, for example in a [multiple birth](https://en.wikipedia.org/wiki/Multiple_birth).

The time interval of a gestation is called the [gestation period](https://en.wikipedia.org/wiki/Gestation_period). In [human obstetrics](https://en.wikipedia.org/wiki/Obstetrics_and_gynecology), [gestational age](https://en.wikipedia.org/wiki/Gestational_age) refers to the [fertilization age](https://en.wikipedia.org/wiki/Human_fertilization#Fertilization_age) plus two weeks. This is approximately the duration since the woman's [last menstrual period (LMP)](https://en.wikipedia.org/wiki/Menstruation#Onset_and_frequency)) began.

Human pregnancy can be divided roughly into three trimesters, each approximately three months long. The first trimester is from the last period through the 13th week, the second trimester is 14th–27th week, and the third trimester is 28th–42nd week. Birth normally occurs at a [gestational age](https://en.wikipedia.org/wiki/Gestational_age) of about 40 weeks, though it is common for births to occur from 37 to 42 weeks. From the 9th week of pregnancy (11th week of [gestational age](https://en.wikipedia.org/wiki/Gestational_age)), the embryo is called a fetus.

Various factors can come into play in determining the duration of gestation. For humans, male fetuses normally gestate several days longer than females and [multiple pregnancies](https://en.wikipedia.org/wiki/Multiple_birth) gestate for a shorter period.

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.

The placenta produces a hormone (similar to thyroid-stimulating hormone) that stimulates the thyroid, causing hyperplasia, increased vascularity, and moderate enlargement. Estrogen stimulates hepatocytes, causing increased thyroid-binding globulin levels; thus, although total thyroxin levels may increase, levels of free thyroid hormones remain normal. Effects of thyroid hormone tend to increase and may resemble hyperthyroidism, with tachycardia, palpitations, excessive perspiration, and emotional instability. However, true hyperthyroidism occurs in only 0.08% of pregnancies.

The placenta produces corticotrophin-releasing hormone (CRH), which stimulates maternal adrenocorticotropic hormone (ACTH) production. Increased ACTH levels increase levels of adrenal hormones, especially aldosterone and cortisol, and thus contribute to edema.

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](https://www.msdmanuals.com/professional/gynecology-and-obstetrics/pregnancy-complicated-by-disease/diabetes-mellitus-in-pregnancy) develop more overt forms of [diabetes](https://www.msdmanuals.com/professional/endocrine-and-metabolic-disorders/diabetes-mellitus-and-disorders-of-carbohydrate-metabolism/diabetes-mellitus-dm).

The placenta produces melanocyte-stimulating hormone (MSH), which increases skin pigmentation late in pregnancy.

The pituitary gland enlarges by about 135% during pregnancy. The maternal plasma prolactin level increases by 10-fold. Increased prolactin is related to an increase in thyrotropin-releasing hormone production, stimulated by estrogen. The primary function of increased prolactin is to ensure lactation. The level returns to normal postpartum, even in women who breastfeed.