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ASSIGNMENT.

Write on the physiology of lactation and details on the physiology of pregnancy in a normal woman.

ANSWERS.

Physiology Of lactation.

**Lactation** is the process by which milk is synthesized and secreted from the mammary glands of the postpartum female breast in response to an infant sucking at the nipple. Breast milk provides ideal nutrition and passive immunity for the infant, encourages mild uterine contractions to return the uterus to its pre-pregnancy size {involution}, and induces a substantial metabolic increase in the mother, consuming the fat reserves stored during pregnancy. Galactopoiesis is the maintenance of milk production., this stage requires prolactin and oxytocin. The pituitary hormone **prolactin** is instrumental in the establishment and maintenance of breast milk supply. It also is important for the mobilization of maternal micronutrients for breast milk.

Near the fifth week of pregnancy, the level of circulating prolactin begins to increase, eventually rising to approximately 10–20 times the pre-pregnancy concentration. 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 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.

Milk Let-Down Reflex

Mechanical stimulation of nipple is responsible for milk delivery to infant and maintenance of lactation. Babies do not suck the milk out of the breast, it is ejected by the let-down reflex. In response to suckling, oxytocin is released from the pituitary gland which stimulates myoepithelial cells that surround alveoli to contract thus squeezing milk out of the breast.

Despite suckling being the major stimulus for milk let down, the reflex can be conditioned. The cry or sight of an infant and preparation of the breast for nursing may cause let down, whereas pain, embarrassment or alcohol may inhibit it.

Physiology Of Pregnancy.

Pregnancy is the time from fertilization of an egg, also known as conception to birth. Getting pregnant and growing a human from scratch is a very complicated biological process that takes a lot of resources, as a result, pregnancy can have a wide range of effects on the mother, both physically and emotionally.

Physiological Changes During Pregnancy.

Hormonal; Pregnant women experience numerous adjustments in their [endocrine system](https://en.wikipedia.org/wiki/Endocrine_system) that help support the developing fetus. The fetal-placental unit secretes steroid hormones and proteins that alter the function of various maternal [endocrine glands](https://en.wikipedia.org/wiki/Endocrine_gland). Sometimes, the changes in certain hormone levels and their effects on their target organs can lead to [gestational diabetes](https://en.wikipedia.org/wiki/Gestational_diabetes) and [gestational hypertension](https://en.wikipedia.org/wiki/Gestational_hypertension). When ovulation occurs an egg emerges from one of the ovaries leaving behind a structure called the corpus luteum. This structure produces large amount of progesterone and estrogen hormones that help prepare the implantation of a fertilized egg. The corpus luteum continues to maintain the hormone levels until the placenta develops and begins to secrete the necessary hormones itself. The corpus luteum typically disappears after 3 to 4 months. The levels of the progesterone and estrogen human chorionic gonadotropin doubles every two days in the first 10 weeks to prevent any further menstruation and to prepare the placenta.

Immune tolerance; The growing fetus is a foreign object, something that the immune system is programmed to attack and reject. In order to prevent this from happening, as soon as the embryo becomes implanted in the uterine wall, a key pathway that usually triggers the launch of an immune attack is turned off, making this part of the immune system dormant and preventing immune cells from targeting the fetus.

Cardiovascular; Cardiac output increases throughout early pregnancy, and peaks in the third trimester, usually to 30-50% above baseline. Estrogen mediates this rise in cardiac output by increasing the pre-load and stroke volume, mainly through a higher overall blood volume {which increases by 40–50%}. The heart rate increases, but generally not above 100 beats/ minute. Total systematic vascular resistance decreases by 20% secondary to the vasodilatory effect of progesterone. Overall, the systolic and diastolic blood pressure drops 10–15 mm Hg in the first trimester and then returns to baseline in the second half of pregnancy. All of these cardiovascular adaptations can lead to common complaints, such as palpitations, decreased exercise tolerance, and dizziness. Uterine enlargement beyond 20 weeks size can compress the inferior vena cava, which can markedly decrease the return of blood into the heart or preload. As a result, healthy pregnancy patients in a supine position or prolonged standing can experience symptoms of hypotension.

Hematologic; During pregnancy the [plasma](https://en.wikipedia.org/wiki/Blood_plasma) volume increases by 40-50% and the red blood cell volume increases only by 20–30%. These changes occur mostly in the second trimester and prior to 32 weeks gestation. Due to dilution, the net result is a decrease in hemoglobin, which are measures of red blood cell concentration. [Erythropoietin](https://en.wikipedia.org/wiki/Erythropoietin), which stimulates red blood cell production, increases throughout pregnancy and reaches approximately 150 percent of their pregnancy levels at term. The slight drop in hemoglobin is most pronounced at the end of the second trimester and slowly improves when reaching term. The white blood cell count increases with occasional appearance of myelocytes or metamyelocytes in the blood. During labor, there is a rise in leukocyte count.

Renal; Progesterone causes many changes to the genitourinary system. A pregnant woman may experience an increase in the size of the kidneys and ureter due to the increase blood volume and vasculature. Progesterone causes vasodilatation and increased blood flow to the kidneys, and as a result [glomerular filtration rate](https://en.wikipedia.org/wiki/Glomerular_filtration_rate) (GFR) commonly increases by 50%, returning to normal around 20 weeks [postpartum](https://en.wikipedia.org/wiki/Postpartum). The increased GFR increases the excretion of protein, albumin, and glucose. The increased GFR leads to increased urinary output, which the woman may experience as increased urinary frequency. Progesterone also causes decreased motility of the ureters, which can lead to stasis of the urine and hence an increased risk of urinary tract infection.

Respiratory; There are many physiologic changes that occur during pregnancy that influence respiratory status and function. Progesterone has noticeable effects on respiratory physiology, increasing [minute volume](https://en.wikipedia.org/wiki/Minute_ventilation) {the amount of air breathed in and out of the lungs in 1 minute} by 40% in the first trimester through an increase in [tidal volume](https://en.wikipedia.org/wiki/Tidal_volume) alone, as the respiratory rate does not change during pregnancy. As a result, [carbon dioxide](https://en.wikipedia.org/wiki/Carbon_dioxide) levels in the blood decrease and the [pH](https://en.wikipedia.org/wiki/PH) of the blood becomes more alkaline. This causes the maternal kidneys to excrete [bicarbonate](https://en.wikipedia.org/wiki/Bicarbonate) to compensate for this change in pH. The combined effect of the decreased serum concentrations of both carbon dioxide and bicarbonate leads to a slight overall increase in blood pH. As the uterus and fetus continue to enlarge over time, the diaphragm progressively becomes more upwardly displaced. This causes less space to be available for lung expansion in the chest cavity, and leads to a decrease in [expiratory reserve volume](https://en.wikipedia.org/wiki/Lung_volumes) and [residual volume](https://en.wikipedia.org/wiki/Lung_volumes). Oxygen consumption increases by 20% to 40% during pregnancy, as the oxygen demand of the growing fetus, placenta, and increased metabolic activity of the maternal organs all increase the pregnant person's overall oxygen requirements.

Metabolism; During pregnancy, both [protein metabolism](https://en.wikipedia.org/wiki/Protein_metabolism) and [carbohydrate metabolism](https://en.wikipedia.org/wiki/Carbohydrate_metabolism) are affected. One [kilogram](https://en.wikipedia.org/wiki/Kilogram) of extra [protein](https://en.wikipedia.org/wiki/Protein) is deposited, with half going to the [fetus](https://en.wikipedia.org/wiki/Fetus) and [placenta](https://en.wikipedia.org/wiki/Placenta), and another half going to [uterine](https://en.wikipedia.org/wiki/Uterus) contractile proteins, [breast glandular](https://en.wikipedia.org/wiki/Breast_gland) tissue, plasma protein, and [hemoglobin](https://en.wikipedia.org/wiki/Haemoglobin). An increased requirement for nutrients is given by fetal growth and fat deposition. Changes are caused by steroid hormones, lactogen, and cortisol. Maternal insulin resistance can lead to [gestational diabetes](https://en.wikipedia.org/wiki/Gestational_diabetes). Increased liver metabolism is also seen, with increased gluconeogenesis to increase maternal glucose levels.

Body Weight; Some degree of weight gain is expected during pregnancy. The enlarging uterus, growing fetus, [placenta](https://en.wikipedia.org/wiki/Placenta), [amniotic fluid](https://en.wikipedia.org/wiki/Liquor_amnii), normal increase in body fat, and increase in water retention all contribute weight gain during pregnancy. The amount of weight gain can vary from 5 pounds (2.3 kg) to over 100 pounds (45 kg).

Gastrointestinal; Changes in the gastrointestinal (GI) system during pregnancy are caused by the enlarging uterus and hormonal changes of pregnancy. Anatomically, the intestine and stomach are pushed up from their original positions by the enlarging uterus. While there aren't any intrinsic changes in the sizes of the GI organs, the portal vein increases in size due to the hyperdynamic state of pregnancy. Elevated levels of [progesterone](https://en.wikipedia.org/wiki/Progesterone) and [estrogen](https://en.wikipedia.org/wiki/Estrogen) mediate most of the functional changes of the GI system during pregnancy. Progesterone causes smooth muscle relaxation which slows down GI motility and decreases [lower esophageal sphincter](https://en.wikipedia.org/wiki/Lower_esophageal_sphincter) (LES) tone. The resulting increase in intragastric pressure combined with lower LES tone leads to the gastroesophageal reflux commonly experienced during pregnancy.

Musculoskeletal; The body's posture changes as the pregnancy progresses. The pelvis tilts and the back arches to help keep balance. Poor posture occurs naturally from the stretching of the woman's abdominal muscles as the fetus grows. These muscles are less able to contract and keep the lower back in proper alignment. The pregnant woman has a different pattern of gait. The step lengthens as the pregnancy progresses, due to weight gain and changes in posture. On average, a woman's foot can grow by a half size or more during pregnancy. In addition, the increased body weight of pregnancy, fluid retention, and weight gain lowers the arches of the foot, further adding to the foot's length and width. The influences of increased hormones such as [estrogen](https://en.wikipedia.org/wiki/Estrogen) and [relaxin](https://en.wikipedia.org/wiki/Relaxin) initiate the remodeling of soft tissues, cartilage and ligaments. Certain skeletal joints such as the [pubic symphysis](https://en.wikipedia.org/wiki/Pubic_symphysis) and [sacroiliac](https://en.wikipedia.org/wiki/Sacroiliac_joint) widen or have increased laxity. The addition of mass, particularly around the [torso](https://en.wikipedia.org/wiki/Trunk_%28anatomy%29), naturally changes a pregnant mother's [center of mass](https://en.wikipedia.org/wiki/Center_of_mass) (COM). The change in COM requires pregnant mothers to adjust their bodies to maintain [balance](https://en.wikipedia.org/wiki/Balance_%28ability%29).