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**Assignment Title:** Discuss lactation and gestation period in a normal female

**Course Title:** Physiology of Reproduction and Endocrine Organs

**Course Code:** PHS 204

**Question**

I expect more on the physiology of lactation and details on the physiology of pregnancy in a normal woman

**Answers**

**Lactation**: Lactation is the secretion of milk from specialized glands (mammary glands) to provide nourishment to offspring. Lactation is also the process of milk production; human milk is secreted by the mammary glands, which are located within the fatty tissue of the breast.

The hormone oxytocin is produced in response to the birth of a new baby, and it both stimulates uterine contractions and begins the lactation process. For the first few hours of nursing, a special fluid called colostrum is delivered; colostrum is especially high in nutrients, fats, and antibodies, to protect the newborn from infection. Thereafter, the amount of milk produced is controlled primarily by the hormone prolactin, which is produced in response to the length of time the infant nurses at the breast.

**Physiology of lactation**

The normal physiology of lactation is a process that begins to take effect well before the initial latch of the newborn infant. It requires the breast to change in composition, size, and shape during each stage of female development. Development includes puberty, pregnancy, and lactation. These stages are influenced by a cascade of physiologic changes that are crucial to successful breastfeeding. Breast size before pregnancy does not determine the amount of milk a woman will produce. The hormones during pregnancy include the following:

* **Estrogen** stimulates the ductile systems to grow, then estrogen levels drop after birth.
* **Progesterone** increases the size of alveoli and lobes.
* **Prolactin** contributes to increasing the breast tissue during pregnancy.
* **Alveoli** secrete milk and contract when stimulated.
* **Oxytocin** stimulates milk secretion and is released during the ‘let down’ or milk ejection reflex. After let down, milk travels into the ductules, then to the larger – lactiferous or mammary ducts.
* **Prolactin** levels rise with nipple stimulation.
* **Alveolar cells** make milk in response to prolactin when the baby sucks.
* **Oxytocin** causes the alveoli to squeeze the newly produced milk into the duct system.

**Lactation is under endocrine control. The two main hormones involved are prolactin and oxytocin.**

The chief function of lactation is to provide nutrition and immune protection to the young after birth.

Physiology of lactation Lactation and milk production goes into 3 stages:

 1. Lactogenesis I

 2. Lactogenesis II

 3. Lactogenesis III

Lactogenesis ( I & II ): milk supply is hormonally driven endocrine control system.

Lactogenesis III: switch to the autocrine (or local) control system.

The mother will start making colostrum about halfway through pregnancy (Lactogenesis I), but high levels of progesterone inhibit milk secretion. At birth, the delivery of the progesterone/estrogen placenta results in a sudden drop in Prolactin progesterone/estrogen levels ( Lactogenesis II).

After Lactogenesis II, there is a switch to the autocrine (or local) control system (Lactogenesis III ) Maintenance stage of milk production Milk removal is the primary control mechanism for supply. Under normal circumstances, the breasts will continue to make milk indefinitely as long as milk removal continues.

**The physiological basis of lactation**

It is divided into four phases which include:

1. Preparation of breasts (mammogenesis)
2. Synthesis and secretion from the breast alveoli (lactogenesis)
3. Ejection of milk (galactokinesis)
4. Maintenance of lactation (galactopoiesis)

**Gestation Period:** The unborn baby spends around 38 weeks in the uterus, but the average length of pregnancy or human gestation is 280 days, or 40 weeks, from the first day of the woman’s last menstrual period.

Pregnancy is counted from the first day of the woman’s last period, not the date of conception which generally occurs two weeks later. Since some women are unsure of the date of their last menstruation (perhaps due to period irregularities), a baby is considered full term if its birth falls between 37 to 42 weeks of its estimated due date.

**Physiology of Pregnancy in a normal woman**

Pregnancy is the time from fertilization of an egg, also known as conception, to birth.

The physiology of pregnancy prepares a woman's body to lactate and breastfeed.

**Physiological changes that occur during pregnancy include:**

**Hormonal:** The menstrual cycle refers to the normal changes in your ovaries and uterus that make an egg accessible for fertilization and prepare your uterus for pregnancy. It typically occurs once every 28 days. If you are ovulating normally, an egg, or ovum emerges from one or other of your ovaries, leaving behind a structure called the corpus luteum. This structure produces large amounts of progesterone and estrogen, hormones that help prepare your uterus for implantation of a fertilized egg. If the egg is not fertilized, the corpus luteum degenerates, causing progesterone and estrogen levels to drop, and menstruation to begin. If the ovum is fertilized, on the other hand, the corpus luteum remains intact and continues to maintain the hormone levels you need to keep your uterus baby-friendly. Eventually, the placenta develops the ability to secrete the necessary hormones itself, and the corpus luteum typically disappears after 3 to 4 months.

In addition to progesterone and estrogen, human chorionic gonadotropin also spikes in early pregnancy. The levels of this hormone double every two days in the first 10 weeks of pregnancy. Its primary role is to prevent any further menstruation, and to prepare the placenta - the organ that connects the fetus to the uterus. The placenta allows the fetus to be supplied with nutrients and oxygen, as well as providing a route for the removal of toxic waste products.

**Immune tolerance:** Your growing fetus is a foreign object, something that your immune system is normally 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 your immune system dormant, and preventing immune cells from targeting the fetus or placenta. In addition to making it possible for you to grow your baby, there can be secondary benefits of pregnancy-related changes in immune function. In particular, women suffering from diseases caused by immune disorders, such as rheumatoid arthritis, multiple sclerosis, and psoriasis, may find relief from disease symptoms during pregnancy due to increased levels of anti-inflammatory steroids that occur naturally.

**Cardiovascular**: During pregnancy, your cardiac output - the amount of blood your heart pumps around your body per minute - increases to meet the needs of the developing fetus, and to provide the volume of blood necessary to fill the uteroplacental circulation. This is achieved by increasing the stroke volume, which is the amount of blood pumped out of your heart with each heartbeat.

**Hematologic**: As cardiac output increases, blood volume increases to match. This is due to a 50% increase in the volume of your plasma (the clear, yellowish fluid of your blood), and a 20% increase in the number of red and white blood cells. Overall, this has the effect of diluting the blood, often resulting in “physiological anemia of pregnancy” (a relative deficiency of red blood cells). Iron requirements increase during pregnancy as the fetus and placenta grow, and as the red blood cell numbers rise. Iron is essential for red blood cell production, and supplements are often needed as the amount of iron absorbed from the diet and recruited from iron stores is often not enough. Several hormones are thought to play a role in changing blood composition to support pregnancy including the renin-angiotensin-aldosterone hormonal system, atrial natriuretic peptide, estrogen, and progesterone, although exactly how they do this is not clear. Whatever the mechanism, the increased blood volume is very important as it ensures that the extra blood needed to supply the growing uterus and placenta is available, and can help protect the mother against normal blood loss that occurs while giving birth.

**Renal:** The kidney is responsible for filtering waste products from the blood, and regulating blood pressure and electrolytes; for example, sodium (Na+), potassium (K+) and calcium (Ca2+). During pregnancy, changes in kidney function approximately follow changes in cardiac function - both organs work considerably harder. By around the 20th week, and sometimes as early as the 8th to 10th week of pregnancy, the kidneys are filtering 30% to 50% more blood than before you were pregnant. The effects of this are greater reabsorption of sodium, and increased elimination of sugars (glycosuria), amino acids (aminoaciduria), and creatinine in your urine (creatinine clearance tests are often used by doctors as a measure of how well your kidneys are working). After about the 12th week of pregnancy, progesterone, a smooth muscle relaxant, causes the tubes that transport urine from the kidneys to the bladder, called the ureters, to dilate. As your uterus expands, it may compress the dilated ureters, obstructing the flow of urine to your bladder, and increasing the chances that you get a urinary tract, or kidney infection while you are pregnant. Laying down on your side can help relieve the pressure on your major blood vessels letting your kidneys work more effectively. However, this can make for a lot of urine production and toilet breaks during the night when you are trying to sleep.

**Respiratory**: Breathing exercises are often practised by expectant mothers to use during labour and birth, but this isn’t the only way changes in respiration are helpful. As with your other organs, the growing uterus begins to invade the space normally reserved for your lungs, which restricts their expansion during normal breathing. Once again, progesterone, the multi-talented pregnancy hormone gets to work, triggering your lungs to increase the amount of air inhaled with each breath - the tidal volume - as well as the number of breaths per minute - the respiratory rate.This increases the oxygen supply required to meet the metabolic needs of the fetus, placenta and other organs.

**Metabolic**: Changes in metabolism during pregnancy alter the distribution of body fat, as well as how you digest and process food. While accumulating fats and nutrients is necessary for the healthy growth of your baby, metabolic changes can also affect the way in which medications are processed. As such, it is important to know how your pregnant body may respond to any drugs or homeopathic remedies you may be taking, and whether or not this could have an effect on your growing baby.

**Body weight:** Supporting the growth of a developing fetus takes a lot of energy, so it’s not surprising that more calories are required during pregnancy. In fact, after the first three months (trimester) your appetite generally increases so that you are consuming about 300 extra calories a day. Although in the first trimester you can expect to gain just a few pounds, it’s normal to gain about a pound per week for the rest of your pregnancy. In addition to weighing more, you can expect your breasts to grow around 1 to 2 cup sizes in preparation for breastfeeding.

**Gastrointestinal**: As your uterus grows, it puts pressure on your digestive organs including your colon, gallbladder, liver, and stomach. This can impair their function, and lead to constipation, gallstones, reduced bile transport, as well as a general slowing of the digestive process that is related to lower levels of the hormone gastrin. Gastrin stimulates the secretion of stomach acid, which in turn leads to the production of pepsin, an enzyme that digests proteins in your food - less gastrin leads to slower digestion. In addition to this, elevated progesterone levels during pregnancy slacken the cardiac sphincter, the “door” between your esophagus and stomach, making it open more easily. It is very common to experience heartburn due to acid reflux into your esophagus during the third trimester, as the cardiac sphincter cannot withstand the pressure that builds up in your stomach as your uterus grows. Its also worth noting that taking analgesics during pregnancy may not be for the best, as they can slow down gastric emptying even more, creating an even higher pressure that the cardiac sphincter must withstand.

**Musculoskeletal**: Numerous anatomical and physiological changes occur during pregnancy that strain the muscles and skeleton, particularly the pelvis, and which may lead to lower-back pain, leg cramps, and hip pain. One of the hormones responsible for musculoskeletal changes during pregnancy is relaxin, which softens your ligaments and cartilage tissues to help your body accommodate your growing baby. In addition to relaxin’s relaxing effects, the arrangement of the abdominal muscles themselves is particularly well adapted for childbearing. Unlike in men, where they form a “six pack”, women’s abdominal muscles are positioned to allow them to stretch around a baby-bump.

**Integumentary**: The integumentary system consists of your skin, hair and nails, as well as underlying connective tissue that attaches your skin to your body and various glands including sweat and oil producing glands, and your mammary glands. As your pregnancy proceeds, your skin stretches to accommodate your growing uterus and breast tissue. Sometimes the stretching can tear the underlying connective tissue causing red or purple marks to appear on your abdomen, commonly known as stretch marks. In addition, increased estrogen levels during pregnancy increases the production of melanin, the pigment that gives human skin and hair its color. This often causes the ring of colour around your nipples (areolae) to darken, and may create a line of pigment that typically runs from your navel to your pubic bone. Its also possible you may develop patchy discoloration of your face and darkening of any moles and freckles. Other integumentary changes that may occur during pregnancy include accelerated nail growth and excessive hair growth in unusual places, while increased blood supply to your skin often leads to increased perspiration. Finally, while it’s commonly said that pregnancy makes your skin clear and radiant, it’s also possible for it to become oily and acne prone.