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**MATRIC NUMBER: 18/MHS07/016**

**COLLEGE: MEDICINE AND HEALTH SCIENCE**

**DEPARTMENT: PHARMACOLOGY**

**COURSE CODE: PHS 204**

**COURSE-TITLE: PHYSIOLOGY OF REPRODUCTION AND ENDOCRINE SYSTEM.**

**DATE: 23<sup>RD</sup> APRIL 2020- 10<sup>TH</sup> MAY 2020**

**ASSIGNMENT: I EXPECT MORE ON THE PHYSIOLOGY OF LACTATION AND DETAILS IN THE PHYSIOLOGY OF PREGNANCY IN A NORMAL WOMAN.**

**PHYSIOLOGY OF LACTATION**

Lactation requires the breast to change in composition, size and shape during each stage of female development. The developments includes puberty, pregnancy and lactation. Lactation is the process by which the mammary gland develops the ability to secrete milk and the process of milk production. Breast milk provides ideal nutrition and passive immunity for infants, it encourages mild uterine contraction to return the uterus to its pre-pregnancy size and induces a substantial metabolic increase in the mother, consuming the fat reserves stored during pregnancy. Lactation is under endocrine control. The two main hormones involved in lactation are prolactin and oxytocin. Lactogen stimulates pregnancy. The changes to the mammary gland for milk production begins during the last stage pregnancy. Lactation induces a period of infertility which serves to provide the optimal birth spacing for survival of the offspring less likely till the infant stops suckling. The process of lactation can be negatively affected by anything that interrupts the normal development of the female breast or that interferes with the production of milk. When women have had breast augmentation may experience issues with lactation and breast feeding but this is dependent on the location of the incision. Incision made in the armpit are more favourable for normal breastfeeding while the smile incision on around the areola increases the women's risk of having breastfeeding issues. Some women may experience difficulty with lactation if they have inadequate milk caloric intake to meet demands. The food a baby is provided with through lactation is derived from the mother so it is expected that the mother would avoid any substance that can affect the normal functioning of the child e.g hard drugs, smoking and some skin care products etc.

## **Preparation for lactation**

By the fifth or sixth month of pregnancy, the breast are ready to produce milk, during the later part of pregnancy, the woman breast enter into the lactogenesis stage. This is when the breast makes colostrums, a thick sometimes yellowish fluid. At this stage, most milk production is inhibited by high level of progesterone. At birth, prolactin level remains high while the delivery of the placenta results in a sudden drop in progesterone, estrogen and human placenta lactogen levels. This abrupt withdrawal of progesterone in the presence of high prolactin levels stimulates the copious milk production of the lactogenesis 2<sup>nd</sup> stage. When the breast is stimulated, prolactin level in the blood rise and peak in for about 45 minutes then returns to the pre-breastfeeding state, about three hours later the release of prolactin triggers the cells in the alveoli to make milk. A positive feed back loop ensures continues milk production as long as the infant continues to breast feed. If suckling stops, milk production cease gradually. This is due to the turgor induced damage to secretory cells and low prolactin levels. Milk suppression can also be achieved by steroids. Maternal breast milk will provide vitamins, minerals, protein and anti-infectious factors; antibodies that protect the infant's gastrointestinal tract, resulting in a lower rate of enteric infection in breast-fed than in bottle-fed babies. The bonding that is established through breast feeding for the mother and child is advantageous.

**Properties of milk:** milk can be regarded as an emulsion of fat globules in a

colloidal solution of protein together with other substances in true solution. Two constituents of the milk; the protein casein and the sugar or lactose are not found elsewhere in the body.

## PHYSIOLOGY OF PREGNANCY

Pregnancy begins from conception and ends at birth. Each egg released during menstrual cycle travels to the uterus. On reaching the uterus, fertilization occurs and the egg develops to a tiny embryo. The embryo implants itself in the uterine wall, then develops into a fetus and grows steadily. Until about nine months later it emerges into the outside world as a newborn baby. Fertilization triggers changes in the production of various hormones and hormone changes evolve and persist throughout. Pregnancy helps in the healthy growth of the baby. Pregnancy changes also cause unpleasant side effects; missed period, many women experience tender, swollen breast, fatigue, nausea, vomiting, morning sickness during the few weeks of becoming pregnant. The changes during pregnancy that a woman's body undergoes to accommodate the growing embryo or fetus are of different categories; behavioral (brain), cardiovascular, hematology, metabolism, renal, posture and respiratory changes.

**Hormonal changes that occur during pregnancy:** An egg or ovum emerges from the ovaries leaving behind a structure called corpus luteum. The structure produces large amount of progesterone and estrogen; these hormones prepare the uterus for the implantation of a fertilized egg. If the egg doesn't get fertilized, the corpus luteum degenerates causing a drop in

estrogen and progesterone level. But, if the egg is fertilized the corpus remains and continues to maintain the hormone level need to keep the uterus baby friendly. The placenta eventually develops and secretes the necessary hormones then corpus luteum disappears after 3 to 4 months. In addition to progesterone and estrogen, human chorionic gonadotropin hormone also spikes in the early pregnancy. The level of this hormone doubles, every two days in the first 10 weeks of pregnancy. It's primary role is to prevent menstruation and to prepare the placenta to connect to the fetus. The placenta supplies the fetus with nutrients and oxygen. it also removes toxic waste products.

**Cardiovascular changes that occur during pregnancy:** The heart adapts to the increased cardiac demand that occurs during pregnancy in many ways.

- Cardiac output( lit/min): 6.26
- Stroke volume (ml): 75
- Heart rate ( per min): 85
- Blood pressure: unaffected

The 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 via higher overall blood volume. The heart rate increases but generally not above 100 beats/minute. Total systematic vascular resistance decreases by 20% secondary to the vasodilatory affect by progesterone. The systolic and diastolic blood pressure drops 10 -15 mmHg in the first trimester and then returns to baseline in the

second half of pregnancy. All the cardiovascular adaptation 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 decrease the return of blood into the heart or preload. This makes healthy pregnant patients in a supine position or prolonged standing can experience symptoms of hypotension.

**Hematology changes that occur during pregnancy:** During pregnancy, the 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, hamatocrit decreases while the erythropoietin increases throughout pregnancy and it reaches approximately 150 percent. The slight drop in hematocrit is most pronounced at the end of the second trimester and slowly improves when reaching term.

- **Platelet and white blood cell count:** The effect of pregnancy on platelet count is unclear. The white bold cell count increases with occasional appearance of myelocytes or metamyelocytes in the blood. During labor, there is rise in leukocyte count.
- **Hyper-coagulability:** A pregnant woman is hyper-coagulated leading to increased risk for developing blood clot and embolism. Women 4 – 5 times more likely to develop a clot during pregnancy and in the post natal period than when they are not pregnant. Hyper-coagulation in pregnancy protects women from hemorrhage at the time of miscarriage or childbirth. Factors that increase clot in pregnancy are baseline thrombophillia, caserean section, preeclampsia etc. clot

usually develops in the left leg of left iliac/ femoral venous system.

- **Edema:** Edema or swelling of the feet is common during pregnancy, partly because of the enlarging uterus compresses the veins and lymphatic drainage from the legs.

**Metabolic changes that occur during pregnancy:** During pregnancy, both protein and carbohydrate metabolism are affected. An increased requirement for nutrients is given by fetal growth and fat deposition. Metabolic changes are caused by steroid hormones, lactogen and cortisol.

- **Body weight:** Some increase in weight gain is seen as normal during pregnancy because the enlarging uterus, growing fetus, placenta, amniotic fluid, normal increase in body fat, increase in water retention can all contribute to weight gain during pregnancy.
- **Nutrition:** All patients are advised to take prenatal vitamins to compensate for the increased nutritional requirements. The use of omega 3 fatty acids supports mental and development of infants. choline supplementation of research mammals support mental development that last throughout life.

**Renal changes that occur during pregnancy:** Progesterone causes many changes to the genitourinary system. A pregnant woman may experience an increase in the size of the kidney and ureter due to an increased blood volume and vasculature. Progesterone causes vasodilation and increased blood flow to the kidney due to the glomerular filtration rate (GFR) commonly increased by 50% returning to normal at postpartum. The increased GFR increases the excretion of

protein, albumin and glucose. The increased GFR leads to increased urinary output which causes the women to experience increased urinary frequency. Progesterone also causes decreased motility of the ureter which can lead to stasis of the uterine and hence an increased risk of urinary tract infection.

**Gastrointestinal changes that occur during pregnancy:**The gastrointestinal changes are caused by enlarging of the uterus and hormonal changes of pregnancy. The elevated levels of the progesterone and 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 (LES) tone. The increased occurrence of gallstone during pregnancy is due to the inhibition of gallbladder contraction and reduced biliary transportation of bile which results in cholestasis of pregnancy. Nausea and vomiting of pregnancy commonly known as “morning sickness” is one of the common GI symptoms of pregnancy. It begins between the 4<sup>th</sup> and 8<sup>th</sup> weeks of pregnancy and usually subsides by the 14<sup>th</sup> to 16<sup>th</sup> weeks. The cause of nausea relates with the rise in the level of human chorionic gonadotropin, progesterone and the resulting relaxation of smooth muscle of the stomach. Constipation is another GI symptoms that occurs during pregnancy. It is associated with the narrowing colon as it gets pushed by the growing uterus found adjacent, it leading to mechanical blockade. Dietary craving is common in pregnancy, it is thought that certain foods might relieve nausea. Pica is the intense craving for un-usual materials such as clay and ice .

**Respiratory changes that occur during pregnancy:**There are various



physiological changes that affect respiration. progesterone affects the respiratory physiology during pregnancy, increasing minute volume by 40% in the first trimester via an increase in tidal volume alone as the respiratory rate does not change during pregnancy. Oxygen consumption increases by 20% to 40% during pregnancy as the oxygen demand for the growing fetus, placenta and increased metabolism activity of the maternal organs all increase the pregnant person's overall oxygen requirements.