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**DEPARTMENT: NURSING**

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**COURSE TITLE: PYSIOLOGY**

**ASSIGNMENT**

1. Elucidate the physiological adaptation of the female to pregnancy?

**The physiological adaptation of the female to pregnancy**

 Pregnancy is a unique and important transition in a woman’s life. It involves substantial physiological, psychological and intrapersonal changes and its psychological consequences are described as a continuum of emotions ranging from happiness and joy to considerable burden caused by physical strain and psychosocial disorder. Psychosocial adaptation to pregnancy in women without children means the quality of coping with the transitory state between the two lifestyles of being a woman without children to the life of being a mother. This is developmental process with several incremental steps and no chance of returning to the former self. Psychosocial adaptation to pregnancy affects the physical and mental health of the pregnant woman and appears to influence the health of her developing baby. To understand the quality of psychosocial adaptation to pregnancy and its effects in birth outcomes, a variety of factors, including a woman's sociocultural milieu, need to be considered. Self‐efficacy is a dynamic cognitive process that can be described as a personal conviction to perform a required behavior in a given situation successfully.

In summary, emotional well‐being during pregnancy can be described by the extent of birth anxiety, self‐efficacy, and the quality of psychosocial adaptation to pregnancy in which these variables are influenced by a wide range of psychological, medical, and social factors. This prospective longitudinal study has two main aims. First of all, possibly occurring changes of emotional well‐being in primiparous healthy women during the final trimenon will be described by assessing the extent of birth anxiety, self‐efficacy, and psychosocial adaptation to pregnancy. Second, predictors of the assessed emotional well‐being during the final trimenon of pregnancy as well as for the psychological status postpartum will be shown.

Maternal physiological changes in pregnancy are the adaptations during pregnancy that a woman's body undergoes to accommodate the growing embryo or fetus. These physiologic changes are entirely normal, and include behavioral (brain), cardiovascular (heart and blood vessel), hematologic (blood), metabolic, renal (kidney), posture, and respiratory (breathing) changes. Increases in blood sugar, breathing, and cardiac output are all expected changes that allow a pregnant woman's body to facilitate the proper growth and development of the embryo or fetus during the pregnancy. The pregnant woman and the placenta also produce many other hormones that have a broad range of effects during the pregnancy.

**Hormonal**

Pregnant women experience numerous adjustments in their 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. Sometimes, the changes in certain hormone levels and their effects on their target organs can lead to gestational diabetes and gestational hypertension.

**Fetal-placental unit**

Levels of progesterone and estrogen rise continually throughout pregnancy, suppressing the hypothalamic axis and subsequently the menstrual cycle. The progesterone is first produced by the corpus luteum and then by the placenta in the second trimester. Women also experience increased human chorionic gonadotropin (β-hCG), which is produced by the placenta.

**Pancreatic Insulin**

The placenta also produces human placental lactogen (hPL), which stimulates maternal lipolysis and fatty acid metabolism. As a result, this conserves blood glucose for use by the fetus. It can also decrease maternal tissue sensitivity to insulin, resulting in gestational diabetes.

### Pituitary gland

The pituitary gland grows by about one-third as a result of hyperplasia of the lactrotrophs in response to the high plasma estrogen. Prolactin, which is produced by the lactrotrophs increases progressively throughout pregnancy. Prolactin mediates a change in the structure of the breast mammary glands from ductal to lobular-alveolar and stimulates milk production.

**Parathyroid**

Fetal skeletal formation and then later lactation challenges the maternal body to maintain their calcium levels. The fetal skeleton requires approximately 30 grams of calcium by the end of pregnancy. The mother's body adapts by increasing parathyroid hormone, leading to an increase in calcium uptake within the gut as well as increased calcium reabsorption by the kidneys. Maternal total serum calcium decreases due to maternal hypoalbuminemia, but the ionized calcium levels are maintained.

**Adrenal glands**

Total cortisol increases to three times of non-pregnant levels by the third trimester. The increased estrogen in pregnancy leads to increase corticosteroid-binding globulin production and in response the adrenal gland produces more cortisol. The net effect is an increase of free cortisol. This contributes to insulin resistance of pregnancy and possibly striae. Despite the increase in cortisol, the pregnant mom does not exhibit Cushing syndrome or symptoms of high cortisol. One theory is that high progesterone levels act as an antagonist to the cortisol.

The adrenal gland also produces more aldosterone, leading to an eight-fold increase in aldosterone. Women do not show signs of hyperaldosterone, such as hypokalemia, hypernatremia, or high blood pressure.

The adrenal gland also produces more androgens, such as testosterone, but this is buffered by estrogen's increase in sex-hormone binding globulin (SHBG). SHBG binds avidly to testosterone and to a lesser degree DHEA.

**Thyroid**

The thyroid enlarges and may be more easily felt during the first trimester. The increase in kidney clearance during pregnancy causes more iodide to be excreted and causes relative iodine deficiency and as a result an increase in thyroid size. Estrogen-stimulated increase in thyroid-binding globulin (TBG) leads to an increase in total thyroxine (T4), but free thyroxine (T4) and triiodothyronine (T3) remain normal.

**Breast size**

A woman's breasts grow during pregnancy, usually 1 to 2 cup sizes and potentially several cup sizes. A woman who wore a C cup bra prior to her pregnancy may need to buy an F cup or larger bra while nursing. A woman's torso also grows and her bra band size may increase one or two sizes. An average of 80% of women wear the wrong bra size, and mothers who are preparing to nurse can benefit from a professional bra fitting from a lactation consultant. Once the baby is born up to about 50–73 hours after birth, the mother will experience her breasts filling with milk (sometimes referred to as “the milk coming in”). Once lactation begins, the woman's breasts swell significantly and can feel achy, lumpy and heavy (which is referred to as engorgement). Her breasts may increase in size again by an additional 1 or 2 cup sizes, but individual breast size may vary depending on how much the infant nurses from each breast. A regular pattern of nursing is generally established after 8–12 weeks, and a woman's breasts will usually reduce in size, but may remain about 1 cup size larger than prior to her pregnancy. Changes in breast size during pregnancy may be related to the sex of the infant, as mothers of female infants have greater changes in breast size than mothers of male infants.

**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 via 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.

**Hematology**

**Blood volume and hemoglobin concentration**

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, the net result is a decrease in hematocrit or hemoglobin, which are measures of red blood cell concentration. 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 hematocrit or hemoglobin is most pronounced at the end of the second trimester and slowly improves when reaching term.

**Platelet and white cell count**

The effect of pregnancy on platelet count is unclear, with some studies demonstrating a mild decline in platelet count and other studies that show no effect.[19] The white blood cell count increases with occasional appearance of myelocytes or metamyelocytes in the blood.[19] During labor, there is a rise in leukocyte count.

**Hypercoagulability**

A pregnant woman will also become hypercoagulable, leading to increased risk for developing blood clots and embolisms, such as deep vein thrombosis and pulmonary embolism. Women are 4-5 times more likely to develop a clot during pregnancy and in the postpartum period than when they are not pregnant. Hypercoagulability in pregnancy likely evolved to protect women from hemorrhage at the time of miscarriage or childbirth. In third world countries, the leading cause of maternal death is still hemorrhage. In the United States 2011-2013, hemorrhage made up of 11.4% and pulmonary embolisms made up of 9.2% of all pregnancy-related deaths.

The increased risk of clots can be attributed to several things. Plasma levels of pro-coagulantion factors increased markedly in pregnancy, including: von Willebrand Factor, fibrinogen, factor VII, factor VIII, and factor X. Both the production of prostacyclin (an inhibitor of platelet aggregation) and thromboxane (an inducer of platelet aggregation and a vasoconstrictor) are increased, but overall there is an increase in platelet reactivity which can lead to a predisposition to clots. There is also increased blood stasis due to the compression of the vena cava by the enlargening uterus. Many factors have been shown to increase the risk of clots in pregnancy, including baseline thrombophillia, cesarean section, preeclampsia, etc. Clots usually develop in the left leg or the left iliac/ femoral venous system. Recently, there have been several case reports of May-Thurner Syndrome in pregnancy, where the right common iliac artery compresses the below left common iliac vein.

**Edema**

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

**Metabolic**

During pregnancy, both protein metabolism and carbohydrate metabolism are affected. One kilogram of extra protein is deposited, with half going to the fetus and placenta, and another half going to uterine contractile proteins, breast glandular tissue, plasma protein, and 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. 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, amniotic fluid, 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). In the United States, the range of weight gain that doctors generally recommend is 25 pounds (11 kg) to 35 pounds (16 kg), less if the woman is overweight, more (up to 40 pounds (18 kg)) if the woman is underweight.

**Nutrition**

Nutritionally, pregnant women require a caloric increase of 350 kcal/day and an increase in protein to 70 or 75 g/day. There is also an increased folate requirement from 0.4 to 0.8 mg/day (important in preventing neural tube defects). On average, a weight gains of 20 to 30 lb (9.1 to 13.6 kg) is experienced.

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 visual development of infants. Choline supplementation of research mammals supports mental development that lasts throughout life.