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**COURSE TILTE: PHYSIOLOGY**

Maternal physiological changes in pregnancy are entirely normal and serve as adaptations to better accommodate embryonic/fetal development. Maternal physiological changes in pregnancy are the normal adaptations that a woman undergoes during pregnancy to better accommodate the embryo or fetus, and include cardiovascular, hematologic, metabolic, renal, and respiratory changes. The female body must change its physiological and homeostatic mechanisms in pregnancy to ensure proper fetal development. Increases in blood sugar, breathing, and cardiac output are all required.

* As the fetus grows and develops, several anatomical changes must occur to the female body to accommodate the growing fetus, including placental development, weight gain, abdominal extension, breast enlargement, glandular development, and posture changes.
* During the second trimester, morning sickness subsides, the uterus expands up to 20 times its normal size, breasts enlarge, and movements of the fetus may be felt.
* During the third trimester the fetus grows most rapidly and final weight gain occurs. The abdomen drops and fetal movement can become quite strong. The woman feels ready to give birth.
* Women undergo several changes during pregnancy, including cardiovascular, hematologic, metabolic, renal, and respiratory changes that provide adequate nutrition and gas exchange for the developing fetus.
* Progesterone and estrogen levels rise continually through pregnancy, together with blood sugar, breathing rate, and cardiac output.
* The body’s posture changes during pregnancy to accommodate the growing fetus and the mother will experience weight gain.
* Breasts grow and change in preparation for lactation once the infant is born. Once lactation begins, the woman’s breasts swell significantly and can feel achy, lumpy, and heavy (engorgement). This is relieved by nursing the infant.
* Plasma and blood volume increase over the course of the pregnancy and lead to changes in heart rate and blood pressure. Women may also have a higher risk of blood clots, especially in the weeks following labour.

**Hormonal Changes**

* Pregnant women experience adjustments in their endocrine system. Levels of progesterone and oestrogens rise continuously throughout pregnancy to suppress the hypothalamic axis and, subsequently, the menstrual cycle.
* Estrogen produced by the placenta is associated with fetal wellbeing. Women also experience an increase in human chorionic gonadotropin (β-hCG), which is produced by the placenta and maintains progesterone production by the corpus luteum.
* The increase in progesterone production primarily functions to relax smooth muscles. Prolactin levels increase due to maternal pituitary gland enlargement that mediate a change in the structure of the mammary gland from ductal to lobular-alveolar.
* Human placental lactogen (HPL) is produced by the placenta, stimulating lipolysis and fatty acid metabolism by the woman and conserving blood glucose for use by the fetus. It can also decrease maternal tissue sensitivity to insulin and result in gestational diabetes.

**Weight Changes**

* The weight gain varies and can be anywhere from five pounds (2.3 kg) to over 100 pounds (45 kg). In the U.S., the doctor-recommended weight gain range 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.
* A woman’s breasts grow during pregnancy, usually one to two cup sizes, but possibly larger. 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 women’s torso also grows and her bra band size may increase one or two sizes.
* Once the baby is born (about 50 to 73 hours after birth), the mother will experience her breasts filling with milk, at which point changes in the breast happen very quickly. Once lactation begins, the woman’s breasts swell significantly and can feel achy, lumpy, and heavy (engorgement). Her breasts may increase again in size.

**Circulatory Changes**

* Plasma and blood volume slowly increase by 40–50% over the course of the pregnancy (due to increased aldosterone) to accommodate the changes, resulting in an increase in heart rate (15 beats/min more than usual), stroke volume, and cardiac output. Cardiac output increases by about 50%, primarily during the first trimester.
* The systemic vascular resistance also drops due to the smooth muscle relaxation and overall vasodilation caused by elevated progesterone, leading to a fall in blood pressure. Diastolic blood pressure consequently decreases between 12–26 weeks, and increases again to pre-pregnancy levels by 36 weeks.
* Edema (swelling) of the feet is common during pregnancy, partly because the enlarging uterus compresses veins and lymphatic drainage from the legs.
* A pregnant woman will also become hypercoagulable, leading to increased risk for developing blood clots and embolisms due to increased liver production of coagulation factors. Women are at highest risk for developing clots (thrombi) during the weeks following labour.
* Clots usually develop in the left leg or the left iliac venous system because the left iliac vein is crossed by the right iliac artery. The increased flow in the right iliac artery after birth compresses the left iliac vein leading to an increased risk for thrombosis (clotting) that is exacerbated by a lack of ambulation (walking) following delivery. Both underlying thrombophilia and caesarean section can further increase these risks.

**Exercise and Pregnancy**

* In the absence of complications, pregnant women should continue aerobic and strength training exercise for the duration of gestation.