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DEPARTMENT: BIOMEDICAL ENGINEERING

ASSIGNMENT QUESTION 3

Elucidate the Physiological adaptations of the female to pregnancy?

ANSWER

PHYSIOLOGICAL ADAPTATIONS OF FEMALE TO PREGNANCY

1. SKIN CHANGES

A good amount of changes occur in the skin of pregnant women due to changes in their hormones and blood flow. Some examples are highlighted below:

- **Pigmentation changes:** The area around a pregnant woman's nipples and the skin on her inner thighs, genitals and neck might darken, possibly due to hormonal changes. A dark line from your navel to your pubic bone (linea nigra). Dark patches might develop on her face (chloasma). Avoid sun exposure, which can worsen chloasma (is a tan or dark skin discoloration). Chloasma occurs as a result of increased melanocyte-stimulating hormone activity which in turn is a result of increased estrogen and progesterone levels.
- **Acne:** Some women experience acne during pregnancy. This is caused by an increase in hormones called androgens that can cause the glands in the skin to grow and produce more sebum (an oily, waxy substance). This oil can clog pores and lead to bacteria, inflammation, and breakouts.
- **Varicose veins:** During pregnancy some women might develop enlarged veins in their legs (varicose veins) due to the uterus exerting greater pressure on these veins. Hormonal changes during pregnancy also might play a role.
- **Stretch marks:** Stretch marks (also called striae) are a form of scarring indented streaks on the skin with an off-color hue that often appear on the abdomen, breasts, hips, buttocks and thighs. They're caused by the stretching of the skin and are common during the second and third trimesters. Usually striae remain permanently with some change in color.

There is no clear explanation for these changes, but they most likely represent the result of vasodilatation that happens in the skin during pregnancy.

2. CHANGES IN THE GASTROINTESTINAL SYSTEM

The muscles in the walls of the gastrointestinal system relax slightly, and the rate at which food is squeezed out of the stomach and along the intestines is slowed down in the body of a pregnant woman.



The growing baby crowds the mother's stomach and can cause indigestion and heartburn. She may also feel shortness of breath since the baby crowds her lungs as well.

Many women also have nausea in the early stages of pregnancy. They may even experience indigestion, also known as heartburn which is a burning feeling, or pain in the stomach or between the breasts, in later stages of the pregnancy. It happens because as the pregnancy progresses, the growing baby crowds the mother's stomach and pushes it higher than usual. The acids in the mother's stomach that help digest food are pushed up into her chest, where they cause a burning feeling. This is not a threat to the pregnancy and usually goes away after the birth.

However, if the mother has difficulty with nausea or indigestion, she is advised to eat small, frequent meals.

3. CARDIOVASCULAR/RESPIRATORY CHANGES

This is the single most important change in pregnancy.

During pregnancy, the amount of air moved in and out of the lungs increases by nearly 50% due to two factors:

- Each breath contains a larger volume of air
- The rate of breathing (breaths per minute) increases slightly.

During pregnancy, many women find they experience shortness of breath (cannot breathe as deeply as usual). This is because the growing baby crowds the mother's lungs and she has less room to breathe. But if a woman is constantly short of breath or weak and tired, she should be checked for signs of sickness, heart problems, anaemia or poor diet.

Adequate cardiovascular adaptation secures good placental development and thus appropriate fetal growth.

In brief, the cardiovascular changes involve a substantial change in the blood volume, cardiac output, heart rate, systemic arterial blood pressure, systemic vascular resistance, oxygen consumption and alterations in regional blood flow of various organ systems.

4. BLOOD VOLUME

During the first trimester of pregnancy, a significant increase in the blood volume occurs and continues until the mid-third trimester (at approximately the 32nd to the 34th week).

The average absolute increase in blood volume during pregnancy is about 1600 ml and in terms of percent change one should expect a 40 to 50 percent increase above pre-pregnancy levels. The increase in the blood volume is achieved by a combination of increases in the plasma volume and the RBC mass.

The increase in blood volume with pregnancy appears to serve the essential physiological needs of both the mother and fetus. It ensures adequate supplies required for normal fetal growth and oxygenation even under circumstances that affect the maternal cardiac output (inferior vena cava compression). This increased blood volume also helps normal pregnant women to withstand haemorrhage equal to the volume of blood added to the

circulation during the course of the normal pregnancy without any signs of decompensation.

5. CARDIAC OUTPUT

It is generally accepted that cardiac output begins to rise during the first trimester, probably around the tenth week of pregnancy and continues to rise up until the 24th week of gestation. Once it reaches the peak it stays rather stable.

Cardiac output is a product of stroke volume and pulse rate. The rise in cardiac output early in pregnancy is disproportionately greater than the increase in heart rate, and therefore is attributable to augmentation in stroke volume. As pregnancy advances, heart rate increases and becomes a more predominant factor in increasing cardiac output. At the late stages of pregnancy, the stroke volume declines to normal, non-pregnant values.

6. THE HEART

An amount of changes happen to the heart and vary from one pregnancy to another. Increasing intra-abdominal contents displace the heart upward with some forward rotation. As a result the, anterior posterior diameter and the cardiothoracic ratio are increased. The overall dimensions of the heart are increased during pregnancy as a result of increased diastolic heart volume without any change in the ventricular wall thickness.

7. BLOOD PRESSURE

A slight decrease in the systolic arterial blood pressure and a significant decrease in the diastolic pressure have been observed to occur in normal pregnancy. This decrease becomes evident in the late first trimester and continues throughout most of the second trimester. The lowest values are noted in mid pregnancy and there after the blood pressure returns toward non-pregnant levels before term. The degree of change in the blood pressure parameters has been found to be affected by parity, smoking, Pre-existing hypertension, maternal age and ethnic background.

8. Blood Flow Changes in Various Organ Systems During Pregnancy

The most profound changes in regional blood flow occur in the uterus with a 5 to 10 fold increase. This change starts early in pregnancy and continues until

almost term. Approximately 20% of the maternal cardiac output perfuses the uterine vessels (placental and non-placental). The kidneys also demonstrate substantial increase of the regional blood flow as much as 30 to 80% and at the same time a 50% increase in glomerular filtration rate is observed. The regional blood flow in the extremities also increases and more so in the hands than the legs. As it was mentioned previously, there is a significant dilatation in the skin vessels which leads to an increase in the regional blood flow. These changes in the skin vessels may cause warm skin, clammy hands, vascular spiders, and palm erythema.

The liver circulation is not affected very much and the same is true for the brain blood flow which is auto-regulated. The blood flow to the breast is increased during pregnancy to prepare the breast for lactation. The effect of pregnancy on coronary blood flow is still unknown. It is safe, however, to speculate that an increase may happen since expansion of cardiac function is present during pregnancy.