NAME; WHYTE SOIBI

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**QUESTION;**

Elucidate the Physiological adaptations of the female to pregnancy?

ANSWERS;

Pregnancy is a unique period in a woman's lifetime. A number of anatomic, physiologic, biochemical and psychological changes take place. 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.

**Changes in oestrogen and progesterone**

Oestrogen and progesterone are also the chief hormones throughout pregnancy. A woman will produce more oestrogen during one pregnancy than throughout her entire life when not pregnant. During pregnancy, oestrogen promotes maternal blood flow within the uterus and the placenta. A pregnant woman’s progesterone levels are also very high. Among other effects, high levels of progesterone cause some internal structures to increase in size, including the uterus, enabling it to accommodate a full-term baby.

**Changes in the uterus, cervix and vagina**

* The uterus: After conception, the uterus provides a nutritive and protective environment in which the fetus will grow and develop. It increases from the size of a small pear in its non-pregnant state to accommodate a full-term baby at 40 weeks of gestation. The tissues from which the uterus is made continue to grow for the first 20 weeks, and it increases in weight from about 50 to 1,000 gm (grams). After this time, it doesn’t get any heavier, but it stretches to accommodate the growing baby, placenta and amniotic fluid. At 12 weeks’ gestation (near the end of the first trimester, i.e. three-month period), the fundus (upper margin of the body of the uterus) may be palpated (felt) through the abdomen above the pubic bone (symphysis pubis). The size of the uterus usually reaches its peak at about 36 weeks’ gestation.
* The cervix: The cervix remains 2.5 cm long throughout pregnancy. In late pregnancy, softening of the cervix occurs in response to increasing painless contractions of its muscular walls.
* The vagina: The vagina also becomes more elastic towards the end of pregnancy. These changes enable it to dilate during the second stage of labour, as the baby passes down the birth canal.

**Pregnancy-related changes in posture and joints**

A pregnant woman’s entire posture changes as the baby gets bigger. Her abdomen transforms from flat or concave (dished) to very convex (bulging outwards), increasing the curvature of her back. The weight of the fetus, the enlarged uterus, the placenta and the amniotic fluid (the bag of waters surrounding the baby), together with the increasing curvature of her back, puts a large strain on the woman’s bones and muscles. As a result, many pregnant women get back pain. Too much standing in one place or leaning forward can cause back pain, and so can hard physical work. Most kinds of back pain are normal in pregnancy, but it can also be a warning sign of a kidney infection. In addition, progesterone causes a loosening of ligaments and joints throughout the body. Pregnant women may be at greater risk of sprains and strains because the ligaments are looser, and because their posture has changed.

**Changes in body weight during pregnancy**

Continuing weight increase in pregnancy is considered to be one favourable indication of maternal adaptation and fetal growth. However, routine weighing of the mother during pregnancy is not now thought to be necessary, because it does not correlate well with pregnancy outcomes. For example, there can be a slight loss of weight during early pregnancy if the woman experiences much nausea and vomiting (often called ‘morning sickness’). You will learn more about this and other minor disorders of pregnancy in Study Session 12, later in this Module. The expected increase in weight of a healthy woman in an average pregnancy, where there is a single baby, is as follows:

* About 2.0 kg in total in the first 20 weeks
* Then approximately 0.5 kg per week until full term at 40 weeks
* A total of 9 -12 kg during the pregnancy.

A woman who is pregnant with more than one baby will have a higher weight gain than a woman with only one fetus. She will also require a higher calorie diet. A lack of significant weight gain may not be a cause for concern in some women, but it could be an indication that the fetus is not growing properly.

**Changes in the cardiovascular system**

The cardiovascular system consists of the heart, the blood vessels (veins and arteries), and the blood that circulates around the body. It is the transport system that supplies oxygen and nutritive substances absorbed from the gastrointestinal tract to all the cells, tissues and organs of the body, enabling them to generate the energy they need to perform their functions. It also returns carbon dioxide, the waste product of respiration, to the lungs, where it is breathed out. The chemical processes that go on in the body generate many waste products, which the blood transports to the kidneys and liver, where they are removed. Other functions of the cardiovascular system include the regulation of body temperature, and the circulation and delivery of hormones and other agents that regulate body functions. There are several significant changes in this complex system during pregnancy.

The heart: The heart may increase in size during pregnancy due to an increase in its workload. The amount of blood that is pumped out of the heart each minute is called the cardiac output. The increase in cardiac output is caused by two changes in how the heart functions:

* Increase in the resting heart rate, i.e. the number of heart beats per minute. The heart rate is about 15 beats per minute higher in the pregnant woman.
* Increase in the stroke volume, i.e. the volume of blood pumped out of the heart in a single heart beat. It is about 7 millilitres (ml) larger per heart beat in the pregnant woman.

Cardiac output is calculated by multiplying heart rate and stroke volume.

During the second trimester of pregnancy, the mother’s heart at rest is working 40% harder than in her non-pregnant state. Most of this increase results from a more efficiently performing heart, which ejects more blood at each beat.

Blood volume: Blood volume (the total volume of blood in the circulation, measured in litres) increases gradually by 30-50 % in the pregnant woman, so by full term she has about 1.5 litres more blood than before the pregnancy. A higher circulating blood volume is required to provide extra blood flow through the placenta, so nutrients and oxygen can be delivered to the fetus. The increase in blood volume is caused by two changes:

* Increase in the volume of blood plasma (the fluid part of the blood).
* Increase in the number of red blood cells in the circulation.

The volume of blood plasma increases after about the sixth week of pregnancy. It reaches its maximum level of approximately 50% above non-pregnant values by the second trimester, and maintains this until full term.

**Blood pressure in pregnancy**

We said earlier that progesterone causes the ligaments and joints to loosen during pregnancy. It also acts with some other natural chemicals in the body to cause the muscular walls of the blood vessels to relax slightly. The result is that there is less resistance to the flow of blood around the body, because the same volume of blood is circulating in slightly wider blood vessels. Blood pressure (BP) refers to how hard the blood is ‘pushing’ on the walls of the major blood vessels as it is pumped around the body by the heart. Lower blood pressure is particularly common in early pregnancy. Many women report occasionally feeling dizzy in the first trimester, because less blood and less oxygen is being pumped to the brain. Progesterone can also cause a sudden larger relaxation in the blood vessels, resulting in an acute feeling of dizziness, or even a brief loss of consciousness (passing out).

**Respiratory changes**

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 get short 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 also weak and tired, or if she is short of breath all of the time, she should be checked for signs of sickness, heart problems, anaemia or poor diet.

**Changes in the gastrointestinal system in pregnancy**

As you may remember from your high school biology, food and fluids enter the gastrointestinal system in the mouth, pass through the oesophagus, stomach and intestines, and solid waste exits at the anus. This very long tube from mouth to anus is often called the ‘gut’. Proteins, fats and carbohydrates in our diet are broken down (digested) in the gut into units small enough to be absorbed from the intestines into nearby blood vessels. It is also the route by which nutritious substances, such as vitamins and minerals, enter the body.

During pregnancy, 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.

**Changes in the urinary system during pregnancy**

The urinary system consists of the kidneys (a pair of organs on either side of the abdomen near the back), the tubes connecting the kidneys to the bladder where urine is stored, and a tube called the urethra that passes urine out of the body. The kidneys extract waste from the blood and turn it into urine. They must work extra hard to filter the mother’s own waste products from her blood, plus those of the fetus, and get rid of them in her urine. Therefore, there is also an increase in the amount of urine produced during pregnancy. Needing to urinate (pee) often is normal, especially in the first and last months of pregnancy. This happens because the growing uterus presses against the bladder. In late pregnancy, a woman often has to get up during the night to urinate, because fluid retained in the legs and feet during the day (oedema) is absorbed into the blood circulation when her legs are raised in bed. The kidneys extract the excess fluid and turn it into urine, so the bladder fills more quickly at night.

Skin changes

Changes in the woman’s hormones, and mechanical stretching of her growing abdomen and breasts, are responsible for several changes in the skin during pregnancy.

* Linea nigra: This dark line may appear between the umbilicus (belly-button) and the symphysis pubis (pubic bone); in some pregnant women it may extend as high as the sternum (the bone between the breasts). It is a hormone-induced excess production of brown material (pigment) in the skin cells in this area. After delivery, the line begins to fade, though it may never completely disappear.
* Mask of pregnancy (chloasma): Some women produce a brownish pigmentation of the skin over the face and forehead, known as the ‘mask of pregnancy’ (or chloasma). It gives a bronze look. It begins about the 16th week of pregnancy and gradually increases, but it usually fades after delivery.
* Stretch marks: As the woman’s weight increases, stretching of the skin occurs over areas of maximal growth — the abdomen, thighs and breasts. Pink or brownish stretch marks may appear in some women, which can be quite dramatic. They usually fade after delivery, although they never completely disappear.

**Changes in the breasts**

In early pregnancy, the breasts may feel full or tingle, and they increase in size as pregnancy progresses. The areola around the nipples (the circle of pigmented skin) darkens and the diameter increases. The Montgomery’s glands (the tiny bumps in the areola) enlarge and tend to protrude (stick out more). The surface blood vessels of the breast may become visible due to increased circulation, and this may give a bluish tint to the breasts. By the 16th week (during the second trimester), the breasts begin to produce colostrum. This is the precursor of breastmilk. It is a yellowish secretion from the nipples, which thickens as pregnancy progresses. It is extremely high in protein and contains antibodies (special proteins produced by the mother’s immune system) that help to protect the newborn baby from infection. Near the end of pregnancy, the nipples may produce enough colostrum to make wet patches on the woman’s clothes. Reassure her that this is normal and a good sign. After the baby is born, colostrum is produced for about the first three days, before the proper milk begins to flow. Make sure that the mother breastfeeds the colostrum to her baby, so he or she gets all the nutrients and antibodies it contains.