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- **Adaptations** to pregnancy refers to the change in gait, postural parameters, as well as sensory feedback, due to the numerous anatomical, physiological, and hormonal changes women experience during pregnancy.
- During pregnancy, a woman's body changes in many ways due to the effect of hormones. These changes can sometimes be uncomfortable, but most of the time they are normal and enable her to nourish and protect the fetus, prepare her body for labor, and develop her breasts for the production of milk.

❖ **PHYSIOLOGICAL ADAPTATIONS OF FEMALES TO PREGNANCY**

- **Changes in oestrogen and progesterone**

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

- **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. By the time the pregnancy has reached full term, the uterus will have increased to about five times its normal size

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 labor, 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 to very convex, increasing the curvature of her back, puts a large strain on the woman’s bones and muscles. As a result, many pregnant women get back pain. 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 favorable 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. A woman who is pregnant with more than one baby will have a higher weight gain than a woman with only one fetus. 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 and the blood that circulates around the body.

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.

Changes in cardiac output during pregnancy

Woman’s condition	Cardiac output (liter per minute)
non-pregnant, resting	2.5
end of 1st trimester	5
end of 2nd trimester	6
full-term	7

Blood volume

Blood volume (the total volume of blood in the circulation, measured in liters) increases gradually by 30-50 % in the pregnant woman, so by full term she has about 1.5 liters 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 and increase in the number of red blood cells in the circulation.**

Iron, hemoglobin and anemia

Iron is present in all cells and has several important functions, there is a constant increase in the number of red blood cells in the circulation during pregnancy, the increase in the volume of blood plasma is much larger. So even though the pregnant woman has more red blood cells than before she was pregnant, they are diluted in the much larger volume of blood plasma. The World Health Organization recommends that the pregnant woman's hemoglobin should not fall below 11 grams of hemoglobin per deciliter of blood (Hb 11g/dl). Taking iron supplements during pregnancy can result in a much greater increase in red blood cells, up to 30% more than non-pregnant levels.

- **Blood pressure in pregnancy**

Progesterone 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.. 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.

Exercise and blood flow in pregnancy

The weight gain in pregnant women increases the workload on the body from any physical activity. Steady, non-violent exercise is good for the mother because it prepares her body for labor but sudden strong exercise, or working for too many hours without a break, may make her feel dizzy. This is because the reduced blood pressure and slight physiological anemia cannot keep pace with the demand of her body for more oxygen.

- **Edema in pregnancy**

A combination of the slight increase in the permeability of the smallest of blood vessels, the additional weight of the uterus, and the downward force of gravity, slow down the rate at which blood is pumped back to the heart from the lower half of the body. Fluid often collects in the tissues of the legs and feet of pregnant women after the first trimester, instead of being absorbed into the blood circulation

- **Changes in the urinary system during pregnancy**

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.

- **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 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 breast milk. It is a yellowish secretion from the nipples, which thickens as pregnancy progresses. It is extremely high in protein and contains antibodies 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.

- **Skin changes**

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.

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.

- **Sweat glands**

Activity of the sweat glands throughout the body usually increases during pregnancy, which causes the woman to perspire (sweat) more profusely than usual, particularly in hot weather or during physical work.

- **Changes in the gastrointestinal system in pregnancy**

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.

- **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.

