

Physiological changes in female body during pregnancy:

Structural changes:

Various structural changes are noticed in the primary sex organs, accessory sex organs and in the mammary glands during pregnancy.

1. Ovaries:

Follicular changes do not appear in ovary and ovulation does not occur because the secretion of FSH and LH from anterior pituitary is inhibited. Corpus luteum enlarges and secretes a large quantity of progesterone and little estrogen, which are essential for maintaining the pregnancy. It continues for 3 months and then, corpus luteum degenerates. By this time placenta develops fully and takes over the function of secreting estrogen and progesterone. It continues throughout the period of pregnancy thus inhibiting the secretion of FSH and LH.

2. Uterus:

When the fetus grows, uterus undergoes changes in volume, size, shape and weight. Size of the uterus also increases due to:

- a. Hyperplasia (increase in number of cells) of myometrium.
- b. Hypertrophy (increase in size of the cells) of myometrium.
- c. Growth of fetus.

3. Vagina:

Vagina increases in size and its color changes to violet due to increased blood supply. There is deposition of glycogen in the epithelial cells.

4. Cervix:

In cervix, the number of glands, blood supply and mucus secretion increase. The tough cervix becomes soft and it is closed by mucus plug.

5. Fallopian Tube:

The number of epithelial cells and blood supply increase in fallopian tubes.

6. Mammary Glands:

Size of the mammary glands increases because of development of new ducts and alveoli, deposition of fat and increased vascularization. Pigmentation of nipple and areola occurs.

Average weight gained by the body during pregnancy is about 12 kg. Approximate weight of various structures, which adds to the weight gain:

1. Fetus: 3.5 kg
2. Amniotic fluid: 2.0 kg
3. Placenta: 1.5 kg
4. Increase in maternal: 5.0 kg body weight

If proper prenatal care is not taken, the body weight increases greatly by about 20 to 30 kg.

Metabolic changes:

The metabolic activities are accelerated in the body due to increased secretion of various hormones like thyroxine, cortisol and sex hormones.

1. Basal Metabolic Rate:

Increase in the secretion of various hormones especially thyroxine increases the basal metabolic rate by about 15% in the later stages of pregnancy.

2. Protein Metabolism: The anabolism of proteins increases during pregnancy. Positive nitrogen balance occurs. The deposition of proteins increases in the uterus.

3. Carbohydrate Metabolism:

Blood glucose level increases leading to glucosuria. Ketosis develops either due to less food or more vomiting. Because of all these reasons, there is hyperplasia of beta cells of islets of Langerhans in pancreas leading to increase in secretion of insulin. In spite of this, there is possibility of developing diabetes in pregnancy or latent diabetes after delivery.

4. Lipid Metabolism:

During pregnancy, there is deposition of about 3 to 4 kg of fat in the maternal body. It also increases the blood cholesterol level and ketosis.

5. Water and Mineral Metabolism:

Estrogen and progesterone increase the retention of sodium and water. Secretion of aldosterone increases during pregnancy. Aldosterone in turn increases the reabsorption of sodium from renal tubules. There is retention of calcium and phosphorus as well which are necessary for the growing fetus.

Changes in physiological systems:

1. Blood:

The blood volume increases by about 20% or about 1 L. This increase is mainly because of increase in plasma volume. It causes hemodilution. Because of great demand for iron by the fetus, the mother usually develops anemia. It can be rectified by proper prenatal care and iron replacement.

2. Cardiovascular System:

Cardiac output

Generally, cardiac output increases by about 30% in the first trimester. Reaches peak in 27th week, then for unknown reason cardiac output starts decreasing and reaches almost the normal level in the later stages of pregnancy.

Blood pressure:

Arterial blood pressure remains unchanged during the first trimester. During the second trimester, there is a slight decrease in blood pressure. It is due to the diversion of blood to uterine sinuses, hypertension develops if proper prenatal care is not taken.

3. Respiratory System:

Overall activity of respiratory system increases slightly. Tidal volume, pulmonary ventilation and oxygen utilization are increased.

4. Excretory System:

Renal blood flow and GFR increase resulting in increase in urine formation. It is because of increase in fluid intake and the increased excretory products from fetus. The urine becomes diluted with the specific gravity of 1.025. In the first trimester, the frequency of micturition increases because of the pressure exerted by the uterus on bladder.

5. Digestive System:

During the initial stages of pregnancy, the morning sickness occurs in mother. It involves nausea, vomiting and giddiness. This is because of the hormonal imbalance. The motility of GI tract decreases by progesterone and constipation is common.

6. Endocrine System:

i. Anterior pituitary:

During pregnancy, the size of anterior pituitary increases by about 50%. And secretion of corticotropin, thyrotropin and prolactin increases. However, the secretion of FSH and LH decreases very much. It is because of negative feedback control by estrogen and progesterone, which are continuously secreted from corpus luteum initially and placenta later on.

ii. Adrenal cortex:

There is moderate increase in secretion of cortisol, which helps in the mobilization of amino acids from the mother's tissues to the fetus. Aldosterone secretion also increases. It reaches the maximum at the end of pregnancy. Along with estrogen and progesterone, aldosterone is responsible for the retention of water and sodium.

iii. Thyroid gland:

The size and the secretory activity of thyroid gland increase during pregnancy. The increased secretion of thyroxine helps in the preparation of mammary glands for lactation. It is also responsible for increase in basal metabolic rate.

iv. Parathyroid glands:

Parathyroid glands also show an increase in the size and secretory activity. Parathormone is responsible for maintenance of calcium level in mother's blood in spite of loss of large amount of calcium to fetus.

7. Nervous System:

There is general excitement of nervous system during pregnancy. It leads to the psychological imbalances such as change in the moods, excitement or depression in the early stages of pregnancy. During the later months of pregnancy, the woman becomes very much excited because of anticipation of delivery of the baby, labor pain, etc. ☐

Parturition:

Parturition occurs in three stages:

First Stage: First, the strong uterine contractions called labor contractions or Braxton-Hicks contractions commence. Labor contractions arise from fundus of uterus and move downwards so that the head of fetus is pushed against cervix. It results in dilatation of cervix and opening of vaginal canal. Exact cause for the onset of labor is not known but uterine responsiveness to oxytocin increases 100-fold; blood oxytocin levels don't change all that much. This stage extends for a variable period of time.

Second Stage: In this stage, the fetus is delivered out from uterus through cervix and vaginal canal.

Third Stage: During this stage, the placenta is detached from the decidua and is expelled out from uterus. It occurs within 10 to 15 minutes after the delivery of the child.

Role of hormones:

Hormones involved in the process of parturition:

Maternal Hormones:

1. Oxytocin.
2. Prostaglandins.
3. Cortisol.
4. Catecholamines.
5. Relaxin.

Fetal Hormones:

1. Oxytocin.

2. Cortisol. Fetal cortisol Stimulates the fetal lungs to secrete surfactant in preparation for contact with air so Premature infants at risk for respiratory distress syndrome.

3. Prostaglandins.

Placental Hormones:

1. Estrogen.

2. Progesterone.

3. Prostaglandins.

After delivery Uterus undergoes involution over the next 4–6 weeks, with plenty of lochia (discharge).

Postpartum depression may be due to the crash in the levels of corticotropin-releasing factor.

Lactation:

WE have to consider four events:

1. Breast development during pregnancy supported by:

a) Estrogens.

b) Progesterone.

c) Prolactin.

d) Human chorionic somatomammotropin.

2. Abrupt decline of estrogen and progesterone at parturition starts the flow of milk.

3. Suckling stimulates the hypothalamus, and prolactin and oxytocin are released from the anterior and posterior pituitary, respectively (suckling reflex).

4. Breast-feeding is very beneficial to both, mother and infant.

Menopause:

The human ovaries become unresponsive to gonadotropins with advancing age, and their function declines, so that sexual cycles disappear (menopause). This unresponsiveness is associated with and probably caused by a decline in the number of primordial follicles, which becomes precipitous at the time of menopause. The ovaries no longer secrete progesterone and 17-estradiol in appreciable quantities, and estrogen is formed only in small amounts by aromatization of androstenedione in peripheral tissues. The uterus and the vagina gradually become atrophic. As the negative feedback effect of estrogens and progesterone is reduced, secretion of FSH is increased, and plasma FSH increases to high levels, LH levels are moderately high. In women, a period called perimenopause precedes menopause, and can last up to 10 y. During perimenopause the menses become irregular and the level of inhibins decrease, usually between the ages of 45 and 55. The loss of ovarian function causes many symptoms such as sensations of warmth spreading from the trunk to the face (hot flushes) and night sweats. In addition, the onset of menopause increases the risk of many diseases such as osteoporosis, ischemic heart disease, and renal disease. Hormonal replacement therapy may be used in some cases.

Although the function of the testes tends to decline slowly with advancing age, the evidence is unclear whether there is a "male menopause" (andropause) similar to that occurring in women.