

B.Sc Second year Zoology (Honours)

Paper-4

Dr. Mirza Imteyaz Baig

Changes in maternal physiology during Pregnancy

Once a woman conceives and becomes pregnant, several physiological changes begin to occur in her body. This is not only to **provide nourishment to the developing embryo** but is also **advanced preparation for parturition**. The following **major physiological maternal changes** occur **during pregnancy**:

As the developing fetus removes substrates from the maternal blood, the **desire for food** is greatly increased. The **basal metabolic rate (BMR)** also increases by 15% during the latter half of pregnancy. **Hormones**, such as thyroxin, adrenocortical, and sex hormones also contribute to the increased BMR.

The maternal body stores **nutrients** the fetus requires during the last trimester. The weight of the fetus almost doubles in the last trimester, so it requires large quantities of nutrients. A pregnant woman, in addition to having other nutrients, must take sufficient **iron, calcium, and vitamin D**. In the later stage of pregnancy, she may also require **vitamin K** to prevent the new-born from **hemorrhaging during childbirth**.

Cardiac changes in pregnancy include

The **cardiac output** of the mother increases by 40% because the heart must supply additional blood to the placenta. Cardiac output, however, falls to a little above the normal value during the last eight weeks of pregnancy,

with the maximum effect at 20-28 weeks of pregnancy. Vasodilatation also necessitates increased cardiac output.

There is an increase in stroke volume by about 90% that leads to an increase in left ventricular muscle mass and the end-diastolic volume but not the end-diastolic pressure.

There is a 10-20% increase in the maternal heart rate. Blood pressure decreases during the first and second trimester and returns to normal levels during the third trimester.

Hematological changes in pregnancy

The **maternal blood volume** increases to 30% above normal during pregnancy. This is associated with a constant level of red blood cells hence a fall in the level of hemoglobin and **hematocrit** and red blood cell count. However, there is a normal level of mean corpuscular volume and mean corpuscular hemoglobin concentration. There is an associated fall in the level of thrombocytes; as such, maternal pathological thrombocytopenia is below 100,000. The **blood viscosity** also decreases.

Due to the above changes, pregnancy is associated with a two-three-fold increase in iron requirement for hemoglobin synthesis and fetal development. Similarly, there is a need for increased folate, up to 10-20 times, and a two-fold increased need for vitamin B₁₂.

Pregnancy is referred to as a **hypercoagulable or pro-thrombotic state**. This is thought to prevent **blood loss** during parturition. It begins in the first trimester all the way to 12 weeks post-partum.

The prothrombin time (PT) and activated partial thromboplastin time (APTT) decrease, while procoagulant factors, such as VIII, IX, and X, increase. Fibrinogen levels increase up to 50% and fibrinolytic activity is decreased.

Venous stasis in the lower limbs is associated with vasodilation and decreased flow, which is more marked on the left due to compression of the left iliac vein by the left iliac artery and the ovarian artery.

Respiratory changes in pregnancy

There is a 20% increase in oxygen demand during pregnancy that occurs due to a 15% increase in BMR. Due to increased BMR during pregnancy, **minute ventilation** also increases. Some of it is attributed to an increased level of **progesterone**, which is a direct respiratory stimulant. The **PCO₂ level in the blood** decreases. As the growing uterus presses upon the abdominal structures, the change in the shape of the diaphragm is limited. So, to maintain adequate ventilation, the **respiratory rate** increases.

Renal changes in pregnancy include a 40% fall in systemic vascular resistance that also affects the kidneys, leading to increased renal blood flow. Thus, the glomerular filtration rate (GFR) increases by 50% to excrete out excessive water and salts retained in the body due to hormonal changes occurring during pregnancy. This increase in blood flow causes the kidneys to enlarge by 1-1.5 cm. This may be accompanied by a dilatation of the pelvicalyceal system.

Relaxin secreted from the corpus luteum and the placenta peaks in the first trimester to stimulate the formation of endothelin and vasodilatation of the renal arteries.

Changes in the alimentary canal

Pregnancy is associated with increased nausea and vomiting, which is thought to be due to hormonal imbalances. It is also thought to be a protective mechanism against consuming any teratogenic substances. This phenomenon resolves by the 20th week of gestation in most cases.

Endocrine changes

There is an increased level of all thyroid hormones; thus, pregnancy is considered a hyperthyroid state.

Reduced vascular resistance activates the RAAS system, causing a three-fold increase in aldosterone in the first trimester and a 10-fold increase in the third trimester.

The pituitary gland enlarges during pregnancy due to the proliferation of prolactin-producing cells in the anterior lobe.

Pregnancy is a diabetogenic state associated with an increase in maternal glucose to supply the fetus and accompanying insulin resistance.

Skeletal and bone changes

Pregnancy is associated with reversible bone loss because of increased bone turnover to supply the fetus with calcium.

Summary of maternal changes

The heart rate and stroke volume **increase to maintain cardiac output** and arterial pressure when systemic vascular resistance falls.

If red blood cell production cannot keep pace with increasing plasma volume, **hematocrit falls** during pregnancy, leading to physiological anemia.

