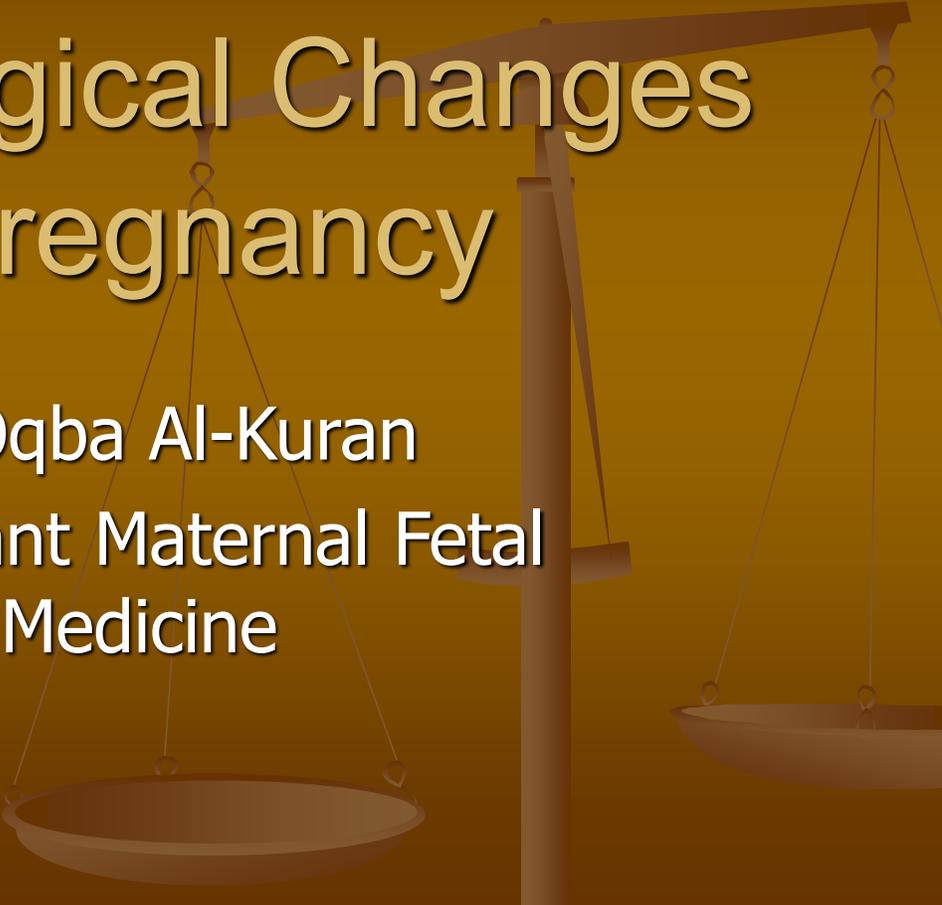
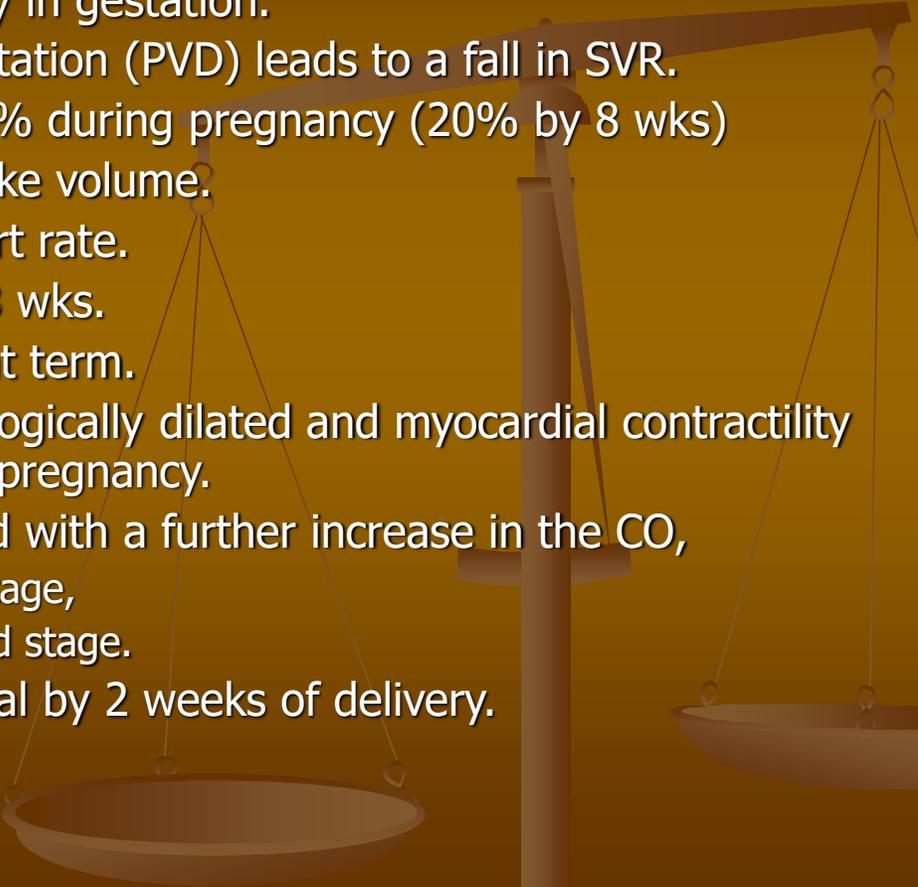


Physiological Changes in Pregnancy



Dr Oqba Al-Kuran
Consultant Maternal Fetal
Medicine

Cardiac

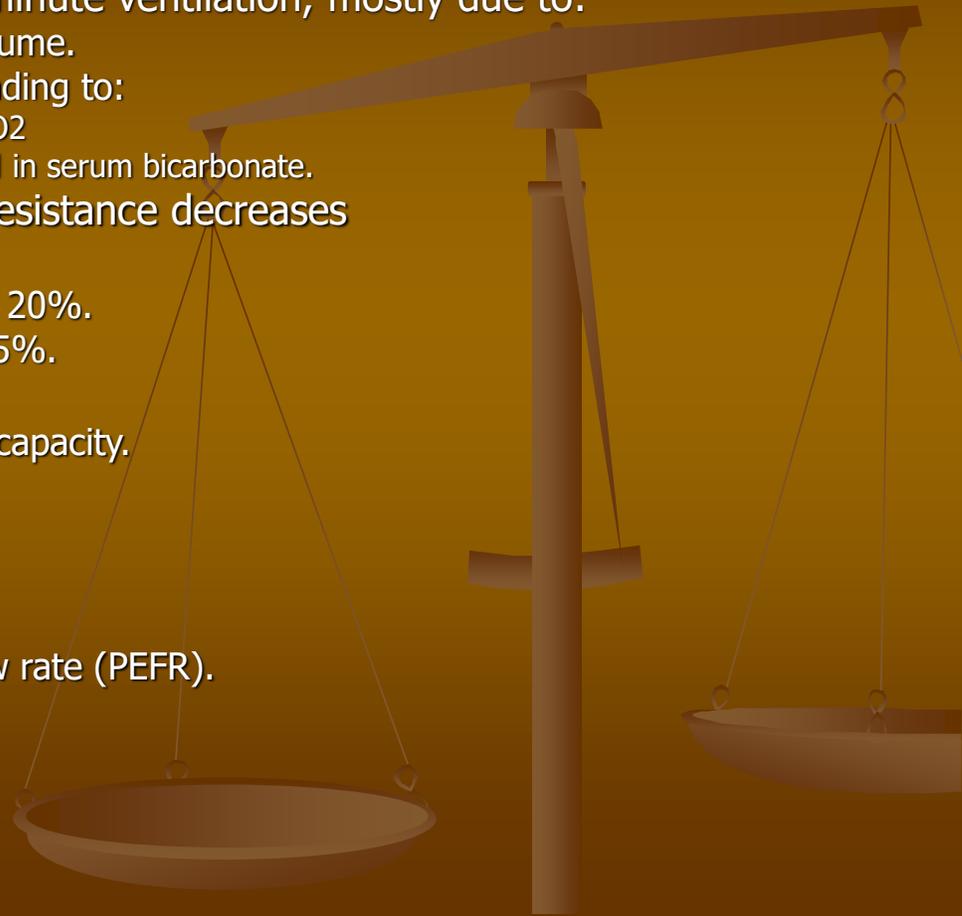
- Changes begin early in gestation.
 - Peripheral vaso-dilatation (PVD) leads to a fall in SVR.
 - CO increases by 40% during pregnancy (20% by 8 wks)
 - Increase in the stroke volume.
 - Increase in the heart rate.
 - Max CO is at 20-28 wks.
 - CO falls minimally at term.
 - The heart is physiologically dilated and myocardial contractility is increased during pregnancy.
 - Labour is associated with a further increase in the CO,
 - 15% in the first stage,
 - 50% in the second stage.
 - CO returns to normal by 2 weeks of delivery.
- 

Vascular

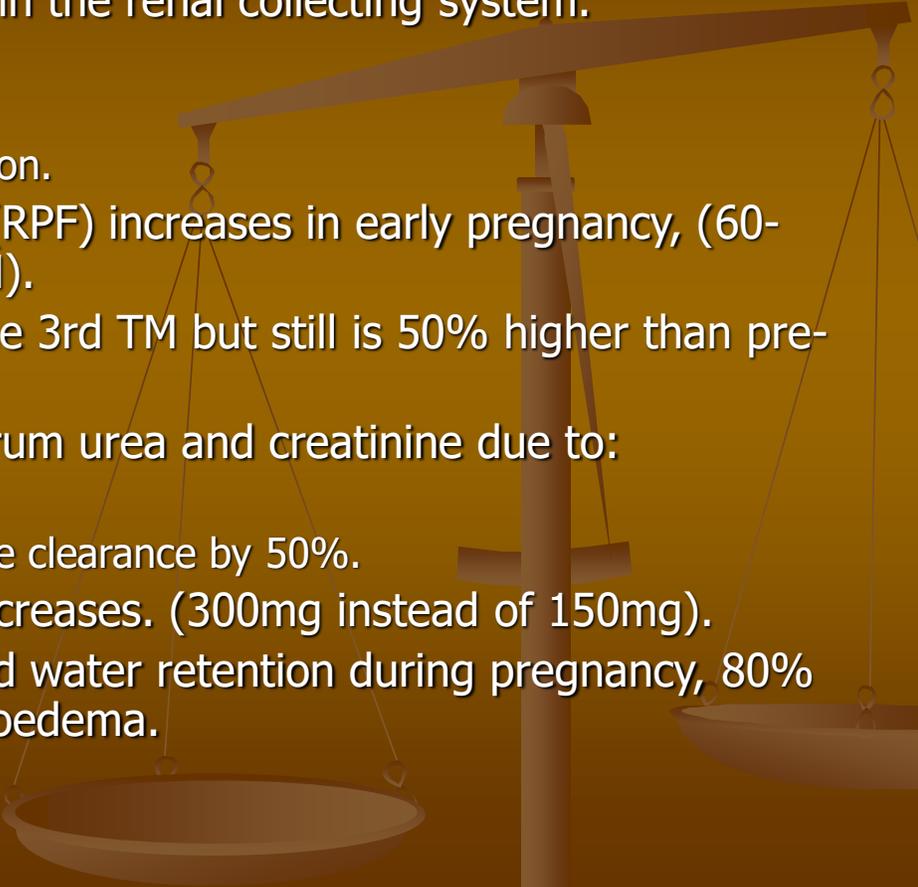
- BP is directly proportional to the systemic vascular resistance and cardiac output.
- Vasodilatation is probably the primary change in pregnancy.
- BP drops from the beginning of pregnancy peaks at 22-24 weeks to go back to pre-pregnancy level at term, due to increase in CO.
- BP measurements:
 - Phase V (disappearance) rather than IV (muffling) Korotkoff sounds.
 - Sitting/Lying 30 degrees tilt
- BP falls immediately after delivery then goes up to peak at day 3-6.
- BP may go up transiently during labour.

Respiratory

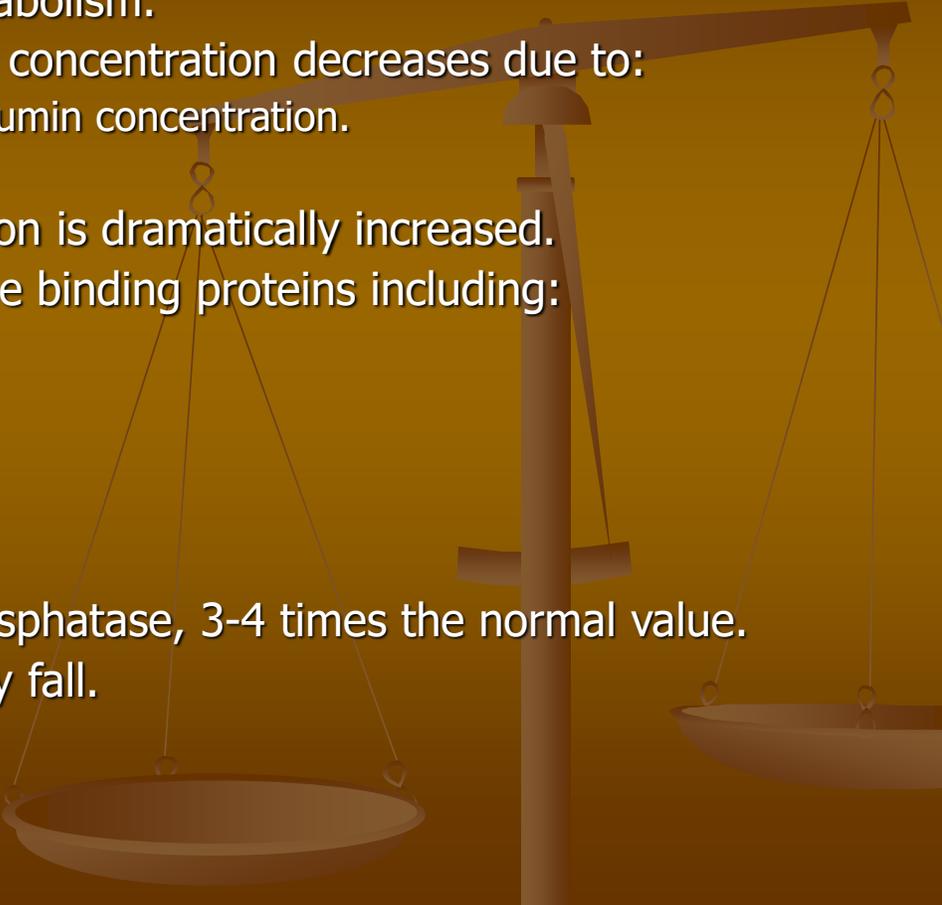
- 40-50% increase in minute ventilation, mostly due to:
 - Increase in tidal volume.
 - Hyperventilation leading to:
 - Reduction in PaCO₂
 - Compensatory fall in serum bicarbonate.
- Pulmonary vascular resistance decreases
- Increase in :
 - O₂ consumption by 20%.
 - Metabolic rate by 15%.
- Decrease in:
 - Functional residual capacity.
- No change in:
 - Respiratory rate.
 - Vital capacity.
 - FEV₁.
 - Peak expiratory flow rate (PEFR).
 - PaO₂.



Renal system

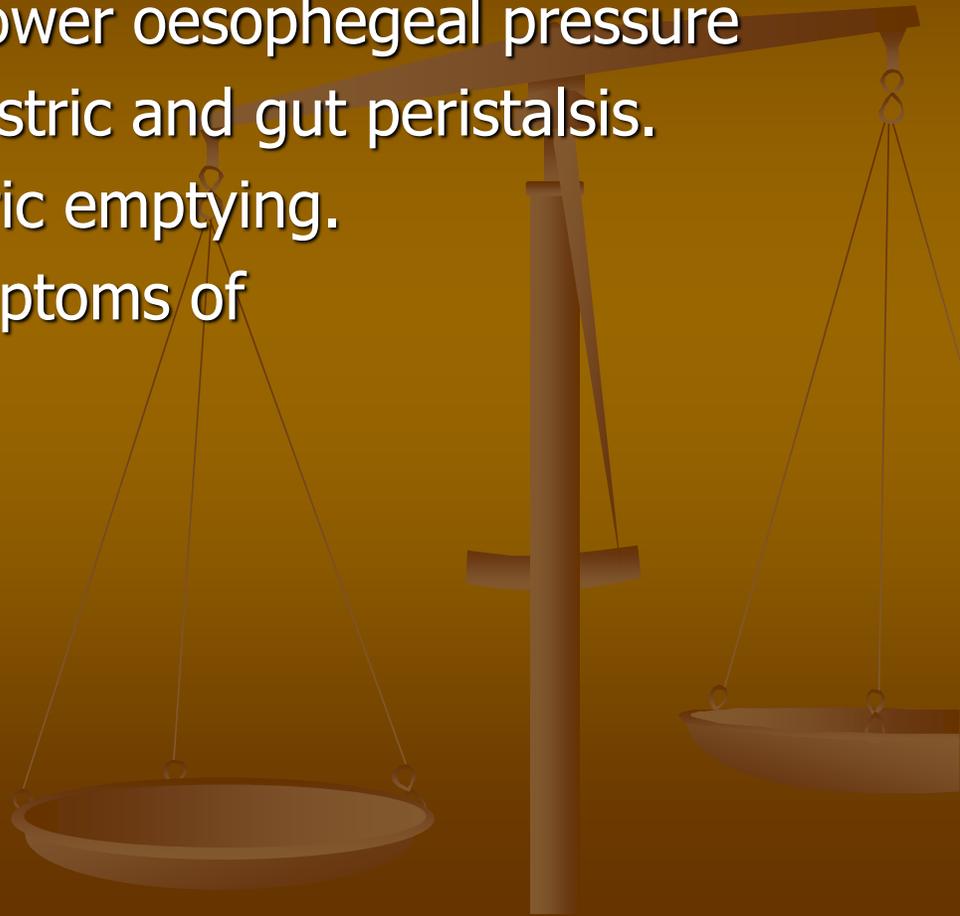
- Dramatic dilatation in the renal collecting system.
 - More on the right
 - Progesterone
 - Uterine compression.
 - Renal plasma flow (RPF) increases in early pregnancy, (60-80% by the 2nd TM).
 - RPF decreases in the 3rd TM but still is 50% higher than pre-pregnancy at term.
 - There is a fall in serum urea and creatinine due to:
 - Increase in GFR
 - Increase creatinine clearance by 50%.
 - Protein excretion increases. (300mg instead of 150mg).
 - Physiological Na and water retention during pregnancy, 80% of women develop oedema.
- 

Hepatobiliary system

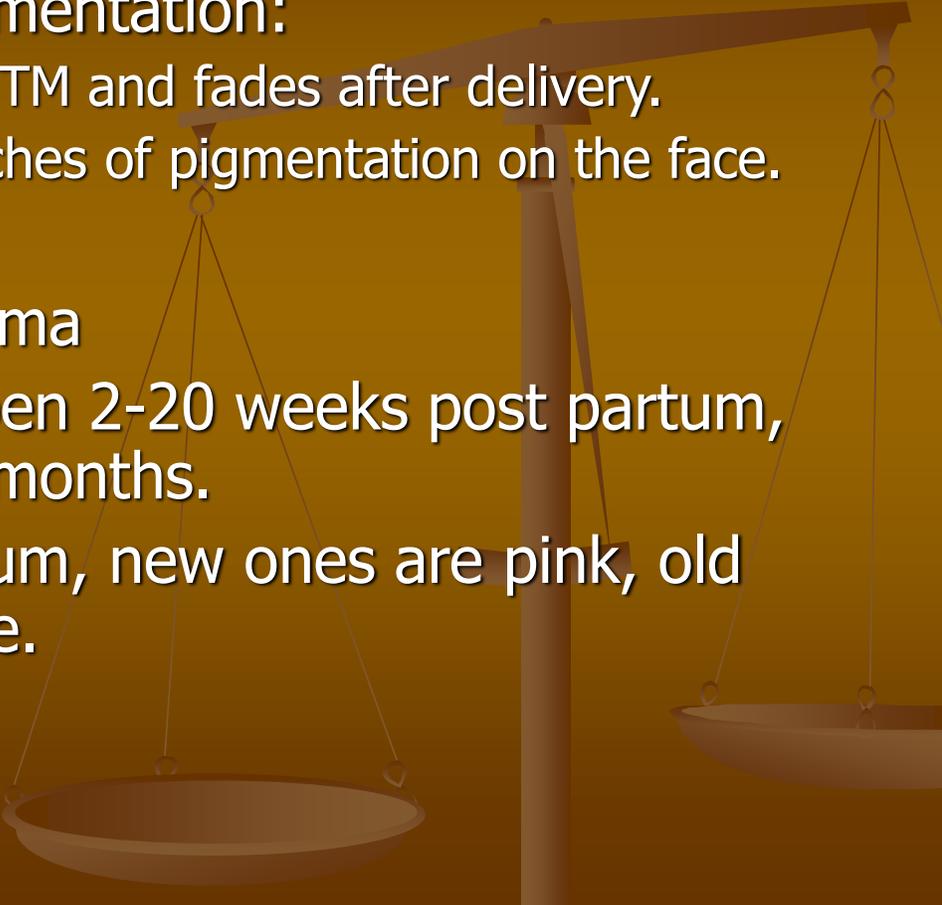
- Increased liver metabolism.
 - Total serum protein concentration decreases due to:
 - 20-40% fall in albumin concentration.
 - Dilution.
 - Fibrinogen production is dramatically increased.
 - Rise in almost all the binding proteins including:
 - Ciruloplasmin.
 - TBG.
 - SHBG.
 - CBG.
 - Transferrin.
 - Rise in Alkaline phosphatase, 3-4 times the normal value.
 - ALT and AST slightly fall.
- 

Gastro-intestinal tract

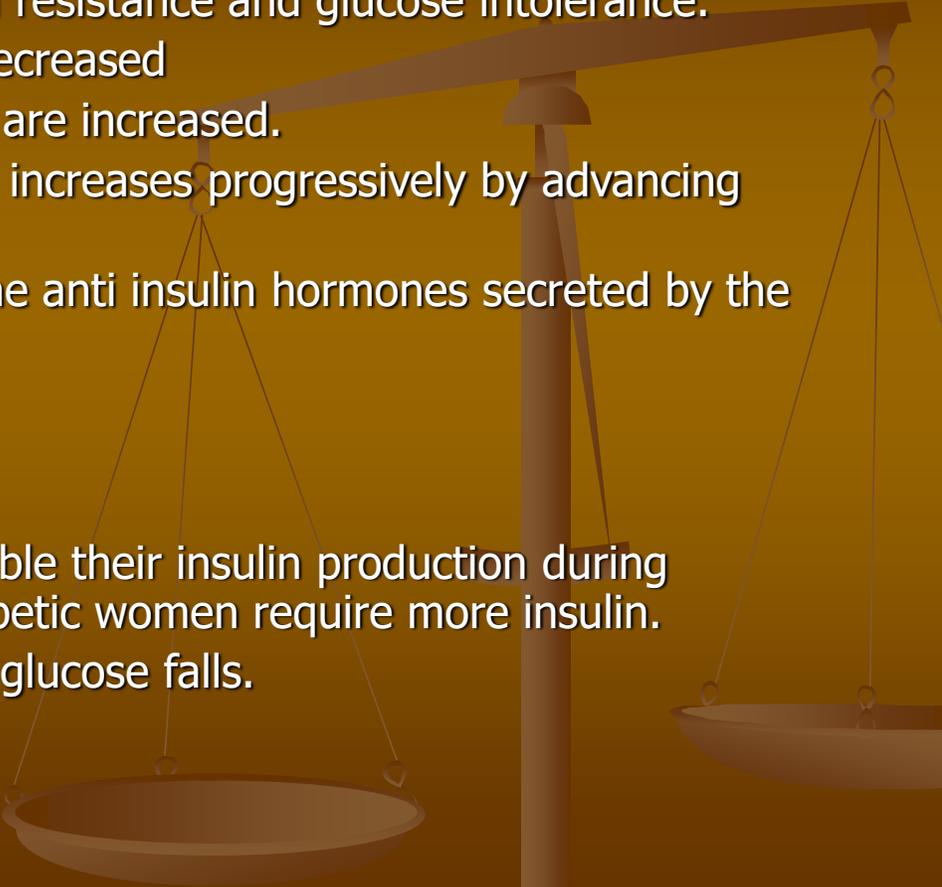
- Decreased lower oesophageal pressure
- Decreased gastric and gut peristalsis.
- Delayed gastric emptying.
- Common symptoms of
 - Constipation.
 - Nausea.
 - Vomiting.



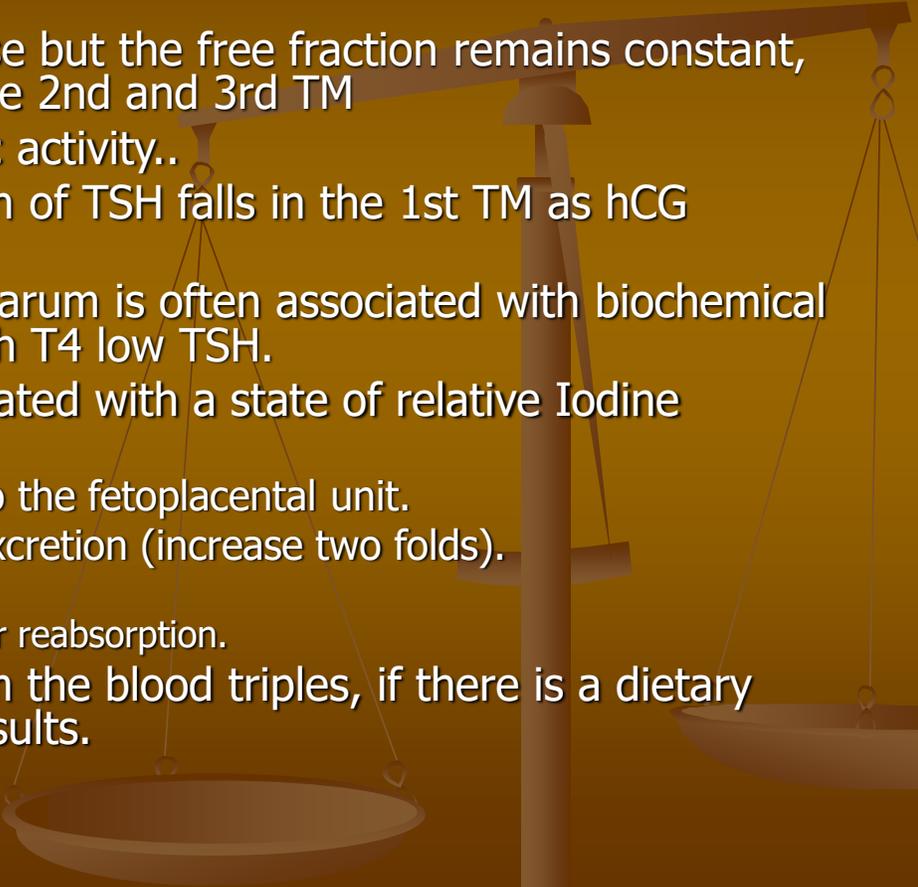
Skin

- Increased pigmentation:
 - Begins in 1st TM and fades after delivery.
 - Melasma: patches of pigmentation on the face.
 - Spider navi.
 - Palmer erythema
 - Hair fall, happen 2-20 weeks post partum, recovers in 6 months.
 - Stria gravidarum, new ones are pink, old ones are white.
 - Pruritus.
- 

Sugar control

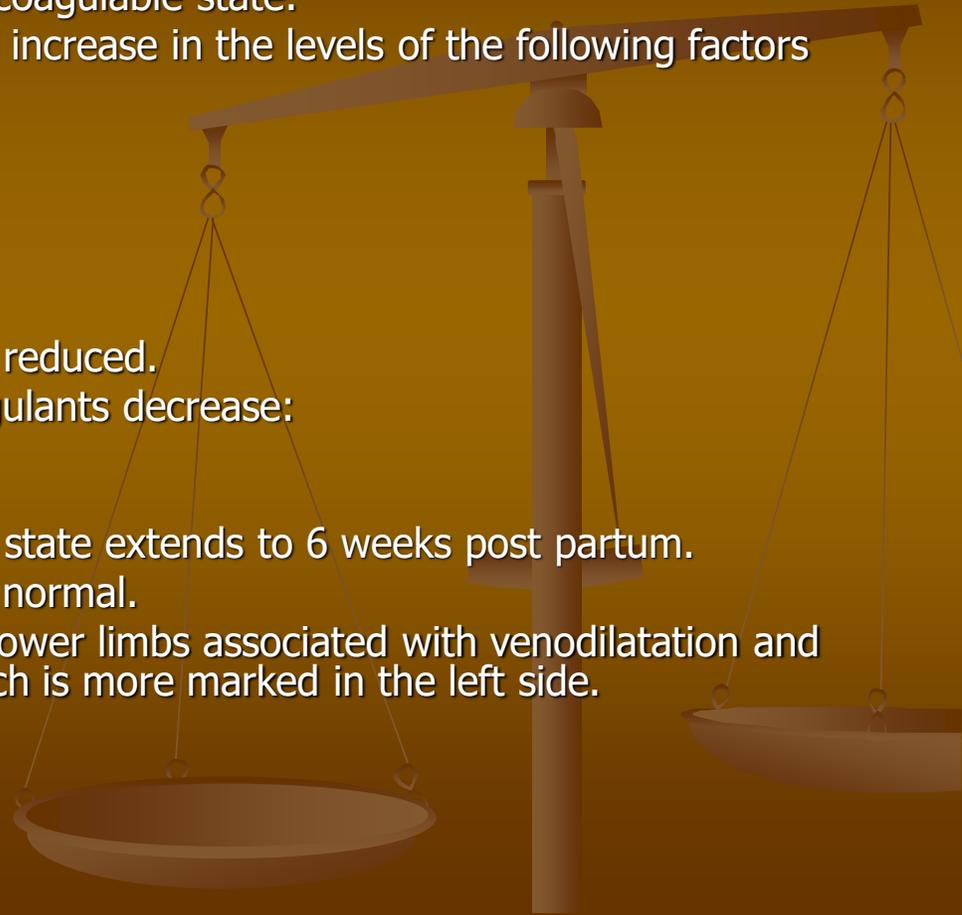
- Physiological insulin resistance and glucose intolerance.
 - Fasting levels are decreased
 - Post prandial levels are increased.
 - Glucose intolerance increases progressively by advancing gestation.
 - This is a result of the anti insulin hormones secreted by the placenta:
 - HPL.
 - Glucagon
 - Cortisol.
 - Normal women double their insulin production during pregnancy, and diabetic women require more insulin.
 - Renal threshold for glucose falls.
- 

Thyroid

- TBG increases.
 - Total T3, T4 increase but the free fraction remains constant, or slightly falls in the 2nd and 3rd TM
 - hCG has thyrotropic activity..
 - serum concentration of TSH falls in the 1st TM as hCG increases.
 - Hyperemesis gravidarum is often associated with biochemical thyro toxicosis., high T4 low TSH.
 - Pregnancy is associated with a state of relative Iodine deficiency because:
 - Active transport to the fetoplacental unit.
 - Increased renal excretion (increase two folds).
 - Increased GFR.
 - Reduced Tubular reabsorption.
 - Thyroid uptake from the blood triples, if there is a dietary deficiency goiter results.
- 

Coagulation

- Pregnancy is a hypercoagulable state:
- There is around 50% increase in the levels of the following factors
 - X
 - IX
 - VIII
 - VII
 - II (Prothrombin)
 - Fibrinogen.
- Fibrinolytic activity is reduced.
- Endogenous anticoagulants decrease:
 - Anti-Thrombin III
 - Protein S.
- The hypercoagulable state extends to 6 weeks post partum.
- Clotting tests remain normal.
- Venous stasis in the lower limbs associated with venodilatation and decreased flow , which is more marked in the left side.



Pituitary and adrenal

- The volume of the anterior pituitary increases progressively during pregnancy by up to 35%.
- Post partum involution is slower if the mother breast feeds.
- Prolactin level increases up to 10X, and return to normal by 2 weeks post partum.
- LH, FSH levels are suppressed.
- The placenta produces the following:
 - hPL, this resembles GH
 - Specific placental GH.
 - ACTH
 - CTH
- Pituitary secretion of ACTH remain unchanged.
- Free and bound cortisol levels increase.
- Diurnal variation is maintained in pregnancy.
- Levels of angiotensin II is increased 2-4X.
- Plasma rennin activity is also increased 2-4X.
- Plasma and urinary levels of aldosterone is increase 3 folds in the 1ST tm and 10 folds by the 3rd TM.

