Overview of Nutritional requirements in Pregnancy
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<td>Nutrition in Life of Women</td>
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<td>Calcium &amp; Vitamin D</td>
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NUTRITION IN LIFE OF WOMEN
Malnutrition affects 1 in 3 people worldwide

7 billion people worldwide
About 2 billion suffer from micronutrient malnutrition
Approx. 800 million people have calorie deficiency

Out of 5 billion adults
Nearly 2 billion are overweight or obese
1 in 12 have type 2 diabetes

Out of 667 million children under age 5 worldwide
159 million under age 5 are stunted
50 million do not weigh enough for their height
41 million are overweight

57 countries out of 129 with data show serious levels of both undernutrition and adult overweight/obesity

38.4% children are stunted

35.7% children are underweight

58.5% children (6 – 59 months are anemic (< 11 g/dl)

53.1% non-pregnant women (15 – 49 years) are anemic (< 12 g/dl)

50.3% pregnant women (15 – 49 years) are anemic (< 11 g/dl)

53% women (15 – 49 years) in total are anemic

Nutrition is Important in all Stages of Life

- **Infants**
  - For growth and appropriate milestones

- **Elderly**
  - For being physically active and healthy

- **Childhood**
  - For growth, development and to fight infections

- **Adolescence**
  - For growth spurt, maturation and bone development

- **Adulthood**
  - For maintaining health, productivity and prevention of diet-related disease and to support pregnancy/lactation

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Physiologically and nutritionally demand is high¹

Woman’s body increases fat deposits during this period to meet additional nutritional requirement¹

During lactation, nutritious food is needed for milk production and to maintain mother’s health²

Nutrition is an important element of health in this situation²

Important nutrients

Additional calories and protein

Folic acid
↓ risk of congenital malformations
↑ birth weight

Iron
Meet high needs for erythropoiesis

Calcium
Formation of bones and teeth of offspring
Production of calcium rich milk
Prevent osteoporosis in woman
**Important nutrients**

**Iodine**
Proper mental health and growth of fetus and infant

**Vitamin D**
For embryo implantation and regulating the secretion of several hormones

**Vitamin A**
Required to improve child survival

**Vitamin C**
Important for absorption of Iron
FOLIC ACID IN PREGNANCY
• Folic acid and folate (its naturally occurring state) are water-soluble vitamin B₉.
• Folic acid supplementation plays an integral role in pre-pregnancy counselling and pregnancy care.
• There is a link between folic acid deficiency during pregnancy and fetal neural tube defects (NTDs).
• Folic acid also prevents pre-conceptionally recurrent and first occurrence of NTDs.

• Folic acid helps to synthesize cells, repair DNA and serves as a cofactor in other biological reaction in the body

• During pregnancy, there is high demand of RBC production due to fetal growth which results in reduction of blood folate level

• The neural tube normally starts forming in first trimester, hence folic acid is more essential during initial pregnancy

• Around 5-15 % of population compromises the tissue folate levels due to variation of 5, 10-methylenetetrahydrofolate reductase enzyme
An additional requirement of 300 and 100 μg respectively during pregnancy and lactation may be added for meeting the factorial extra needs.
<table>
<thead>
<tr>
<th>Category</th>
<th>Folic Acid required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Women of child bearing age planning for pregnancy- without prior history of NTD</td>
<td>0.4 mg (400 μg) daily</td>
</tr>
<tr>
<td>Women with a previous pregnancy affected by NTD</td>
<td>5 mg daily- starting 1 month before conception</td>
</tr>
<tr>
<td>BMI more than 30</td>
<td>5 mg daily- starting 1 month before conception and continue during the first trimester</td>
</tr>
<tr>
<td>Women with diabetes and epilepsy</td>
<td>5 mg daily</td>
</tr>
<tr>
<td>After first trimester, women receiving higher dose of folic acid can transit to daily multivitamin supplements</td>
<td>Multivitamin supplements containing 0.4 mg folic acid- for the duration of pregnancy and lactation</td>
</tr>
</tbody>
</table>
A folate-supplemented diet with additional daily supplementation of multivitamins with 5 mg folic acid should begin at least –

- Three months before conception and continue until 10 to 12 weeks post conception
- From 12 weeks post-conception and continuing throughout pregnancy and the postpartum period (4–6 weeks or as long as breastfeeding continues)
- Supplementation should consist of a multivitamin with folic acid (0.4–1.0 mg)
<table>
<thead>
<tr>
<th>Category</th>
<th>Body Weight (kg)</th>
<th>RDA (mg/d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adult Female</td>
<td>55</td>
<td>200</td>
</tr>
<tr>
<td>Pregnancy</td>
<td>55</td>
<td>500</td>
</tr>
<tr>
<td>Lactation</td>
<td>55</td>
<td>300</td>
</tr>
<tr>
<td>Infants</td>
<td>5.4 (0-6 m)</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>8.4 (6-12m)</td>
<td>25</td>
</tr>
</tbody>
</table>

VITAMIN B12 IN PREGNANCY
• Pregnant women with low or marginal levels of vitamin B12: at ↑ risk of having children with neural tube defects

• Exclusively breastfed children of mothers with vitamin B12 deficiency: ↑ risk of failure to thrive, hypotonia, ataxia, developmental delays, anemia, and general weakness

• Women at high risk of or with known vitamin B12 deficiency should supplement with vitamin B12 while pregnant or breastfeeding
Risk Factors for Vitamin B12 Deficiency

Decreased Ileal Absorption
- Crohn disease
- Ileal resection
- Tapeworm infestation

Decreased Intrinsic Factor
- Atrophic gastritis
- Pernicious anemia
- Postgastrectomy syndrome (includes Roux-en-Y gastric bypass)

Genetic
- Transcobalamin II deficiency

Inadequate Intake
- Alcohol abuse
- Older persons
- Vegetarians (includes exclusively breastfed children of vegetarian mothers)

Prolonged Medication Use
- Histamine H2 blockers
- Metformin
- Proton pump inhibitors

The American Dietetic Association recommends supplemental vitamin B12 for vegans and lacto-ovo vegetarians during both pregnancy and lactation to ensure that enough vitamin B12 is transferred to the fetus and infant.
• Vitamin B12 is as effective as intramuscular vitamin B12 injections, high dose oral vitamin B12 might be a reasonable choice for replacement in many patients with vitamin B12 deficiency, regardless of the etiology

• Vitamin B12 supplementation to reduce elevated serum homocysteine levels in patients with mild to moderate Alzheimer disease should not be given because it does not alter the rate of cognitive decline

• Vitamin B12 supplementation to reduce levels of serum homocysteine in high-risk patients is not recommended because it does not reduce cardiovascular mortality

<table>
<thead>
<tr>
<th>Category</th>
<th>Recommended intake</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adult female (NPNL)</td>
<td>1.0 µg/d</td>
</tr>
<tr>
<td>Pregnancy</td>
<td>1.2 µg/d</td>
</tr>
<tr>
<td>Lactation</td>
<td>1.5 µg/d</td>
</tr>
<tr>
<td>Infant</td>
<td>0.2 µg/d</td>
</tr>
</tbody>
</table>

NPNL: non-pregnant non-lactating
VITAMIN B6 IN PREGNANCY
• Vitamin B6 is a water-soluble vitamin naturally occurs in three forms - *pyridoxine, pyridoxal and pyridoxamine*

• It plays an important role in metabolic processes in the body and also helps with the development of the nervous system

• During pregnancy, vitamin B6 helps to prevent pre-eclampsia, preterm birth and may also reduce pregnancy related nausea

• Vitamin B6 decreases throughout during pregnancy in plasma and blood, especially in the third trimester
Vitamin B6 plays an important role in the healthy functioning of brain and nervous system.

It is important for healthy function of the brain and nervous system.

Vitamin B6 is necessary for the production of 2 main neurotransmitters - serotonin and norepinephrine.

Resolves nausea and vomiting (morning sickness) also maintains blood glucose levels.

Prevents several issues in newborns (eczema and low birth weight).
Implications of Vitamin B6 Deficiency

- Dermatitis/ Cheilosis
- Microcytic Anemia
- Depression And Confusion
- Glossitis
- Immune System: Weakness
- In Infants: Irritability, Abnormally Acute Hearing and Convulsive Seizures

<table>
<thead>
<tr>
<th>Category</th>
<th>Body Weight (kg)</th>
<th>RDA (mg/d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adult Female</td>
<td>55</td>
<td>2.0</td>
</tr>
<tr>
<td>Pregnancy</td>
<td>55</td>
<td>2.5</td>
</tr>
<tr>
<td>Lactation</td>
<td>55</td>
<td>2.5</td>
</tr>
<tr>
<td>Infants</td>
<td>5.4 (0-6 m)</td>
<td>0.1</td>
</tr>
<tr>
<td></td>
<td>8.4 (6-12m)</td>
<td>0.4</td>
</tr>
</tbody>
</table>
IRON IN PREGNANCY
• 50-70% of population in India are anemic

• According to WHO, hemoglobin below 7gm/dl is severe anemia

• As of 2010, in India, prevalence of mild anemia was 13%, moderated was 57% and severe anemia was 12%

• According to NNMB and NFHS-3 surveys, in mean prevalence of anemia was 24.3% aged more than 20 years
• Iron is needed for fetus growth, maternal tissue expansion including the red cell mass, iron in the placental tissue and the blood loss during parturition

• Additional 760 mg of iron is required during pregnancy

• In Indian women, a gestational weight gain should be around 10-12 kgs

• During lactation, iron requirement is the total of mother requirement plus making up the iron lost in the breast milk
Rasmussen KM. Is there a causal relationship between iron deficiency or iron-deficiency anemia and weight at birth, length of gestation and perinatal mortality?. The Journal of nutrition. 2001 Feb 1;131(2):590S-603S
• An additional 760 mg of iron is required during the entire pregnancy period in Indian women.

<table>
<thead>
<tr>
<th>Trimester</th>
<th>Requirement mg</th>
<th>10 kg GWG</th>
<th>12 kg GWG</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Trimester</td>
<td>130</td>
<td>138</td>
<td></td>
</tr>
<tr>
<td>2nd Trimester</td>
<td>320</td>
<td>372</td>
<td></td>
</tr>
<tr>
<td>3rd Trimester</td>
<td>310</td>
<td>351</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>760</td>
<td>861</td>
<td></td>
</tr>
</tbody>
</table>

GWG: gestational weight gain

Recommended Dietary Allowance: 35 mg/day

• Daily oral iron supplementation resulted in a significantly higher maternal mean hemoglobin (Hb) concentration and a reduced risk of anemia in mothers at term

• ↓ risk of iron-deficiency anemia and also a ↑ mean Hb concentration within 1 month postpartum

• The benefits to the infant:
  1. significant increase in birth length
  2. higher mean ferritin concentrations at 3 and 6 months of age
<table>
<thead>
<tr>
<th>Category</th>
<th>Body weight Kg</th>
<th>Requirement µg/kg/d</th>
<th>Absorption assumed %</th>
<th>RDA mg/d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adult Woman</td>
<td>55</td>
<td>30</td>
<td>8</td>
<td>21</td>
</tr>
<tr>
<td>Pregnant woman</td>
<td>55</td>
<td>51</td>
<td>8</td>
<td>35</td>
</tr>
<tr>
<td>Lactating woman (0-6m)</td>
<td>55</td>
<td>23</td>
<td>8</td>
<td>25</td>
</tr>
<tr>
<td>Infants</td>
<td>5.4 (0-6 m)</td>
<td>46 (0-6 m)</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td></td>
<td>8.4 (6-12 m)</td>
<td>87 (6-12 m)</td>
<td>15 (6-12 m)</td>
<td>5 (6-12 m)</td>
</tr>
</tbody>
</table>

Recommendation: prescribed daily iron supplement in 2 or 3 equally spaced doses

Oral iron supplements must dissolve rapidly in the stomach so that the iron can be absorbed in the duodenum or upper jejunum

Enteric-coated preparations and long-acting supplements may be ineffective, since they do not dissolve in the stomach

CALCIUM AND VITAMIN D
• Required for the skeletal development of the fetus

• Role in neuromuscular function and blood coagulation

• Deficiency alters membrane permeability and smooth muscle contractility could affect blood pressure, as well as lead to premature uterine contractions and subsequent delivery

• R D A in pregnancy: 1200 mg/day

• Supplementation during pregnancy
  – ↓ the risk of high blood pressure (with or without proteinuria) by 30% (RR:0.70; 95%CI: 0.57-0.86)
  – It also significantly reduced the risk of preeclampsia by 52% (RR:0.48; 95%CI: 0.33-0.69)
During pregnancy, vitamin D deficiency has been linked with a number of serious short- and long-term health problems in offspring, (impaired growth, skeletal problems, Type 1 diabetes, asthma and schizophrenia)

- It also has consequence on fetal hypovitaminosis D, neonatal rickets and tetany, and infantile rickets

- Vitamin D deficiency early in pregnancy has been associated with a 5 fold increased risk of preeclampsia

- Also, vitamin D deficiency early in pregnancy may increase the risk of low birth weight babies

- **Recommended dietary allowance: 400 IU**


Calcium

RDA: 1000 mg/day
Pre-eclampsia
Preterm
Premature
Rupture Of The Membranes
Early Contraction

Vitamin D

RDA: 400 - 600 IU/day
Impaired Growth
Skeletal Problems
Pre-eclampsia
Type 1 Diabetes
Asthma
Schizophrenia

“Low calcium intake may be associated with vitamin D deficiency and may be a risk factor for preeclampsia”


<table>
<thead>
<tr>
<th>Category</th>
<th>Calcium Required mg/d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adult Women</td>
<td>600</td>
</tr>
<tr>
<td>Pregnancy</td>
<td>1200</td>
</tr>
<tr>
<td>Lactation</td>
<td>1200</td>
</tr>
<tr>
<td>Infants</td>
<td>500</td>
</tr>
<tr>
<td>Post-menopausal women</td>
<td>800</td>
</tr>
</tbody>
</table>