Health & Mind

January - 2013 Health - 3 Mind - 1 Price - Rs. 5/- Yearly Subscription - Rs. - 60/- only

FETAL GROWTH & THE HIDDEN HUNGER

Dr. Cynthia Alexander MD . , DGO .
Consultant Gynecologist, Obstetrician
Padma Clinic & Nursing Home

Printed on 22.01.2013 Posted on 24.1.2013

Pregnancy is a beautiful journey in every woman's life

- It is precious for her family and doctor
- Prevention, anticipation and management of unforeseen complications will ensure a safe and smooth journey BON VOYAGE!!
- Every child comes into this world to say that God Still Loves The World
- Every mother has a dream of a healthy and intelligent baby
- William Wordsworth in his poem ' The Rainbow ' wrote that The Child Is The Father of Man
- "What we eat is what we are" Dr. Oski

Goals of adequate maternal Nutrition

- Reduce Maternal Mortality and all pregnancy related complications
- Promote maternal health for long term outcomes, prevent onset of metabolic diseases.
- Promote maternal health and adaptation to lactation needs of the energy and essential nutrients.
- Ensure adequacy of all essential nutrients for the infant.
- Reduce child mortality and ensure normal birth weight

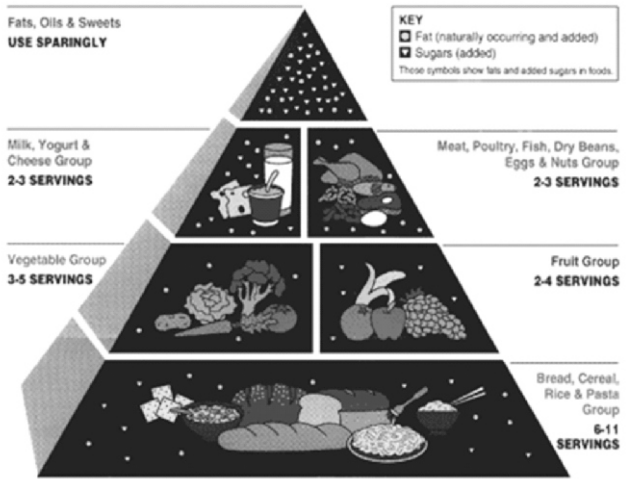
Nutritional requirements during pregnancy

- Nutrition of women in preconception and early pregnancy is essential for normal development not only during pregnancy but also for the future development too
- The threat of nutritional deficiency that starts in the womb continues through the life cycle affecting the nutritional status and health of the next generation
- Targeting under nutrition should be considered as an inter-generational investment

Programming:

vicious cycle of maternal and infant nutritional deficiencies

Fetal programming hypothesis



Maternal Morbidity

- Maternal health issues increase risk and contribute to poor outcome
- Adverse pregnancy outcomes threaten maternal/infant survival
- Maternal diet affects fetal stress tolerance
- Poor nutritional status, infection, and personal stress limit the mother's ability to support fetal development
- Iron deficiency anemia (IDA) is common and contributes to poor maternal/fetal outcomes

1. Jackson AA et al. J Nutr. 2003;133:1589S-1591S.
2. CDC. MMWR. 1998;47(RR-3):1-36.

Pregnancy Outcome-India

- Data from a study in India have shown that women who have severe chronic energy deficiency are 3 times more likely to give birth to a low birth weight baby compared to a woman with normal BMI.
- India is home to around 34% of stunted children worldwide.

Approximately 51% of all children <5 years of age, i.e., around 61 million, are stunted in India.

BMI

- Low BMI is a major predictor of IUGR
- Low birth weight of 2000 -2499 have a four fold risk of neonatal death as compared to babies with a birth weight of 2500-3499

Energy transfer nutrients

- 15 key nutrients are essential to prevent small babies
- Magnesium,iron, phosphorous, zinc, potassium, thiamine, niacin ,copper, pantothenic acid, calcium, riboflavin, folic acid, pyridoxine ,biotin and B12
- Deficiency of these nutrient might limit the amount of nutrient oxidation and ATP turnover
- This will impact cell replication, growth and development
- Low folate level, low B12 level cause neural tube defects
- Vit B6 deficiency is usually associated with folate and B12 deficiency and contributes to hyperhomocystinuria

Importance of Adequate Nutrition

- Optimizes completion of adolescent growth
- Establishes nutrient reserves before pregnancy
- Protects maternal/fetal health during pregnancy
- Maintains adequate nutritional status after menopause
- Combats chronic and/or life-threatening disease

MACRONUTRIENTS Provide Energy and Building Material

Nutrient	Key Roles in the body
Protein	Main building block of the body's cell. Helps produces extra maternal blood and energy stores.
Carbohydrates	Provides energy for the mother and fetus during pregnancy
Fat	Provides long term energy for the growth. Should contribute ≤ 30 % of daily calories.
Essencial Fatty Acids (EFAs)	Incorprated into Central Nervous System, Brain and tissues of the fetus . Essencial for proper Brain growth and Development

Worthington-Roberts B, Williams SR. Maternal nutrition and the outcome of pregnancy.Nutrition in Pregnancy and Lactation, 4th ed. College Publishing: St. Louis, Missouri, 1989. Kline DA. Macronutrient requirements during pregnancy.

VITAMINS Promote Metabolism and Tissue Integrity

Nutrient	Key Roles in the body
Vitamin A	Promotes healthy Skin and mucous membranes of the GI, Urinary and respiratory tracts. Promotes Vision and Immunity, Assist with bone and teeth development.
Vitamin C	Promotes healthy Gums, Bone and teeth. Enhances Iron absorption. Acts as Anti Oxidants.
Vitamin E	Prevents the oxidation of unsaturated fatty acids, which makes up the structure of cell membranes.
Vitamin B6	Helps in production of RBC's, needed for amino acids, fatty acid metabolisms, and protein synthesis.
Vitamin B12	Helps in production of RBC's. Promotes normal growth and maintenance of nervous system.
Folic acid / Folate	Need for the production, repair and functioning of DNA,Need to produce blood and Helps in Enzyme Action

MINERALS Promote: Structural Tissues & Organ System Development

Nutrient	Key Roles in the body
Calcium	Helps building strong bones and teeth by promoting adequate mineralization. Involved in muscle contraction and relaxation, Nerve functioning, blood clotting, blood pressure and Immunity
Iron	Helps in synthesizing RBC's.helps prevent maternal Fatigue.Need by enzymes that make amino acids, collagen, harmones.
Magnesium	Helps build strong bones and teeth. Helps regulate Insulin and blood sugar levels. Helps maintain acid - base balance
Zinc	Helps form organs, skeleton, nerves and circulatory organs. Is a component of Insulin and several other enzymes. Helps Synthesize DNA,RNA and proteins. Involved in wound healing

Whitney EN, Rolfes SR. Understanding Nutrition, 9th ed. Wadsworth/Thomson Learning: Belmont, CA; 2002.
Kline DA. Macronutrient requirements during pregnancy.Today's Dietitian Jan 2004:20-24.

Dietary Quality and Timing: The First Trimester

- Both the amount of a nutrient and its timing of intake are extremely important to fetal development.
- The first trimester is a time of rapid cell division, organ development, and preparation for the demands of rapid fetal growth that occur later in pregnancy.
- Critical nutrients during this phase include:
  - Protein
  - Folic acid
  - Vitamin B12
  - Zinc

Dietary Quality and Timing: The 2nd and 3rd Trimesters

- Energy intake is especially important since 90% of fetal growth occurs during the last half of gestation.
- Critical nutrients during this phase include:
  - Protein
  - Iron
  - Calcium
  - Magnesium
  - B vitamins

Omega-3 fatty acid, docosahexaenoic acid (DHA)

- Additional energy for a full term pregnancy is around 80000 calories

King JC. Physiology of pregnancy and nutrient metabolism.Am J ClinNutr 2000;71:1218S-1215S.
Kline DA. Macronutrient requirements during pregnancy.Today's Dietitian Jan 2004:20-24.

Energy Needs: During Pregnancy

- Extra Energy Needs for Normal Weight Women:
- First trimester ~ 0 kilocalories
- Second trimester ~ 350 kilocalories
- Third trimester ~ 500 kilocalories
- There is great variability among pregnant women with regard to energy costs during pregnancy related to differences in body size and lifestyles.
- Appropriate weight gain and appetite are better indicators of energy sufficiency than the amount of kilocalories consumed.
- Protein need increases due to an increase in protein turnover and deposition in the fetus and uterus
- Expanded maternal blood volume, mammary glands and skeletal muscle also increases the protein requirement.
- There are no indications that pregnant women have specific needs with regards to total fat.
  - However, Essential Fatty Acids (EFA) are needed in higher amounts during pregnancy.
  - Essential fatty acids (EFA) are those which cannot be synthesized by the body and therefore have to be provided by the diet. The supply from the maternal circulation a major source of the EFA in fetus.
- Pregnancy complications like intrauterine growth retardation1, pregnancy-induced hypertension2, and pre-eclampsia3 are associated with distinct alterations in both the maternal as well as the neonatal essential fatty acids status.
- Two important Polyunsaturated fatty acids (PUFA) are EFA:
  - Linoleic acid (n-6; LA)
  - Alpha-linolenic acid (n-3; ALA)
  - LA and ALA extend their chain and inserts further double bonds to form long-chain polyunsaturated fatty acids (LC-PUFA)
    - Arachidonic acid (AA)
    - Docosahexaenoic acid (DHA)

- Eicosapentaenoic acid (EPA)

DHA

- ✔ Important component of cell membranes
- ✔ Abundant in neural, retinal and cardiovascular conducting tissue
- ✔ DHA is particularly found in the membranes of neuronal synapses and in the outer segments of retinal rods and cones
- During the growth spurt of the brain there is a 30-fold increase in the total amount of DHA.
- Within the visual system, docosahexaenoicacid (DHA, 22:6n–3) is an important structural component for retinal photoreceptors and cortical gray matter
- There is a marked decrease in neural DHA accumulation in the face of DHA deficiency
- In full-term infants, improved visual function related to the provision of n–3 fatty acids during the postnatal period has been repeatedly reported based on the application of methods of visual acuity assessment.

Nutrient	Maternal	Fetal	Neonatal
Calcium	Preeclampsia	Premature Delivery Abnormal Fetal development	Hypertension Increased risk of adult disease
Copper	Miscarriage	Anencephaly Abnormal Fetal development	No Neonatal stores
Iodine	Miscarriage	Premature Delivery Anencephaly Abnormal Fetal development	Mental retardation
Iron	Preeclampsia Hemorrhage Postnatal depression	Premature Delivery Spina bifida Low birthweight	Low Neonatal stores Anemia Delayed Neurological development Increased risk of adult disease
Magnesium	Preeclampsia	Premature Delivery Spina bifida Low birthweight	Increased risk of adult disease
Selenium	Preeclampsia Miscarriage	Premature Delivery Spina bifida	
Zinc	Preeclampsia	Premature Delivery Anencephaly Spina bifida Low birthweight	Low Neonatal stores

- Integral part of many proteins including hemoglobin
- 2/3rd iron as hemoglobin and remainder as other heme protein (myoglobin, cytochromes) and transport vehicles
- Marked increase in the maternal blood volume and red cell mass increases the demand for iron.
- Erythrocyte volume increases by 20% to 30%.
- Most accretion occurs after the 20th week of gestation
- Most women enter pregnancy with low iron stores.
- Maternal anemia, defined by a hematocrit less that 32% and aHb of 11g/dl.
- Maternal anemia increases maternal mortality, preterm delivery, LBW babies, iron deficiency anemia in infants and increased peri-natal infant mortality
- To prevent anemia iron supplementation usually in the form of ferrous salts, is often recommended.
- Iodine is an essential part of the thyroid hormones thyroxine (T4) and trijodthyronine (T3) which play an important role in
  - Growth regulation
  - Bone metabolism
  - Brain development
  - Human metabolism
  - Fetus is dependent on its own hormone production as the thyroid hormones cannot pass the placenta

Maternal iodine deficiency is associated with cretinism, aberrations in brain development, deaf-mutism and altered psychomotor development in the infant.

- The total amount of zinc retained during pregnancy has been estimated to be 1.5mmol (100mg).
- During the third trimester, the physiological requirement of zinc is approximately twice as high as that in non pregnant women
- Zinc is needed for
  - Central role in cell division
  - Growth of fetus
  - Protein synthesis
- Increased B complex vitamins
  - B complex vitamins for increased maternal metabolism & accretion of different maternal & fetal tissues
- Increased Vitamin A requirement for:
  - Sustain the growth of fetus
  - Limited reserve in fetal liver
  - Maintaining maternal tissue growth
  - Additional Vitamin C (especially during the 3rd

trimester) for:

- Protecting the Mother & fetus against oxidative stress
- Growing needs of the fetus

- Pyridoxal 5 Phosphate

RDA is 1.9micro gram/day – pregnancy
2.0 Micro Gram/day – Lactation
Def causes Pre-eclampsia
Low apgar
In homocysteine metabolism increases the risk of NTD
Hyper homocysteinemia (associated with increased risk of congenital defects

B12

2.6 micro grams/day – pregnancy
2.8 micro grams/day – lactaion
Def -> increases early pregnancy loss and pre-eclamsia
Increased risk of abnormal behavior and development
Impairs myelination of fetus and infant leading to learning and social interaction
In infants deficiency when not detected can cause severe and permanent neurological damage
Increases risk of NTD and hyper homocysteinamia

- Folate plays an important role in the synthesis of DNA and RNA and a cofactor in other metabolic processes during development
- It is required for the proper closure of the spinal cord and brain, (between day 21 and day 27 of pregnancy)
- Maternal folic acid deficiency in this period may lead to an increased risk of fetal neural tube defects (NTDs) - spina bifida, anencephaly, cleft lip and cleft palate
- An erythrocyte folate level of 906 nmol/l is required for optimal NTD risk reduction.
- This can be achieved by supplementation of L methylfolate 416 micro grams/day (or)
  - Folic acid 400 micro grams /day
  - RDA is 400-800 perday in pregnancy
  - 500 micro grams in lactation
  - In previous NTD it is 4000 micro grams

Therapeutic supplementation of L methyfolate

In pre-conception phase

1. better than folic acid
2. better bio availability
3. and better preservation of maternal folate levels

Supplementation during pregnancy

1. to avoid low birth weight
2. abruptions and spontaneous abortions hence better to continue RDA of 600 micro grams /day from 3 months preconception to end of pregnancy and lactation – 500 micro grams

- Choline is essential as cannot be sufficiently synthesized to meet metabolic needs
- Needed for structural integrity of cell membranes.
- Essential for brain development and prevention of memory impairment in infants

Choline and folate are also important in later periods of pregnancy when the memory center of brain (hippocampus) is developing.

Additional Energy requirement:

- Milk production is 80% efficient: production of 100 ml milk expends 85Kcals
- During first 6 months average milk production is 750ml/day.
- Maternal fat stores accumulated during pregnancy provide 100-150Kcals to support early months of lactation
- Women who are already lean may be at risk for reduced milk production if they restrict their energy intake.

Additional Protein requirement:

- The average protein requirement for lactation is estimated from milk composition data and the mean daily volume of 750ml, assuming an efficiency of 70% in the conversion of dietary protein to milk protein.
- Additional requirements are be decided on clinical judgement as difference in requirement occurs with overweight and woman with lower BMI.

 Women with surgical delivery and women who enter pregnancy in poor nutritional shape may need additional protein.
 The infants depend on mother's milk for DHA requirements which comes from the maternal diet
Probiotics are bacterial preparations that impact clinically verified beneficial effects on health of the host when consumed orally

J Nutrition 2005

In simple words, Probiotics are viable microbial food supplements, which have beneficial impact on human health
 Supplementation with probiotics in pregnancy has the potential to influence fetal immune parameters as well as immunomodulatory factors in breast milk.
 Neonates whose mothers had received a probiotic had higher cord blood IFN- levels (P = 0.026)
 Mothers in the probiotic groups were significantly more likely (88%) to have any detectable IgA in early breast milk samples.
 Epidemiological studies point to the early environment as a window of opportunity in shaping the infant's immune responder type.
 Probiotics during pregnancy and breast feeding helps in establishment of bifidobacteriummicrobiota.
 The incorporation of probiotics in the mother's diet before delivery and in the infant diet during breastfeeding has the potential to influence fetal immune parameters
The colonization of the neonatal gut starts immediately after birth
 is influenced by the mode of delivery
 composition of the maternal microbiota
 mode of feeding ie, breast milk or infant formula
 In early infancy, the intestinal microbiota further influences the development of the immune system
It has been found to be associated with the later appearance of allergies

Conditions That May Result in Inadequate Nutrient Intake and Weight Gain During Pregnancy
 Nausea and vomiting
 Heartburn
 Constipation
 Food aversions – alcohol, caffeinated beverages, and meats.
 Food avoidances – milk, lean meats, pork, and liver.
 Poor pre-pregnancy diet:
 Inappropriate dietary patterns
 History of frequent dieting, weight cycling, and/or eating disorders
Excessive physical activity

Eating Strategies
 Strategies that are recommended to deal with some of these issues include:
 Small, frequent meals and snacks
 Adequate fiber intake
 Adequate fluid intake
 Avoiding an empty stomach
Choosing foods that are well tolerated

Life in Balance
 The risk of overweight due to excessive pregnancy weight gain needs to be balanced against the risk of poor fetal growth associated with inadequate weight gain.
 Diet needs to be nutrient dense to supply sufficient nutrients to the developing fetus, since fetal demands may double some micronutrient requirements.2
Eating for Two?
▶ Another study of the dietary intakes of pregnant women enrolled in WIC found the following:
▶ Consumed only 85% of the RDA for energy (kilocalories).
▶ Average energy intake from fat was higher than recommended (37% vs. 30%).
▶ 90% consumed less than 2/3 of the RDA for iron.
▶ 22% had iron-deficiency anemia.

The Dilemma
- Overeating of total energy/kilocalories
- Undereating of total energy/kilocalories
- Overconsumption of low nutrient-dense foods
- Underconsumption of high nutrient-dense foods

Beyond Pregnancy
- Energy and nutrient needs continue to be elevated postpartum, particularly in women who choose to

breastfeed or who have had a cesarean section.

- The energy required for daily milk production is close to 560 kilocalories.1
- The inherent demands of a newborn are a challenge to the new mother and her family!

Summary

- Inadequate nutrition intake during pregnancy results in an adverse impact on the maternal, fetal and subsequently the infant health status
- Folate deficiency in pregnant women is associated with increased risk of giving birth to low-birth-weight, premature infants with NTD
- Pre-conceptionalfolate supplementation during early pregnancy reduced the risk of developing NTDs as well as orofacial anomalies
- Advantages of supplementation with L-methylfolate include:
  - reduced masking of vitamin B12 deficiency
  - alleviation of possible adverse effects of un-metabolized folic acid in the peripheral circulation
- PLP is the most common form of vitamin B6
- Clinical studies have shown that maternal vitamin B6 deficiency may be responsible for increased risk of pre-eclampsia and low APGAR scores in infant
- Maternal vitamin B12 deficiency affects myelination of the brain and thereby affects brain development
- Vitamin B12 shares an inverse relationship with homocysteine and its deficiency results in hyperhomocysteinemia.
- Hyperhomocysteinemia predicts the risk of pre-eclampsia and is associated with early recurrent pregnancy loss.
- DHA is a major poly-unsaturated fatty acid, which is found in the brain and is involved in brain development and function
- Maternal vitamin B12 deficiency during pregnancy affects:
  - myelination of the brain and therefore brain development
  - Psycho-educational development of the infant

L-methylfolate, PLP, methylcobalamin and DHA are required during pregnancy throughtout lactation for the normal development of the fetus and the infant, while folate is required from the pre-conception phase.

Social Picture

- India is Shining – no doubt!
- But in certain aspects – Infant Mortality maternal mortality preterm delivery rates

Stunted growth

- Are we in the right direction towards our care for our women and children?
- Is it lack of knowledge? Myths,superstitions, poverty, lack of food ?
- 20 % of the population consumes 80% while 80% of the population is left with remaining 20%

Ask Your Doctor

PMJF Lion Prof. **Dr.K.GIREESH**
M.D.(Gen Med)., DM., (Neurology).,
M.ch. (Neurosurgery)
Neurophysician & Neurosurgeon

This page consists of answers to questions asked by the patients and public to Doctor K. GIREESH eminent Physician Neurophysician and Neurosurgeon in his regular out patient clinic and answers to questions which he has received by email and online chat.

Q. I had been having headache on the right side and sometimes in the neck. A All investigations are within normal limbs. I had been treated for Rheumatocid Arthritis. The family doctor said that it could be Temporal arteritis? What is this disease? - Kalaiselvi

Ans. Temporal arteritis is a granulomatous arteritis affecting large – size and medium arteries of the upper part of the body, including the temporal vessels. Hist6ologic studies reveal intimal thickening and lymphocytic infiltration of the media and adventitia.

Postal Registration Number: TN/CCN/550/11-13
R.N.I.no. TN ENG/2011/38850 - Posted on Dt. 24-1-2013

Patient generally present after ago 60. The headaches are sometimes abrupt in onset. And patient also complain of polymyalgia pain and stiffness in the neck, shoulders, and back and sometimes in the pelvic gridle.

Severe pain may be experienced in one temple but often occurs in the occipital area, face, jaw, or side of the neck and may be associated with exquisite hypesthesia throughout the scalp. The pain may have a throbbing character.
The most severe complication is loss of vision, which may not be reversible.In addition to clinical findings, ancillary data include an elevated sedimentation rate and positive temporal artery biopsy.

Treatment involves immediate use of large doses(i.e.,40-60mg)of prednisone daily for the first week, with gradual reduction over the next 4-6 weeks to a maintenance dose of 5-10mg/day. Sedimentation rates can to be followed, and when the sedimentation rate is normal for 4months, further tapering of medication is justified.

Owned and Published by: Dr.Kannan Gireesh
Printed by : S. Bakthan, Printed at : Devi Suganth Printers,
17, Jani Batcha Lane, Royapettah Chennai-14.
Published at : 432/753, Poonamallee High Road,
Kilpauk, Chennai - 10, **Editor : Dr.Kannan Gireesh**

Registered newspaper Posted at Egmore RMS Patrika Channel