THINK FIRST NUTRITION TO SUPPORT QUALITY OF PREGNANCY

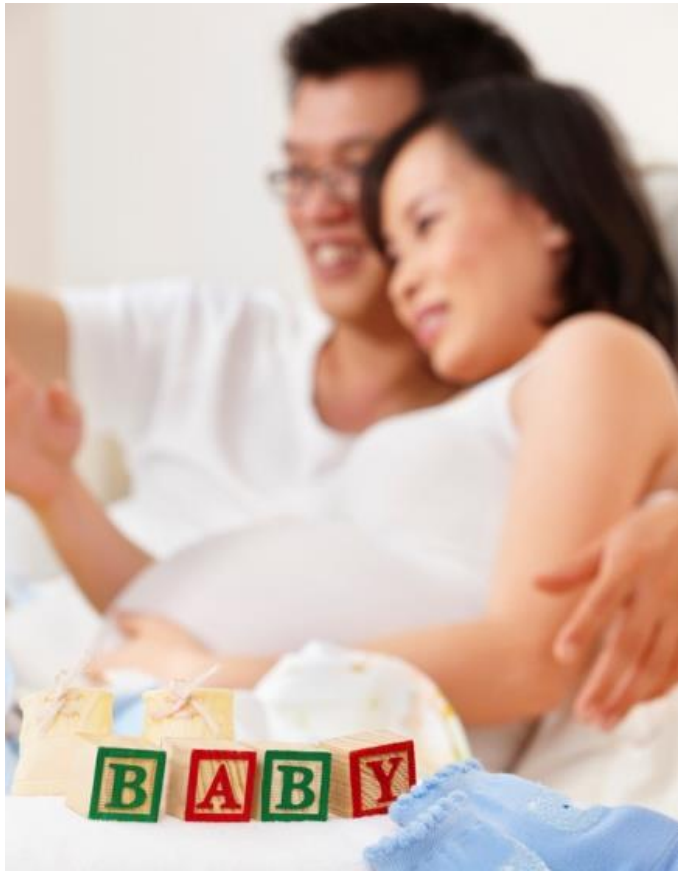
19th of SCGO's Symposium

Date: 21st Nov, 2020

By Prof. Keth Lysotha

To day objective:

1. Impact of nutrition on fetal development
   - Short term & Long term
2. Nutrition goals
   - Food Guide
3. Barriers to good nutrition
   - Role of maternal nutrition supplements



Maternal Nutrition
– Does it matter what you eat & drink?

THINK NUTRITIONIST

> "The nutritional status of a woman before and during pregnancy is important for a healthy pregnancy outcome."
>
> - *Robert E Black et al. Lancet 2008*

Give Your Baby A Great Start

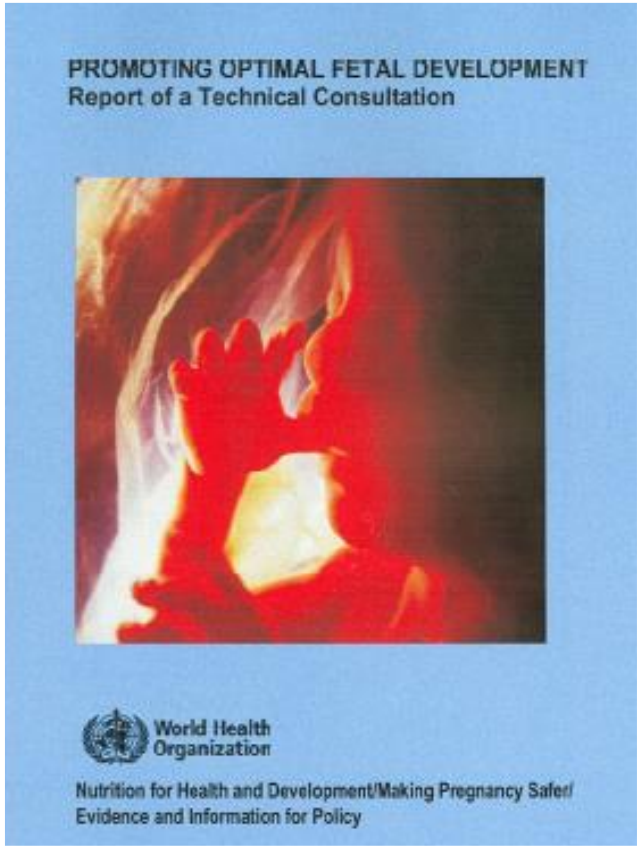
Ensure Your Child's Current and Long-term health

Maternal Nutrition → Child Health

Good maternal nutrition improves infant health in the following ways:

- School performance and skills
- Physical work capacity
- Learning skills
- Resistance to infections
- Health during adolescence, especially among girls
- Health in adult life
- Productivity and economic gains

Reference: Promoting Optimal Fetal Development - Report of a Technical Consultation – World Health Organization, 2003.



*"Securing **optimal fetal development** requires the potential mother to be in a state of physical and emotional health prior to and during her pregnancy."*

Maternal Nutrition – Does it matter what you eat & drink?

Recommendations for optimizing nutrition throughout the life cycle

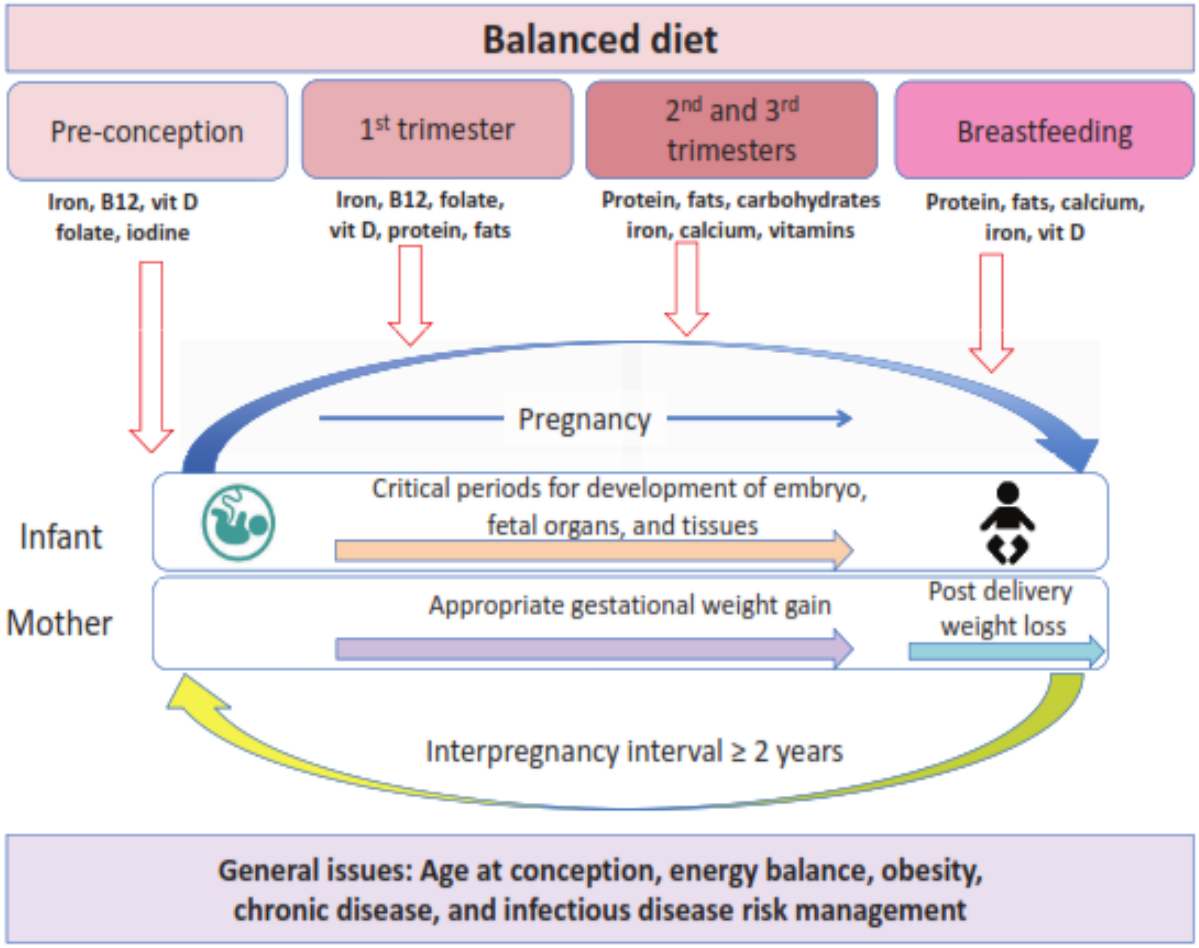
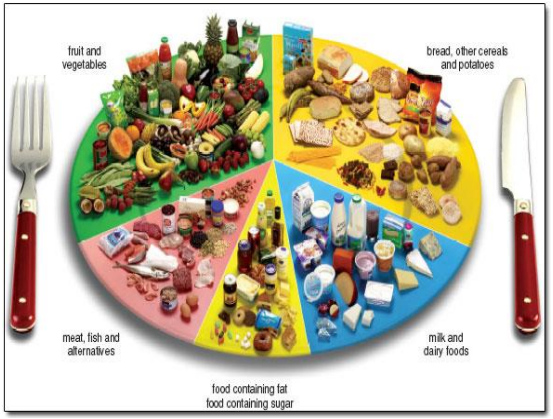


Figure 5 Examples of key nutritional issues for mother and baby through different stages of pregnancy.

- FIGO recommends that adolescent, preconception, and maternal nutrition should be part of a life course approach
- Standard care should involve a wide range of healthcare providers working together, with a focus on nutrition health, and lifestyle during adolescence and through a woman's reproductive life and beyond



M.A. Hanson et al. International Journal of Gynecology and Obstetrics 131 S4 (2015) S213–S253

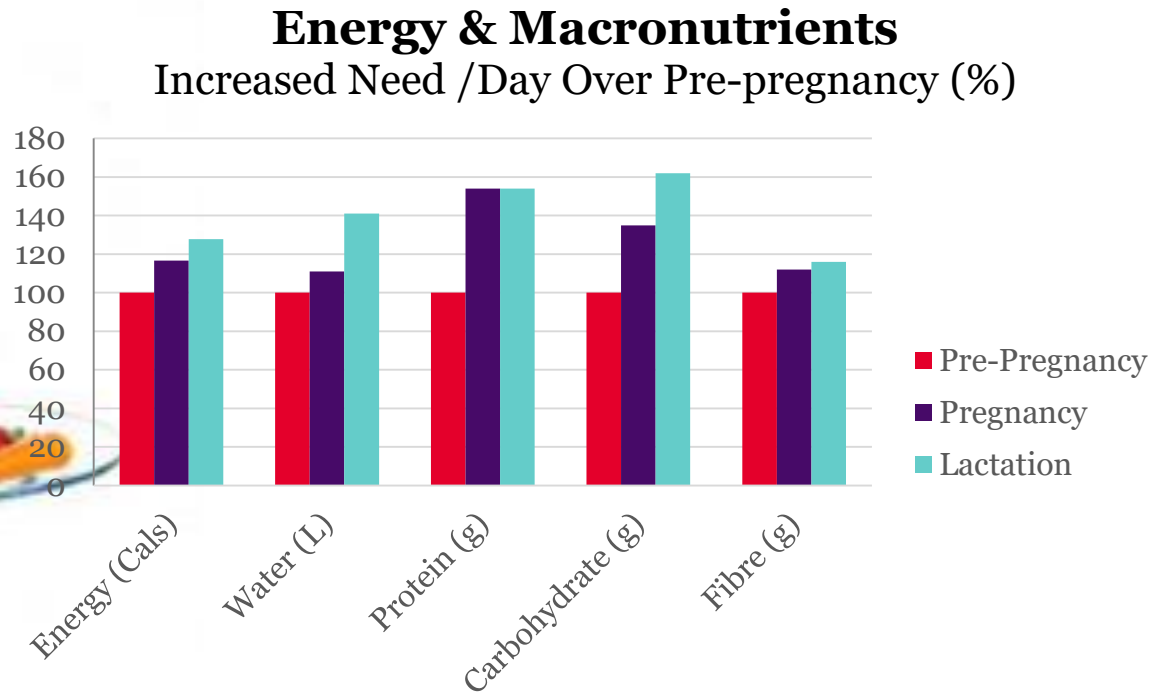
Maternal Nutrition Overview

- A healthy**, balanced diet that contains adequate amounts of nutrients** is essential for the development of a baby.
- During pregnancy and after delivery, a mother's body goes through many physiological changes.
- At no other time in woman's life is nutrition more important than before, during and after pregnancy
  - » Preconception nutrient needs
  - » Pregnancy stages increased nutrient demands
  - » Lactation nutrient needs

The **American College of Obstetricians and Gynecologists (ACOG).** Your Pregnancy and Childbirth Month to Month, May 2010. 5th edition

Preconception Nutrient Needs (1/3)

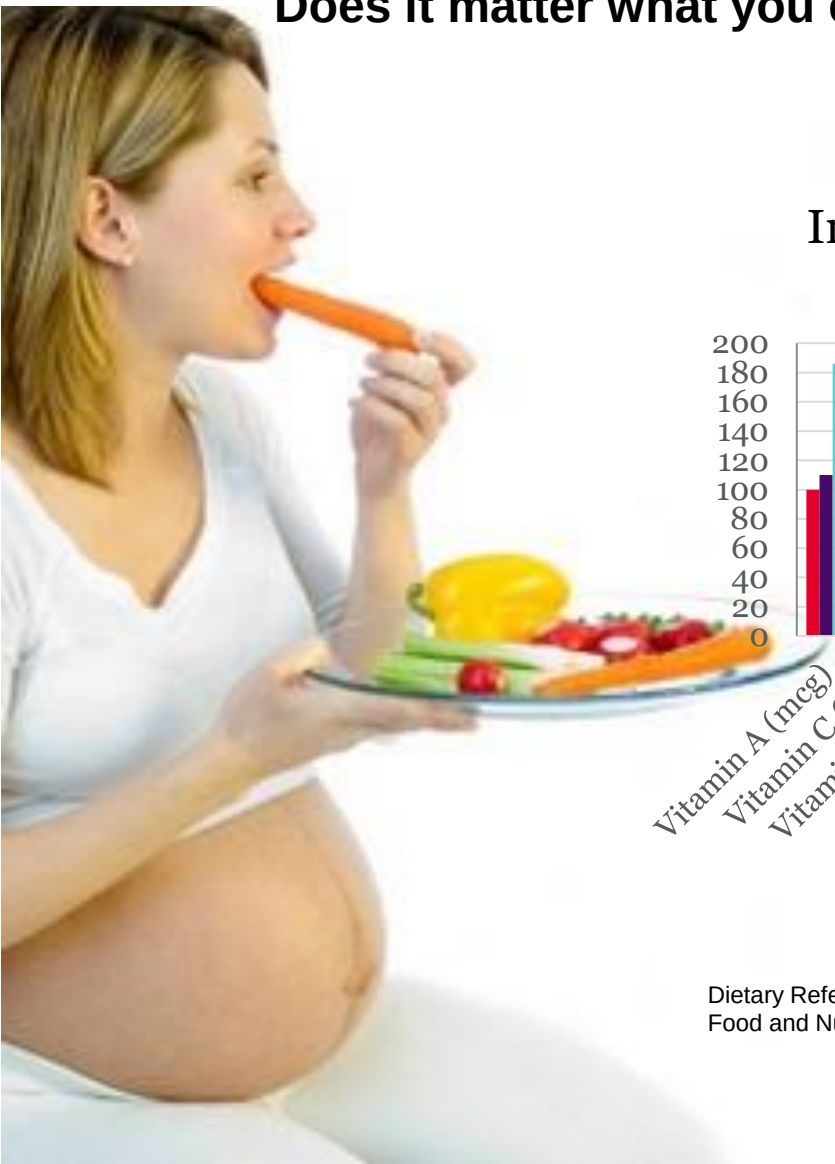
Does it matter what you eat & drink?

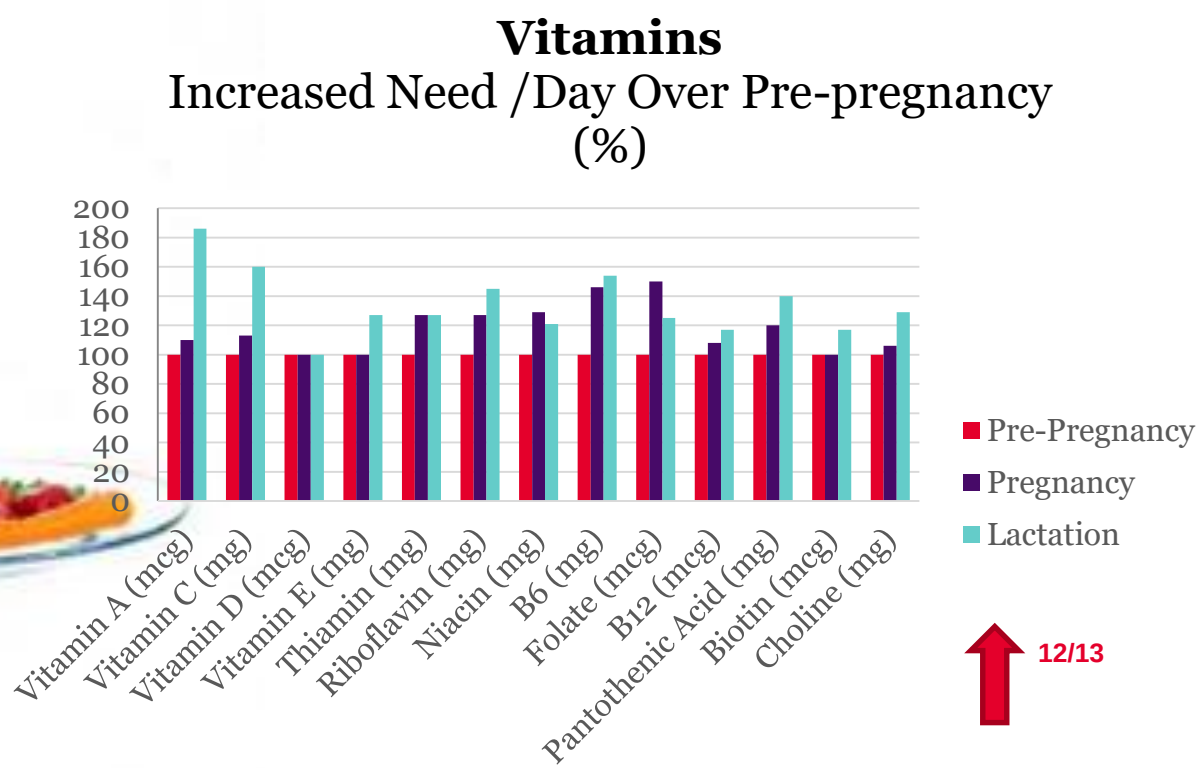


Dietary Reference Intakes (DRIs): Recommended Dietary Allowances and Adequate Intakes, Water and Macronutrients
Food and Nutrition Board, Institute of Medicine, National Academies (2011)

Preconception Nutrient Needs (2/3)

Does it matter what you eat & drink?





Dietary Reference Intakes (DRIs): Recommended Dietary Allowances and Adequate Intakes, Vitamins
Food and Nutrition Board, Institute of Medicine, National Academies (2011)

Preconception Nutrient Needs (3/3)

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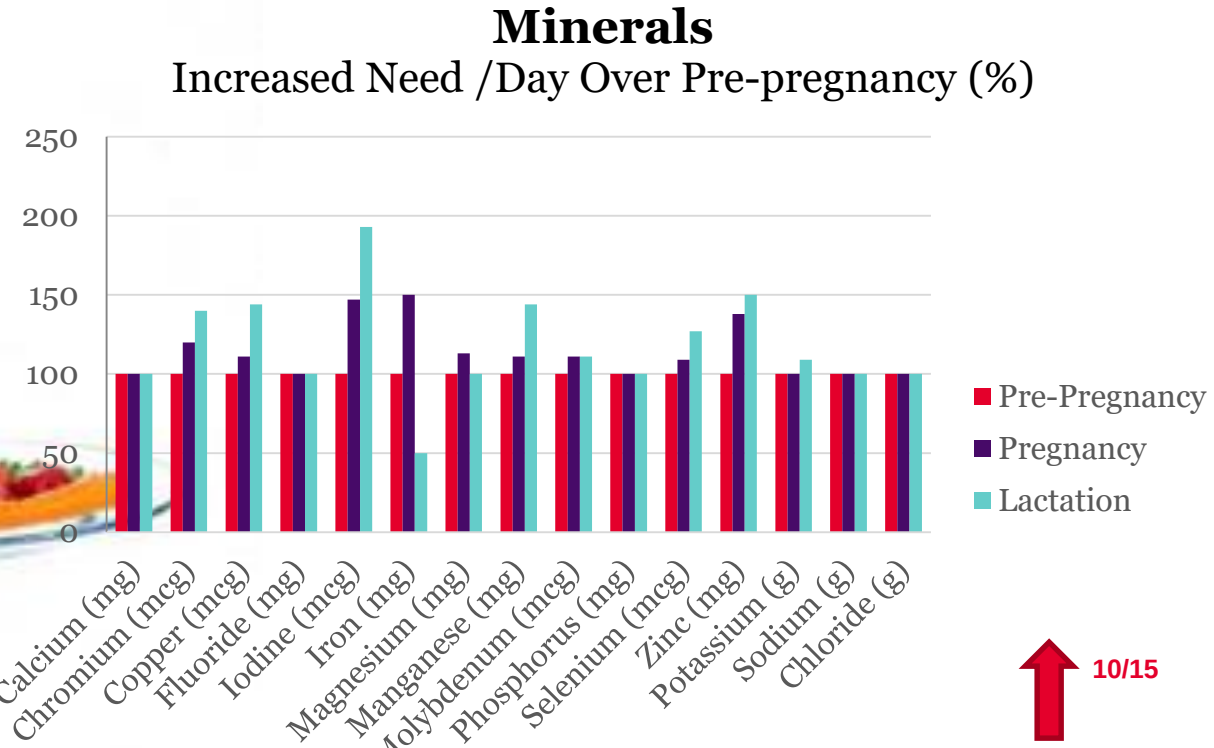
Does it matter what you eat & drink?



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Dietary Reference Intakes (DRIs): Recommended Dietary Allowances and Adequate Intakes, Elements
Food and Nutrition Board, Institute of Medicine, National Academies (2011)

Prenatal Nutrition Overview (2/9)

Months 1 & 2

ACOG says 70 - 85% pregnant women experience **morning sickness** during first trimester (can occur any time of day)

- Generally nausea begins about the 6th week & ends by 14 weeks
- Up to 2% experience hyperemesis gravidarum

ACOG recommends **prenatal vitamins** as soon as conception

- Difficult to get important nutrients during times of nausea
- Women may have poor quality diets

By week 4, the embryo's **neural tube** is completing development

- The neural tube forms the brain, spinal cord and backbone
- **Folic acid** helps prevent defects and is needed in the 1st trimester (US DRIs)

Prenatal Nutrition Overview (3/9)
Months 1 & 2

Maternal **Iodine**

- Iodine is essential for thyroid hormone function
- Thyroid hormones regulate key biochemical reactions for normal brain development and maturation
- Iodine deficiency in mother can cause severe mental retardation (cretinism) in the baby
- **Before/during the first 3 mo of pregnancy** –maternal supplementation of 220 mcg/day can prevent brain damage
- Eliminate maternal iodine deficiency via this supplementation (US DRIs)
- Good sources include
  - Seafood
  - Salt has been fortified with iodine in several countries

Prenatal Nutrition Overview (4/9)

Months 3 & 4

Iron needed as weight gain begins (between 0.5-2 kg by end of 4 mo) (ACOG, US DRIs)

- Iron is found primarily in hemoglobin helps carry oxygen to the fetus
- Blood volume increases as placenta fully develops
- Anemic women need 60 mg iron until anemia is resolved (ACOG)

Vitamin B_{12}

- Vegans and lacto-ovo vegetarians need supplemental vitamin B_{12} (Jensen 1995)
- Essential for normal blood formation and neurological functions
- Necessary to avoid neurological developmental delays in the baby

Prenatal Nutrition Overview (5/9)
Months 3 & 4

Oral health is especially important

- Dental check up needed during pregnancy
  - Hormonal changes put pregnant women at increased risk for cavities and gum disease (ACOG 2010)
- Use softer brush
  - Hormones may cause gum swelling and bleeding

Appetite may increase in 2nd trimester (ACOG 2010)

- **Occasional cravings** for certain foods okay
- Consuming only a few types of food eaten over a long period can be a hindrance to a healthy diet
- **Pica**
  - Nonfood cravings (laundry starch, clay or chalk) are harmful & prevent good nutrition
- Must **discuss this craving with health care provider** if it exists

Prenatal Nutrition Overview (6/9)

Months 5 & 6

B vitamins – Thiamin, Riboflavin, Vitamin B_6

- Essential to supply energy in 1st & 2nd trimester
- Energy needed to begin to build new tissues (such as the placenta) and other tissues for the baby's development (US DRIs)

Normal maternal weight gain by the end of 6 months is generally 4.5-11.5 kg (ACOG 2010)

DHA Omega-3 fatty acids

- End of the 2nd trimester & beginning of 3rd trimester
- DHA functions in cell signaling, regulating inflammation and neurological functioning
  - Brain growth reaches maximum growth velocity in final 3 months of pregnancy

Choline

- Beginning of 3rd trimester choline is especially important to help with cell structural integrity, neurotransmitter signaling to support brain development (Ziesel 2009)
- Choline is not normally found in prenatal vitamins

Prenatal Nutrition Overview (7/9)

Months 7, 8, & 9

Water

- 1.4-2 L/day (six to eight 8-ounce cups/day [ACOG 2010])
- Needed for circulation of nutrients within and out of the body
- Aids digestion
- Helps form amniotic fluid

Fiber

- For laxation, promotion of satiety, attenuate blood glucose levels, normalize serum cholesterol levels
- Recommended 28g/d for pregnancy and 29g/d during lactation (US DRI)
- Food sources (fruits, vegetables, whole grains, beans & seeds
- Functional sources (scFOS non-digestible carbohydrates)

Prenatal Nutrition Overview (8/9)

Months 7, 8, & 9

Vitamin D

- Functions primarily to aid in intestinal absorption of calcium and phosphorus
- Vitamin D deficiency in pregnancy is associated with disorders:
  - Calcium metabolism (mother and infant)
    - Neonatal hypocalcemia and tetany
  - Infant hypoplasia of tooth enamel
  - Maternal osteomalacia
- Prevalence vitamin D deficiency is high
  - Compared to light skin, dark skin individuals have decreased vitamin D synthesis action from the sun (Dijkstra 2007, Sahu 2009)

Calcium

- Calcium is needed for structure of baby's bones and teeth
- Pregnant women have an increased level of calcium absorption due to hormonal changes (Kovacs 2001)
- If not enough calcium is present in the diet, calcium needed by baby is taken from mother's bones

Prenatal Nutrition Overview (9/9)

Months 7, 8, & 9

Zinc and Antioxidant Vitamins C & E for a healthy immune system (Antioxidant section of DRIs)

- Important for over-all health of the immune system
- Helps build strong bones and muscles
- Biosynthesis of collagen and neurotransmitters
- Protects cell membranes as reducing agents
- Regulate other hormone actions

DHA and Choline

- 3rd trimester DHA benefit is greatest during rapid brain growth (Ziesel 2009)
- Necessary to support the function and integrity of cells during rapid brain growth
- DHA is most abundant fatty acid in the brain and eye (retina) where visual and mental development occurs

Lactation
General Information

Breastfeeding is universally recommended by International agencies and various US health organizations as the **preferred method of infant feeding**

Nutritionally adequate mothers, provided with adequate energy and profile of nutrients support normal growth and development without any additional foods through the first 4 to 6 months of life

Human milk provides an array of non-nutritive growth factors, **immune factors, hormones, and other bioactive ingredients that act as biological signals** and confer protection against illness in infancy and later in life

(Picciano 2001)

Lactation (1/4)
Composition and Volume

Composition and **volume** of human milk secreted are influenced by many factors:

- Genetic individuality
- Maternal nutritional status
- Stage of gestation and lactation

Milk secretion volume

- Day 1 - 50 mL
- Day 5 - 500 mL
- Day 30 - 650 mL
- Month 3 - 750 mL

(Picciano 2001)

Lactation (2/4)
Energy Requirements

Calories

- 750 - 1000 mL of human milk is average volume (Jensen 1995)
- Nursing mothers recommended increase in energy intake:
  - 1st 6 months 450 calories/day
    - *Assumption that 170 calories/day will be mobilized from energy stores accumulated during pregnancy*
  - After 6 months - 400 calories/day (Picciano 2003)
- Energy demands of lactation exceed pre-pregnancy demands by approximately 640 calories/day during the 1st 6 months post partum (IOM 1991)

The estimated **energy cost** of 6 to 9 months of lactation exceeds that of pregnancy by approximately 42% and 98%, respectively (Picciano 2001)

Lactation (3/4)
Maternal Nutrition Needs

Maternal nutritional requirements are exceedingly high to support lactation and are among the **highest in human development**

Macronutrients, vitamins and minerals are transferred to support growth and development of growing infants

Increased requirements pregnancy:

- Energy, Vitamin C, Riboflavin, Vitamin B_6, Vitamin B_{12}, Pantothenic Acid, Biotin, Choline, Vitamin A, Vitamin E, Zinc, Iodine, Selenium. (IOM)

Nutritional deficiencies may develop during this period and affect both mother and infant

(Picciano 2001)

Lactation (4/4)
Vitamins, Human Milk & Maternal Nutrition

In general, **vitamin content** of human milk is affected by maternal vitamin intake and nutritional status (Jensen 1995)

Vitamins increased in human milk with maternal supplementation

- **Vitamin C, Thiamin, Riboflavin, Niacin** (Picciano 2001)

Breastfed infants can develop rickets

- Lack of **Vitamin D** in milk
  - Breast milk is unresponsive to maternal intake (Hollis 2004, Sharma 2009, Ward 2007)
- Vegetarian mothers who restrict their intake of vitamin D-rich foods, shield body from sunlight, or live in northern latitudes
- Vitamin D supplementation for breastfed infants is recommended

Maternal Nutrition
- Goals for pregnancy

More than 30 different types of nutrients needed daily to sustain good health and promote foetal growth.

A maternal nutritional supplement should satisfy both the need for:

- **Macronutrients Balance**
  – carbohydrate, protein and fat

- **Micronutrients diversity**
  – vitamins and minerals

Professor David Barker
University of Southampton, UK

Role of Maternal Nutritional Supplementation

Discomforts of Pregnancy

- Morning sickness
- Heartburn
- Indigestion
- Food cravings
- Food aversions
- Poor appetite

Imbalanced diet &
Nutrient inadequacies

A maternal nutritional supplement is helpful to achieve nutritional adequacy.

70 - 85% pregnant women experience **morning sickness** during first trimester (can occur any time of day)

- Generally nausea begins about the 6th week & ends by 14 weeks
- Up to 2% experience hyperemesis gravidarum

Why Take A Prenatal Supplement?

During pregnancy, nutrient needs increase for several vitamins and minerals. This makes it difficult to get all the nutrients need from food.

Supplement Do's and Don'ts

- Take a prenatal supplement instead of individual vitamins or minerals.
- Do not encourage self medication with OTC dietary supplements or herbal products.
- Ask about any supplements you are already taking, including herbal or botanicals, to protect against mother taking too much.

Know the Supplement Difference

- **Calcium Tablets**
  - Only helps meet calcium needs
  - Does not provide other macro- and micronutrients or fiber

- **Multivitamins Tablets**
  - Provides vitamin and minerals
  - Does not contain macronutrients or fiber

Know the Supplement Difference

- **Regular Fresh Milk**
  - Goodness of Milk, especially protein and calcium

    On A Quest For The Best?
    - ✓Lower fat option
    - ✓Added with vitamins/minerals

- **Maternal Milk Supplement**
  - Goodness of Milk, especially protein and calcium
  - + Vitamins and Minerals; **+ DHA**, Choline, Fiber & more…

    On A Quest For The Best?
    - ✓Lowest in fat
    - ✓Most complete range of vitamins and minerals to help meet nutrient recommendations
    - ✓Maternal Milk supplement which contains **Natural Vitamin E (NVE) and Lutein better on Brain and Eyes development.**

New Heroes: *RRR* Vitamin E (NVE), Lutein and DHA

A New Look at

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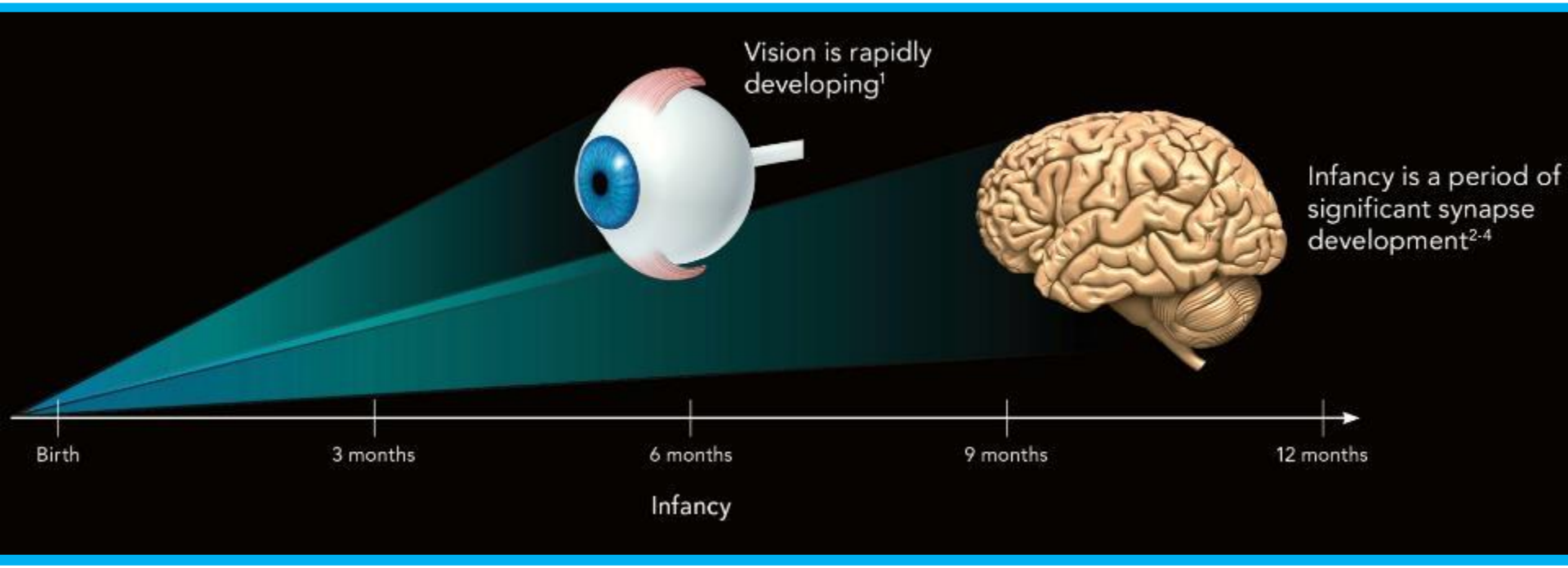
Natural Vitamin E, Lutein related DHA in



Brain and eye development are occurring rapidly in infancy First Year

1. Fanaroff AA, et al, eds. *Neonatal-Perinatal Medicine: Diseases of the Fetus and Infant*. 5th ed. St. Louis, MO: Mosby Year Book; 1992:1359–1365.
2. Wilson HR. *Vision Res*. 1988;28:611–628.
3. Huttenlocher PR, et al. *Neurosci Lett*. 1982;33:247–252.
4. Wainright PE, et al. In: Lieberman HR, et al, eds. *Nutritional Neuroscience*.Boca Raton, FL: CRC Press; 2005:163–186.

Nutrients – all found in nature

Vitamin E

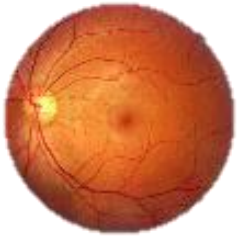
Lutein

DHA

Key ideas on lutein in human development

ABSORBS
high energy blue light
that can damage the retina[1]

PROTECTS
against oxidative damage[2]



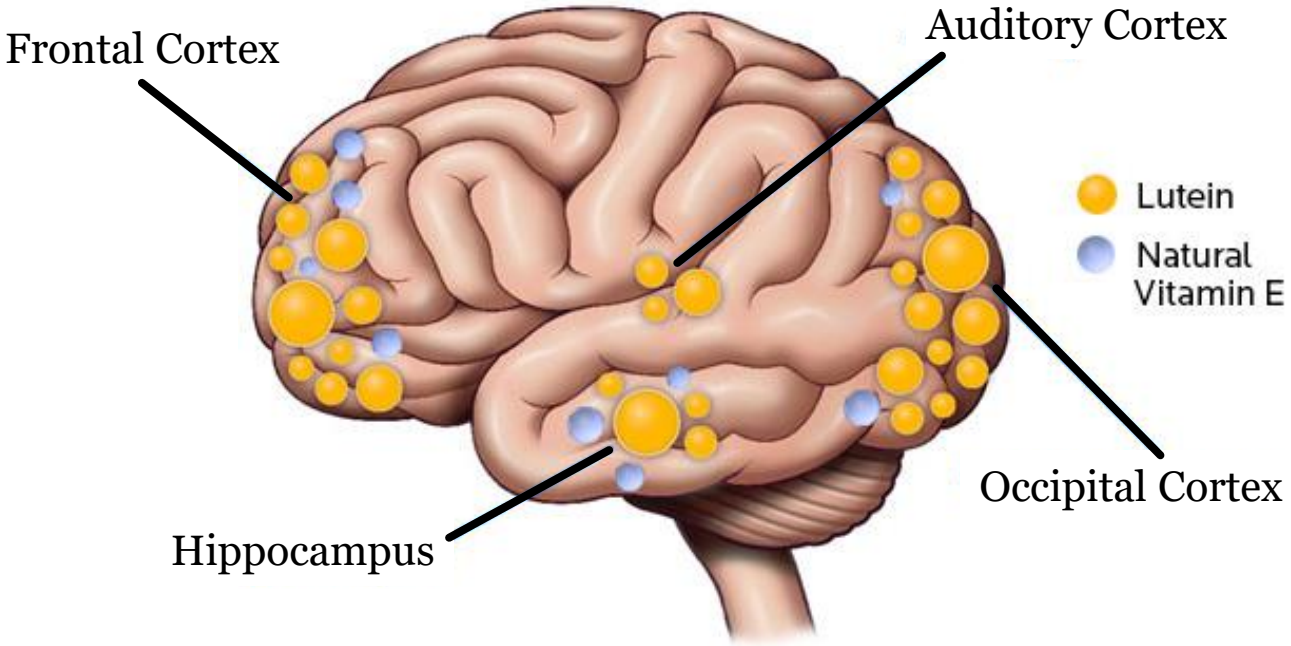
- **Present in colostrum and mature human milk and in some infant formulas**
  - Cannot be made by the body, only obtained through diet
- **Provides benefits to babies**
  - Eye health and brain development
  - Affects membrane stability and function
- **Lutein is Found in the brain[3]**

  Auditory Cortex, Occipital Cortex, Frontal Cortex, Hippocampus

1. Bone RA, et al. *Exp Eye Res*. 1997;64(2):211–218.
2. Krinsky NI, et al. *Annu Rev Nutr*. 2003;23:171–201.
3. Vishwanathan R, et al. *Acta Biologica Cracoviensia.* 2011;53(suppl 1). Abstract 1.23.

Lutein and vitamin E* reach important parts of the Infant brain

Lutein and Natural Vitamin E in Important Areas of the Brain

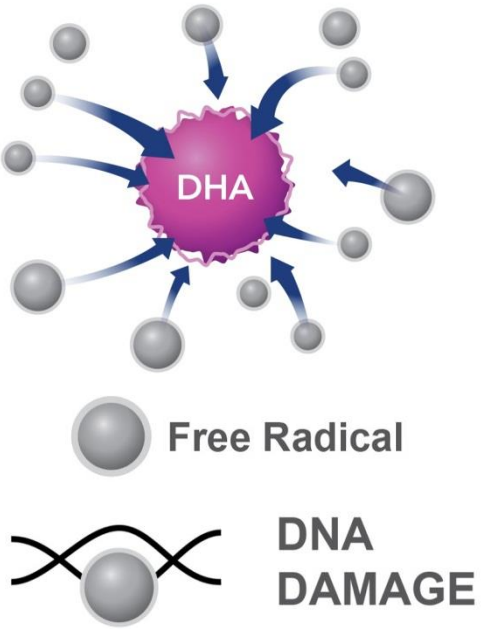


**RRR*-alpha-tocopherol.

Lai CS, et al. Poster presented at: Advances and Controversies in Clinical Nutrition; December 5–7, 2013; Washington, DC. Vishwanathan R, et al. *Acta Biologica Cracoviensia*. 2011;53(suppl 1). Abstract 1.23, presented at the International Symposium on Carotenoids, July 2011.

What is DHA?

- Docosahexaenoic acid (DHA; 22:6n-3) makes up 17% by weight total brain fatty acids
  - Also known as n-3 or omega-3 fatty acid
- Can be synthesized from alpha-linolenic acid (LNA:18:3 n-3)
  - Alpha-linolenic acid is essential
- Nutrient naturally occurring in fish and eggs
- Neo-popular food additive
- Biologically important
  - Component of neural membrane and synaptic vesicles
  - Improves the fluidity of neural function
- Endogenous synthesis of DHA is not sufficient for brain development (Congnition)
  - Fetus and neonate rely on maternal DHA
  - Only a back-up; low rate of conversion
- Fewer than 40% of trials show effects in full terms
- DHA is damaged by reactive oxygen species and free radicals (Free radicals damage cell membranes and DNA)



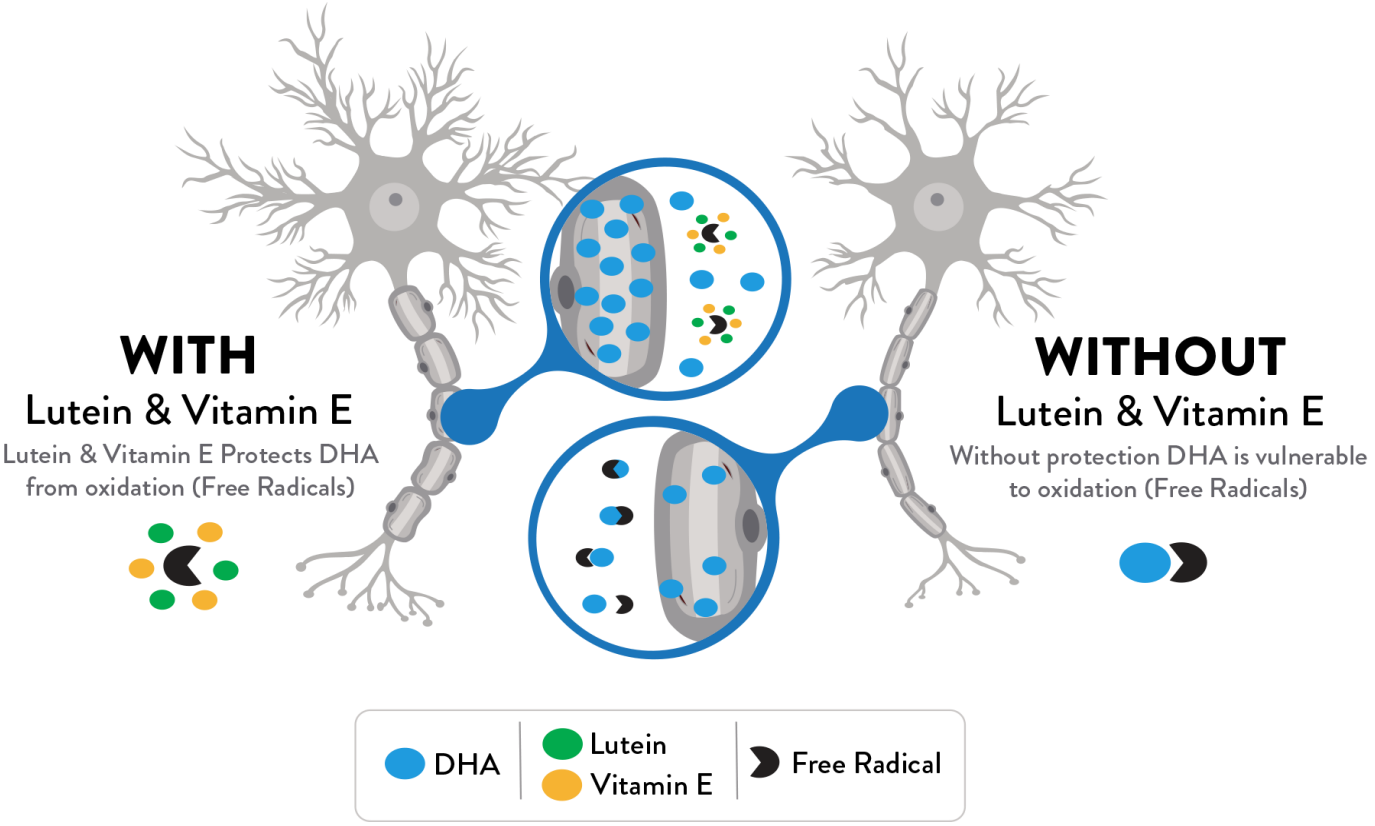
Working Together

Why NVE and Lutein are Important

Anti-oxidant

Fats like DHA are susceptible to oxidative damage. Lutein and Natural Vitamin E protect DHA against oxidation.

A Powerful Antioxidant: Protects DHA



**RRR* alpha-tocopherol
† Primary cortical neurons from neonatal rats.
1. Vazhappilly R, et al. Poster presented at: American College of Nutrition 54th Annual Conference; November 13–16, 2013; San Diego, CA.

Working Together

NVE, LUTEIN and DHA how they work?

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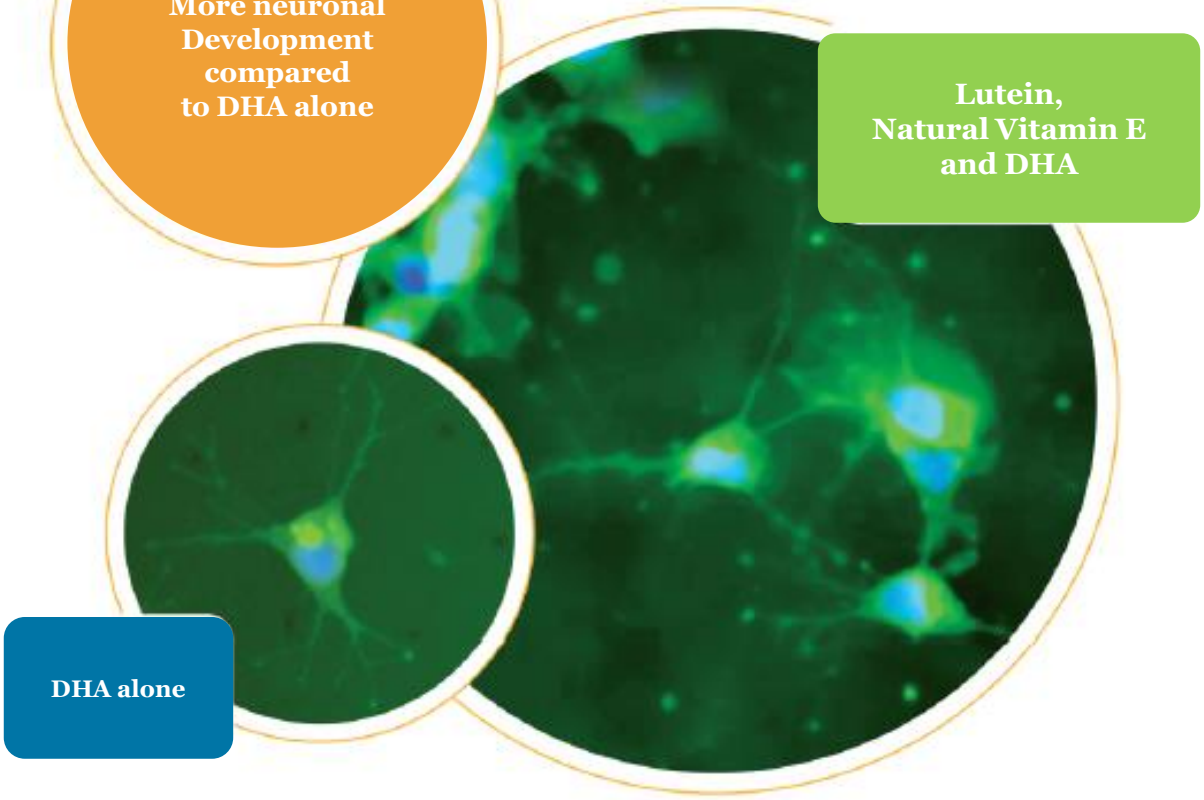
Lutein + *RRR* Vitamin E (NVE) + DHA Supports Better Learning

81%
More neuronal Development compared to DHA alone



Goldstein EB. *Sensation and Perception*, 7th ed. Belmont, CA: Thomson, Wadsworth; 2007
Data on File.
To be presented: Vazhappilly et al. American College of Nutrition's 57th Annual Conference, Sand Diego, CA USA; November 9-11, 2016.
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Working Together

It takes a lot of nutrients to build the brain[1,2,3]

THINK NUTRITION ST

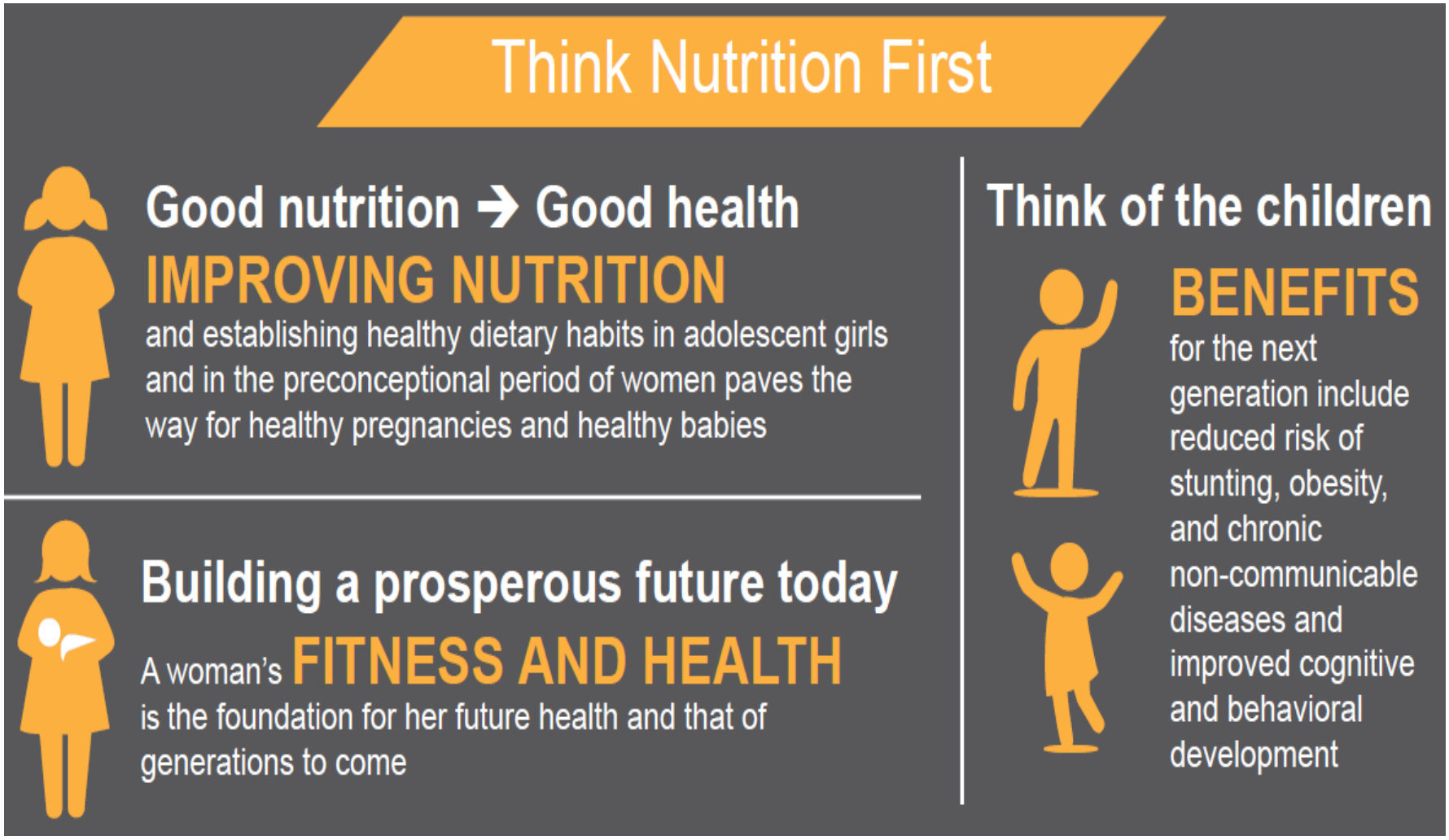
	NEURODEVELOPMENTAL PROCESS			
	Neuron Proliferation	Axon + Dendrite Growth	Synapse Formation, Pruning + Function	Myelination
Lutein	●	●	●	
NVE	●	●	●	●
DHA+ARA	●	●	●	●
Iron	●	●	●	●
Iodine	●	●	●	●
Zinc	●	●	●	
Choline	●		●	
B vitamins	●	●	●	●

A combination of nutrients makes the difference in active brain development[5,6]

DHA=docosahexaenoic acid.
ARA=arachidonic acid.

1. Vishwanathan et al. 2004 (infant) Craft 2004 (adult)
2. Craft 2004 (adult) Lieblein-Boff 2013 (infant)
3. Lauritzen 2001

Take-home messages



Take-home messages

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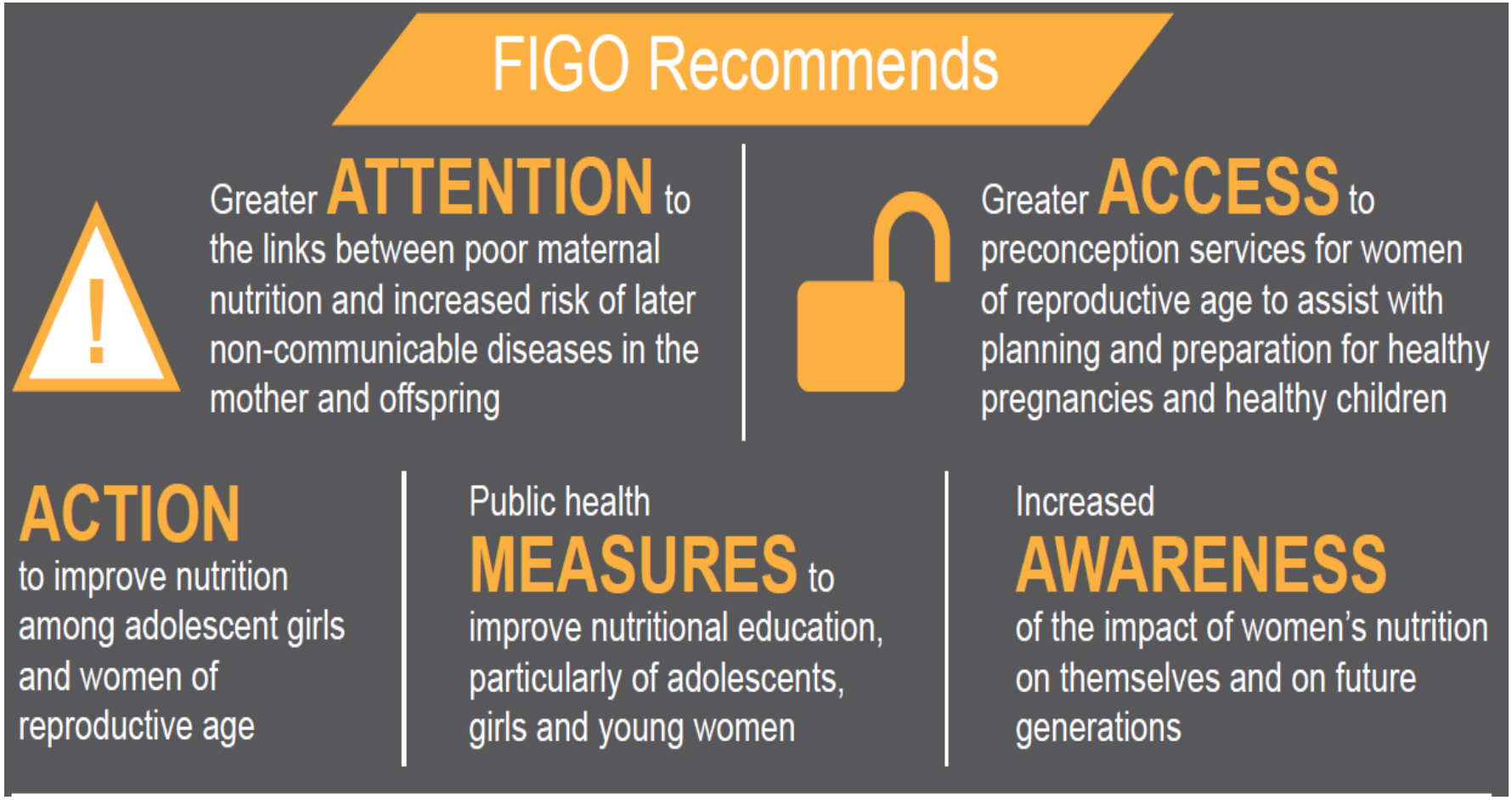


Give Your Baby
The Nutrient+++ Advantage
Eat Well. Stay Well.
Thank for Your Attention!
Research at the crossroads of nutrition and neuroscience