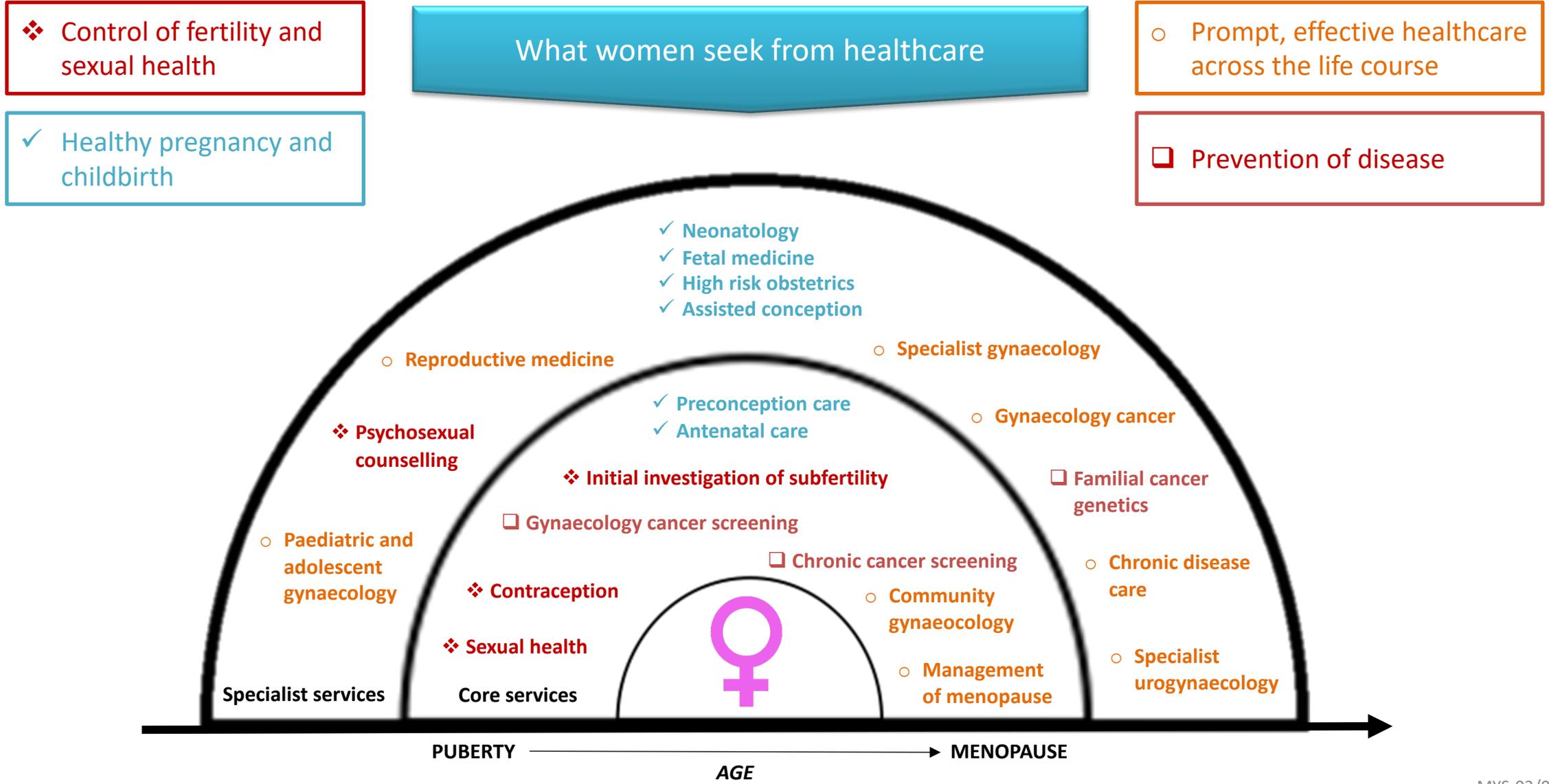


# Nutrition In Pregnancy - What Is New In The Horizon

S Raman MBBS, MD, FRCPI, FRCOG, FACS  
Obstetrician & Gynaecologist

# LIFE COURSE VIEW OF A HEALTH SERVICE FOR WOMEN

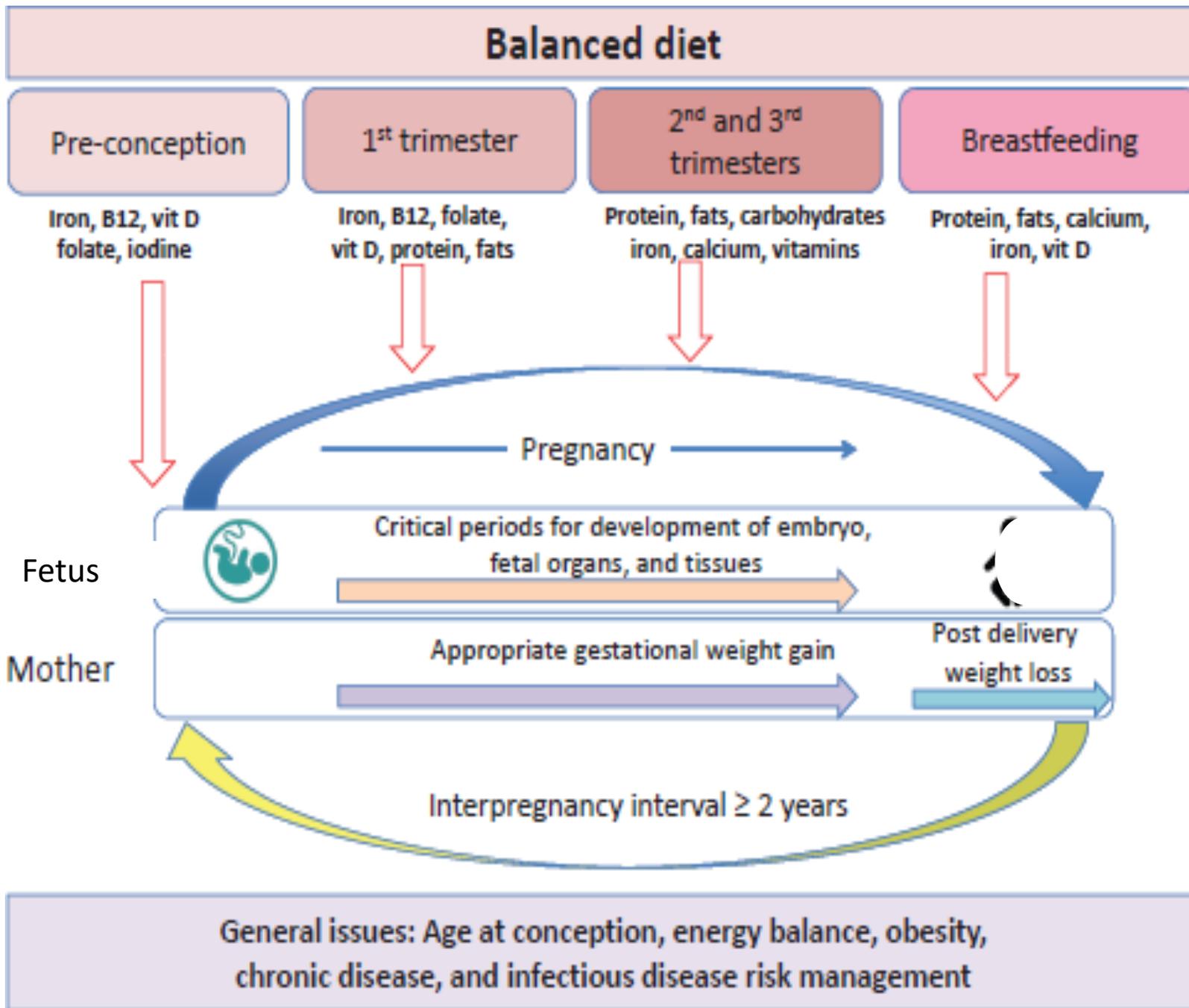


# Nutrition During Pregnancy

- The requirement for nearly all nutrients increases during pregnancy
- Select foods high in nutrient density
- Pay attention to intakes of:
  - Macronutrients (energy)
  - Micronutrients
  - Fluids

# Maternal Malnutrition and Pregnancy Outcome

- Severe nutritional deprivation (Netherlands 1944–45) – overall data
  - Birth weight significantly influenced by starvation
  - Perinatal mortality rate not affected
  - No increase incidence of malformation
  - In healthy women, state of near starvation is needed to affect pregnancy outcome
- Severe nutritional deprivation (Netherlands 1944–46)
  - Periconception: Decreased fertility, increased neural tube defect
  - 1st/2nd trimester: Increased stillbirths, preterm births, early newborn deaths
  - 3rd trimester: Low birth weight, small for gestational age, preterm birth



# Vitamins & minerals pregnancy considerations

- Micronutrient requirements ↑ during pregnancy
- Deficiencies can exist due to
  - Losses
  - Malabsorption
  - Inadequate intake
  - Ignorance about prenatal nutrition
  - Dietary taboos
- Pregnancy physiological changes can be aggravated by undernutrition leading to micronutrient deficiency states

# Macronutrients

- Energy
  - Second and third trimesters: add 350–450 calories/day
  - Maximize nutrient density
  - Safe and physician-approved program of regular moderate physical activity
- Proteins and carbohydrates
  - 1.1 gm/kg body weight/day of protein
  - 175 grams/day minimum of carbohydrates

# Macronutrients (cont.)

- Fat
  - Same percentage of calories as in non-pregnancy
  - Limit saturated fat; avoid trans fats
  - Fat helps newborn regulate body temperature
  - Omega-3 polyunsaturated fatty acid docosahexaenoic acid (DHA) is critical for neurologic and eye development

# Micronutrients

Micronutrients that are most critical during pregnancy includes

- Folate
- Vitamin B12
- Vitamin C
- Vitamin A
- Vitamin D
- Calcium
- Iron
- Zinc
- Sodium
- Iodine

## RDA's in pregnancy

Nutrients	Percentage ↑ over non-pregnant state (%)
Calcium	140-160
Iron	180-450
Zinc	43
Iodine	33
Selenium	26
Vitamin A	20
Vitamin D	300
Vitamin C	67
Folate	118-176

## RDA Recommendations

Non-pregnant	2200kcal
First trimester	2300kcal
2nd and 3rd trimester	2500kcal
Lactating	2600kcal

## Recommended daily energy intake in pregnancy

<b>Trimester</b>	<b>Increase daily energy</b>
First	100kcal
Second	300kcal
Third	300kcal

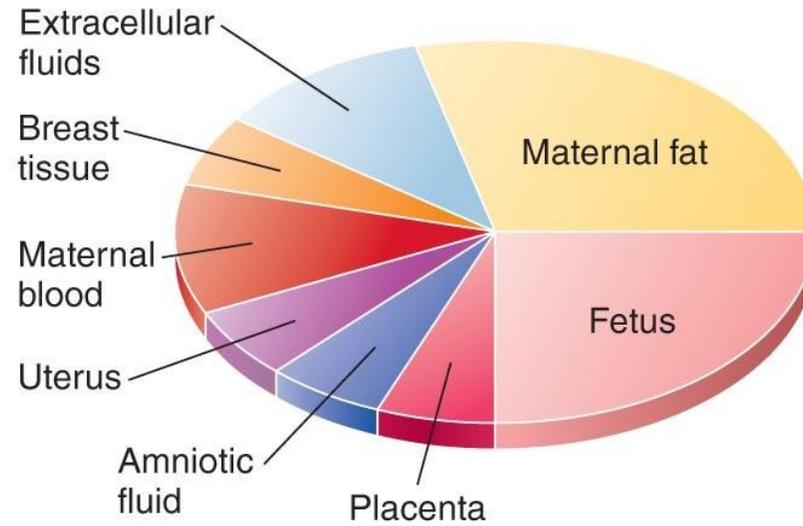
Recommended Weight Gain During Singleton Pregnancy			
Pre-pregnancy BMI (kg/m <sup>2</sup> )	Rates of Weight Gain for 1 <sup>st</sup> Trimester (total in kg)	Rates of Weight Gain for 2 <sup>nd</sup> & 3 <sup>rd</sup> Trimesters (kg/wk)	Total Weight Gain (kg)
Underweight (<18.5)	1.0-3.0	0.51 (0.44-0.58)	12.5-18.0
Normal weight (18.5-24.9)	1.0-3.0	0.42 (0.35-0.50)	11.5-16.0
Overweight (25.0-29.9)	1.0-3.0	0.28 (0.23-0.33)	7.0-11.5
Obese (>30.0)	0.2-2.0	0.22 (0.17-0.27)	5.0-9.0

As recommendations may vary between countries, please refer to available BMI cut-off limits & gestational weight gain recommendations from local health authority.

Modified from: 2009 US Institute of Medicine & National Research Council Recommendations

WHO BMI categories for Asians are underweight <18.5 kg/m<sup>2</sup>, normal weight 18.5-23 kg/m<sup>2</sup>, overweight 23-27.5 kg/m<sup>2</sup>, obese ≥27.5 kg/m<sup>2</sup>

# WEIGHT GAIN DURING PREGNANCY



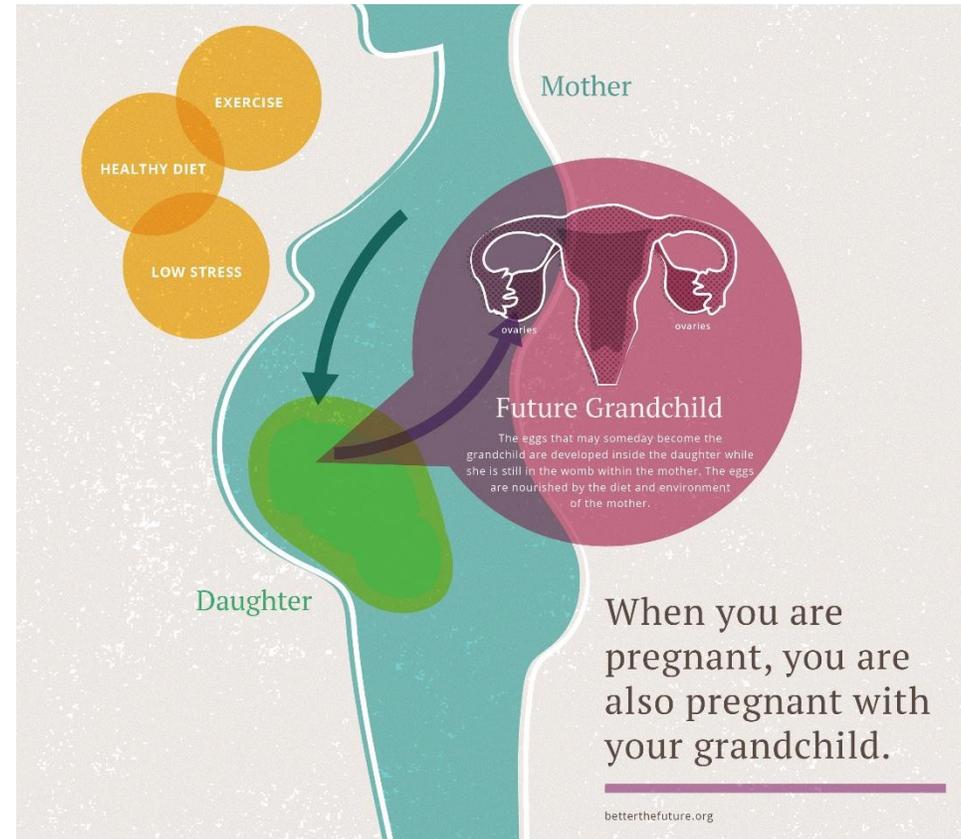
# Diet in pregnancy

- Protein 20%
- Fat 30%
- CHO 50%

# Maternal Malnutrition and Pregnancy Outcome (continued)

- Dietary restriction trials in pregnant women
  - High weight for height or high weight gain
  - Inconclusive results to demonstrate or exclude effect on fetal growth or any significant effect on other outcomes
- Mixed result with nutritional supplementation trials
  - High protein: No evidence of benefit on fetal growth
  - Balanced protein and energy: minimal increase in average birth weight (~30 g) and small decrease in incidence of small for gestational age newborns
  - Women manifesting nutritional deficits can benefit from a balanced energy/protein supplementation

# Fetal Programming and Future Health Consequences



# Pregnancy issues - First Trimester

- 50% nausea and vomiting, 25% nausea only, 25 % no symptoms
- Worse in multiple pregnancy and molar pregnancy
- In severe cases dehydration and acidosis
- Treatment mild acupressure, ginger
- Moderate maxolon, Phenergan
- Severe iv hydration, hyperalimentation, iv drugs including Zofran , steroids, intravenous multivitamins
- Usually improves in the second trimester
- Acute sense of smell and altered taste – beware of loss of taste and smell in the Covid era

# Pregnancy issues - Second trimester

- Anemia – nutritional ( watch out for bleeding problems and thalassemia, restless leg syndrome, fatigue etc)
- Use of bovine lactoferrin (anemia, anemia due to inflammation , Minor thal etc ( Lepanto et al Front Imm 2018 ,21 sept)
- Preeclampsia – Aspirin before 16 weeks taken at night after 930 pm. Also Calcium 1000mg and Vitamin D 800iu
- Gestational diabetes –diet, probiotics , Inositol & Lapoic acid ( especially in PCOS)
- Reflux esophagitis – Diet, Gaviscon Advance , Proton Pump Inhibitors
- Preterm labour – low dose aspirin , DHA
- Folic acid and prevention of CHD & Limb reduction defects. High blood folate and increase incidence of autism spectrum disorder.
- Low Vitamin D and COVID 19

Low-dose aspirin for the prevention of preterm delivery in nulliparous women with a singleton pregnancy (ASPIRIN): a randomised, double-blind, placebo-controlled trial

[Matthew K Hoffman](#)<sup>1</sup>, [Shivaprasad S Goudar](#)<sup>2</sup>, [Bhalachandra S Kodkany](#)<sup>2</sup>, [Mrityunjay Metgud](#)

Cardiovasc Diagn Ther 2019 Oct;9(Suppl 2):S424-S433.

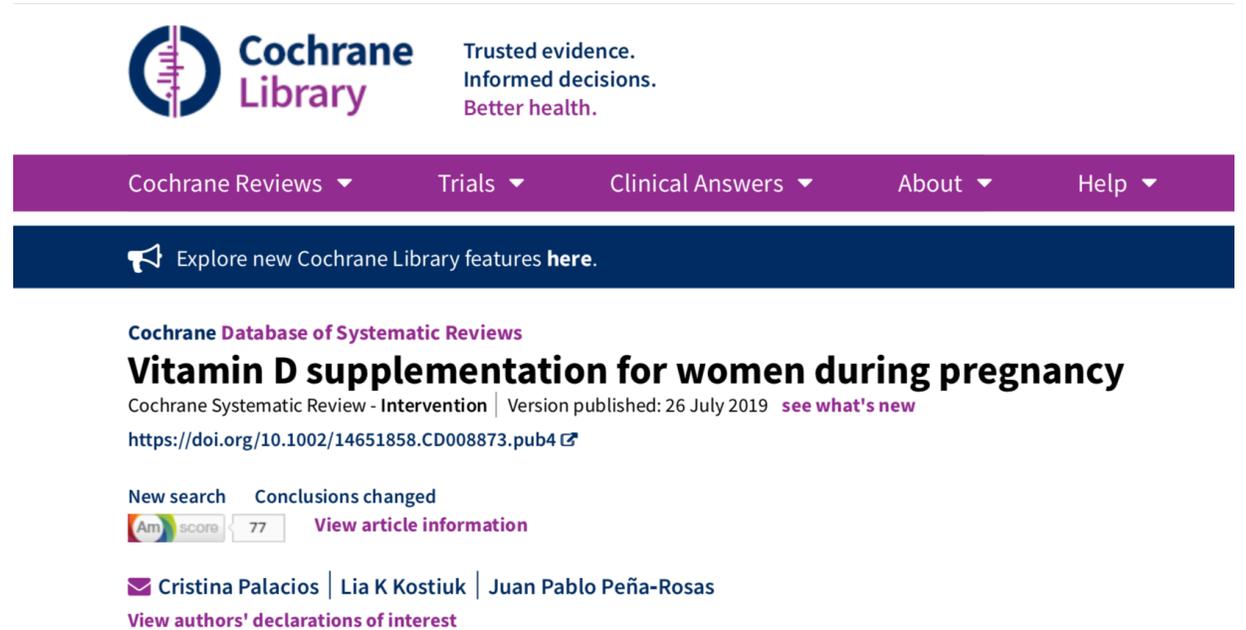
Folate supplementation for prevention of congenital heart defects and low birth weight: an update

[Rima Obeid](#)<sup>1</sup>, [Wolfgang Holzgreve](#)<sup>2</sup>, [Klaus Pietrzik](#)<sup>3</sup>

Lancet 2020 Jan 25;395(10220):285-293

# Vitamin D in pregnancy

- Bone metabolism
- ART and early pregnancy loss
- Improve follicle development in PCOS
- Higher incidence of live birth
- Decrease risk of Pre eclampsia
- Gestational diabetes decreased
- Low birth weight less likely
- Increase immunity if infected with COVID 19

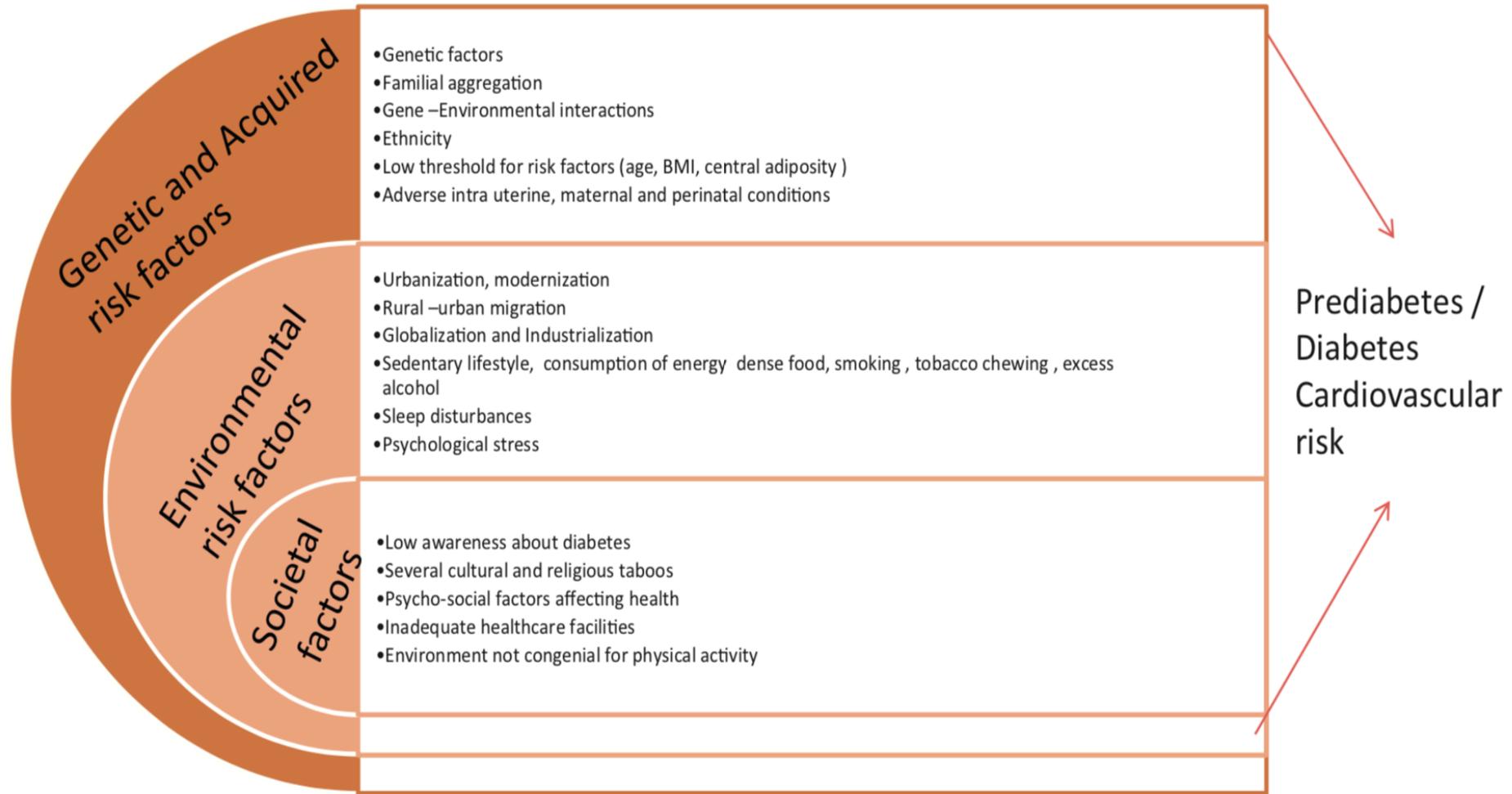


The screenshot shows the Cochrane Library website interface. At the top, the Cochrane Library logo is displayed with the tagline "Trusted evidence. Informed decisions. Better health." Below the logo is a navigation bar with links for "Cochrane Reviews", "Trials", "Clinical Answers", "About", and "Help". A dark blue banner below the navigation bar contains a megaphone icon and the text "Explore new Cochrane Library features here." The main content area features the title "Vitamin D supplementation for women during pregnancy" under the heading "Cochrane Database of Systematic Reviews". Below the title, it indicates "Cochrane Systematic Review - Intervention" and "Version published: 26 July 2019" with a link to "see what's new". The DOI link "https://doi.org/10.1002/14651858.CD008873.pub4" is provided. A "New search" button and a "Conclusions changed" notification are visible, along with an "Am score" of 77 and a "View article information" link. At the bottom, the authors "Cristina Palacios", "Lia K Kostiuk", and "Juan Pablo Peña-Rosas" are listed, with a link to "View authors' declarations of interest".

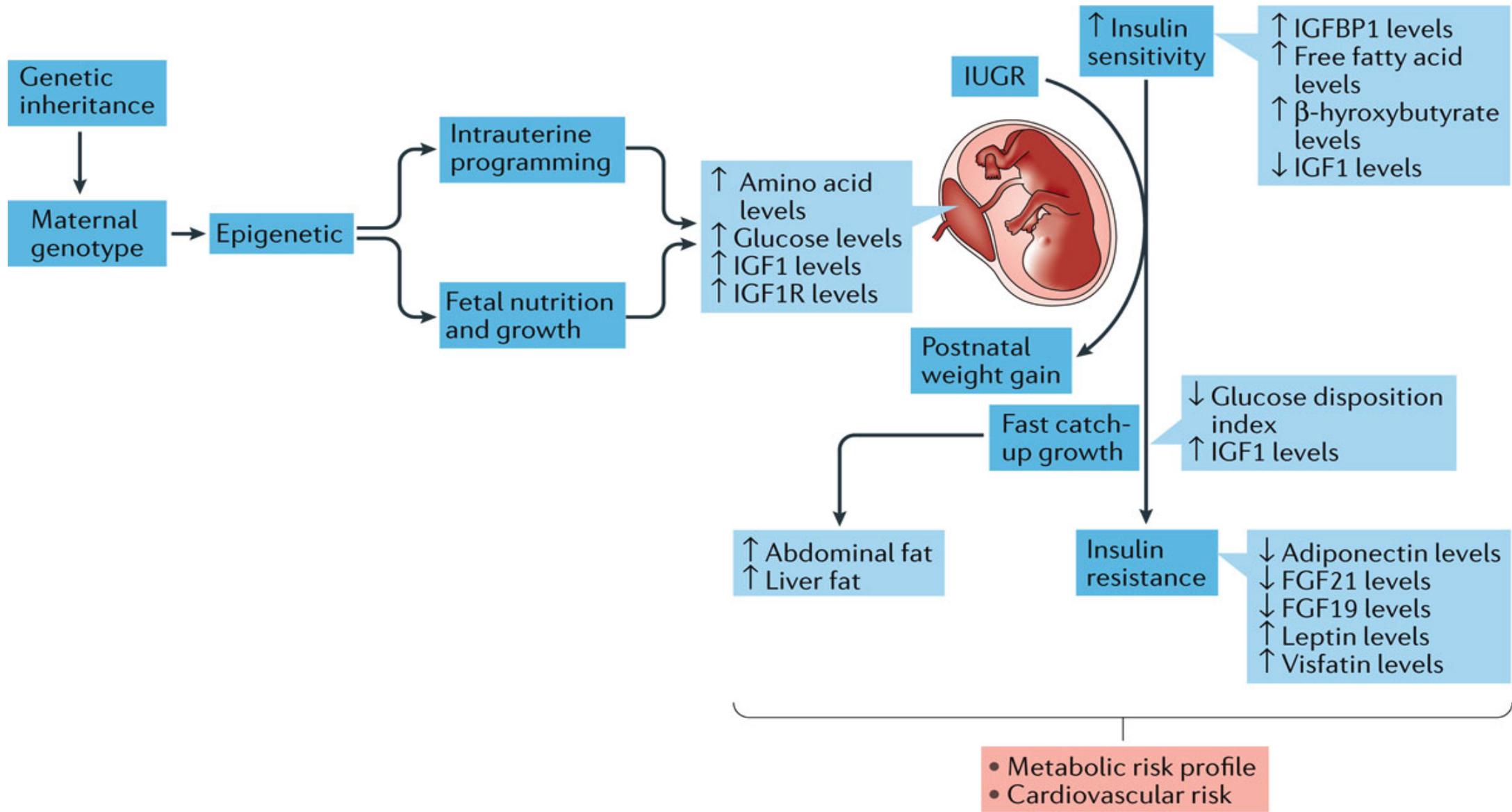
Supplementing pregnant women with vitamin D alone probably reduces the risk of pre-eclampsia, gestational diabetes, low birthweight and the risk of severe postpartum haemorrhage.

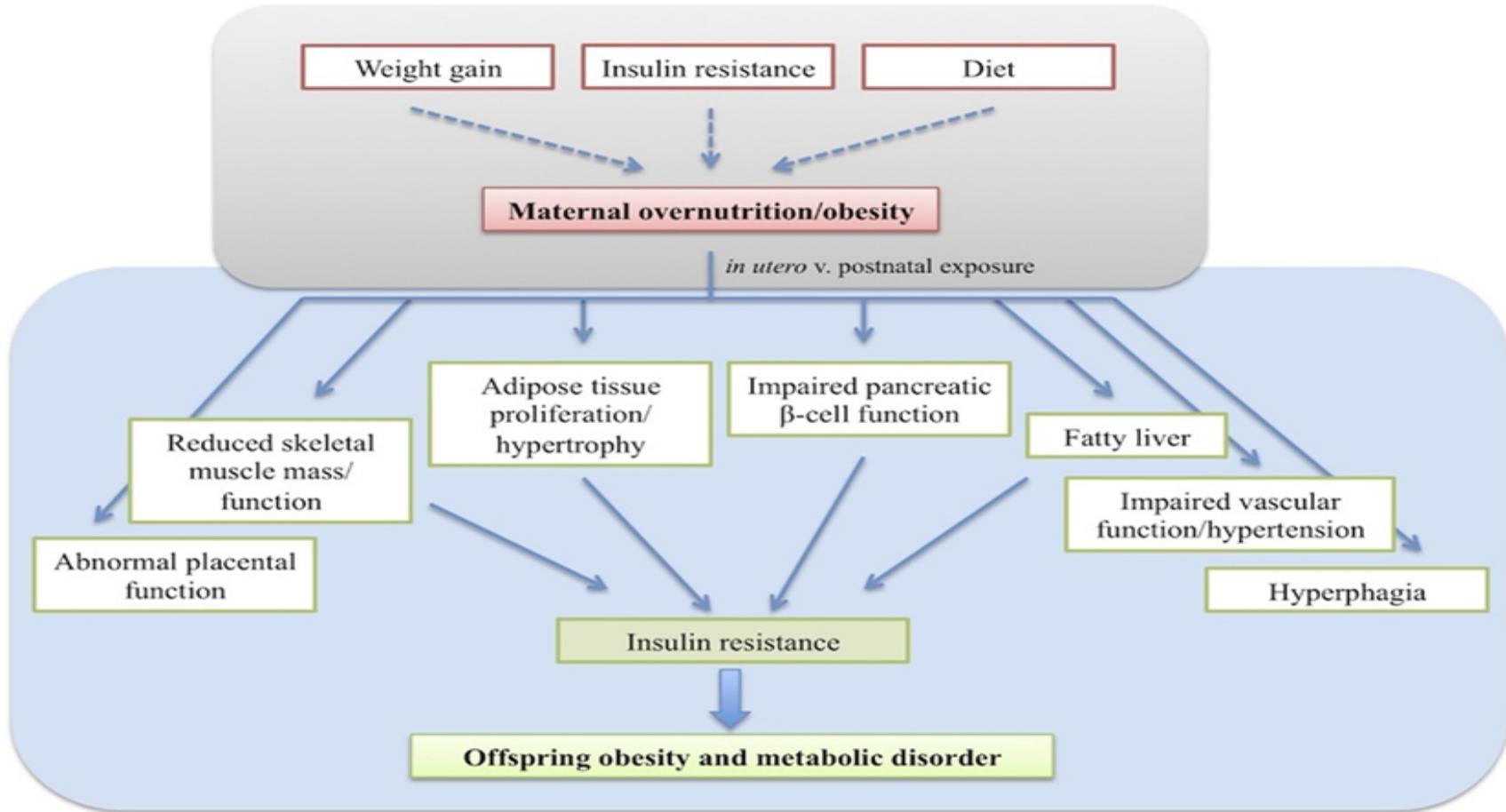
# Pregnancy issues - Third trimester/ Labour

- Constipation – High fibre , Duphalac ( figs)
- Aches and pains - Stretching exercises
- Labour eat till about 4-5 cm dilated easily digested low fat diet (porridge , soup)
- Adequate hydration – decreases acidosis – fetal distress . More energy to push

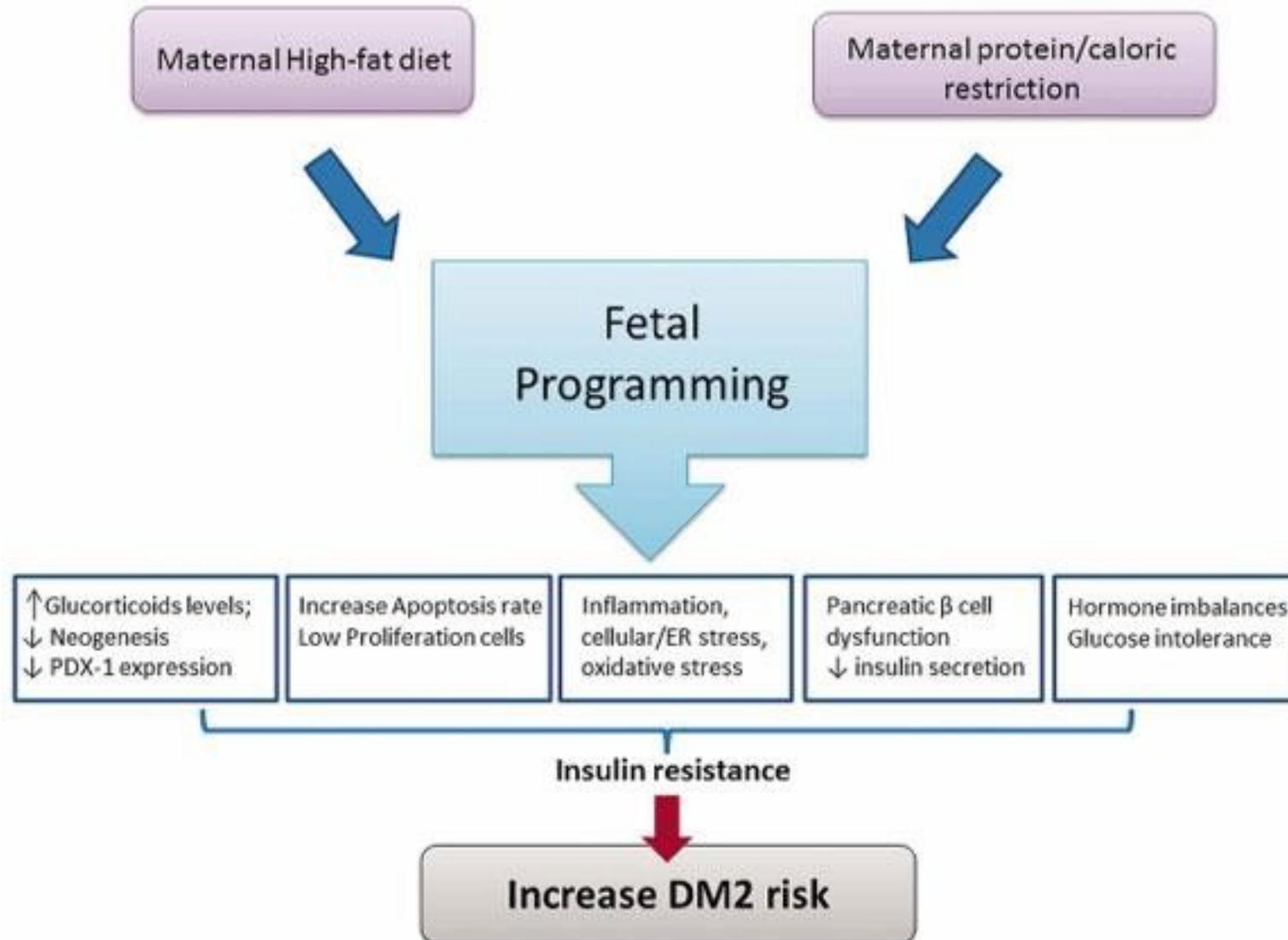


Possible etiological factors enhancing the predisposition to type 2 diabetes among South-East Asians.





# Maternal Nutrition Restriction and Insulin Resistance



## Early pregnancy probiotic supplementation with *Lactobacillus rhamnosus* HN001 may reduce the prevalence of gestational diabetes mellitus: a randomised controlled trial

Kristin L. Wickens<sup>1\*</sup>, Christine A. Barthow<sup>1</sup>, Rinki Murphy<sup>2</sup>, Peter R. Abels<sup>1,3</sup>, Robyn M. Maude<sup>4</sup>, Peter R. Stone<sup>2</sup>, Edwin A. Mitchell<sup>2</sup>, Thorsten V. Stanley<sup>1,3</sup>, Gordon L. Purdie<sup>1</sup>, Janice M. Kang<sup>1</sup>, Fiona E. Hood<sup>1</sup>, Judy L. Rowden<sup>2</sup>, Phillipa K. Barnes<sup>1</sup>, Penny F. Fitzharris<sup>5</sup> and Julian Crane<sup>1</sup>

<sup>1</sup>*University of Otago, Wellington 6021, New Zealand*

<sup>2</sup>*University of Auckland, Auckland 1142, New Zealand*

<sup>3</sup>*Capital and Coast DHB, Wellington 6021, New Zealand*

<sup>4</sup>*Victoria University, Wellington 6021, New Zealand*

<sup>5</sup>*Auckland Hospital, Auckland 1142, New Zealand*

(Submitted 23 August 2016 – Final revision received 10 January 2017 – Accepted 24 January 2017 – First published online 3 April 2017)

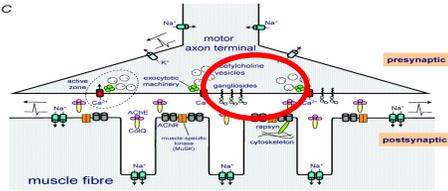
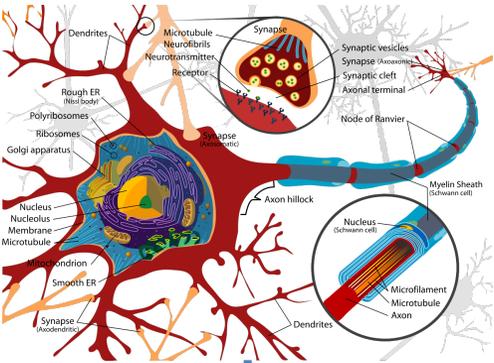
# Maternal Nutrition and the developing brain

**Structure and Formation:**  
 Folic acid  
 Choline  
 Protein  
 LCPUFA  
 MFGM  
 Vitamin B 12  
 Zinc  
 Vitamin D?

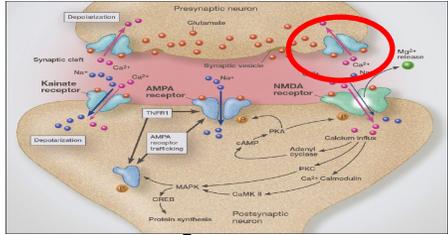


**Eye health**  
 Lutein  
 DHA

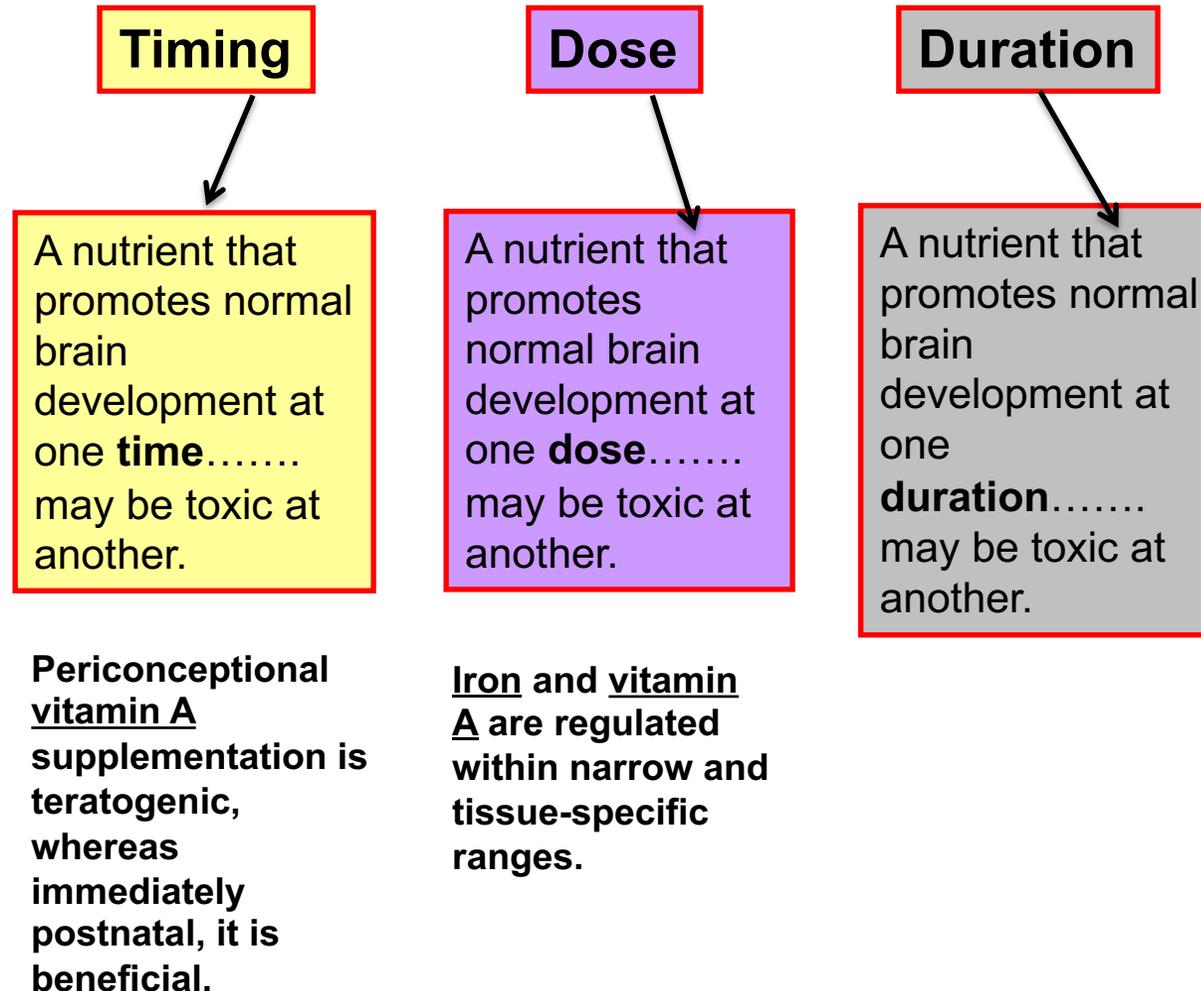
**Myelination & Synaptogenesis**  
 Protein  
 MFGM  
 LCPUFA  
 Copper  
 Iron  
 Choline  
 Iodine



**Neural Transmission:**  
 Choline  
 Copper  
 Protein  
 Vitamin B 6  
 Taurine  
 Zinc  
 MFGM

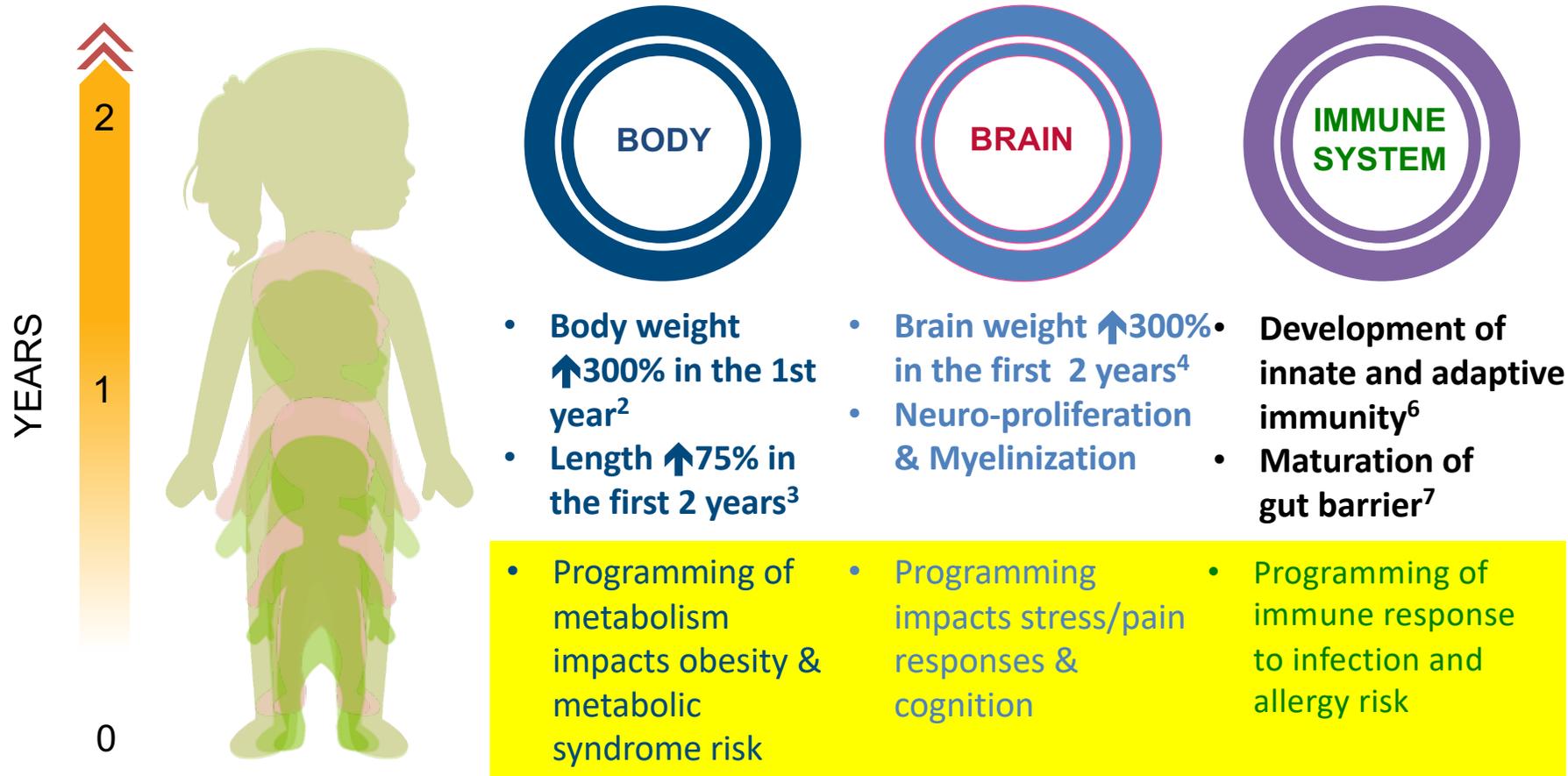


# Principles Governing the Role of Nutrients Brain Development



# Nutrition Is Critical in the Early Years of Life

Optimal nutrition during infancy and early childhood is essential for children to reach their full potential in lifelong health.<sup>1</sup>



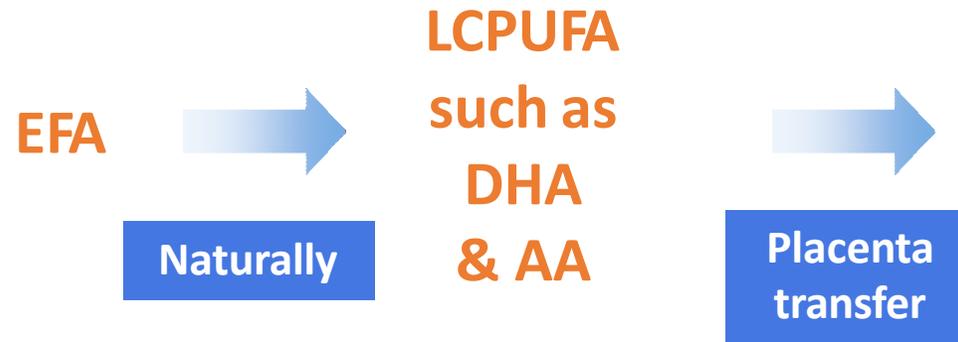
1. Black RE, et al. *Lancet*. 2013;382:427-451.  
2. CDC. Data table of infant weight-for-age charts  
3. CDC. Data table of infant length-for-age charts.  
4. Dobbing J, Sands J. *Arch Dis Child*. 1973;48:757-767.  
5. Georgieff MK. *Am J Clin Nutr*. 2007;85:614S-620S.

6. Field CJ, et al. *Lipids*. 2001;36:1025-1032.  
7. Jacobi SK, Odle J. *Adv Nutr*. 2012;3:687-696.

# EFA in maternal nutrition

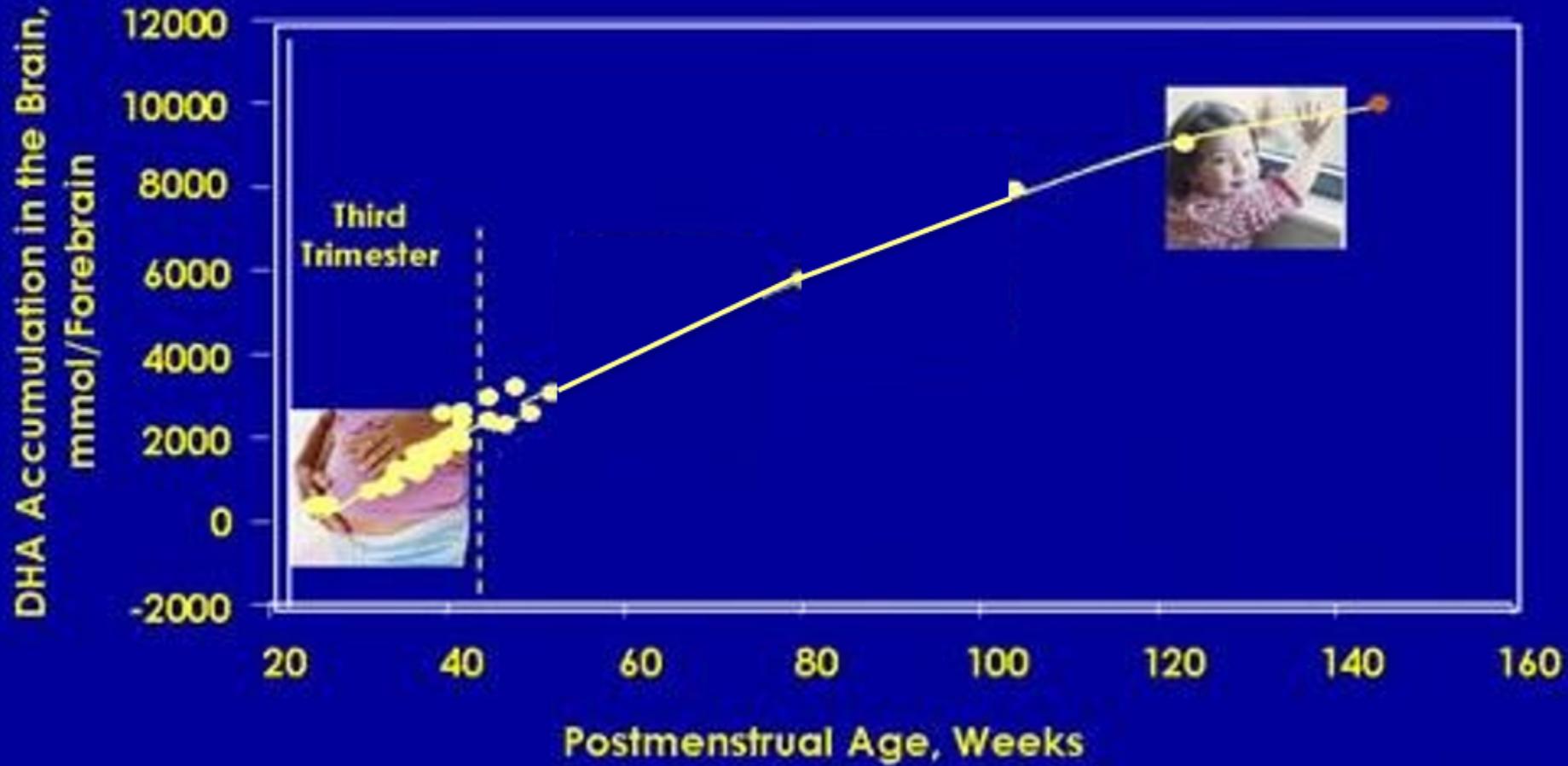
## EFA requirements during pregnancy

Large accumulation of LCPUFA during the last trimester



Overall growth and development of foetus

# DHA Accumulates in the Brain Beginning In Utero Through Toddlerhood



Martinez M. *J Pediatr.* 1992;120:S129-S138.

# Choline: A Vital Nutrient for Brain Development

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Is an important constituent of brain development

Is a precursor of acetylcholine (neurotransmitter) and phosphatidylcholine (major membrane constituent)<sup>2</sup>

Is essential for structural integrity and signaling functions of cell membranes<sup>3</sup>

Modifies the structure and function of the brain and spinal cord<sup>3</sup>

Is also essential for neural tube closure, cognition, and lifelong memory function<sup>3,4</sup>

1. Ozarda Y, et al. *J Hum Lact*. 2014;30(2):161-6. 2. Wurtman RJ, Cansev M, Ulus IH. Choline and its products acetylcholine and phosphatidylcholine. In: Lajtha A, Tettamanti G, Gianfrancesco G, (eds). *Handbook of Neurochemistry and Molecular Neurobiology: Neural lipids*. 3rd edn. Berlin: Springer, 2009, pp. 443-502. 3. Zeisel SH. *Annu Rev Nutr*. 2006;26:229-250. 4. Caudill MA. *J Am Diet Assoc*. 2010;110(8):1198-206.

# Key Brain Nutrients That Support Brain Development

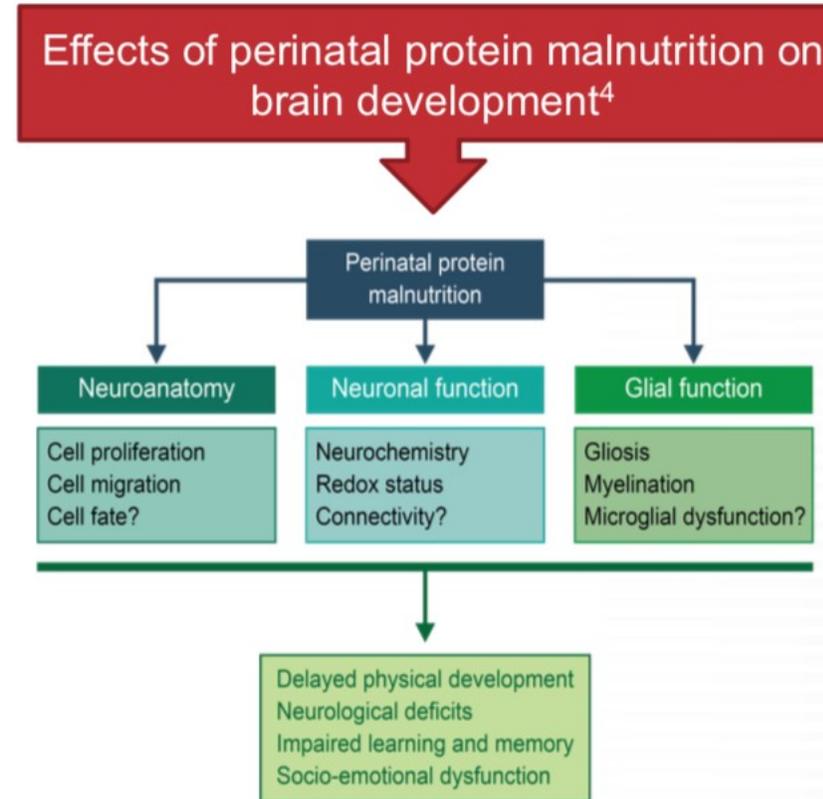
Nutrient	Role in brain development
Protein-energy <sup>1</sup>	Cell proliferation, cell differentiation, synaptogenesis
α-lactalbumin <sup>2</sup>	Neurotransmitter synthesis
LC-PUFAs <sup>1</sup>	Synaptogenesis, myelin formation
Choline <sup>1</sup>	Neurotransmitter synthesis, DNA methylation, myelin synthesis
Lutein <sup>1</sup>	Brain electrical activity
Phospholipids <sup>3</sup>	Myelination
Iron <sup>1</sup>	Myelin, monoamine synthesis, neuronal and glial energy metabolism
Zinc <sup>1</sup>	DNA synthesis, neurotransmitter release
Copper <sup>1</sup>	Neurotransmitter synthesis, neuronal and glial energy metabolism, antioxidant activity
Vitamins B <sub>1</sub> , B <sub>2</sub> , B <sub>6</sub> , B <sub>12</sub> , and folate <sup>4</sup>	Neurotransmitter synthesis and functioning, myelination, brain energy metabolism

LC-PUFAs: Long-chain polyunsaturated fatty acids; DNA: Deoxyribonucleic acid.

1. Georgieff MK. *Am J Clin Nutr* 2007;85(suppl):614S–620S. 2. Jenkins TA, et al. *Nutrients*. 2016;8(1):56. 3. Tanaka K, et al. *Brain Dev*. 2013;35(1):45-52. 4. Swaminathan S, et al. *Eur J Clin Nutrition*. 2013;67:467-474.

# Protein Intake and Brain Functioning

- Amino acids and proteins:
  - Serve as structural links between neurons<sup>1</sup>
- Brain growth and functioning:
  - May be regulated by variations in protein intake during the first year of life<sup>2</sup>
- Hippocampus and cortex:
  - Susceptible to PEM<sup>3</sup>



A question mark indicates that further study is warranted in the area.

1. Hay WW, et al. *Pediatr Neonatol.* 2010;51(4):198–207. 2. Luque V, et al. *Nutr Metab Insights.* 2015;8(S1):49–56. 3. Georgieff MK. *Am J Clin Nutr.* 2007;85(suppl):614S–620S. 4. Chertoff M. *Brain Disord Ther.* 2014;4:168.

# Effects of an altered gut microbiota

- Changes in the types and numbers of bacteria in the gut may lead to the development of diseases.
- This is known as 'dysbiosis', means **disturbance** or **imbalance** in the gut microbiota.
- Alterations of the intestinal microbiota can manifest as several diseases in children, including



Inflammatory bowel disorders



Obesity and metabolic disorders



Asthma



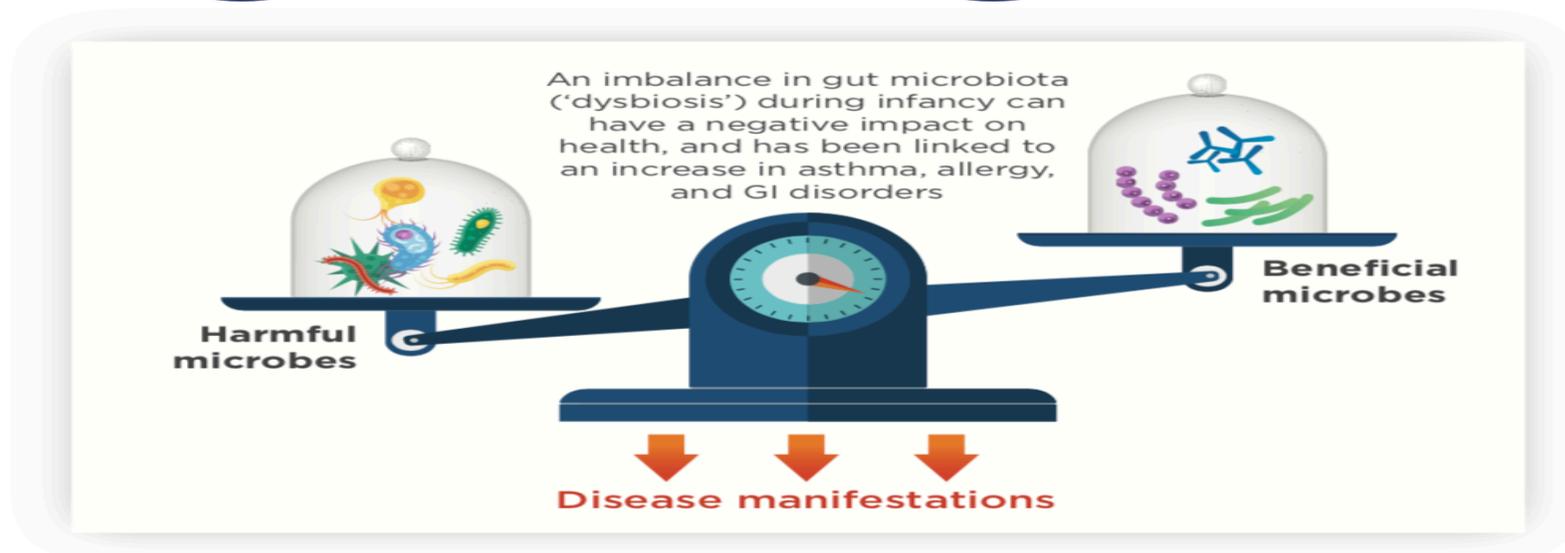
Infections



Allergy and atopic disorders



Aberrant behaviour and autism spectrum disorders





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## Original Contribution

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# Intake of Probiotic Food and Risk of Preeclampsia in Primiparous Women

## The Norwegian Mother and Child Cohort Study

**Anne Lise Brantsæter\*, Ronny Myhre, Margaretha Haugen, Solveig Myking, Verena Sengpiel, Per Magnus, Bo Jacobsson, and Helle Margrete Meltzer**

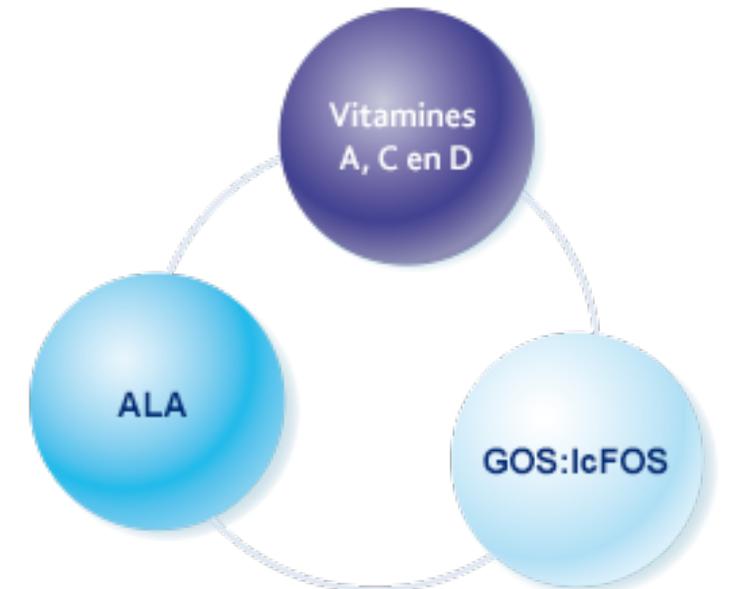
\* Correspondence to Dr. Anne Lise Brantsæter, Department of Food Safety and Nutrition, Division of Environmental Medicine, Norwegian Institute of Public Health, P.O. Box 4404, Nydalen, N-0403 Oslo, Norway (e-mail: Anne.Lise.Brantsaeter@fhi.no).

*Initially submitted February 23, 2011; accepted for publication April 21, 2011.*

# GALACTO- AND FRUCTO-OLIGOSACCHARIDES FOR GUT HEALTH

Concept: Addition of prebiotics oligosaccharides to milk to confer the good intestinal environment"

- ★ An increase in the number of bifidobacteria;
- ★ Stimulation of specific *Bifidobacterium* and *Lactobacillus* species;
- ★ Reduction in pathogenic bacteria.
- ★ Relief of gastrointestinal symptoms
- ★ Reduction of digestive problems
- ★ Improvement in intestinal tolerance





Updated June 25, 2020

Other Languages ▾

Print Page



## Protect yourself and your family from COVID-19



Based on what we know at this time, **pregnant people might be at an increased risk for severe illness from COVID-19** compared to non-pregnant people. Additionally, there may be an increased risk of adverse pregnancy outcomes, such as preterm birth, among pregnant people with COVID-19. Therefore, if you are pregnant, be mindful about reducing your risk of getting sick. If you are caring for children, you can teach them [everyday steps](#) (such as proper [handwashing](#)) to help them stay healthy and, in turn, help protect yourself and your family.

Risk factors that appear to be associated with hospital admission with COVID-19 illness include:

1. Black, Asian or minority ethnicity (BAME)
2. Overweight or obesity
3. Pre-existing comorbidity
4. Maternal age >35 years



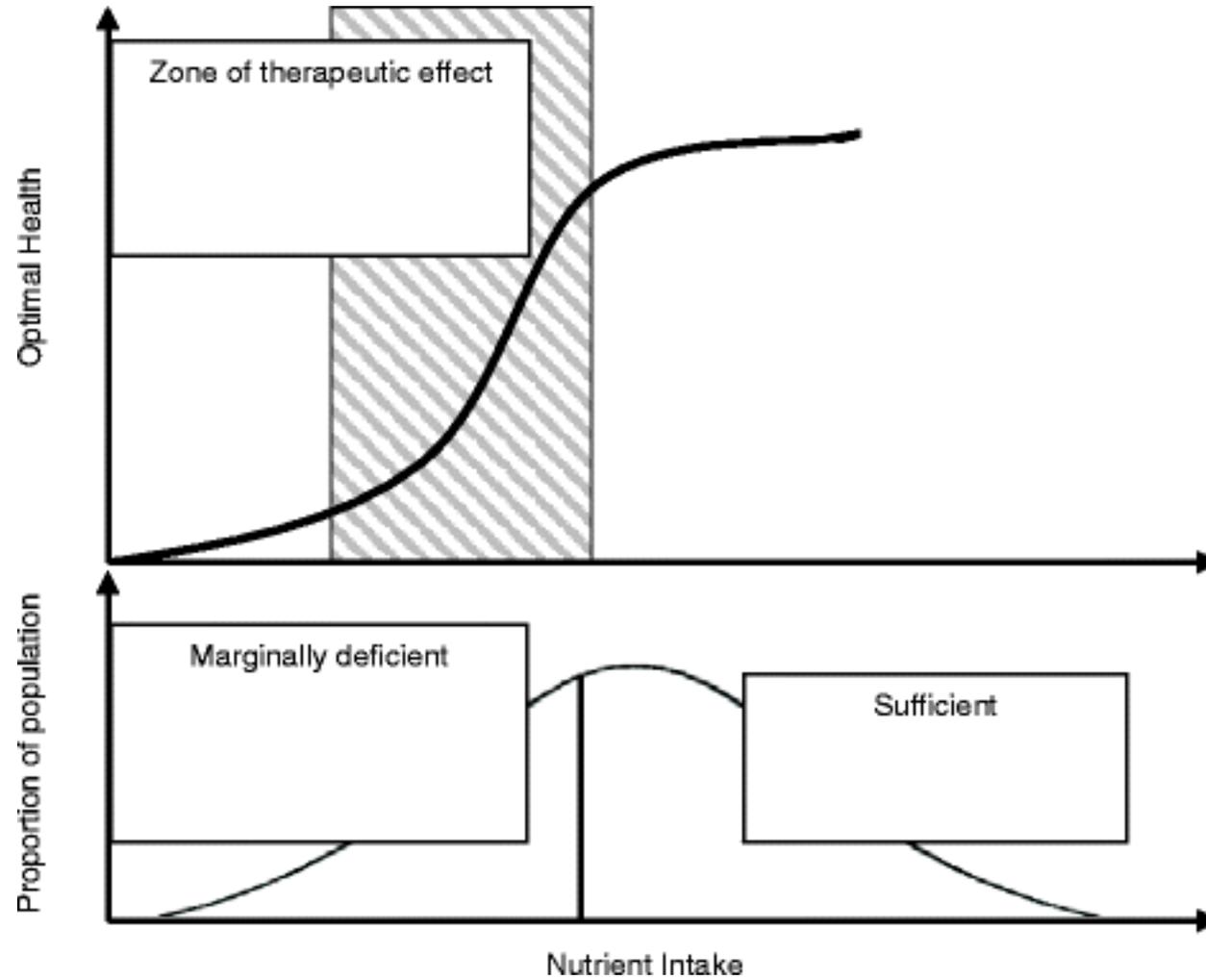
## Coronavirus (COVID-19) Infection in Pregnancy

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Information for healthcare professionals

Version 10: Published Thursday 4 June 2020

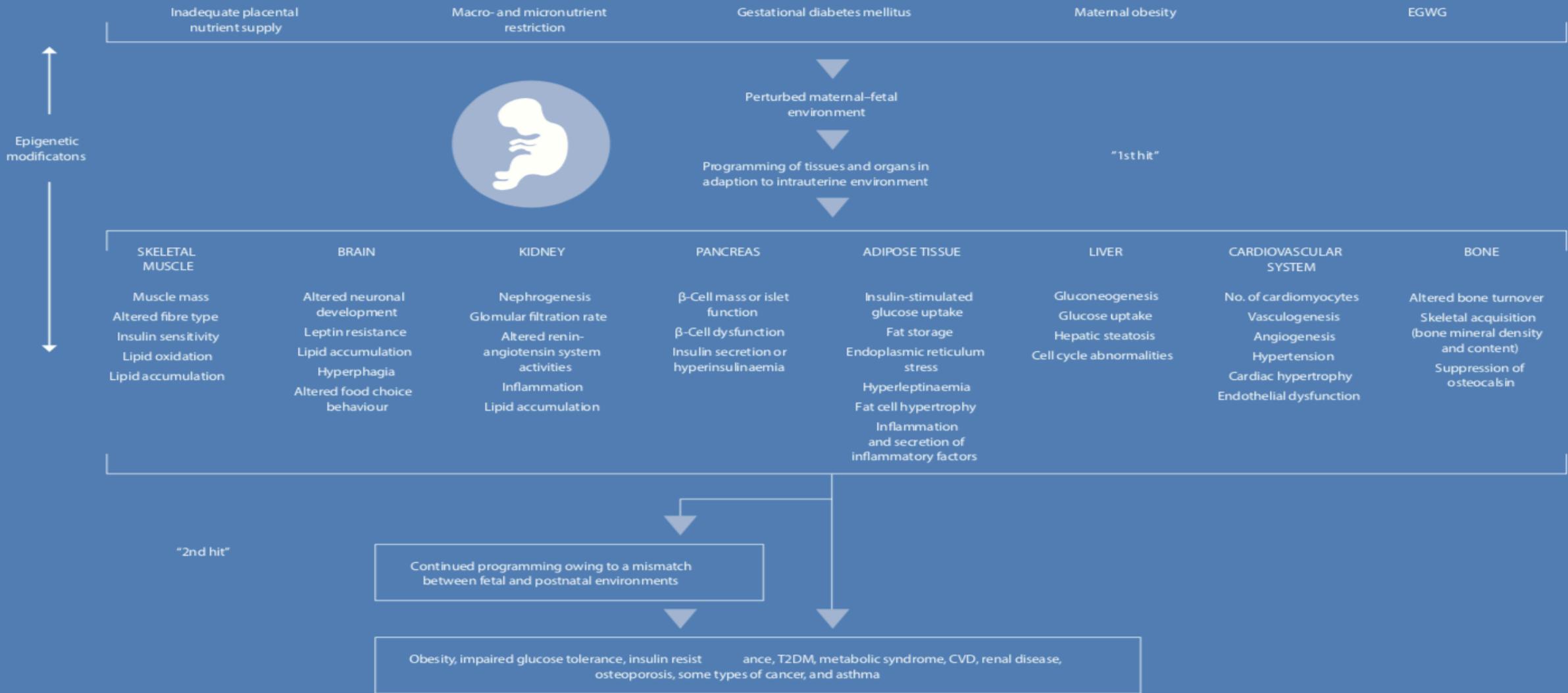




Role of nutrient status on physiological response

MYS-03/07H21/20061

Fig. 4. Nutritional stressors involved in metabolic programming of obesity and NCDs



Probiotics have been suggested to modify placental trophoblast inflammation, systemic inflammation, and blood pressure, all potentially interesting aspects of preeclampsia. The authors examined the association between consumption of milk-based probiotic products in pregnancy and development of preeclampsia and its subtypes. The study was performed in the Norwegian Mother and Child Cohort Study by using a prospective design in 33,399 primiparous women in the years 2002–2008. The intake of milk-based products containing probiotic lactobacilli was estimated from a self-reported food frequency questionnaire. Preeclampsia diagnoses were obtained from the Norwegian Medical Birth Registry. Intake of probiotic milk products was associated with reduced risk of preeclampsia. The association was most prominent in severe preeclampsia (adjusted odds ratio (OR) = 0.79, 95% confidence interval (CI): 0.66, 0.96). With probiotic intakes divided into categories representing no, monthly, weekly, or daily intake, a lower risk for preeclampsia (all subtypes) was observed for daily probiotic intake (OR = 0.80, 95% CI: 0.66, 0.96). Lower risks for severe preeclampsia were observed for weekly (OR = 0.75, 95% CI: 0.57, 0.98) and daily (OR = 0.61, 95% CI: 0.43, 0.89) intakes. These results suggest that regular consumption of milk-based probiotics could be associated with lower risk of preeclampsia in primiparous women.

cohort studies; pre-eclampsia; pregnancy; primiparity; probiotics

# Minerals & trace elements in pregnancy

- **Iron –in pregnancy 500mg for red cell mass,500mg for fetal and placental tissues. Pregnancy 30mg of Fe, lactation 15mg**
- **Calcium- pregnancy and lactation 1000mg**
- **Phosphorus – pregnancy & lactation 1000mg**
- **Zinc- pregnancy 15mg , lactation 19mg**

**B NUTRIENT SUPPLEMENTATION (CONT'D)****Daily Recommended Dietary Allowances of Micronutrients for Pre-pregnant, Pregnant & Lactating Women**

Micronutrient	Pre-pregnant	Pregnant	Lactating
Calcium	700-1000 mg	1000 mg	1000 mg
Folic acid	400 mcg	600 mcg	500 mcg
Iodine	150 mcg	200 mcg	200 mcg
Iron	29-39 mg	*	15-20 mg
Vitamin A	500 mcg	800 mcg	850 mcg
Vitamin B1	1.1 mg	1.4 mg	1.5 mg
Vitamin B2	1.1 mg	1.4 mg	1.6 mg
Vitamin B3	14 mg	18 mg	17 mg
Vitamin B6	1.3 mg	1.9 mg	2.0 mg
Vitamin B12	2.4 mcg	2.6 mg	2.8 mcg
Vitamin C	70 mg	80 mg	95 mg
Vitamin D	5-10 mcg	5 mcg	5 mcg
Zinc	4.4 mg	5-10 mg	7.2-9.5 mg

\*Iron tablet supplements are recommended for all pregnant women. Daily 100-mg iron supplements given during the 2nd half of pregnancy are adequate in the non-anemic pregnant woman. If the woman is anemic, higher doses should be provided. *WHO recommends a daily oral supplementation of 30-60 mg of elemental iron for pregnant women.*

List shown above is not exhaustive & as recommendations may vary between countries, please refer to available nutrition guidelines from local health authority.

Modified from: Barba CV, Cabrera MI. Recommended dietary allowances harmonization in Southeast Asia. *Asia Pac J Clin Nutr.* 2008;17 Suppl 2:405-408.

# Food

## What is food?

**The 3 main components are:**

**Nutrients** → essential for life

**Water** → essential for life

**Additives** → not essential for life but useful

Eg. Natural milk + fortified nutrients + preservative = **milk**



# Food Pyramid



Taking a variety of food to get all the essential

nutrients

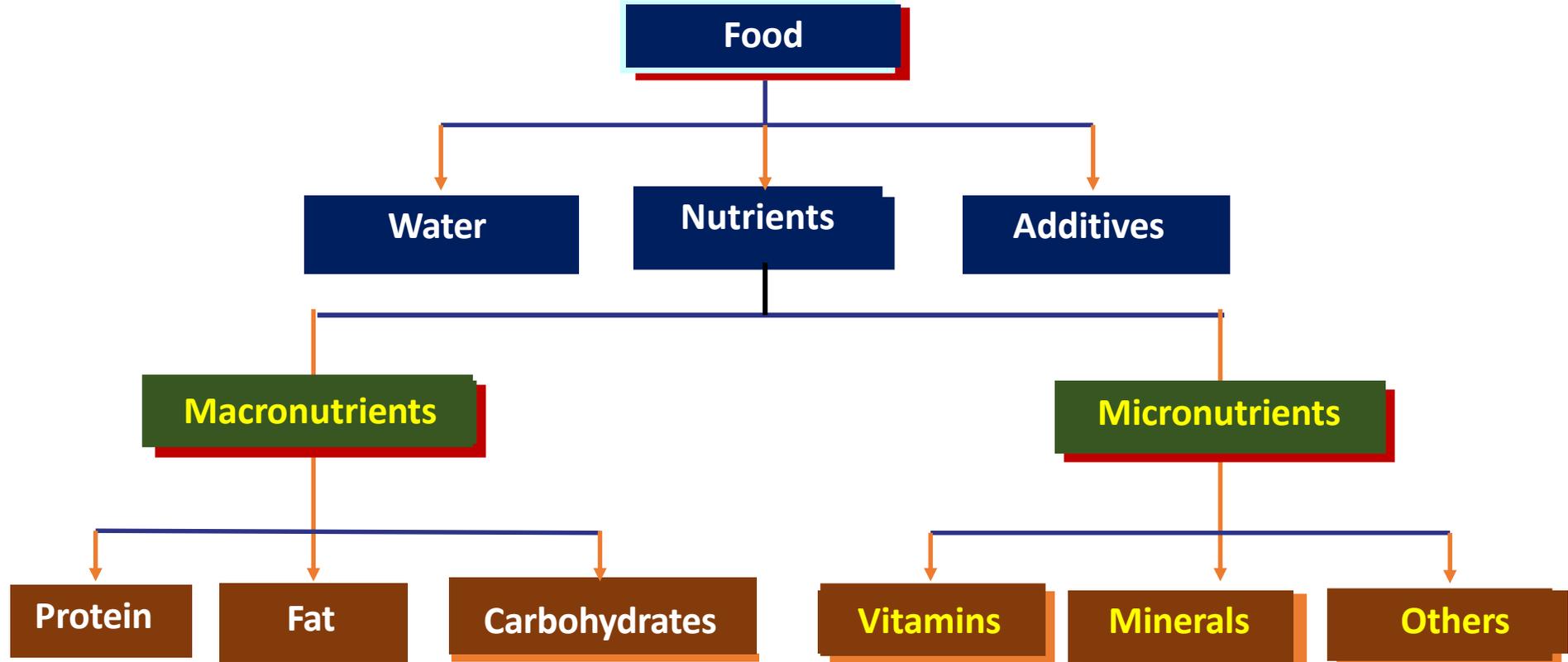
# Nutrition - Its all about BALANCE



- **Over-nutrition = an excess of energy or nutrients**
  - **Can lead to:**
    - **Obesity**
    - **Toxicity of some vitamins or minerals (especially fat soluble ones)**
- **Under-nutrition = a deficiency of energy or nutrients**
  - **Can lead to:**
    - **Thinness/ starvation**
    - **Deficiency in vitamins or minerals – rickets, goitre, anaemia etc etc.**
- **Over-nutrition and under nutrition can co-exist**
  - **In the same country**
  - **And even in the same person!**

# Food

What is food?



# Food

## Why do we have to eat?

### Functions of food:

- To provide energy
  - Fat
  - Carbohydrates
  - Protein
- To provide building blocks for body and important for growth
  - Protein
  - Vitamins and minerals
  - Trace elements
  - Water



# Macronutrients

## Energy in food



Energy is calculated using the following factors:

1g of protein gives **4 kcal = 17 kJ**

1g of carbohydrate gives **4 kcal = 17 kJ**

1g of fat gives **9 kcal = 37 kJ**

Total energy in **kcal** and **kJ**

*\* 1 kilocalorie (kcal) = 4.18 kilojoule (kJ)*