

Normal Feeding Normal Nutrition



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Health Insight / Dpt Physiology UP

Infant Feeding

2 Main Objectives



- Promotion of normal growth and brain development
- Prevention of illness during first year of life

Infants grow and develop rapidly during first 2 years, making them vulnerable to nutritional inadequacies

Breast feeding alone (4-6 months) followed by the slow introduction of a wide variety of solid foods over the next month, provide best opportunities for optimal growth



Value of breast feeding



- Optimal nutrition source for all infants
- Provides immediate protection – greatest during early month (*passive immunity*), but increases with duration of breast feeding (*mucosal immunity promoted in the suckling infant*)
- Provides all baby needs for first 4-6 months, besides Vit D and K
- Rich source of LCPUFA'S
- Rich source of nucleotides and prebiotics
- Rich source of complex oligosaccharides

Value of Breast feeding (continued)

- Protects against resp. and GIT infection
- Decreases risk of otitis media
- Decreases incidence of food allergies in babies with genetic predisposition
- Appears to play a role in prevention of IDDM
- Cognitive development slightly higher than bottle fed babies
- Psychological benefit of early and prolonged physical contact – bonding
- Safety
- Cost



Human Milk

- Rich source of complex oligosaccharides
- All carry lactose at their reducing end
- Monomers are : glucose, galactose, fucose, sialic acid, **N-acetylglucosamine**
- Compete with microorganisms (E coli) for binding of epithelial receptors of mucosal surface

N-acetylglucosamine

- So called “bifidofactor”
- Supports and stimulates the growth and activity of *Bifidobacterium infantis* in the infants gut (pre-probiotic)
- this bacterium constitutes over 96% of the intestinal microflora of healthy, breast-fed infants

Role of Intestinal Microflora

- Act as a protective barrier against colonization of pathogens
- Prevent diarrhoea and intestinal infections
- Promotes gut immune functions like:
 - phagocytosis
 - IgA secretion
 - maturation of mucosal immune system
- Reduction in lactose intolerance
- Improvement in nutrient digestion
- Improved abs of minerals like calcium

Formula Feeding

- Commercial infant formulas try to emulate human milk – generally adequate for first year
- Generally **cow based milk formula**
 - Skim milk powder
 - Lactose
 - Blend of oils
 - Fortified with vitamins and minerals



- Soy based formulas
 - Soy protein
 - Vegetable oils
 - Glucose polymers



- For infants of vegetarian families, lactose intolerant, or with allergy to cows milk
- Lactose-free cows milk based formula for lactose intolerant infants
- Follow on/transition formulas for second 6 months – superior to cows milk in this period

Introduction to Solids



- Breast milk exclusively for 4 – 6 months
- Complimentary foods then introduced
- Most common first food is iron-fortified infant cereal (rice cereal)
- Keep allergenic load as low as possible (GIT mucosa)
- Gluten
 - Very common allergen
 - Is found in **rye, wheat, oats, barley**
 - **NOT in rice or maize**
- Next pureed or finely mashed fruit and veges
- Pureed meat, poultry and fish around 6 – 7 month of age – slowly increasing in texture to encourage chewing
- 9 –12 month of age introduce finger foods to encourage self-feeding (beware of choking)



Cows Milk

- Not recommended before 9 – 12 months of age
- Higher in
 - Protein
 - Calcium
 - Phosphorus
 - Sodium
 - Potassium
- Lower in
 - Iron
 - Zinc
 - Vitamin C
 - Linoleic acid (LA – Omega 6)

(iron not bioavailable, abs impaired by Ca, P and low vitamin C)
- Low fat milk not to be given – lack of EFA's – high renal solute load as large volumes are drunk to satiate hunger



Cows Milk and IDDM

- **IDDM requires genetic predisposition and environmental trigger**

- ? Early exposure to cows milk protein
- ? Early termination of breast feeding
- ? Early exposure to solid food
- ? Early exposure to soy protein



THUS:

Breast feed for first year of life

For infants from families with IDDM

- Only breast feed for first year

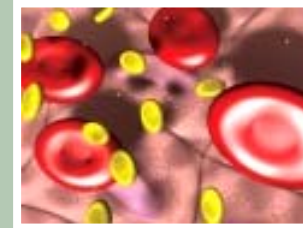
- Avoid commercially available cows milk

- Avoid products with cows milk protein for 1st year



Iron Deficiency

- **Most common 6-24 months of age**
- **Major risk factors**
 - ❖ Socioeconomic status
 - ❖ Early consumption of cows milk
 - ❖ No money for adequate food
 - ❖ Poor knowledge of nutrition
 - ❖ High risk group – low birth weight
 - Prem infants
 - ❖ Older infants who drink lots of milk or juice and eat little solid foods
- ***Prevent rather than treat*** iron deficiency anaemia
 - A risk factor for developmental delays in cognitive function
 - Irreversible with iron therapy – persists into childhood



Energy and Nutrient Requirements of Infants

High growth rate +

High Metabolic rate

= *Energy requirement higher than any other time in life*



CNS develops most rapidly in first year of life

Breast milk: 50 –60% fat (6% EFA's + EPA +DHA)

First year

Birth weight triples

Second year

Child has grown to half adult height

Childhood Feeding

- Periods between 2 and 10 years of age
- Potentially vulnerable – entirely dependent on parents/caregivers
- Inadequate intake of energy and essential nutrients may compromise growth and development, with lasting consequences
- In developing countries – malnutrition widespread
- In affluent countries – obesity rather major nutritional disorder

*High fat, sugary, energy dense, nutrient poor
("overfed and undernourished")*

Childhood Feeding (cont)

- **EATING HABITS** established in **CHILDHOOD** may be **NB** determinants of chronic disease later in life
- Gradually reduce fat intake after 2 years of age so that by age 5, it supplies 30 –35% of energy
- Low fat products not before age of 5
- 40 –50% of energy supplied by CHO
- Adequate protein intake with all 10 essential a/a
- Sufficient intake of calcium and iron
- Not too much fibre (bran) – besides being satiety inducing, the abs of calcium, zinc and iron may be reduced

UNHEALTHY

FATS

CARBOHYDRATES

HEALTHY FATS

HEALTHY CARBS

Daily physical activity; waist circumference

NEW FOOD PYRAMID (2003) Willett and Stampfer

Red meat & butter
Use sparingly



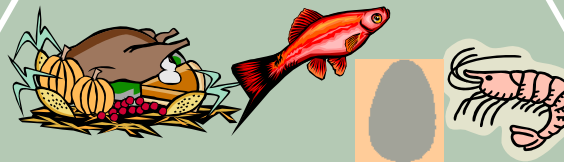
**Refined carbohydrates, sweets
pasta (made from cake flour), white
bread, white rice, potatoes**
Use sparingly



1 – 2 servings dairy



0 - 2 servings
Fish, poultry, eggs



water

water

1 – 3 servings
Nuts and legumes



Plant oils at most
meals



Whole grain
at most meals



**In
abundance**

VEGES



2 – 3 servings
fruit



water

Daily physical activity; waist circumference

water

NEW FOOD PYRAMID (2003) mod Willett and Stampfer

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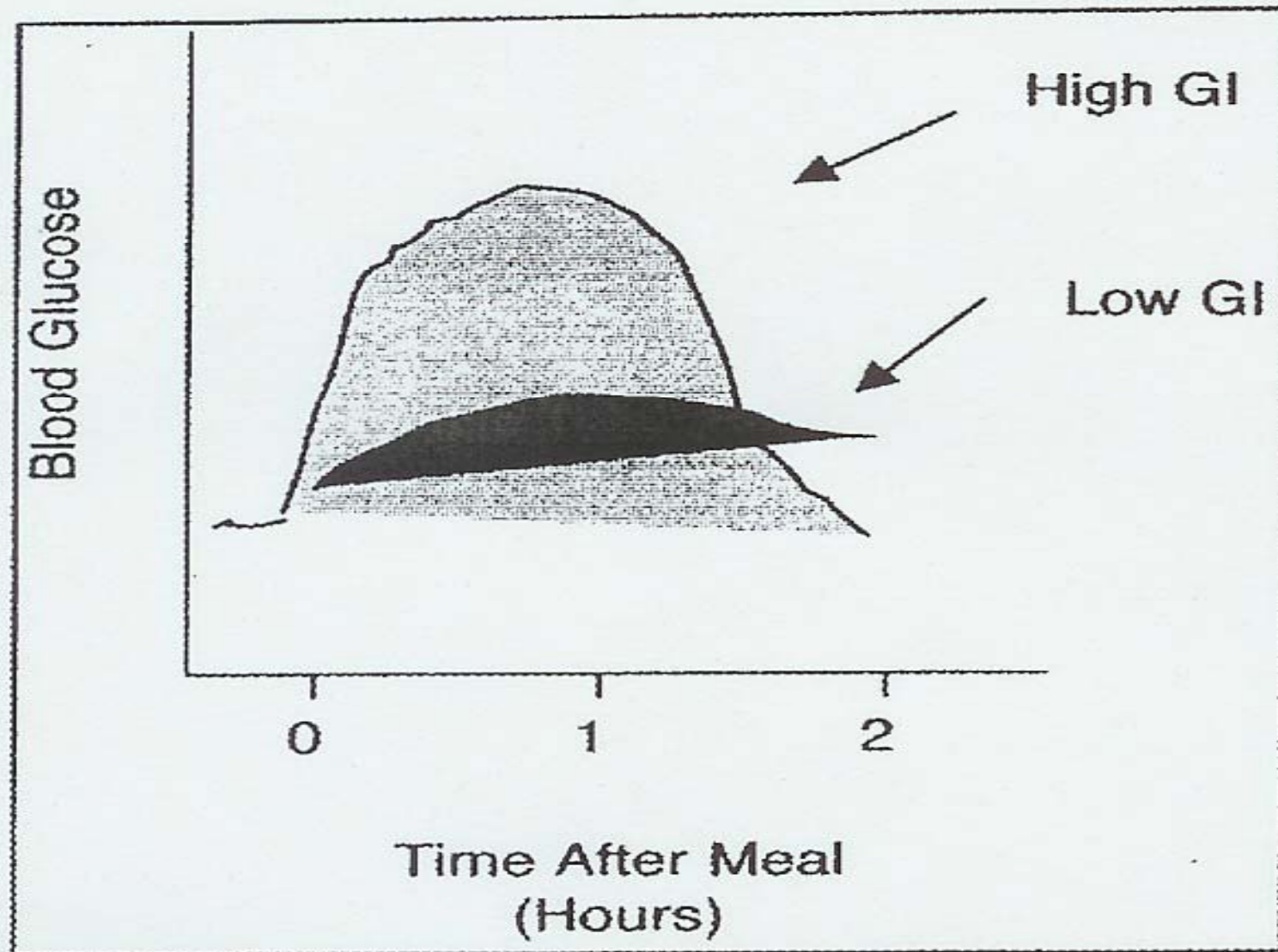
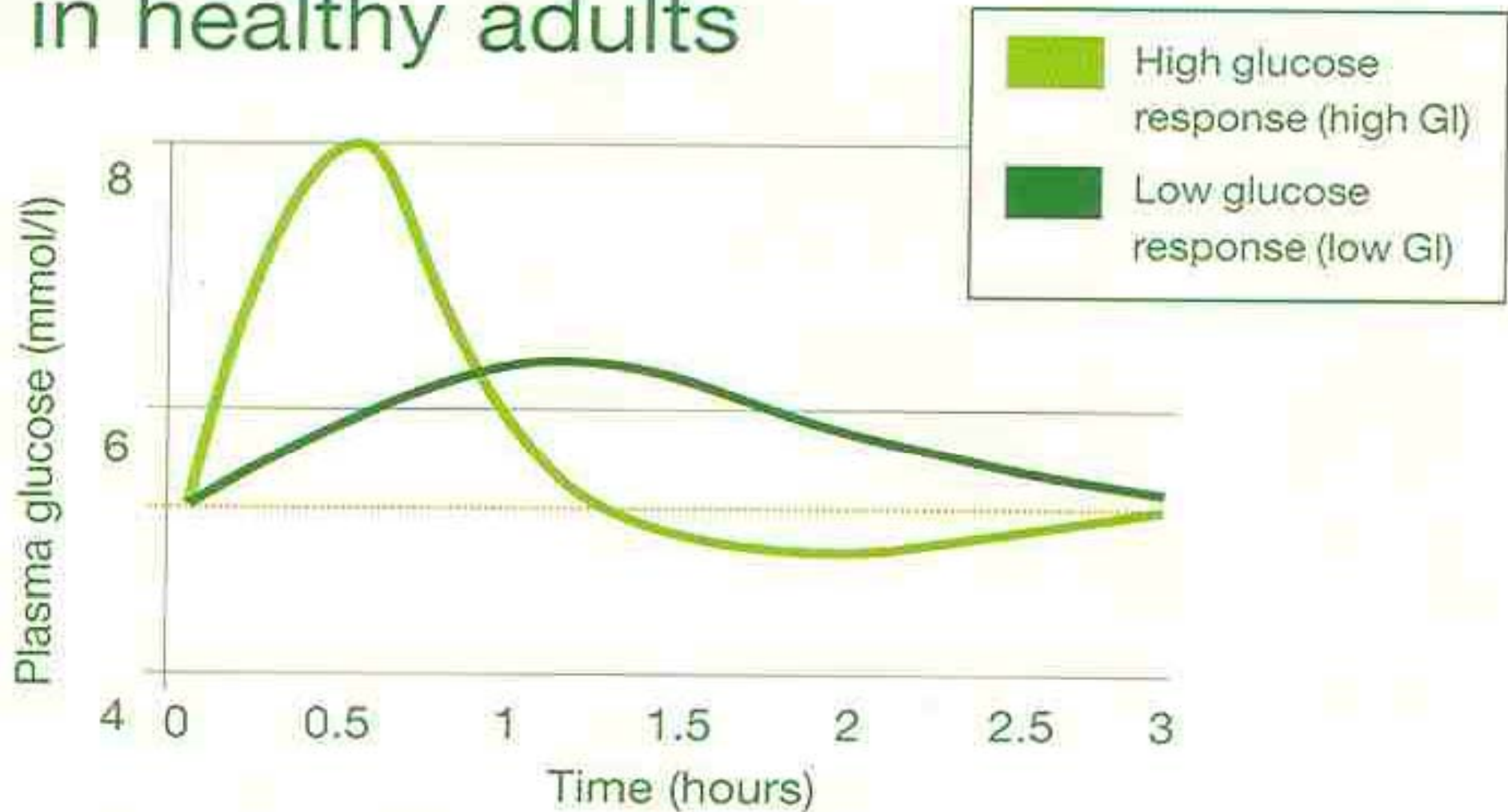


Figure 1. Schematic illustration of the effects of high- and low-GI carbohydrates on blood glucose. GI = glycemic index. Reproduced from *Nutrition Reviews* June 2002, 163-169.

Glycaemic response in healthy adults



Plasma glucose response (mmol/l) from a high versus a low GI food. The change in blood glucose concentration over time is expressed and calculated as the area under the curve (AUC) (Wolever et al., 1991).

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NEW FOOD PYRAMID (2003) Willett and Stampfer

BASED ON SCIENTIFIC FINDINGS :

TOTAL FAT INTAKE

SHOULD BE ABOUT 30% OF TOTAL
ENERGY INTAKE

- **Saturated Fat** **below** **10%**
 - **Unsaturated Fat** **mono** **10 to 15%**
 - **Unsaturated Fat** **poly** **7 to 10%**
- **DIETARY CHOLESTEROL BELOW 300MG / DAY**

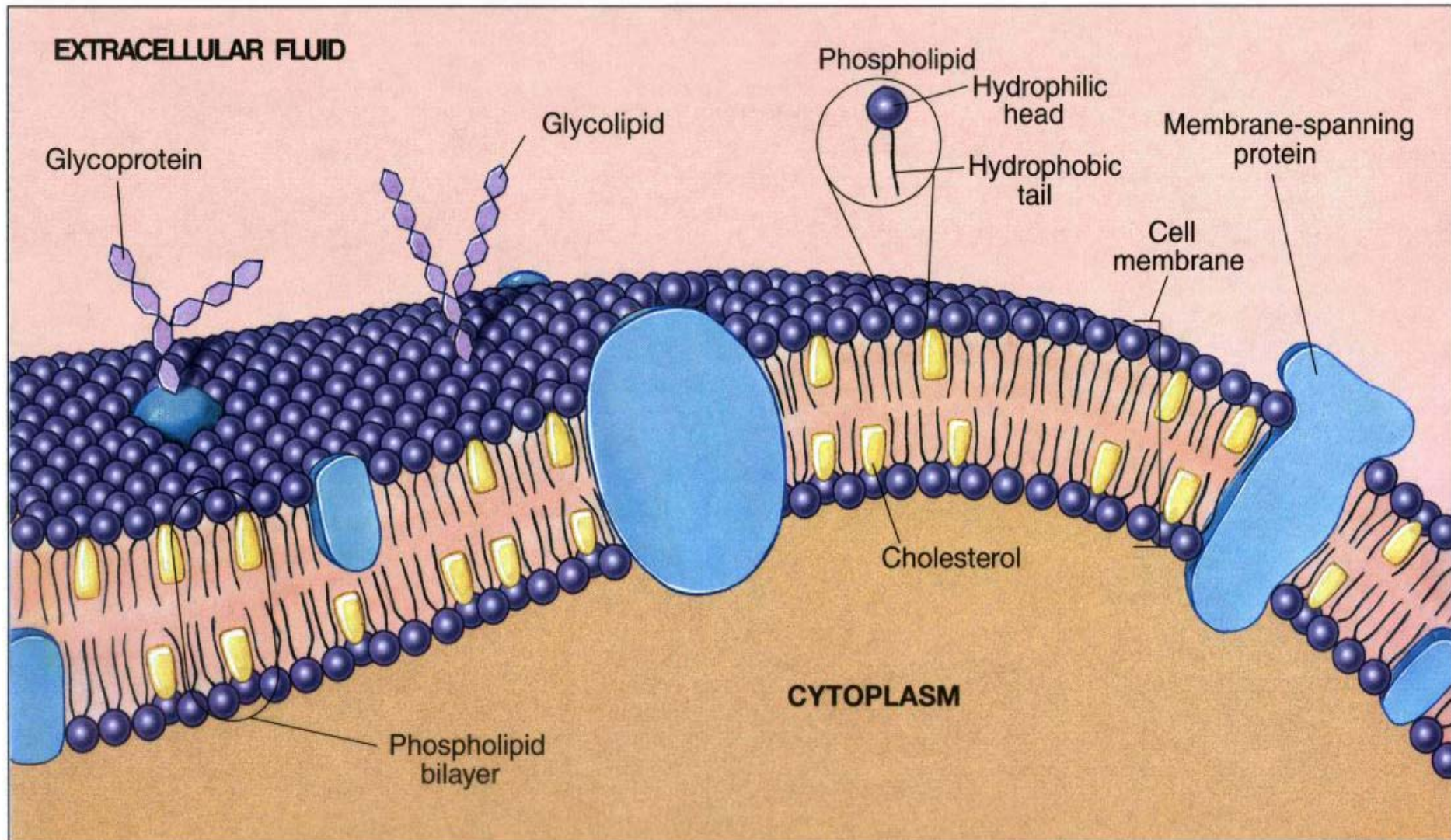
FUNCTIONS OF LIPIDS IN THE HUMAN BODY

- ❑ RESERVE STORE OF ENERGY
- ❑ HEAT INSULATION – SUBCUTANEOUS ADIPOSE TISSUE
- ❑ ELECTRICAL INSULATION OF NERVES –
MYELIN SHEATH
- ❑ SUPPLY OF FAT SOLUBLE VITAMINS

FUNCTIONS OF FATS IN THE HUMAN BODY

- ❑ **CHOLESTEROL – NEEDED TO MAKE CERTAIN HORMONES**
- ❑ **COMPONENTS OF CELL MEMBRANES**
- ❑ **SUPPLY OF ESSENTIAL FATTY ACIDS**
(omega 3 and omega 6)

THE CELL MEMBRANE



EFA's

OMEGA-3

ALPHA LINOLENIC ACID (ALA)

OMEGA-6

LINOLEIC ACID (LA)

FUNCTIONS OF EFA'S IN HUMANS

- ❑ REQUIRED FOR NORMAL GROWTH AND DEVELOPMENT**
- ❑ REQUIRED FOR STRUCTURAL INTEGRITY OF ALL CELL MEMBRANES (fluidity)**
- ❑ PRECURSORS OF HORMONE-LIKE SUBSTANCES : ** PROSTAGLANDINS (PG'S)**
- ❑ cell signalling ; regulation of gene expression - transcription factors eg PPAR**

DIET



FATTY ACIDS

Omega 3

Omega 6



CELL MEMBRANE

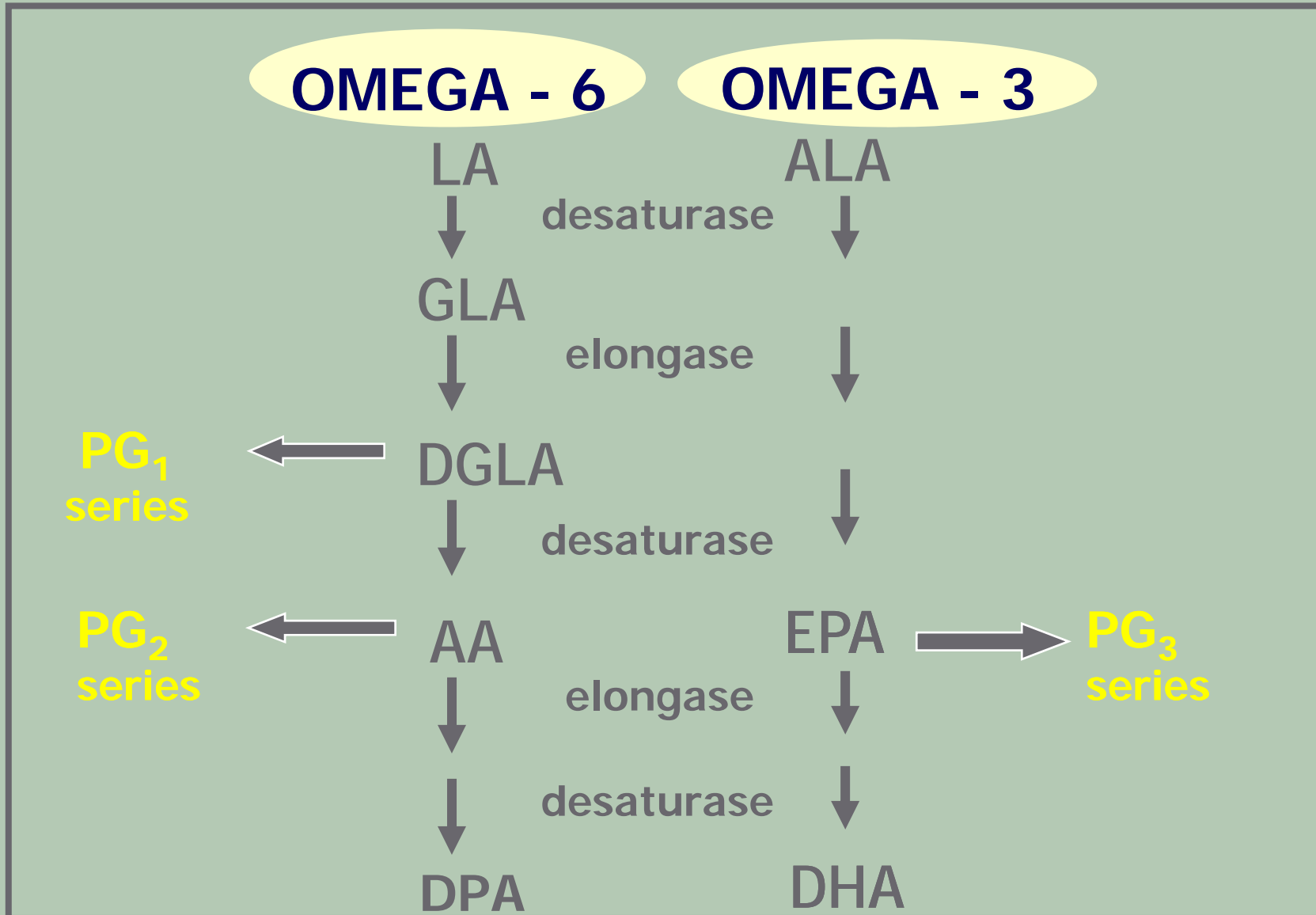


LOCAL HORMONES INSIDE CELL

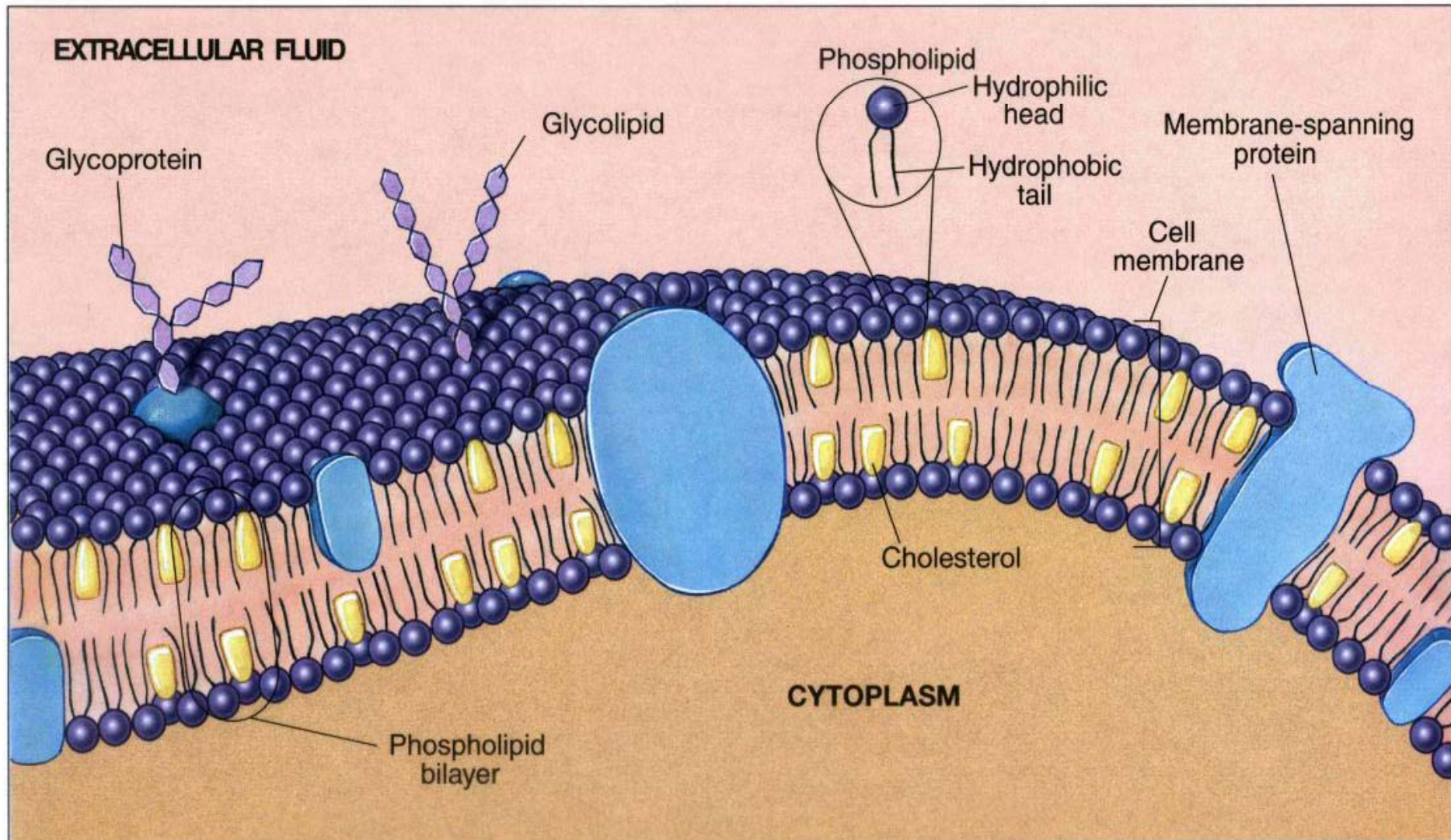
(PROSTAGLANDINS)

INCORRECT RATIO OF
OMEGA-6 TO OMEGA-3

ESSENTIAL FATTY ACID METABOLISM



THE CELL MEMBRANE



Vegetarianism

- **Beware:** low saturated fat intake
high fibre content
 - Careful monitoring and planning needed
 - Most vegetarians breast feed well into 2nd year
 - Vitamin B₁₂ intake of mother NB
- In vegan children, where eggs and dairy products are excluded, considerable difficulty is experienced in achieving:
1. Sufficient amounts of vit B₁₂
 2. Sufficient amounts of calcium
 3. Sufficient amounts of iron
 4. Sufficient amounts of zinc
 5. Sufficient energy



Common Feeding Problems

- **Food allergy**
- **Food intolerance**

Common Feeding Problems

Food Allergy (Immune system involved)

- 1- 8% frequency in first year
- Genetic predisposition
- Age at which food was introduced
- Most common: **milk, eggs or peanuts**
- Also **soy, fish, nuts and wheat**
- All together responsible for **97% of allergies** in infants and toddlers
- Rare to have allergies to more than 2 – 3 foods
- Management : strict avoidance; read labels to detect hidden sources
- Sensitivity tends to disappear within a few years
- Retest / re-challenge at regular intervals
- Allergies to peanuts, nuts, fish and seafood are most severe and tend to be life-long

Cows Milk Protein Allergy

- 1 – 5% prevalence – NB food allergy in infants
- 15 – 50% of milk sensitive infants also react to soy
- Goats milk has some similar antigens to cows milk – thus not recommended
- Choice of formula decided by severity of allergic reaction to cows milk

Mild reaction

- Try soy formula
- Less expensive
- Palatable

High allergic infants

- Formulas with cows milk protein hydrolysates
(proteins very much reduced in size)

Not sure

- Partially hydrolysed protein
- Less expensive, more palatable
(still contains 20% of allergenic peptides)



Lactose Intolerance

- Does not involve immune system
- Congenital lactase deficiency very rare
- Primary hypolactasia more common due to normal developmental decrease in lactase activity
- Can develop in infants secondary to mucosal damage caused by:
 - gastroenteritis
 - malnutrition
 - coeliac disease
 - inflammatory bowel disease
 - drugs
- Symptoms include gas, cramps and explosive diarrhoea
- Management: use lactose-free cow milk formula or soy formula



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Use sparingly



**Refined carbohydrates, sweets
pasta (made from cake flour), white
bread, white rice, potatoes**
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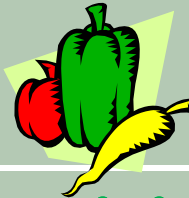
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Whole grain
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**In
abundance**

VEGES



2 – 3 servings
fruit

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Daily physical activity; waist circumference

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NEW FOOD PYRAMID (2003) mod Willett and Stampfer

Reduce your carbon footprint !

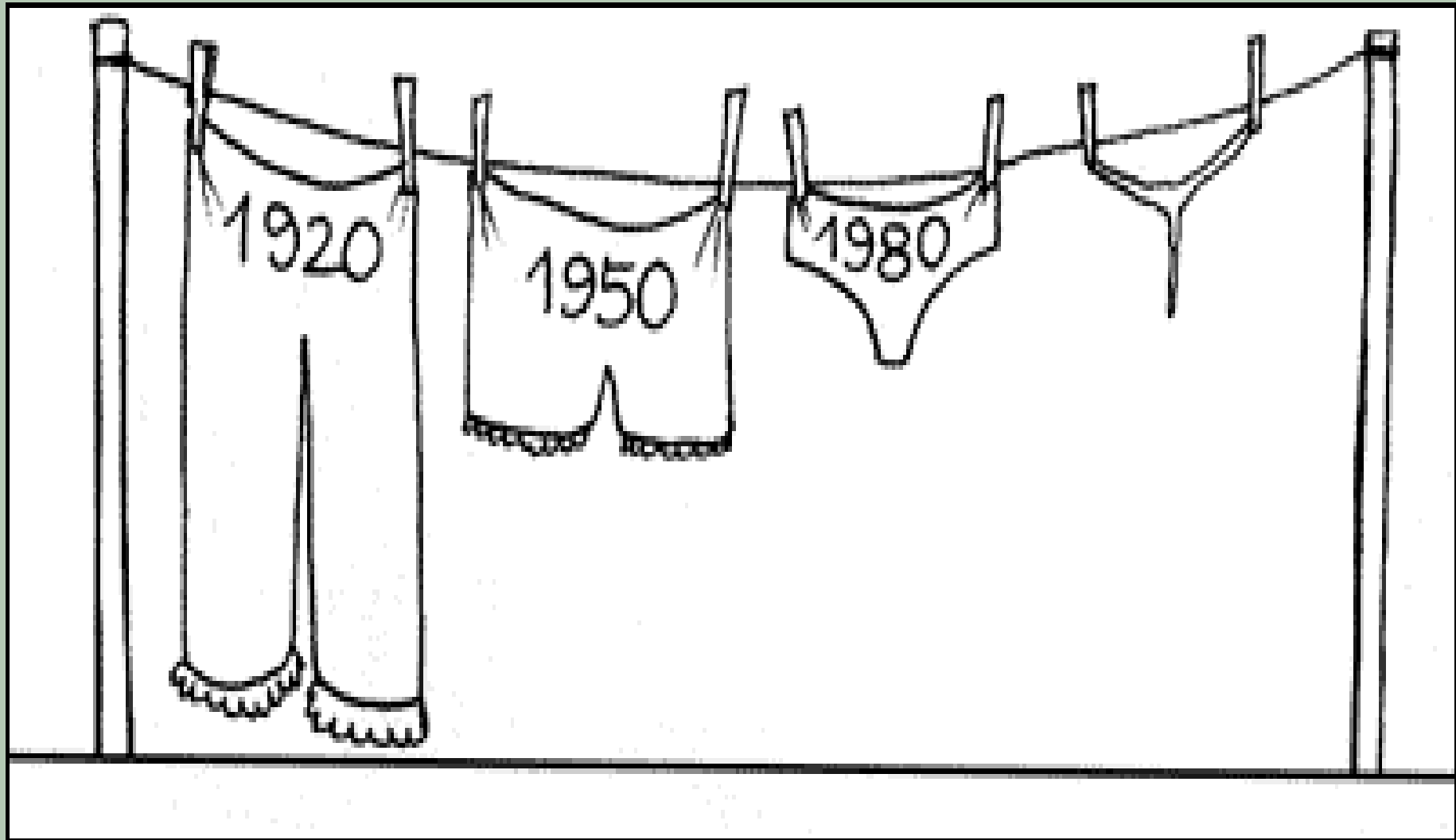
Greater intake of plants and fruits,
and less meat and dairy

Vegetables, fruits and grains require 2
calories of fossil fuel energy to cultivate
one calorie of food energy, whereas
raising cattle (beef) the ratio is 60 : 1

**These are the exact
recommendations of the latest
food pyramid !**

**Best way to combat the global scourge of
chronic diseases of lifestyle – obesity, heart
disease, diabetes and cancer**

EFFECTS OF GLOBAL WARMING



**“Man lives on a quarter of what he
eats.....**

**on the other three – quarters lives his
doctor”**

Inscription on pyramid dating from 3800 BC

90 people get the Swine Flu and everybody wants to wear a mask.

A million people have AIDS and no one wants to wear a condom.

References

- Rautava et al "Probiotics during pregnancy and breastfeeding might confer immunomodulatory protection against atopic disease in the infant" *J Allergy Clin Imm* 109(1), 2002; 119-121
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- Moran and Aggett eds , *Maternal and Child Nutrition – special issue*, 3(4), October 2007
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Thank you

