AND NUTRITION

Dept of Pedodontics and Preventive Dentistry

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DEFINITION

- Diet and nutrition are often used interchangeably.
- However, according to the **Taber's Medical Dictionary**, they have distinctly different scientific meanings.
  - **Diet** is defined as what you eat and drink.
  - **Nutrition** is the internal processing of foods and beverages, such as ingestion, digestion, absorption, assimilation, distribution, and elimination (i.e., metabolism).
- Nutrition, according to **Dr. Nizel** is a science that deals with the study of nutrients & foods, their effects on nature & function of organism under varied conditions of age, health & disease.
- According to **WHO**, "Nutrition is the science of food and its relationship to health."
- **"Clinical" nutrition** refers to macro-nutrient (protein, carbohydrate and fats/oils) and micro-nutrient (vitamins, minerals and water) deficiencies at a cellular and tissue (clinical) level that leads to organ/gland dysfunctions and eventually to disease.

COMPONENTS OF DIET

- MAJOR NUTRIENTS:
  - Carbohydrates
  - Proteins
  - Fats/lipids
- MICRO NUTRIENTS
  - Vitamins
  - Minerals
- TRACE NUTRIENTS

- **PROTEINS**
  - word protein means "**of prime importance**", because it mediates most of the actions of life.
  - essential for all body tissues: skin, tendons, bone matrix, cartilage, and connective tissue.
  - also forms hormones, enzymes, antibodies and acts as a chemical messenger within the body.
  - Requirements for protein vary between 40-65 g/day depending on physical activity, stress, and growth cycles.
  - Excess is stored as fat.
  - The specific dynamic action (SDA) or the thermic effect of food (TEF) for protein (29%) is much higher than that of carbohydrate and fat (5%).

Deficiency state: **Protein energy malnutrition (PEM) :**

Kwashiorkar, Marasmus and Marasmic Kwashiorkar

- Amino acids:
  - Building blocks of proteins.
  - 24 in number, 8 of them being essential amino acids which cannot be synthesized by the human body.
  - Among them, glutamine is termed as "**antistress nutrient**", and is present in largest amount in plasma.
  - Tryptophan: also called
    - "**nature's sleeping pill**": precursor of serotonin
    - "**provitamin B3:** precursor of niacin (60mg tryptophan = 1mg niacin)

- Quality of protein:
  - That provides amino acid pattern close to that of tissue protein
  - Breast milk and egg protein satisfy this criteria.
  - Egg: called **reference protein:** provides all essential amino acids.

KWASHIORKAR

- First recognized by **Prof Cicely Williams** in 1933 from Gold Coast.
- She observed that this was the disease of the first child when the second was on the way displacing the first child from breast feeding.
- She named it Kwashiorkar, word taken from Ga language of Ghana, which means the **'red boy'** due to characteristic pigmentary changes.
- Later on, the term was interpreted as "deposed child".
- Classic signs:
  - Stunted growth
  - Hepatomegaly
  - Anaemia
  - Oedema

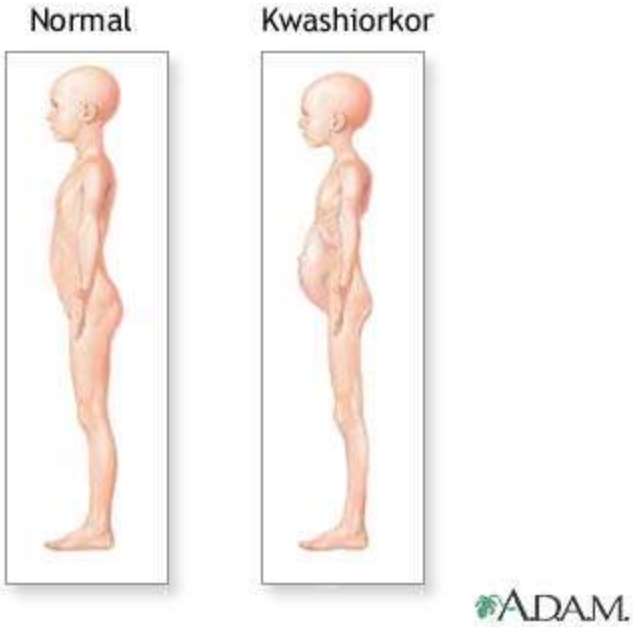
Grading

Grade I- pedal oedema

Grade II- I +facial oedema

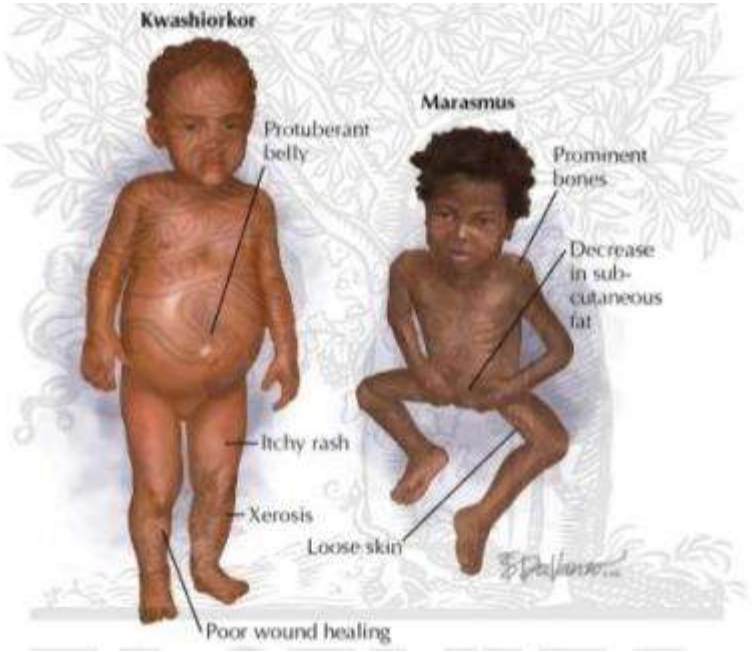
Grade III – II + paraspinal and chest oedema

Grade IV- III + ascites



MARASMUS

- Word Marasmus is derived from Greek word Marasmos, which means “wasting”.
- Affected children exhibit extreme wasting.
- Old man appearance to jaws and skin and bones.
- Grading
  - **Grade I**: wasting starting in axilla and groin.
  - **Grade II**: I + wasting in thigh and buttock region
  - **Grade III**: II+ chest and abdomen
  - **Grade IV:** buccal pad of fat
- Wasting of brown fat occurs first.
- Marasmic Kwashiorkar: when marasmic children develop oedema.



ORAL MANIFESTATIONS

- Bright reddening of tongue
- Loss of papillae: erythematous and smooth dorsum of tongue
- Kwashiorkar:
  - Edema of tongue with scalloping around the lateral margins due to indentation of the teeth.
- Bilateral angular cheilosis
- Fissuring of lip
- Loss of circumoral pigmentation
- Dry mouth
  - Reduced caries activity due to lack of substrate carbohydrate.
- Decreased overall growth of jaws
- Delayed eruption
- Deciduous teeth may show linear hypoplasia.

LIPIDS

- Fats insulate against the cold, cushion organs, slow digestion, carry fat-soluble vitamins A, D, E, K, and make foods taste good.
- Types :

Saturated fats

•mainly from animal foods, such as meat, poultry, butter, and whole milk.

•They increase the risk of cardiovascular disease, cancer, and obesity.

Unsaturated fats:

•Mono and polyunsaturated fats are heart healthy fats.

• EFA: "essential fatty acids" are Polyunsaturated fatty acids, used to be called "queen of vitamins" and then it was designated as vitamin F.

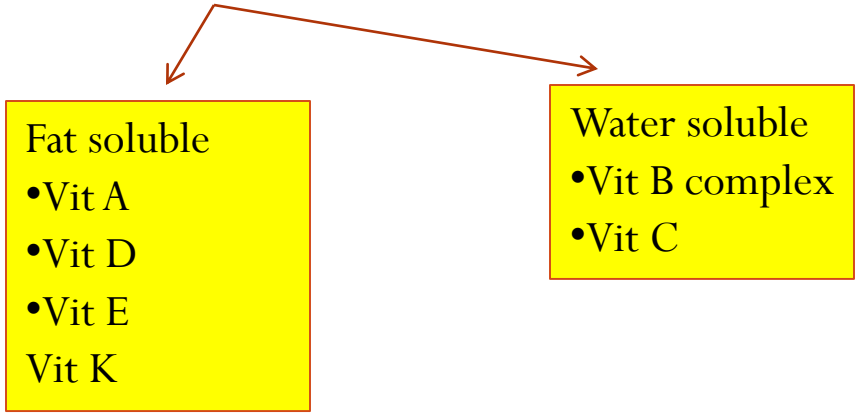
Nutrient	Function	Deficiency Symptoms	Toxicity Symptoms	Major Food Sources
Protein	Anabolism of tissue proteins; helps maintain fluid balance; energy source; formation of immunoglobulins; maintenance of acid-base balance; important part of enzymes and hormones	Kwashiorkor-edema; reddish pigmentation of hair and skin; fatty liver; retardation of growth in children; diarrhea; dermatosis; decreased T-cell lymphocytes with increased secondary infections; Marasmus- muscle and fat wasting; anemia	Azotemia; acidosis; hyperammonemia	Breast milk, infant formula, meat, fish, poultry, egg yolk, cheese, yogurt, legumes
Carbohydrate	Major energy source; protein sparing; necessary for normal fat metabolism; glucose is the sole source of energy for the brain; many sources also provide dietary fiber	Ketosis		Breast milk; infant formula; whole-grain breads, cereals, and other fortified or enriched grain products; potatoes; corn; legumes; fruits; vegetables
Fat	Concentrated energy source; protein sparing; insulation for temperature maintenance; supplies essential fatty acids; carries fat-soluble vitamins A, D, E, K	Eczema; low growth rate in infants; lowered resistance in infection; hair loss		Breast milk, infant formula, protein-rich foods (meats, dairy products, egg yolk, nuts), butter, margarine, cream, salad oils and dressings, cooking and meat fats

RDA: Recommended Dietary Allowance

- According to the **American Food and Nutrition Board**, RDAs are "**levels of intake of essential nutrients that on a basis of scientific knowledge are adequate to meet the known nutrient needs of all healthy persons.**"
- **Methods of calculation:**
  - **ICMR** recommendations
  - **Coefficient of calorie requirement:**
    - Given by National Institute of Nutrition, Hyderabad
    - Assuming 2400 kcal as 1 unit of energy, RDA is expressed as a proportion of this.
    - Lower than ICMR recommendations.
  - **Holliday and Segar formula**
    - RDA is expressed as that for the age of the child and not for the present weight.
  - **Weech formula**
    - For bedside approximation of expected weight and height
    - Infant weight = (age in months + 9)/2

Nutrition and child Development,3rd edition : KF Elizabeth

- VITAMINS:



- Vitamins and Minerals form the protective foods and are also called functional foods.
- Those with RDA<100mg/day were traditionally called **micro-nutrients.**

Fat soluble vitamins

- Vitamin A deficiency is a preventable cause of blindness in children.
- According to **Vitamin A prophylaxis programme**, children between 9 months to 3 yrs are given 5 megadoses of vitamin A concentrate at 6 months interval.
- Intake of 25000 IU or more during early pregnancy can lead to congenital malformations.
- Hypervitaminosis leads to GI upset, pseudotumour cerebri, skin desquamation , dry hair and hyperostosis of tibia.

Preparations:

- **Aquasol A** : 50,000 IU/capsule, inj 50,000 IU/ml
- **Arovit** : 50,000 IU/tab, drops 50,000IU/ml
- **Adexolin A & D**: vit A 5000 IU and vit D 400 IU

Daily requirement:
1500 IU (500 µg)

ORAL MANIFESTATIONS

- **TEETH**:
  - Defective formation of enamel
  - Odontogenic epithelium fails to undergo normal histodifferentiation and morphodifferentiation, leading to increased rate of cell proliferation.
  - Epithelial invasion of pulpal tissue is characteristic of vitamin A def.
  - Distortion of shapes of incisors and molars.
  - Enamel hypoplasia:
    - enamel matrix is poorly defined.
    - Calcification is disturbed.
  - Atypical dentin: lacking normal tubular arrangement, and containing vascular and cellular inclusions.
  - Increased caries susceptibility.
  - Delayed eruption.
- **GINGIVA**
  - Hyperplastic gingival epithelium
  - In prolonged defi: shows keratinization
- Major and minor **salivary glands** show typical keratinizing metaplasia.

Fat soluble vitamins (contd)

Daily requirement:400 IU (10µg)

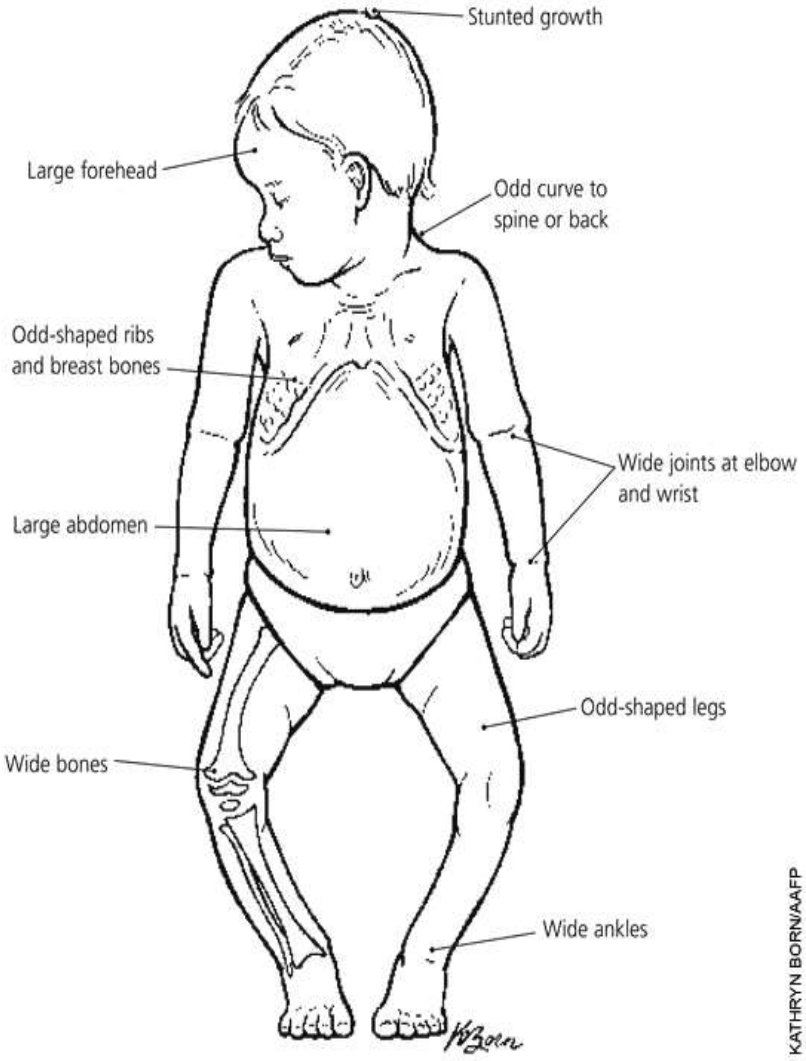
288 nm UV light

- The active form (**Calcitriol**) promotes bone resorption and mineralization and intestinal calcium and phosphorus absorption.
- Pre-term babies not exposed to sunlight, babies of mothers with severe vit D deficiency, and those with fat malabsorption are prone to develop deficiency.
- In preterm babies, deficiency may manifest as early as 8 weeks of age, leading to rickets.
- Deficiency is treated with administration of **6lakhs IU of vitamin D oral or IM**.
- **Hypervitaminosis** leads to GI upset, hypotonia, polyuria, polydypsia, hypercalcemia, hypercalciuria, metastatic calcification, clouding of cornea and conjunctiva.
- **Aluminium hydroxide** is useful in treating hypervitaminosis.

Vitamin D (contd)

- Rickets
  - Large head
  - Wide open anterior fontanelle
  - Frontal, parietal and occipital bossing

  (hot cross bun appearance or caput quadratum)
  - Pigeon chest : Pectus carinatum
  - Rachitic rosaries
  - Harrison's sulcus
  - Knock knee
  - Lateral bowing of tibia
  - Widening of wrist
  - Double malleoli



Preparations:
- **Calcirol** sachets- 60000 IU/sachet
- **Arachitol** – 3lakhs and 6lakhs IU/ml
- **Alphadol** tab 0.25µg
- **Adexolin-** A& D cap: A5000IU, D 400IU

ORAL MANIFESTATIONS

- Developmental abnormalities of dentin and enamel.
- Delayed eruption.
- Malalignment of teeth.
- Higher caries index.
- Enamel: may be hypoplastic, mottled, yellow gray in colour.
- Large pulp chambers.
- High pulp horns.
- Delayed closure of root apices.
- Osteoid is so soft that the teeth are displaced, leading to malocclusion of the teeth.

OSTEOMALACIA

- Adult rickets
- Only flat bones and diaphyses of long bones are affected.
- Commonly seen in post-menopausal women with a H/O low dietary calcium intake and low exposure to UV light.
- Oral manifestations:
  - Severe periodontitis in some cases.

VITAMIN D RESISTANT RICKETS

- X linked trait with some defect in reabsorption.
- **Oral manifestations:**
  - Abnormal ,wide pulp chambers with faulty calcifications and marked interglobular space in dentin.
  - Pulp horns are elongated and extend high often reaching DEJ.
  - Periapical involvement of a grossly normal appearing primary or permanent tooth followed by development of multiple gingival fistulae.
  - Abnormal cementum formation.

Fat soluble vitamins (contd)

Daily requirement: 5-15 IU (5-15mg)

Preparations:
- **Evion**
- **Tocofer**
- **E cod-** 100 mg, 200mg, 400mg pearls
- **Evion drops** 50mg/ml

- Protects cell membranes and tissues from damage by oxidation.
- Aids in the formation of red blood cells and the use of vitamin K.
- Promotes function of a healthy circulatory system.
- Called "**shady lady of nutrition**" as more applications are yet to be known.
- Vit E supplementation is needed in fat malabsorption and cholestasis and in premature infants.
- 15-25IU/day is given in such cases.
- Excess may cause **necrotising enterocolitis** in the newborn.

ORAL MANIFESTATIONS OF VITAMIN E DEFICIENCY

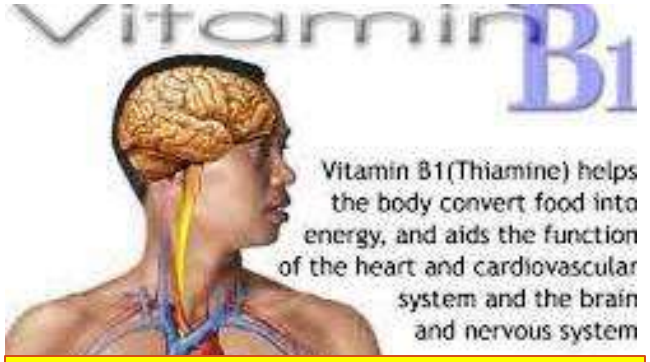
- Loss of pigmentation
- Atrophic degenerative changes in enamel.

Fat soluble vitamins (contd)

Preparations:
Menadione sodium 10mg/ampoule

- Synthesized by intestinal flora
- Participates in oxidative phosphorylation.
- Increases concentration of prothrombin (II), proconvertin (VII), plasma thromboplastin component (IX) and stuwart-prower factor (X).
- Naturally occuring vit K is K1 (phytomenadione)
- K2 (menaquinones) is of bacterial origin
- Deficiency leads to **haemorrhagic disease of new-born (HDN)**, commonly seen in breast-fed babies due to delayed colonisation of gut and due to lower concentration of vit K in breast-milk (15 µg%) compared to cow's milk (60 µg%).
- In HDN, 2-5mg vit K is given. In severe cases, blood transfusion is needed.
- **Oral manifestation** of deficiency: Gingival bleeding

Water soluble vitamins



Daily requirement: 0.5-1.5mg/day (1mg/1000cal)

Also known as "aneurin"
Discovered by Eijkman in 1897.

- Plays important role in metabolism of carbohydrates, alcohol and branched chain amino acids.
- Main deficiency diseases are **beri-beri** and wernicke- korsakoff syndrome.(**WKS**)
- Wet beri-beri manifests as high output cardiac failure.
- Dry beri-beri presents with neuritis.
- Infantile beri-beri presents with aphonia and combined features of dry and wet beri-beri.
- Responds to thiamine, 10-100 times the requirement.
- **Anaphylaxis** may occur on thiamine injection.

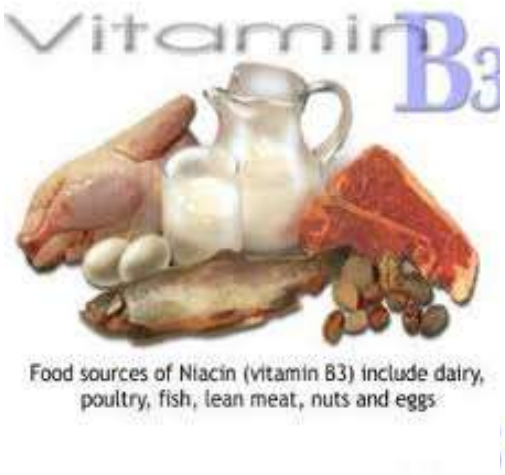
Water soluble vitamins (contd)

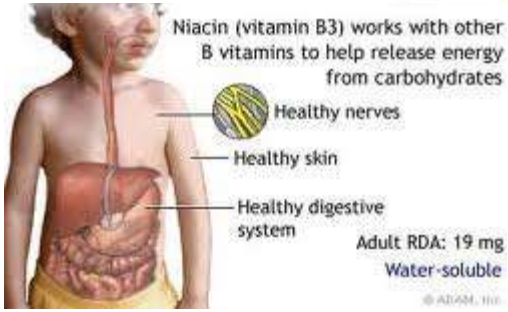
Daily requirement:0.5- 1.5mg

- Common deficiency seen in south india, where staple diet is polished rice.
- It is rare in milk drinking countries.

- Earlier called vitamin G.
- Has a vital role in cellular oxidation.
- Deficiency manifests as angular stomatitis, cheilosis, atrophic papillae on tongue, nasolabial dyssebacea and neovascularisation of cornea.
- In severe cases, tongue becomes glazed and smooth due to complete atrophy of papillae.
- Lips: red and shiny because of epithelial desquamation.

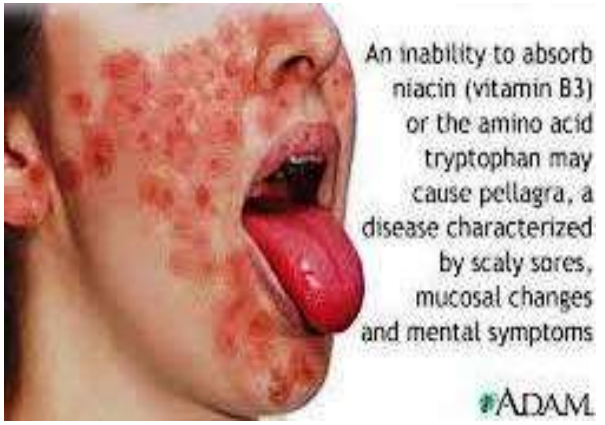
Water soluble vitamins (contd)



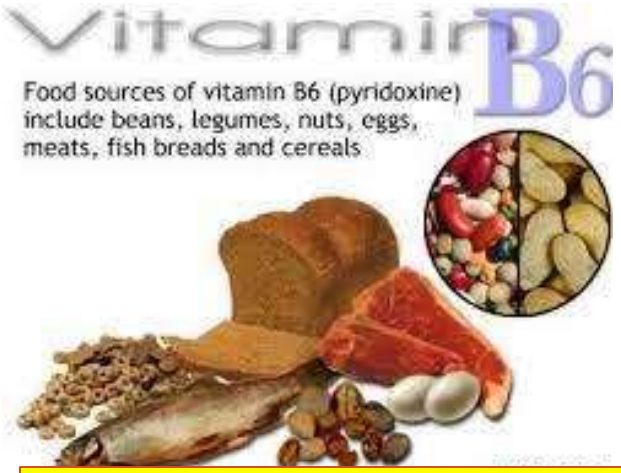


- **Niacin** : also called "**Nature's valium**"
- a part of NADP co-enzymes.
- Tryptophan amino acid is the precursor, also called "**Nature's sleeping pill"**
- 70mg protein intake provides 12mg of niacin.
- Deficiency state is termed **PELLAGRA** which leads to photosensitive dermatitis, diarrhoea and dementia.
- Casal's necklace and glove and stocking type dermatitis occurs in the exposed parts.

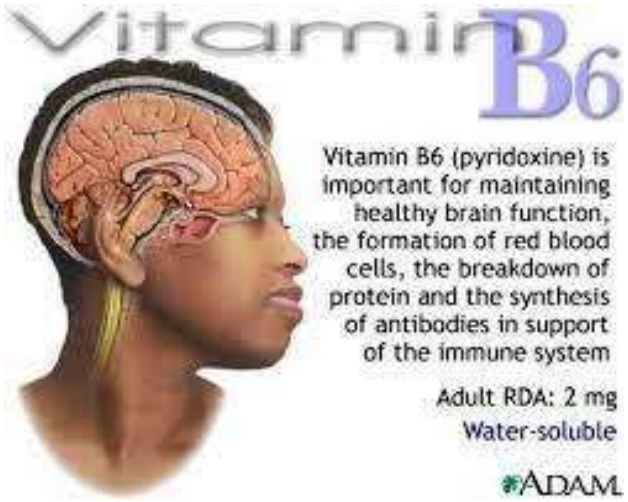
Daily requirement: 5-15 mg



Water soluble vitamins (contd)



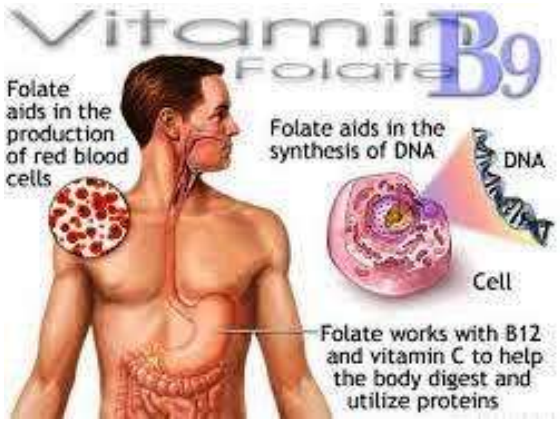
Daily requirement:0.5- 1.5mg



- **Pyridoxal, pyridoxamine and their phosphates have B6 activity.**
- **It keeps up the level of GABA, an inhibitory neurotransmitter.**
- **Also beneficial in homocystinuria, hyperoxaluria, sideroblastic anemia and radiation sickness.**
- **Deficiency causes**
  - **Neuritis**
  - **Anemia**
  - **Convulsions**
- **Oral manifestations:**
  - **Cheilosis**
  - **Glossitis**
  - **Angular stomatitis**
  - **Halitosis due to tooth decay**

Water soluble vitamins (contd)

Daily requirement:50-150 µg/day



Was also called vitamin M.

Food sources include beans and legumes, citrus fruits, whole-grains, dark green leafy vegetables, poultry, pork, shell fish and liver.

Important in DNA synthesis.

Deficiency leads to megaloblastic anemia, diarrhoea, and knuckle and periungual pigmentation.

Preconceptional administration can prevent neural tube defects in the baby.

Water soluble vitamins (contd)

Daily requirement: 05-1.5 µcg/day

Cyanocobalamine: Called "red vitamin"
Contains cobalt in the molecule: only vitamin that contains a mineral.

Present only in animal foods, fish and milk.
Even though colonic bacteria synthesize it, but its not bio-available.

Absorbed from ileum under the influence of intrinsic factor secreted from the stomach.

Takes part in synthesis of fatty acids in myelin.
Deficiency leads to perinicious anemia, and subacute combined degeneration of spinal cord . Additional signs are weight loss, pallor, confusion and hypotension.

In 2001, neurologic impairment resulting from vit B12 deficiency was reported in 2 children breast-fed by mothers who followed vegetarian diets.

Georgia 2001, MMWR Morb Mortal Wkly Rep 52 (4):61-64,2003

ORAL MANIFESTATIONS OF VIT B12 DEFICIENCY

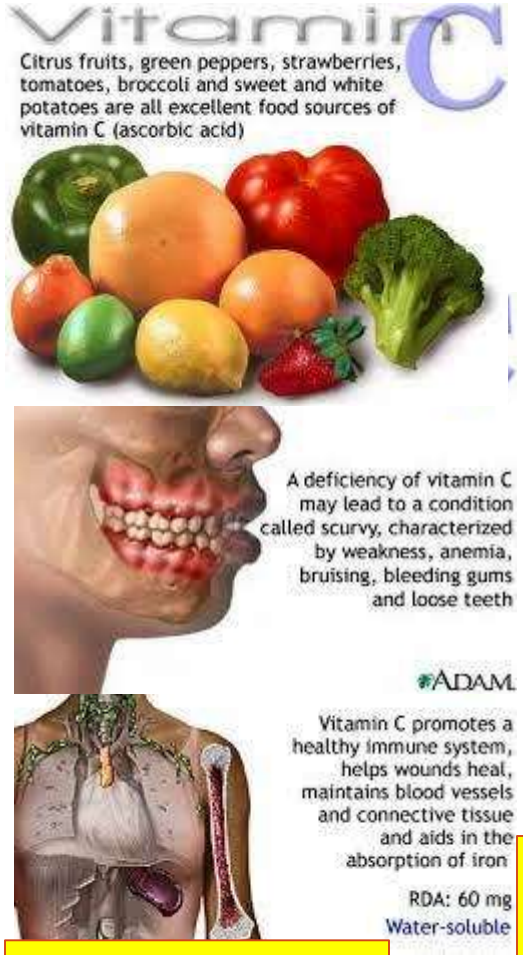
- Tongue:
  - Sore painful tongue, glossitis and glossodynia
  - Beefy red tongue
  - Small shallow ulcers with atrophy of papillae with a loss of normal muscle tone, called as **Hunter's glossitis.**

Vitamin B Complex

- Additional vitamins
  - **Pantothenic acid:**
    - Referred to as vitamin B5
    - Described by Dr Gopalan.
    - Deficiency causes dermatitis, hallucinations.

- Preparations:
  - **Neurobion**
  - **Polybion**
  - **Becosules**
  - **Berocin C**

Water soluble vitamins (contd)

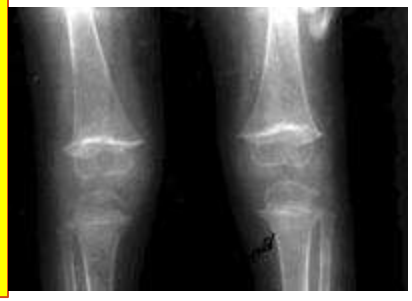


Converts proline to hydroxyproline, which is a constituent of collagen.
Involved in collagen synthesis and teeth formation.
Increases iron absorption.
Acts as antioxidant due to its reducing property.

Deficiency leads to scurvy, defective bone growth, bleeding gums and delayed wound healing.
Subperiosteal bleeding and calcification.
Scorbutic rosaries are tender and angulated.
White line of Fraenkel: a dense white line at metaphyses due to excessive calcification.

Daily requirement: 40mg/day

Preparations:
Celin- 100mg,500mg
Suckcee, **Limcee—** 500mgchewable tab
Cecon drops-100mg/ml



ORAL MANIFESTATIONS OF VIT C DEFICIENCY

- Occurs chiefly in gingival and periodontal region.
- Interdental and marginal gingiva is bright red, swollen, smooth, shiny surface producing an appearance called, “Scurvy bud”.
- In fully developed deficiency, gingiva becomes boggy, ulcerated and bleeds easily.
- Typical fetid breath.

Nutrient	Food Sources	Functions	Deficiency Signs	Signs of Excess	Notes
Vitamin A (Retinol) RDA: M: 900 µg F: 700 µg	Cod liver oil and other fish liver oils, liver, egg yolk, full cream dairy, yellow and dark green vegetables.	Essential nutrient for eye health. Important for growth and development of body tissues. Maintenance of healthy skin, nails and hair.	Changes in skin texture. Increased risk for respiratory infections. Visual impairment, night blindness and possible blindness. Skin problems.	Dry, red, cracking skin Hair loss, brittle nails Dizziness, headaches and nausea	If pregnant, avoid Vitamin A intake of > 3000 µg/day. Beta Carotene is a safe supplement option during pregnancy.
Vitamin B1 (Thiamine)	Whole grains, lean pork, liver, wheat-germ, eggs, dried beans, nuts, seeds, yeasts, potatoes.	Required for the release of energy from glucose and for the transformation of carbohydrates to fat. Maintains healthy nerve function.	Fatigue Depression & irritability Weight loss & muscle weakness.	Headaches Convulsions, muscular weakness Irregular heartbeat	Requirements increase with: • alcohol consumption • oral contraceptives, HRT, anticonvulsants, antidepressants, bronchodilators, corticosteroids, diuretics & antibiotics • pregnancy & breastfeeding
Vitamin B2 (Riboflavin)	Dairy products, fish, dark green vegetables, eggs, beef, wholegrain cereals.	For the production of energy from protein, fat and carbohydrates. Helps maintain healthy skin. May reduce frequency and severity of migraines. Supports eye health.	Fatigue. Cracking of lips & corners of mouth, watering, itching, burning eyes, lesions around eyes. Soreness and burning of lips and tongue.	Harmless effect: bright yellow discolouration of urine.	Requirements increase with: • alcohol consumption • taking oral contraceptives, HRT, antidepressants & antibiotics • pregnancy & breastfeeding
Vitamin B3 (Nicotinic Acid)	Poultry, beef, fish, liver, pulses, peanuts, wholegrain cereals, yeasts, nuts.	Helps the body in protein metabolism and the conversion of fats and carbohydrates into energy. May assist in maintaining healthy cholesterol levels.	Skin irritations, dermatitis. Dementia. Appetite loss, diarrhoea, nausea. Memory loss, confusion, fatigue. Muscle weakness.	Flushing & itching of skin, liver damage.	Requirements increase with: • alcohol consumption • taking antidepressants & antibiotics • pregnancy & breastfeeding
Vitamin B5 (Pantothenic Acid)	Wholegrain cereals, eggs, yeasts, dried beans, fish, meat, poultry.	Plays a role in the metabolism of fatty acids, glucose and proteins for energy production. Helps maintain healthy skin and mucus membranes.	Fatigue. Dry skin & hair. Burning feet. Insomnia.	Diarrhoea.	Requirements increase with: • alcohol consumption • taking antibiotics • pregnancy & breastfeeding
Vitamin B6 (Pyridoxine)	Dark green vegetables, bananas, wholegrain cereals, oats, fish, poultry, pork, peas.	For energy release from protein, carbohydrates and fat. Helps maintain healthy skin. Cardiovascular support nutrient as it helps to maintain healthy levels of homocysteine.	Fatigue. Dermatitis, acne, mouth sores. Insomnia, depression. Peripheral neuropathy.	Peripheral neuropathy, numbness of feet.	Requirements increase with: • alcohol consumption • taking antibiotics, antidepressants, bronchodilators, corticosteroids, diuretics, oral contraceptives, HRT, medication for hypertension & Parkinson's disease • pregnancy & breastfeeding
Vitamin B12 (Cyanocobalamin)	Organ meats, red meat, pork, poultry, seafood, eggs, dairy products.	Contributes to the health of the nervous system and is involved in the manufacture of red blood cells. Cardiovascular support nutrient as it helps to maintain healthy levels of homocysteine. Important for strict vegetarians.	Peripheral numbness, muscle weakness. Memory loss, confusion, dementia, fatigue, neurological degeneration.	None known.	Requirements increase with: • strict vegetarian diet • alcohol consumption • taking antacids, antibiotics, anticonvulsants, corticosteroids, oral contraceptives, HRT, medication for cholesterol, diabetes hypertension, Parkinson's disease & ulcers • pregnancy & breastfeeding
Folic Acid	Brussels sprouts, spinach, broccoli, celery, lentils, asparagus, yeast, oranges, green beans, wholegrain cereals, fish, eggs, organ meats.	Important for cell division and in the regeneration of blood cells. Essential during pregnancy to optimise the development of the baby's nervous system. Cardiovascular support nutrient as it helps to maintain healthy levels of homocysteine.	Anaemia (megaloblastic), spina bifida (birth defect of spinal cord), retarded growth in children, chronic diarrhoea.	Increased risk of seizures in cases of epilepsy.	Requirements increase with: • alcohol consumption • taking antacids, antibiotics, anticonvulsants, antidepressants, anti-inflammatory drugs, diuretics, pain killers, corticosteroids, oral contraceptives, HRT, medication for cholesterol, diabetes hypertension, Parkinson's & ulcers • pregnancy & breastfeeding
Biotin	Liver, soya beans, soya flour, oatmeal, brown rice, whole grains, yeasts.	Plays a role in the formation of fatty acids. Helps the body with the transformation of fats and carbohydrates into energy. Contributes to healthy skin and hair.	Seborrheic dermatitis, hair loss. Appetite loss, nausea. Paralysis.	None known	Requirements increase with: • alcohol consumption • taking antibiotics & anticonvulsants • pregnancy & breastfeeding
Vitamin C (Ascorbic Acid)	Citrus fruits, peppers (yellow, green & red), chilli, guavas, tomatoes, lettuce, kiwi fruit, papaya.	Plays a role in maintaining healthy gums, skin and connective tissue. Helps with the absorption of iron from food. Functions as a tissue antioxidant thereby keeping cells healthy. Supports cardiovascular health and the immune system.	Bleeding gums, poor healing of bruises and wounds. Muscular atrophy. Skin lesions. Rheumatic pain in legs. Depression.	Diarrhoea, gastro-intestinal disturbance. Increased risk for oxalate kidney stones.	Requirements increase with: • alcohol consumption • taking anti-inflammatory drugs, corticosteroids, oral contraceptives, HRT, medication for hypertension & pain killers • pregnancy & breastfeeding
Vitamin D (Cholecalciferol)	Fatty fish, eggs, liver, fish liver oil, foods enriched with vitamin D such as butter & margarine.	For the maintenance of healthy bones and teeth. Helps the body utilise calcium which is necessary for the normal development and maintenance of strong bones and teeth.	Rickets in children. Loss of bone density in adults with increased risk for osteoporosis.	Constipation, appetite loss, nausea, vomiting. Calcium deposits in soft tissues (kidneys, lungs, heart). Increased risk for kidney stones. Irregular heartbeat.	Requirements increase with: • poor sunlight exposure of skin, as sunlight activates inactive form of vitamin D in our bodies. • taking antacids, anticonvulsants, anti-inflammatory drugs & corticosteroids.
Vitamin E (Tocopherol)	Avocado, wheat germ, wheat germ oil, whole-wheat foods, nuts, seeds, green leafy vegetables.	Functions as a tissue antioxidant, thereby keeping cells healthy. Protects unsaturated fatty acids and Vitamin A against oxidation in the body. Supports cardiovascular health. Protects red blood cells.	Neurological damage, shortened life-span of red blood cells. Balance & coordination problems. Visual impairment.	Gastro-intestinal disturbances. Fatigue, muscle weakness. Headaches.	Requirements increase with: • breastfeeding
Vitamin K (Menadione)	Alfalfa, spinach, cabbage, lettuce, Swiss chard, broccoli, spring onions, Brussels sprouts, pistachio nuts.	Vitamin K is an important factor for blood clotting. It is also an important vitamin for bone health.	Increased bruising, poor blood clotting with subsequent bleeding.	Flushing, sweating.	Vitamin K supplements should only be used on prescription and under strict medical supervision.

Minerals

- Elements present in higher concentrations in the body- >0.01% body weight

Nutrient	Food Sources	Functions	Deficiency Signs	Signs of Excess
Calcium	Milk, yoghurt, cheese, tinned sardines or pilchards, spinach, sesame seeds, soy beans, soy milk.	Structural mineral for bones and teeth. Sufficient, regular intake assists in optimising bone density. Assists with muscle contraction.	Increased risk for osteoporosis and colon cancer.	Calcium deposits in soft tissues, such as kidneys. Constipation.
Magnesium	Green vegetables, lean red meat, wholegrain cereals, nuts, pulses.	Structural mineral in bones. Assists in muscle contraction. Energy and protein metabolism. Maintenance of nervous system and cardiovascular system.	Muscle spasms, convulsions. Muscle weakness. Appetite loss, nausea, vomiting. Increased risk for osteoporosis. Irregular heartbeat.	Diarrhoea
Phosphorus	Cheese, eggs, milk, yoghurt, meat, fish, poultry and other protein rich foods.	Important for healthy bones and teeth. Maintenance of pH (acid/base) balance. Important component of genetic material.	Muscle weakness.	Reduction in bone density.
Iron	Red meat, molasses, spinach, liver, egg yolk, oysters, raisins, prunes.	Important component of haemoglobin in red blood cells, required for oxygen transfer in blood stream.	Anaemia with subsequent fatigue and shortness of breath. Learning difficulties in children. Increased susceptibility to infections.	Increased risk for heart disease and certain types of cancer. Aching joints. Constipation, nausea.

Zinc	Oysters and other shellfish, pumpkin seeds, sunflower seeds, pulses, nuts, dairy products, wholegrain cereals.	Immune support nutrient. Assists in healing of wounds. Maintenance of healthy hair, skin and nails. Supports eye health. Bone health nutrient.	Increased susceptibility to infections. Delayed wound healing, skin lesions. Hair loss, decrease in taste sensation.	Decreased Copper absorption with Zinc intakes exceeding 150 mg per day. Gastro-intestinal irritations, nausea and vomiting.
Fluoride	Water, tea, coffee, rice, spinach, soybeans, onions, lettuce.	Maintenance of healthy teeth and bones.	Increased risk of dental caries.	Discolouration of teeth. Flaking and decay of teeth.
Iodine	Kelp, Iodised salt, spirulina, fish & seafood, most vegetables.	Important component of thyroid hormones which control metabolism.	Concentration problems in children. Thyroid problems such as goiter. Cretinism among children.	Tyroid problems.
Selenium	Brazil nuts, other nuts, seeds, wholegrain cereals, onions, lean meats.	Antioxidant nutrient, protecting body cells against free radical damage. Supports healthy immune function.	Suppressed immune function. Joint pain, swelling and stiffness. Increased risk for cancer.	Changes in skin and nails. Tooth decay. Nausea and gastro-intestinal upsets.
Chromium	Brewer's yeast, broccoli, turkey, pulses, wholegrain cereals, seafood, potatoes, molasses.	Supports insulin action, therefore important nutrient for glucose metabolism and blood glucose control.	Insulin resistance. Blood lipid abnormalities: increased cholesterol and triglyceride levels. Impaired growth.	Skin lesions
Manganese	Spinach, beet greens, blueberries, wholegrain cereals, nuts, tea, pulses, organ meats.	Maintenance of healthy bone tissue. Enzyme activator. Co-factor in energy metabolism.	None documented.	None documented.
Copper	Mushrooms, liver, kidneys, shellfish, cherries, nuts, wholegrain cereals.	Component of DNA & RNA (genetic material), as well as important enzymes controlling various metabolic processes in the body.	Anaemia. Demineralisation of bone tissue. De-pigmentation of skin and hair.	Liver cirrhosis. Abnormalities in red blood cells.
Molybdenum	Pulses, dark green leafy vegetables, organ meats.	Essential component of important enzymes that regulate various biochemical processes.	Mental abnormalities.	Gout type symptoms.

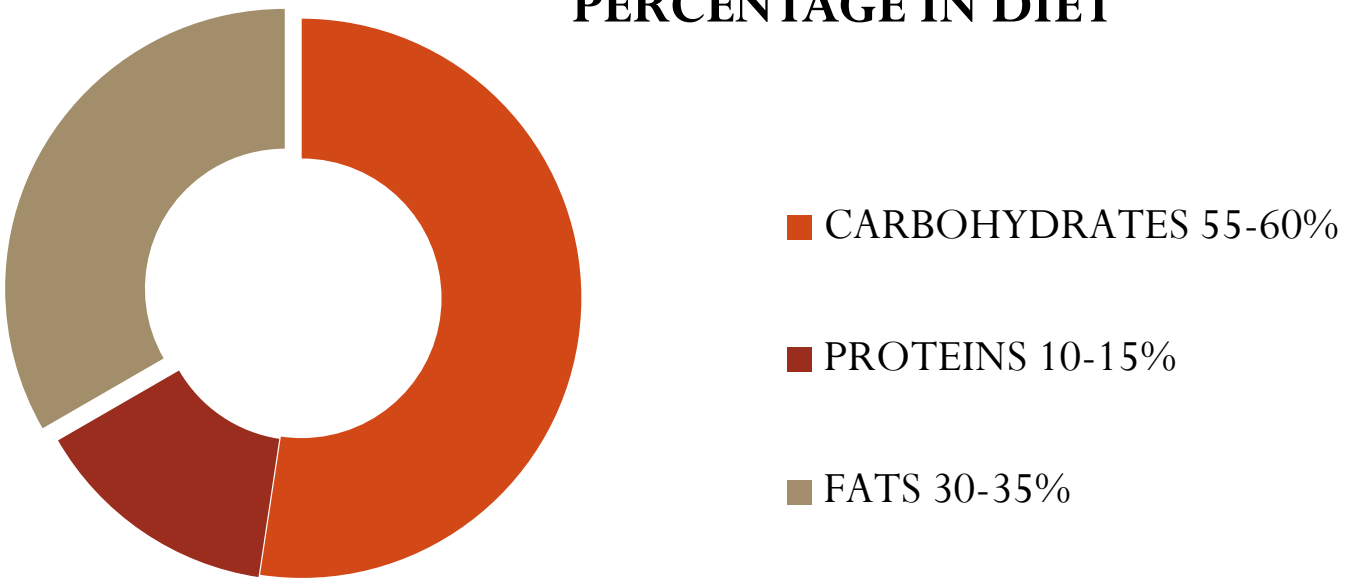
RDA of micro-nutrients

NUTRIENT	RDA
CALCIUM	500-1000mg/day
PHOSPHORUS	500-1000mg/day
SODIUM	10-15g/day
POTASSIUM	2-3mEq/kg/day
MAGNESIUM	200-300mg/day

TRACE ELEMENTS	RDA
IRON	2mg/kg/day
IODINE	50-150 µg/day
COPPER	1-2 mg/day
ZINC	5-15 mg/day
COBALT	Not known
CHROMIUM	10 µg/day
FLOURINE	1-5 mg/day

BALANCED DIET

- One which supplies all the nutrients in the right quantity and proportion.
- Requirement of an adult sedentary male: 2400 kcal, ie 1 unit of energy.



SPECIAL CONSIDERATIONS IN BALANCED DIET

- Supplementation during **pregnancy** : 300 kilocalories extra
- During **lactation**: 600 kilocalories extra
- Exchanges for **non-vegetarians**:
  - 50%legumes + 1egg/30g meat or fish.
  - No legume, 1 egg + 30g meat or fish
  - No legume, no egg, 60g meat or fish

END OF PART I

NUTRITIONAL CONSIDERATIONS IN PEDIATRICS

- NUTRITIONAL CONSIDERATIONS FOR
  - INFANT AND TODDLER (0 TO 3 YRS)
  - PRESCHOOLER (3 TO 6 YRS)
  - SCHOOL AGED CHILD (6 TO 12 YRS)
  - ADOLESCENT (12 TO 18 YRS)
- NUTRITION ASSESSMENT AND SCREENING
- NUTRITION RELATED PEDIATRIC DISORDERS
  - EARLY CHILDHOOD CARIES
  - FAILURE TO THRIVE
  - OBESITY
  - DISORDERED EATING
- DIET AND DENTAL CARIES
- LATEST AAPD GUIDELINES
- NUTRITIONAL CONSIDERATIONS FOR SPECIAL CHILDREN
- REFERENCES

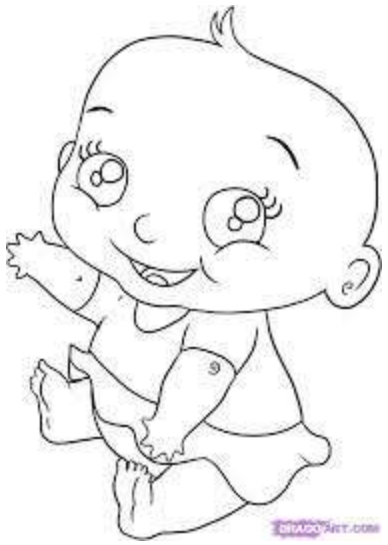
NUTRITIONAL CONSIDERATIONS FROM INFANCY THROUGH ADOLESCENCE

INFANT AND TODDLER (0 to 3 yrs)

- **First six months of life**: period of most rapid growth, apart from prenatal existence.

- American academy of Pediatrics recommends human milk as the sole source of nutrition for first six months, with continued intake for the first year, and as long as desired thereafter.

- **Breastfeeding**
  - Advantageous to the child
  - Advantageous to the mother



INFANT AND TODDLER (0 to 3 yrs)

- **Adequacy of milk intake:**
  - Assessed by voiding and stooling patterns.
  - Well hydrated infant: voids 6-8 times a day
  - By 5-7 days: loose yellow stools passed atleast 4 times a day.
  - Most objective indicator: Rate of weight gain
    - **Total weight loss after birth should not exceed 7%.**
    - **Birth weight should be regained by 10 days.**

- **Serum bilirubin:**
  - More elevated in breastfed infants than formula fed infants.
  - Feeding frequency during the first 3 days of life are inversely related to the level of bilirubin.
    - **Frequent feedings stimulated meconium passage and excretion of bilirubin in the stool.**

- **Breast milk jaundice: (1-2 weeks)**
  - After first week of life, serum bilirubin is elevated due to some unknown factor in milk that increases intestinal absorption of bilirubin.

INFANT AND TODDLER (contd)

- **Milk substitutes**:
  - Regular unmodified cow's milk is not suitable:
    - Insufficient source of vitamin C and iron.
    - It may cause gastrointestinal bleeding.
    - Its solute load is too heavy for the infant's renal system to handle .
  - Low-fat milk: should not be used,
    - Insufficient energy provision.
    - Lack of essential fatty acids.

Cases of severe nutrient deficiencies resulting in kwashiorkar and rickets have been reported from regular consumption of non-fortified rice, soy based health food milk alternatives.2

- **Solid diet:**
  - No nutritional need for introducing before 6 months of age.1
  - Earlier use may contribute to development of allergies or increased risk of obesity.
  - Egg yolk may be safely introduced into the weanling diet with no elevation in plasma cholesterol level or increase in prevalence of egg allergies.3

INFANT AND TODDLER (contd)

- The immature kidneys of infants cannot concentrate waste efficiently.

- As a result, infant must excrete more water than does an adult to excrete a comparable amount of waste.

  One must be on guard against dehydration, which has potentially serious consequences.

- **Supplements**:
  - Vitamin D, iron, and flouride : after consulting with Pediatrician.
  - Iron:
    - **Low tissue iron levels adversely affect brain, intellectual development and performance.**
    - **Desirable to begin at 4 months of age, (often with ferrous sulphate) for breast fed infants.**

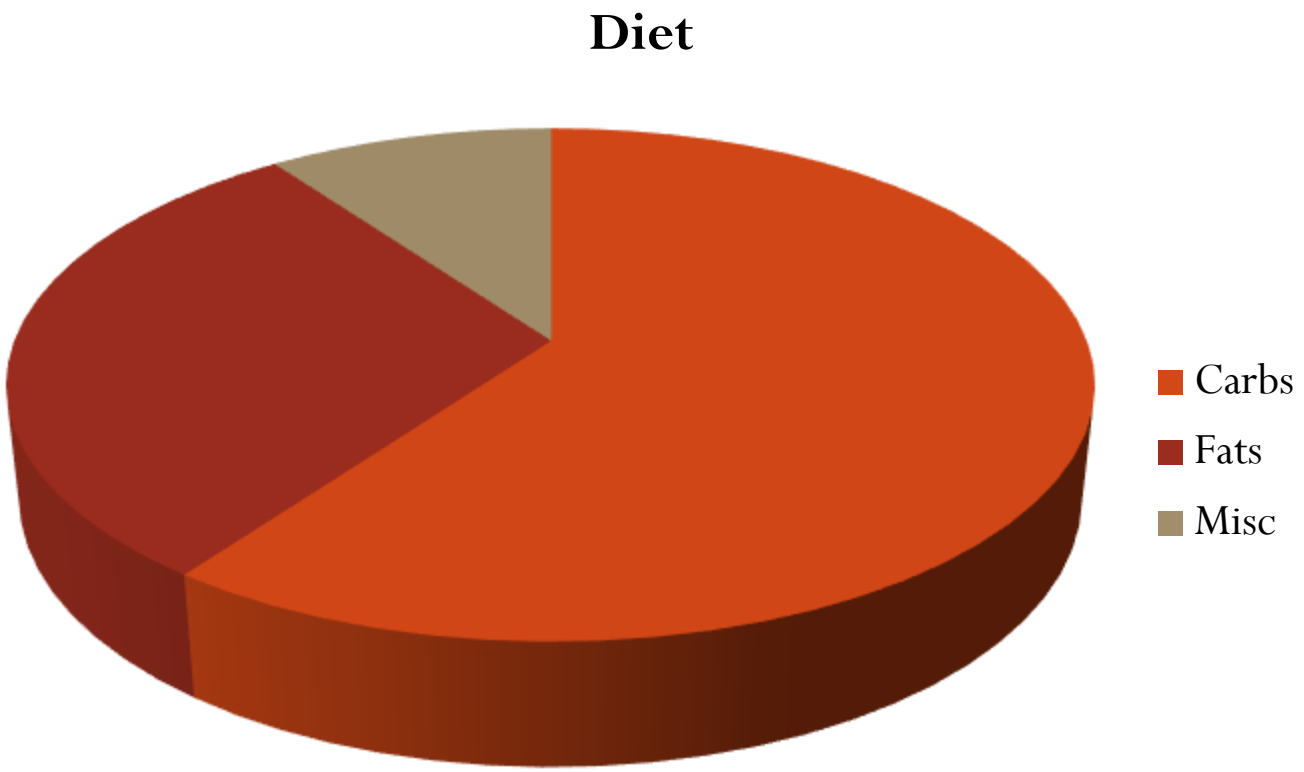
INFANT AND TODDLER (contd)

- 2nd year of life/ infant to toddler:
  - Reduction in appetite: NORMAL
  - Dietary needs for proteins and minerals remain high.
  - Brightly coloured foods are appealing.

- During first two years of life: 40-50% of energy should come from fat.
- **Older than 2 years:**
  - Roughly 30% should come from fat, with no more than 10% from either saturated fats or polyunsaturated fats.
  - Carbohydrates: 55-60% of calorie reqmts with no more than 10% from simple sugars.
  - RDA of dietary fibre = 5 plus the age of the child.

DIET GUIDELINES FOR CHILDREN OLDER THAN 2 YRS.

- **GENERAL RECOMMENDATIONS:**
  - Consume 3 regular meals daily with healthful snacks (2-3/day) according to apetite, activity and growth needs .
  - Include a variety of foods with abundant vegetables and fruits.
- **KEY NUTRIENTS:**
  - **CARBOHYDRATES**:
    - Complex carbohydrate should provide >= 55-60% of daily calories, half of all grains should be whole grain, high-fibre foods.
    - Simple sugars should be limited to <10% daily calories.
  - **FATS**:
    - <30% of total calories should come from dietary fat.
    - Saturated and polyunsaturated fats should make up for <10% total calories each.
    - Monounsaturated fats should provide atleast 10% total calories.
    - Encourage lean cuts of meat, fish, low-fat dairy products, vegetable oils.
    - Cholesterol intake should approximate 100mg/1000kcal/day (max of 300mg/day)
    - Severe fat restriction (<=15-20% of total calories) should be avoided bacause it may result in growth failure.


Diet
Carbs
Fats
Misc

PRESCHOOLER (3-6 YRS)

- Physical growth occurs in spurts.
- Fewer calories are required, but relatively high protein and mineral needs remain.
- Child should be helped to lose 'baby fat' by increasing physical activity rather than by severely restricting calories.
- Dental implications:
  - Wholesome, nutritious, low sugar snacks can promote adequate intake of essential nutrients without adding calories or promoting dental caries.

SCHOOL AGED CHILD (6- 12 YRS)

- Decline in food requirements per unit body weight.
  - Because of reduction in growth rate.

Thus, emphasis on **high nutrient density : High ratio of nutrients to calories**

- Diet counselling:
  - Children should be encouraged to have breakfast.

In a study of fourth through sixth graders in a school with a universal school breakfast program, Reddan and colleagues found that the majority of students believed that eating breakfast provides benefits of increased energy and ability to pay attention in school.
Reddan J et al. Children's perceived benefits and barriers in relation to eating breakfast in schools with or without Universal School Breakfast, J Nutr Educ Behav 34(1):47-52,2002

ADOLESCENT (12 TO 18YRS)

- Nutritional requirements are influenced primarily by onset of puberty and the final growth spurt of childhood.

- Increased needs for energy, protein, minerals and vitamins.

- Adolescent females:
  - Consume less food than boys.
  - Encounter significant social and peer pressure .
  - **"Female athlete triad"** : American College of Sports Medicine (ACMS) in 1992.
    - **Seen among adolescent female athletes**
    - **Disordered eating behaviours**
    - **Amenorrhoea**

Gabel K. Special nutritional concerns for the female athelete. Curr Sports Med Rep S:187-191,2006

Beals K. Eating behaviours, nutritional status and menstrual function in elite female adolescent volleyball players, J Am Diet Assoc 102(9):1293-1296,2002

Sherman R, Thompson R. Female athlete triad. J School Nurs 20 (4): 197-202,2004

NUTRITION ASSESSMENT AND SCREENING

NUTRITION SCREENING

- Should always include a brief assessment of the adequacy of usual dietary intake.

- Food frequency questionnaires (FFQs), 24-hour recalls, and food records or diaries are suitable methods for use with adolescents; however not all methods are suitable for use in a single dietary screening session.

- **SCREENERS**:
  - Short dietary assessment questionnaires that focus on specific eating behaviors, such as consumption of savory snacks, fast foods and high-sugar beverages, are appropriate for use during the initial nutrition screening.
  - Suitable for adolescents with limited cognitive skills or limited comprehesion of english language.
  - Can be completed rapidly.
  - Useful for determining the need for more extensive dietary assessment and nutrition counselling.

TABLE 4
Strengths and Limitations of Various Dietary Assessment Methods Used in Clinical Settings

	Strengths	Limitations	Applications
24-Hour Recall	Does not require literacy Relatively low respondent burden Data may be directly entered into a dietary analysis program May be conducted in-person or over the telephone	Dependent on respondent's memory Relies on self-reported information Requires skilled staff Time consuming Single recall does not represent usual intake	Appropriate for most people as it does not require literacy Useful for the assessment of intake of a variety of nutrients and assessment of meal patterning and food group intake Useful counseling tool
Food Frequency	Quick, easy and affordable May assess current as well as past diet In a clinical setting, may be useful as a screening tool	Does not provide valid estimates of absolute intake of individuals Can't assess meal patterning May not be appropriate for some population groups	Does not provide valid estimates of absolute intake for individuals, thus of limited usefulness in clinical settings May be useful as a screening tool, however, further development research is needed
Food Record	Does not rely on memory Food portions may be measured at the time of consumption Multiple days of records provide valid measure of intake for most nutrients	Recording foods eaten may influence what is eaten Requires literacy Relies on self-reported information Requires skilled staff Time consuming	Appropriate for literate and motivated population groups Useful for the assessment of intake of a variety of nutrients and assessment of meal patterning and food group intake Useful counseling tool
Diet History	Able to assess usual intake in a single interview Appropriate for most people	Relies on memory Time consuming (1 to 1-1/2 hours) Requires skilled interviewer	Appropriate for most people as it does not require literacy Useful for assessing intake of nutrients, meal patterning and food group intake Useful counseling tool

Source: Adapted from Story M, Stang J. Nutrition assessment of pregnant adolescents. In: Story M, Stang J. eds. Nutrition and the pregnant adolescent: a practical reference guide. Minneapolis, MN: Center for Leadership, Education and Training in Maternal and Child Nutrition, Division of Epidemiology, University of Minnesota, 2000. http://www.epi.umn.edu/let/pubs/nmpa.shtm

ANTHROPOMETRICS FOR NUTRITION ASSESSMENT

- WEIGHT
- STATURE
- OTHERS
  - HEAD CIRCUMFERENCE (<36 MONTHS)
  - CHEST CIRCUMFERENCE

WEIGHT

- Defined as the heaviness of the body.
- Measured using a balance-beam scale.
- Indicator of both acute and chronic nutritional status.
- Typically described with respect to age or height.
- Weight-for-age value compares the child's weight to a peer reference group.
- Toddlers and older children should be weighed with minimal clothing on a standing scale to 0.1 kg.
- Special needs: may need a lift scale or wheelchair scale.
- **Rayner and Rudolf** suggested that a low weight-for-age is a marker of Failure to thrive.

Raynor P, Rudolf MCJ. Anthropometric indices of failure to thrive. Arch Dis Child 2000;82:364-5

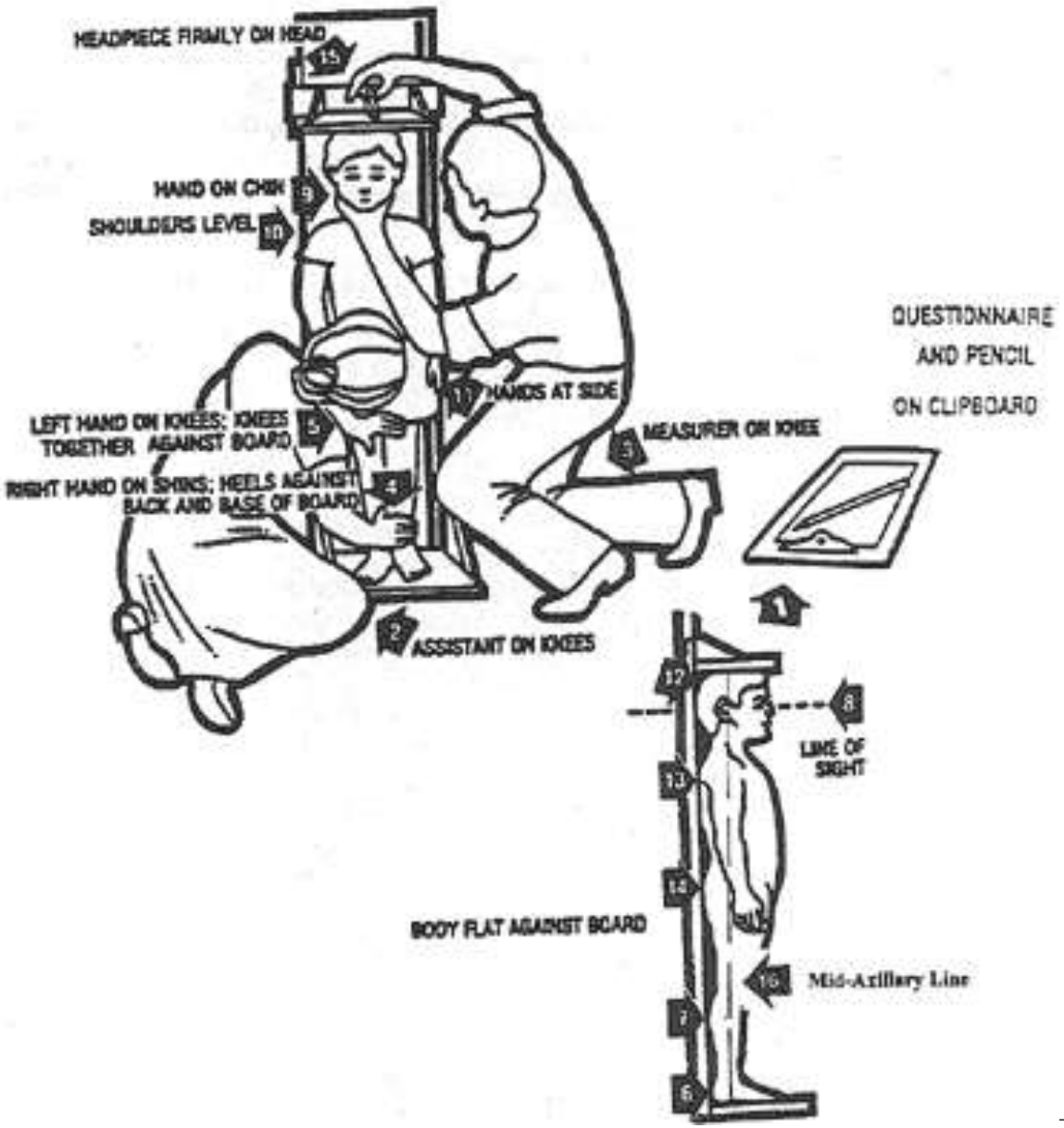
Nutrition and Oral Health ; Laura M Romito, DDS,MSThe dental clinics of North America April 2003, volume 47 number 2

STATURE

- Under 2 yrs, stature is defined as recumbent length and is assessed using a length board with a stationary head and adjustable foot.
- After 2 yrs of age, it is defined as height in a standing position and assessed with a stadiometer or with the heels, buttocks and head flat against a tape measure embedded in a wall.
- Both compare the child's height to a peer reference group.
- Historically, a value less than 5^{th} or 10^{th} percentile of a peer reference group has been used to screen for PEM.
- CDC guidelines define a height-for age value less than 5^{th} percentile as short stature.

Kuczmarski RJ, Ogden CL, Grummer-Strawn LM et al. CDC growth charts: United states Advance data 2000;314: 1-27

ILLUSTRATION #2 *
Standing Height



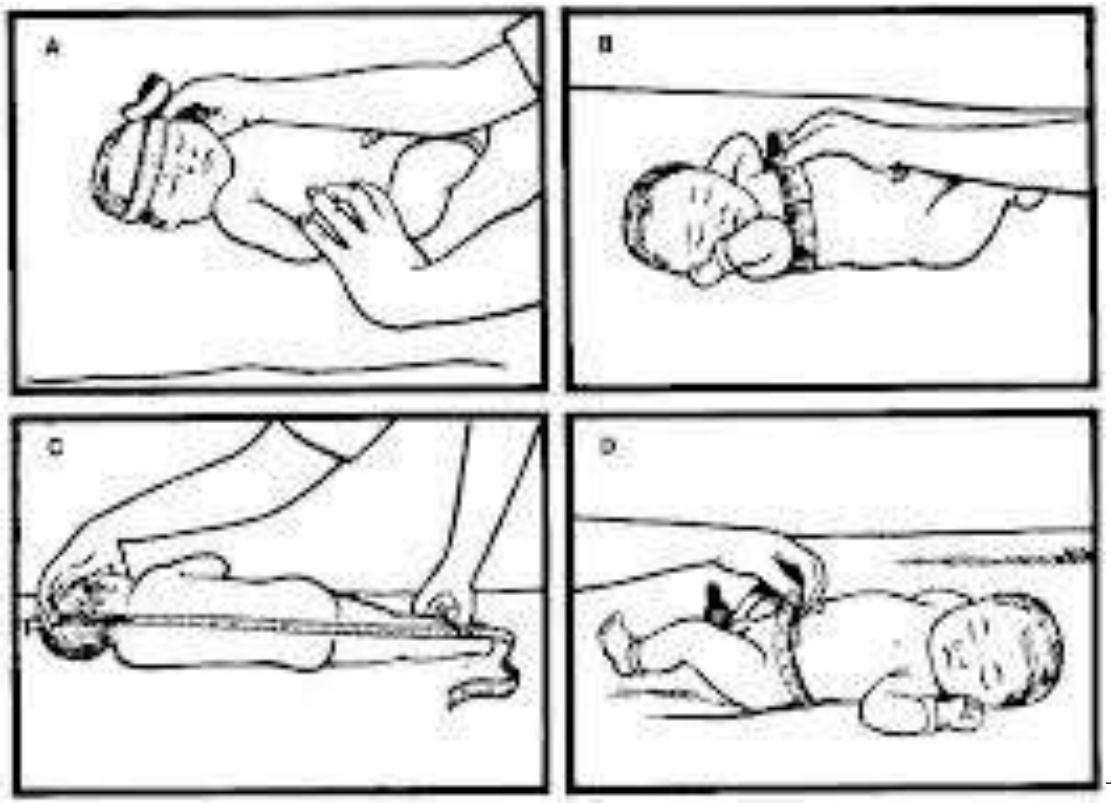
STADIOMETER

HEAD CIRCUMFERENCE

- At birth, the head circumference is 35 cm.
- Increases to 40 cm by 3 months.
- 43 cm by 6 months.
- 45 cm by 9 months.
- 47 cm by 1 year.
- 49 cm by 2 years.
- 50 cm by 3 years.
- Approximate increase is 2 cm/month in the first 3 months, 1cm/month in the next 3 months and 0.5 cm/month in the next 6 months.

CHEST CIRCUMFERENCE

- Measured at the nipple midway between inspiration and expiration.
- At birth, the head circumference is more than chest circumference, but it equalises by 1 year.
- Thereafter, chest circumference is more than head circumference.



WEIGHT-FOR-HEIGHT RATIO/ BMI

- Most reflective of body fat and is calculated by dividing the weight (kg) by the height in meters.
- Historically, the weight-for-height ratio less than 5th or 10th percentile has been used to screen for PEM.
- Current CDC guidelines define 85th to less than 95th percentile as *at risk for overweight* and define greater than the 95th percentile as *overweight*.

Kuczmarski RJ, Ogden CL, Grummer-Strawn LM et al. CDC growth charts: United states Advance data 2000;314: 1-27

NUTRITION SCREENING (contd)

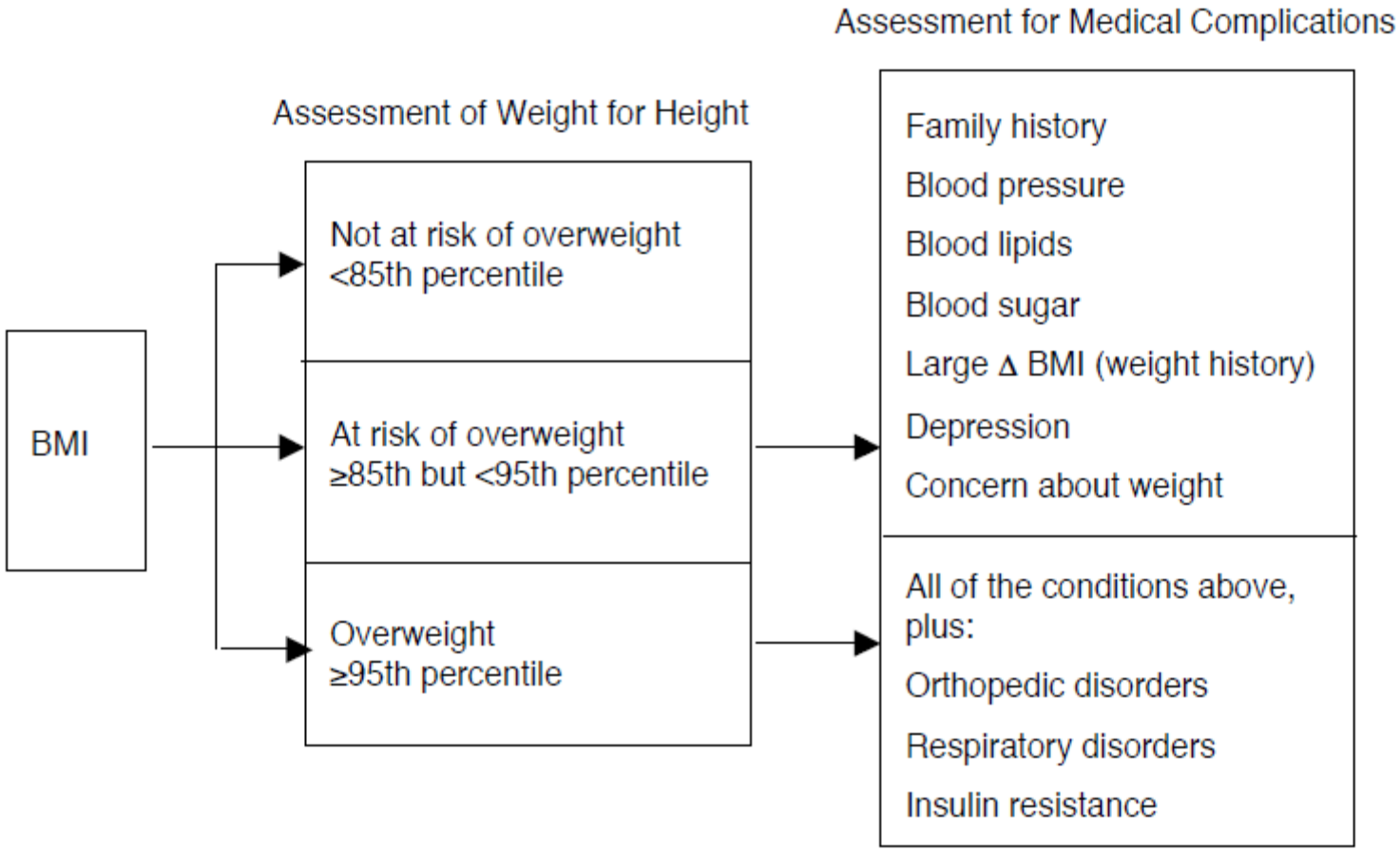
- Begin with an accurate measurement of height and weight, and calculation of BMI (body mass index).
- These data should be plotted on age and gender appropriate growth charts to determine the appropriateness of weight for height and the presence of potential growth disorders.

TABLE 2
Indicators of Height and Weight Status for Adolescents

Indicator	Anthropometric Variable	Cut-off Values
Stunting (low height-for-age)	Height-for-age	<3rd percentile
Thinness (low BMI-for-age)	BMI-for-age	<5th percentile
At risk for overweight	BMI-for-age	≥85th percentile, but <95th percentile
Overweight	BMI-for-age	≥95th percentile

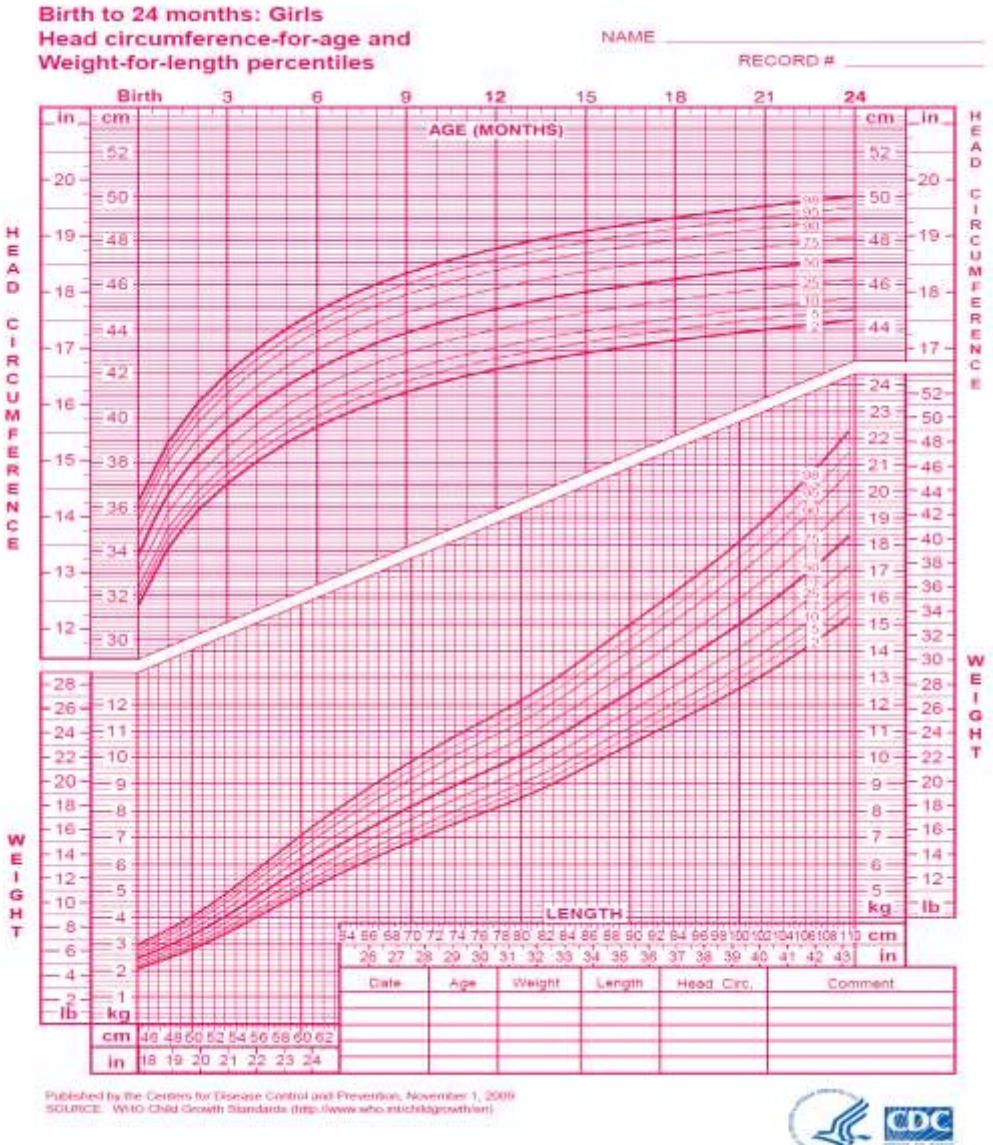
Reprinted from Story M, Holt K, Sofka D, eds. Bright Futures in practice: nutrition. Arlington, VA: National Center for Education in Maternal and Child Health, 2000, Table 5, p. 115. Compiled from Physical status: the use and interpretation of anthropometry. Report of a WHO Expert Committee. World Health Organization Technical Report Series 854:1-452, World Health Organization; 1995; and Himes JH, Dietz WH. Guidelines for overweight in adolescent preventive services: recommendations from an Expert Committee. Am J Clin Nutr 1994;59:307-316.

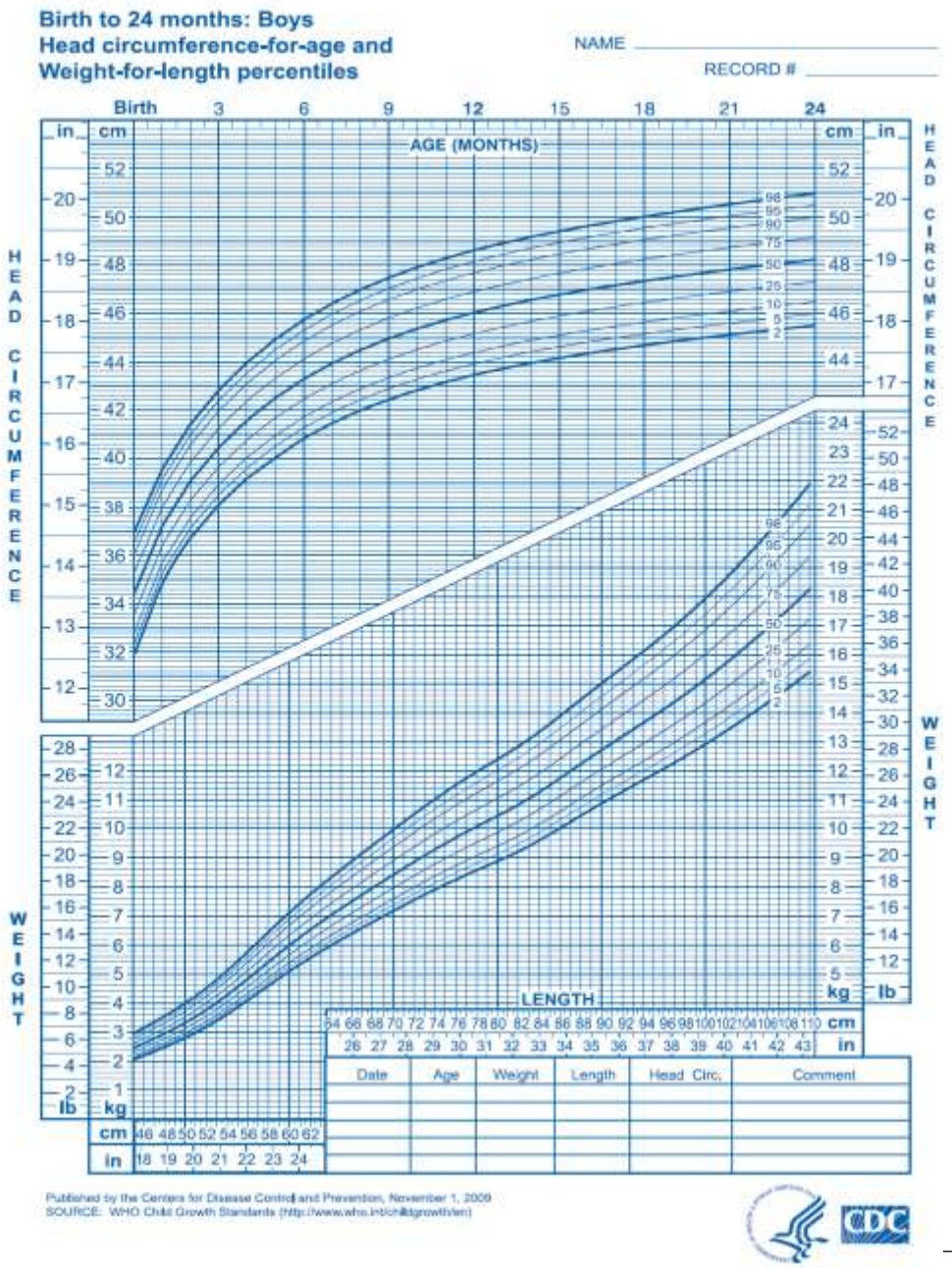
FIGURE 1
Schematic Representation of Recommended Overweight Screening in Adolescence

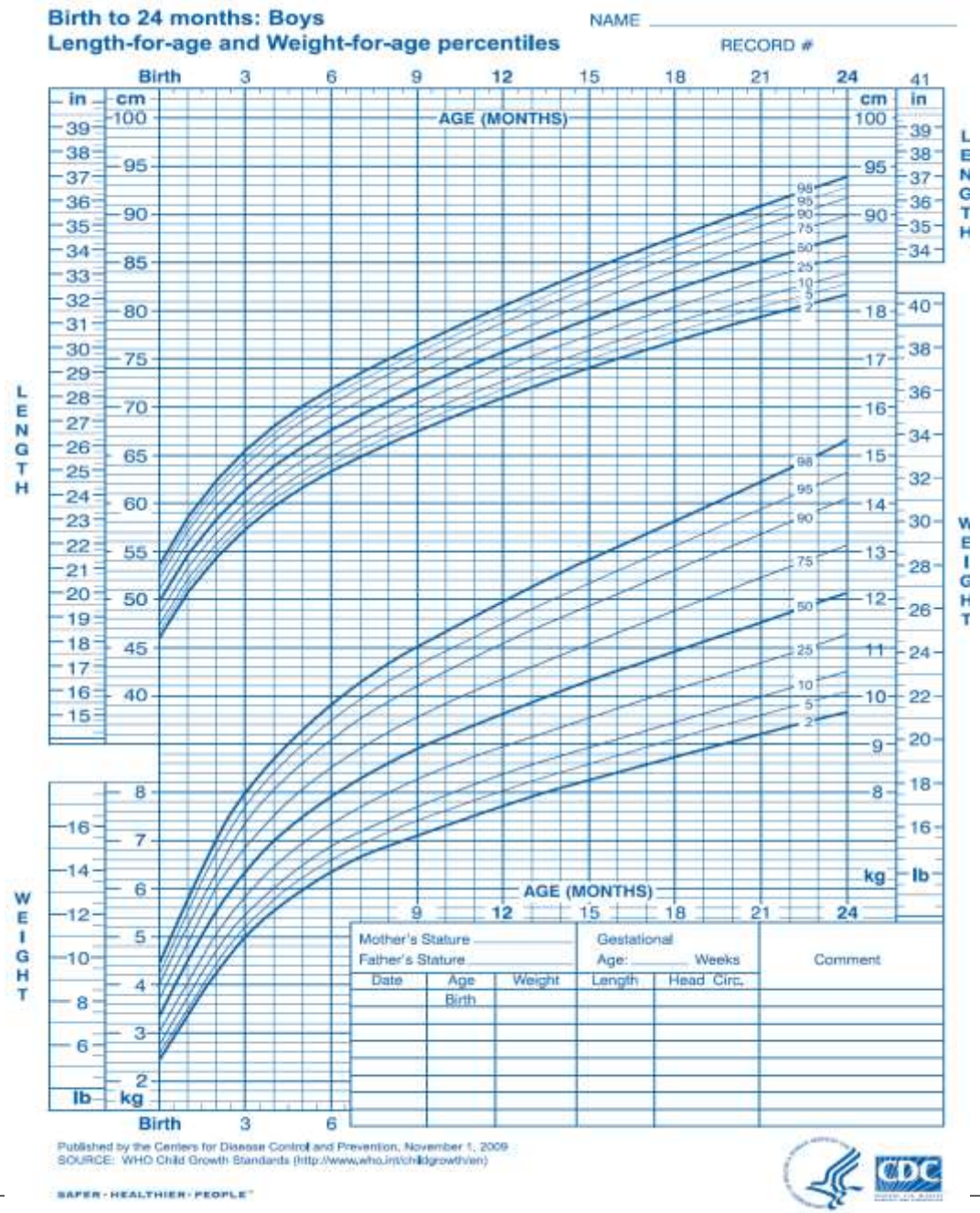


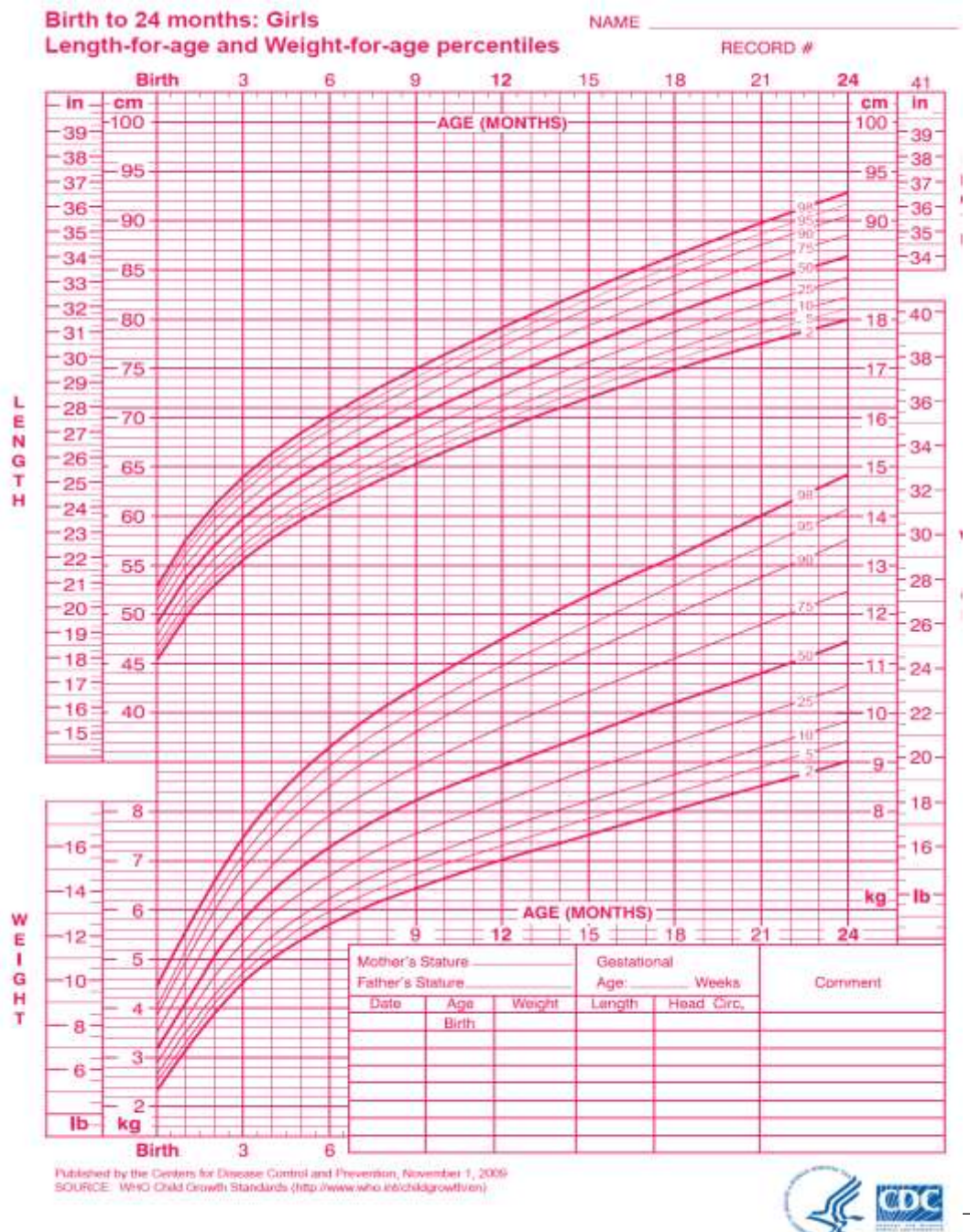
Source: Adapted from Himes JH, Dietz WH. Guidelines for overweight in adolescent preventive services: recommendations from an Expert Committee. Am J Clin Nutr 1994;49:307-316.

WHO SPECIFIC GROWTH CHARTS




Birth to 24 months: Boys
Head circumference-for-age and
Weight-for-length percentiles
NAME
RECORD #
Birth 3 6 9 12 15 18 21 24
AGE (MONTHS)
HEAD CIRCUMFERENCE
WEIGHT
LENGTH
Date
Age
Weight
Length
Head Circ.
Comment
Published by the Centers for Disease Control and Prevention, November 1, 2009
SOURCE: WHO Child Growth Standards (http://www.who.int/childgrowth/en)
CDC


Birth to 24 months: Boys
Length-for-age and Weight-for-age percentiles
NAME
RECORD #
AGE (MONTHS)
LENGTH
WEIGHT
Mother's Stature
Father's Stature
Gestational Age: Weeks
Comment
Date
Age
Weight
Length
Head Circ.
Birth
Published by the Centers for Disease Control and Prevention, November 1, 2009
SOURCE: WHO Child Growth Standards (http://www.who.int/childgrowth/en)
SAFER · HEALTHIER · PEOPLE™


Birth to 24 months: Girls
Length-for-age and Weight-for-age percentiles
NAME
RECORD #
AGE (MONTHS)
LENGTH
WEIGHT
in
cm
lb
kg
Mother's Stature
Father's Stature
Gestational Age: Weeks
Comment
Date
Age
Weight
Length
Head Circ.
Birth
Published by the Centers for Disease Control and Prevention, November 1, 2009
SOURCE: WHO Child Growth Standards (http://www.who.int/childgrowth/en)

NUTRITION ASSESSMENT

- Key indicators of nutrition risk for adolescents can be based on:
  - Food choices
  - Food resources
  - Physical activity
  - Eating behaviours
  - Weight and body image
  - Growth
  - Medical conditions
  - Lifestyle

Source: Adapted from Story M, Holt K, Sofka D, eds. Bright Futures in practice: Nutrition. Arlington, VA: National Center for Education in Maternal and Child Health; 2000 (Appendix D, p. 243-255).

TABLE 5
Key Indicators of Nutrition Risk for Adolescents

FOOD CHOICES

Indicators of Nutrition Risk	Relevance	Criteria for Further Screening and Assessment
Consumes fewer than 2 servings fruit or fruit juice per day. Consumes fewer than 3 servings of vegetables per day.	Fruits and vegetables provide dietary fiber and several vitamins (such as A and C) and minerals. Low intake of fruits and vegetables is associated with an increased risk of many types of cancer. In females of childbearing age, low intake of folic acid is associated with an increased risk of giving birth to an infant with neural tube defects.	Assess the adolescent who is consuming less than 1 serving of fruit or fruit juice per day. Assess the adolescent who is consuming fewer than 2 servings of vegetables per day.
Consumes fewer than 6 servings of bread, cereal, pasta, rice or other grains per day.	Grain products provide complex carbohydrates, dietary fiber, vitamins, and minerals. Low intake of dietary fiber is associated with constipation and an increased risk of colon cancer.	Assess the adolescent who is consuming fewer than 3 servings of bread, cereal, pasta, rice, or other grains per day.
Consumes fewer than 3 servings of dairy products per day.	Dairy products are a good source of protein, vitamins and calcium and other minerals. Low intake of dairy products may reduce peak bone mass and contribute to later risk of osteoporosis.	Assess the adolescent who is consuming fewer than 2 servings of dairy products per day. Assess the adolescent who has milk allergy or is lactose intolerant. Assess the adolescent who is consuming more than 20 oz of soft drinks per day.
Consumes fewer than 2 servings of meat or meat alternatives (e.g., beans, eggs, nuts, seeds) per day.	Protein-rich foods (e.g., meats, beans, dairy products) are good sources of B vitamins, iron, and zinc. Low intake of protein-rich foods may impair growth and increase the risk of iron-deficiency anemia and of delayed growth and sexual maturation. Low intake of meat or meat alternatives may indicate inadequate availability of these foods at home. Special attention should be paid to teens who follow a vegetarian diet.	Assess the adolescent who is consuming less than 2 servings of meat or meat alternatives per day or if following a vegan diet.
Has excessive intake of dietary fat.	Excessive intake of total fat contributes to the risk of cardiovascular diseases and obesity and is associated with some cancers.	Assess if teen has family history of premature cardiovascular disease. Assess the adolescent who has a body mass index (BMI) greater than or equal to the 85th percentile.

FOOD RESOURCES

Indicators of Nutrition Risk	Relevance	Criteria for Further Screening and Assessment
Has inadequate financial resources to buy food, insufficient access to food, or lack of access to cooking facilities.	Poverty can result in hunger and compromised food quality and nutrition status. Inadequate dietary intake interferes with learning.	Assess the adolescent who is from a family with low income, is homeless, or is a runaway.

PHYSICAL ACTIVITY

Indicators of Nutrition Risk	Relevance	Criteria for Further Screening and Assessment
Is physically inactive: engages in physical activity fewer than 5 days per week.	Lack of regular physical activity is associated with overweight, fatigue and poor muscle tone in the short term and a greater risk of heart disease in the long term. Regular physical activity reduces the risk of cardiovascular disease, hypertension, colon cancer, and type 2 diabetes mellitus. Weight-bearing physical activity is essential for normal skeletal development during adolescence. Regular physical activity is necessary for maintaining normal muscle strength, joint structure, and joint function; contributes to psychological health and well-being; and facilitates weight reduction and weight maintenance throughout life.	Assess how much time the adolescent spends watching television/ videotapes and playing computer games. Assess the adolescent's definition of physical activity.
Engages in excessive physical activity.	Excessive physical activity (nearly every day or more than once a day) can be unhealthy and associated with menstrual irregularity, excessive weight loss, and malnutrition.	Assess the adolescent for eating disorders.

EATING BEHAVIORS

Indicators of Nutrition Risk	Relevance	Criteria for Further Screening and Assessment
Exhibits poor appetite.	A poor appetite may indicate depression, emotional stress, chronic disease or eating disorder.	Assess if BMI is less than the 15th percentile or if weight loss has occurred. Assess if irregular menses or amenorrhea has occurred for 3 months or more. Assess for organic and psychiatric disease.
Consumes food from fast-food restaurants 3 or more times per week.	Excessive consumption of convenience foods and foods from fast-food restaurants is associated with high fat, calorie, and sodium intakes, as well as low intake of certain vitamins and minerals.	Assess the adolescent who is at-risk for overweight/obese or who has diabetes mellitus, hyperlipidemia, or other conditions requiring reduction in dietary fat.
Skips breakfast, lunch, or dinner/supper 3 or more times per week.	Meal skipping is associated with a low intake of energy and essential nutrients, and, if it is a regular practice, could compromise growth and sexual development. Repeatedly skipping meals decreases the nutritional adequacy of the diet.	Assess the adolescent to ensure that meal skipping is not due to inadequate food resources or unhealthy weight loss practices.
Adolescent consumes a vegetarian diet.	Vegetarian diets can provide adequate nutrients and energy to support growth and development if well planned. Vegan diets may lack calcium, iron, vitamins D and B-12. Adolescents who have eating disorders may adopt low fat vegetarian diets.	Assess the adolescent who consumes fewer than 2 servings of meat alternatives per day. Assess the adolescent who consumes fewer than 3 servings of dairy products per day. Assess the adolescent for eating disorder and adequacy of energy intake who follows a low fat vegetarian diet and experiences weight loss.

WEIGHT AND BODY IMAGE

Indicators of Nutrition Risk	Relevance	Criteria for Further Screening and Assessment
Practices unhealthy eating behaviors (e.g., chronic dieting, vomiting, and using laxatives, diuretics, or diet pills to lose weight).	Chronic dieting is associated with many health concerns (fatigue, impaired growth and sexual maturation, irritability, poor concentration, impulse to binge) and can lead to eating disorders. Frequent dieting in combination with purging is often associated with other health-compromising behaviors (substance use, suicidal behaviors). Purging is associated with serious medical complications.	Assess the adolescent for eating disorders. Assess for organic and psychiatric disease. Screen for distortion in body image and dysfunctional eating behavior, especially if adolescent desires weight loss, but BMI is less than the 85th percentile.
Is excessively concerned about body size or shape.	Eating disorders are associated with significant health and psychological morbidity. Eighty-five percent of all cases of eating disorders begin during adolescence. The earlier adolescents are treated, the better their long-term prognosis.	Assess the adolescent for distorted body image and dysfunctional eating behaviors, especially if adolescent wants to lose weight but BMI is less than the 85th percentile.
Exhibits significant weight change in past 6 months.	Significant weight change during the past 6 months may indicate stress, depression, organic disease, or an eating disorder.	Assess the adolescent to determine the cause of weight loss or weight gain (limited or too much access to food, poor appetite, meal skipping, eating disorder).

GROWTH

Indicators of Nutrition Risk	Relevance	Criteria for Further Screening and Assessment
Has BMI less than the 5th percentile.	Thinness may indicate an eating disorder or poor nutrition.	Assess the adolescent for eating disorders. Assess for organic and psychiatric disease. Assess for inadequate food resources.
Has BMI greater than the 95th percentile.	Obesity is associated with elevated cholesterol levels and elevated blood pressure. Obesity is an independent risk factor for cardiovascular disease and type 2 diabetes mellitus in adults. Overweight adolescents are more likely to be overweight adults and are at increased risk for health problems as adults.	Assess the adolescent who is overweight or at risk for becoming overweight (on the basis of present weight, weight gain patterns, family weight history).

MEDICAL CONDITIONS

Indicators of Nutrition Risk	Relevance	Criteria for Further Screening and Assessment
Has chronic diseases or conditions.	Medical conditions (diabetes mellitus, spina bifida, renal disease, hypertension, pregnancy, HIV/AIDS) have significant nutritional implications.	Assess adolescent's compliance with therapeutic dietary recommendations. Refer to dietitian if appropriate.
Has hyperlipidemia.	Hyperlipidemia is a major cause of atherosclerosis and cardiovascular disease in adults.	Refer adolescent to a dietitian for cardiovascular nutrition assessment.
Has iron-deficiency anemia.	Iron deficiency causes developmental delays, behavioral disturbances, and increased lead absorption.	Screen adolescents if they have low iron intake, history of iron-deficiency anemia, limited access to food due to poverty or neglect, special health care needs, or extensive menstrual or other blood losses. Screen annually.

MEDICAL CONDITIONS (continued)		
Indicators of Nutrition Risk	**Relevance**	**Criteria for Further Screening and Assessment**
Has dental caries.	Eating habits have a direct impact on oral health. Calcium and vitamin D are vital for strong bones and teeth, and vitamin C is necessary for healthy gums. Frequent consumption of carbohydrate-rich foods (e.g., lollipops, soda) that stay in the mouth longer may cause dental caries. Fluoride in water used for drinking and cooking as well as in toothpaste reduces the prevalence of dental caries.	Assess the adolescent's consumption of snacks and beverages that contain sugar, and assess snacking patterns. Assess the adolescent's access to fluoride (e.g., fluoridated water, fluoride tablets).
Is pregnant.	Pregnancy increases the need for most nutrients.	Refer the adolescent to a dietitian for further assessment, education, and counseling as appropriate.
Is taking prescribed medication.	Many medications interact with nutrients and can compromise nutrition status.	Assess potential interactions of prescription drugs (e.g., asthma medications, antibiotics) with nutrients.
Is using nutritional supplement.	Vitamin and mineral preparations can be healthy additions to dietary intake, especially if pregnant, lactating, or has history of anemia; frequent use or high doses can have serious side effects. Those using other "nutritional supplements" for "bulking up" may be at risk for experimentation with anabolic steroids.	Inquire about type and dosage of supplement; rule out anabolic steroid use. Screen for nutrient-nutrient or drug-nutrient interactions.

LIFESTYLE		
Indicators of Nutrition Risk	**Relevance**	**Criteria for Further Screening and Assessment**
Engages in heavy alcohol, tobacco, and other drugs.	Alcohol, tobacco, and other drug use can adversely affect nutrient intake and nutrition status.	Assess the adolescent further for inadequate dietary intake of energy and nutrients.
Uses dietary supplements.	Dietary supplements (e.g., vitamin and mineral preparations) can be healthy additions to a diet, especially for pregnant and lactating women and for those with a history of iron-deficiency anemia; however frequent use or high doses can have serious side effects. Adolescents who use supplements to "bulk up" may be tempted to experiment with anabolic steroids. Herbal supplements for weight loss can cause tachyardia and other side effects. They may also interact with over the counter prescription medications.	Assess the adolescent for the type of supplements used and dosages. Assess the adolescent for use of anabolic steroids and megadoses of other supplements.

Source: Adapted from Story M, Holt K, Sofka D, eds. Bright Futures in practice: Nutrition. Arlington, VA: National Center for Education in Maternal and Child Health; 2000 (Appendix D, p. 243-255).

NUTRITION RELATED PEDIATRIC DISORDERS

- EARLY CHILDHOOD CARIES
- FAILURE TO THRIVE
- OBESITY
- DISORDERED EATING

EARLY CHILDHOOD CARIES

- Defined as " the presence of one or more decayed (noncavitated or cavitated lesions), missing (due to caries), or filled tooth surfaces in any primary tooth in children from birth through 71 months of age".
- Age specific definitions have been proposed to distinguish severe ECC from ECC.
- Severe ECC is characterized by the presence of
  - One or more decayed, missing or filled smooth surfaces in children less than 36 months;
  - Cavitated, filled or missing (due to caries) smooth surfaces in primary maxillary anterior teeth;
  - Or multiple decayed, missing or filled surfaces in children aged 36 to 71 months.

Drury TF, Horowitz AM et al. diagnosing and reporting early childhood caries for research purposes. J Public Health Dent 1999;59:192-7

ECC (contd)

- It is a preventable childhood disease affecting disproportionate numbers of children from low income households and racial minorities. [9]
- Associated with
  - Self-esteem issues
  - Missed school days
  - Behavioural problems
  - Oral pain
  - Impaired eating
  - Oral abscesses
  - Poor growth
- Etiology: multifactorial
  - Bacteria associated: Streptococcus mutans
  - Genetic analysis of the bacteria found in young children suggests that the transmission is typically from mother to the child.[10]

ECC contd

- Increased risk for ECC:
  - Delayed or abnormal progression through transition stage of infant nutrition: by increasing the quantity or frequency of carbohydrate exposure.
  - Excessive reliance on beverages for nutrition.
  - Delayed acceptance of solid food .
  - Delivery of beverages by bottle or closed cup system.
  - Continued nocturnal bottles combined with decreased saliva during sleep.
  - Prolonged breast feeding [12]
- Prevention:
  - Early evaluation of dietary habits
  - Anticipatory guidance
  - Appropriate transition to table food
  - Limited intake of sugared beverages

FAILURE TO THRIVE

- Refers to a condition when the physical growth of a child is less than expected , usually below the third or fifth centile, or when a child has significant loss of weight in a short time.
- Divided into 3 **categories**:
  - **Organic FTT**: (30%) with a known medical condition.
  - **Non-organic**/ **psychosocial** FTT: (70%) without any known medical condition. A majority is due to psycho-social neglect. Also called Environmental FTT because of poverty and accidental errors.
  - **Mixed** type FTT.

- FTT and PEM are closely related. FTT is a medical problem or a label for investigation and PEM is the diagnosis.
- Organic causes:
  - GIT
  - Renal
  - Neurologic
  - Cardiovascular
  - Respiratory
  - Endocrine
  - Infections
  - Miscellaneous

- **Clinical features:**
  - Developmental delay
  - Growth retardation
  - Mental changes
  - Behavioural problems
  - Soft neurological signs.

- **Management**:
  - Hospitalization
  - Dietary support
  - Counselling

OBESITY

- CDC guidelines suggest refraining from using the term obesity when working with children and prefer the terms at risk for overweight and overweight.
- Weight-for-age values greater than 90th to the 95th percentile may be used to screen for over weight, however weight-for-height relationship provides a much more valuable assessment of body fat.
- Age specific weight-for-height ratio or BMI from the 85th perentile to less than 95th percentile is indicative of at risk for overweight.
- Age specific weight-for-height ratio or BMI greater than 95th percentile is indicative of overweight.

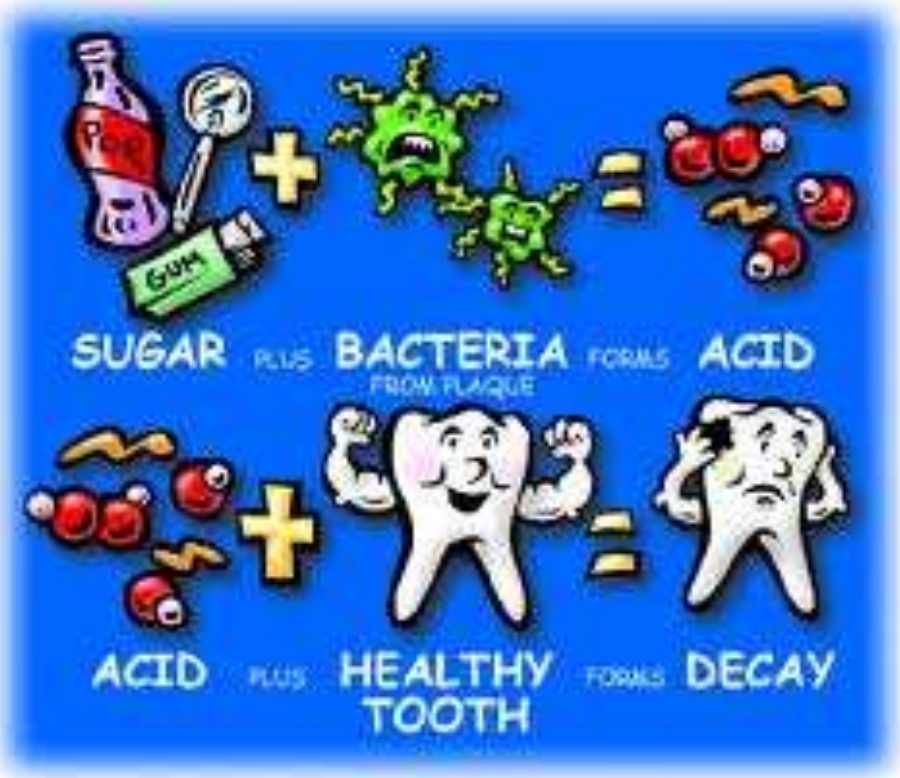
DISORDERED EATING

- **Psychosocial dwarfism:**
  - Deceleration of linear growth and characteristic behaviour disturbances including bizarre eating patterns and sleeping habits.
  - Children do not demonstrate expected growth in response to appropriate food intake in their home environment secondary to neglect and/or severly dysfunctional caregiver-child interactions.
  - Typical presentation occurs at 18-48 months
- **Rumination**
  - Voluntary regurgitation, chewing and reswallowing of stomach contents.
  - Self-stimulatory behaviour
  - Typically associated with psychosocial issues and/or mental retardation.
  - Age of onset is typically 3-12 months but occurs later in individuals with mental retardation.
  - Children are at risk for enamel erosion .

DISORDERED EATING

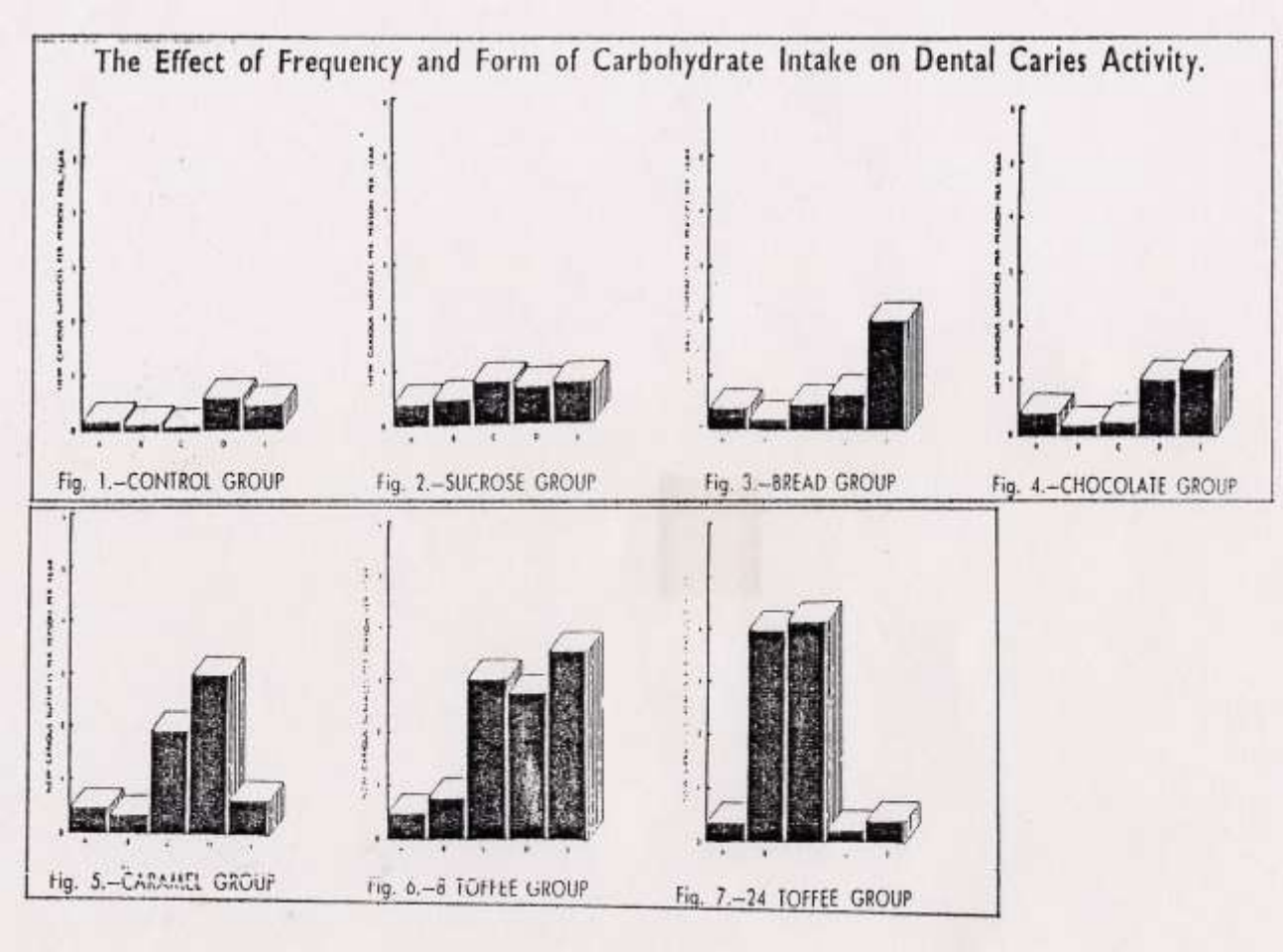
- **Pica**:
  - Pathologic craving for a food item or substance not commonly regarded as food .
  - Classic example: starch, ice or paint chips, dirt and paper.
  - Risk of direct toxicity from the desired substance and lead poisoning from incidental exposure.

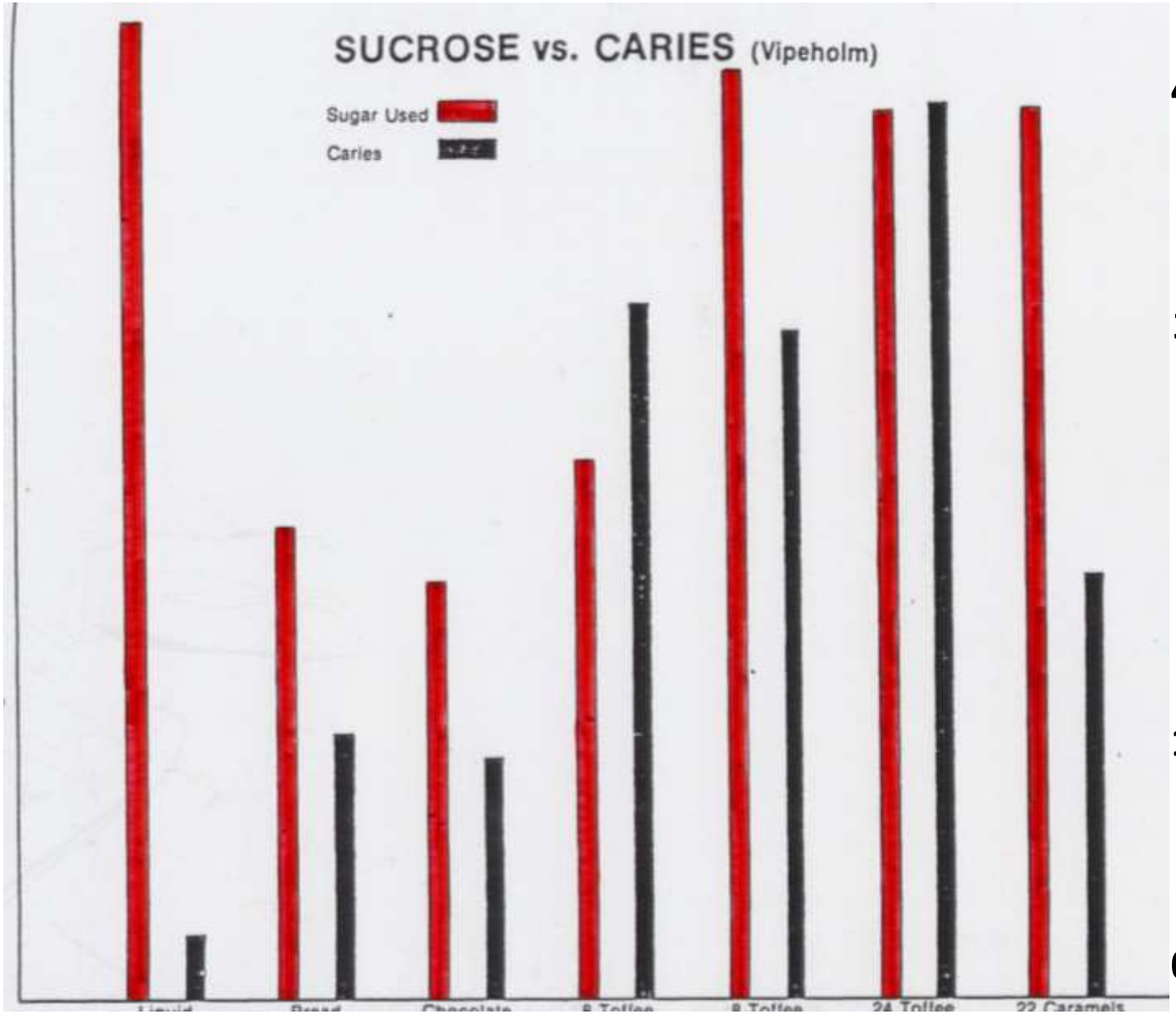
DIET AND DENTAL CARIES



Gustafsson et al. (1954). The Vipeholm dental caries study. Acta Odontlogica Scandinavica 11:232-364.

5 yr investigation on 436 adult inmates in a mental institution ,**Vipeholm institution** in Sweden.




SUCROSE vs. CARIES (Vipeholm)
Sugar Used
Caries
300
200
100
0
Sugar consumed gm per day
4
3
1
0
New DMFT per year

Conclusions

- Increase in Carbs definitely increases caries activity.
- Risk of caries is greater if sugar is consumed in a form that will be retained on the teeth.
- Risk of caries is greatest if sugar is consumed between meals.
- Increase in caries activity varies widely among individuals.
- Upon withdrawl of sugar rich foods, the caries activity rapidly disappears.
- High concentration of sugar in solution and its prolonged retention on tooth surfaces leads to increased caries activity.
- Clearance time of sugar correlates closely with caries activity.

The Dental Caries Experience of the Children of Hopewood House

Sullivan and Harris *Med J Aust*, June 1953

- Dental status of children between 3 and 14 yrs age residing at Hopewood house, Bowral, New South Wales was studied longitudinally for 10 years.
- Strict institutional diet, with the exception of occasional serving of egg yolk, was entirely vegetable in nature and largely raw.
- Principle features:
  - Absence of meat
  - Rigid restriction of refined carbohydrate
  - No tea
  - Vitamin supplements
  - Occasional serving of nuts and a sweetening agent such as honey

Findings

- At the end of 10 yr period,
  - Average DMFT : 1.6
  - Corresponding figure for general population was 10.7
- 53% of children were caries free whereas only 0.4% of the 13 yrs old, state school children were free from caries.
- Children's oral hygiene was poor, calculus uncommon, but gingivitis was prevalent in 75% of children.

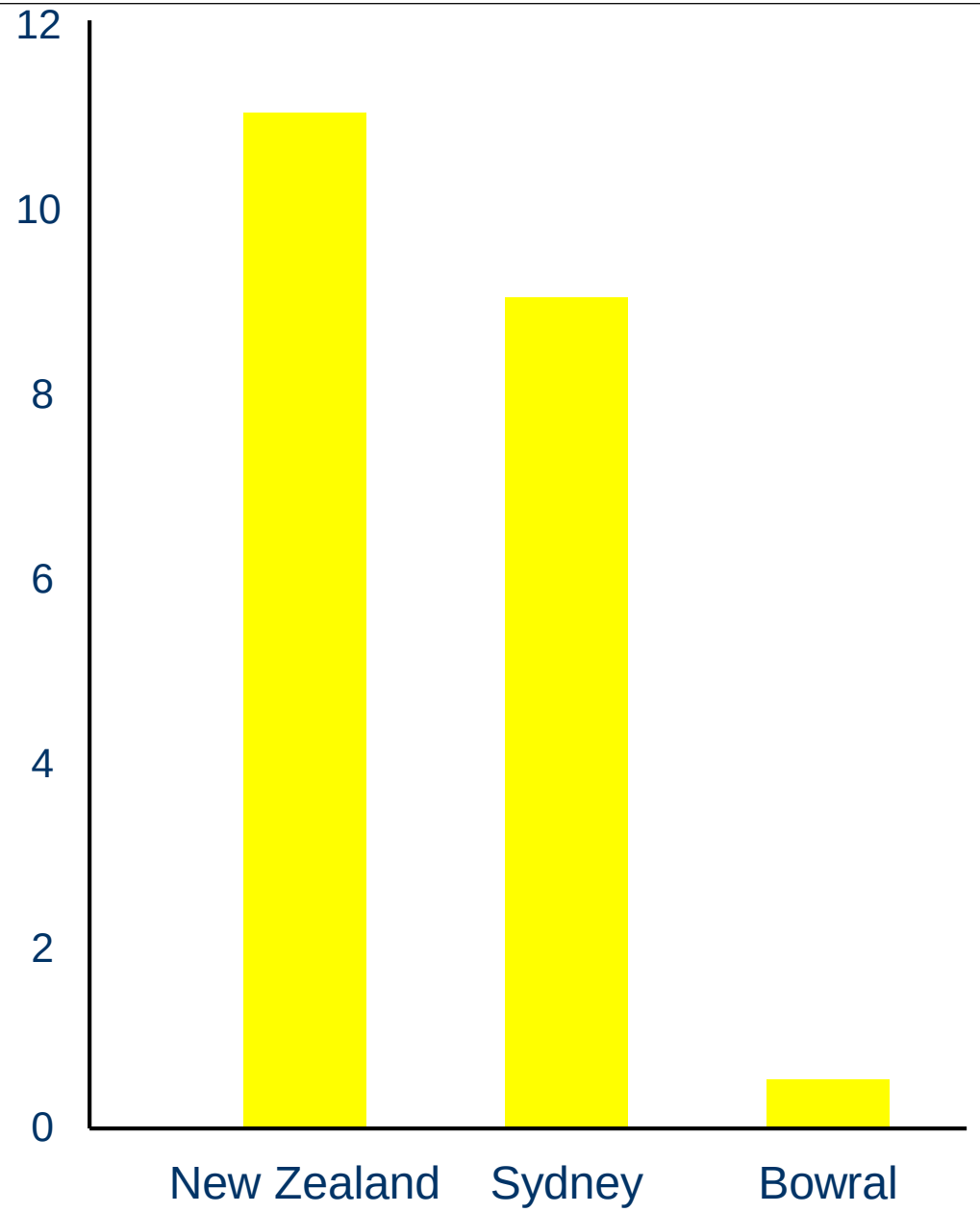
CONCLUSION:

In institutionalized children, at least dental caries can be reduced by Spartan diet, without the beneficial effects of flourides and in the presence of unfavorable oral hygiene.

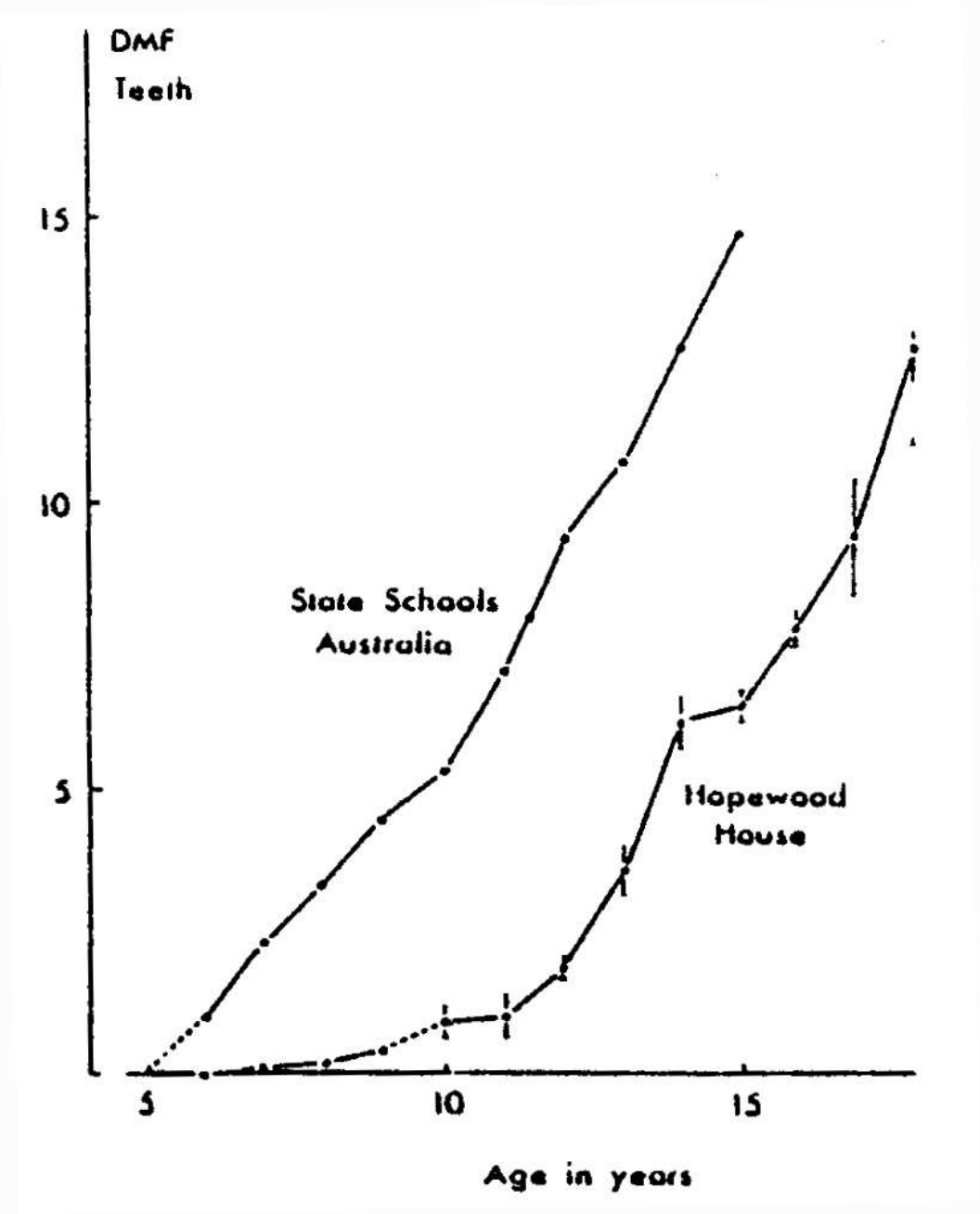
HOPEWOOD HOUSE

BOWRAL, NSW

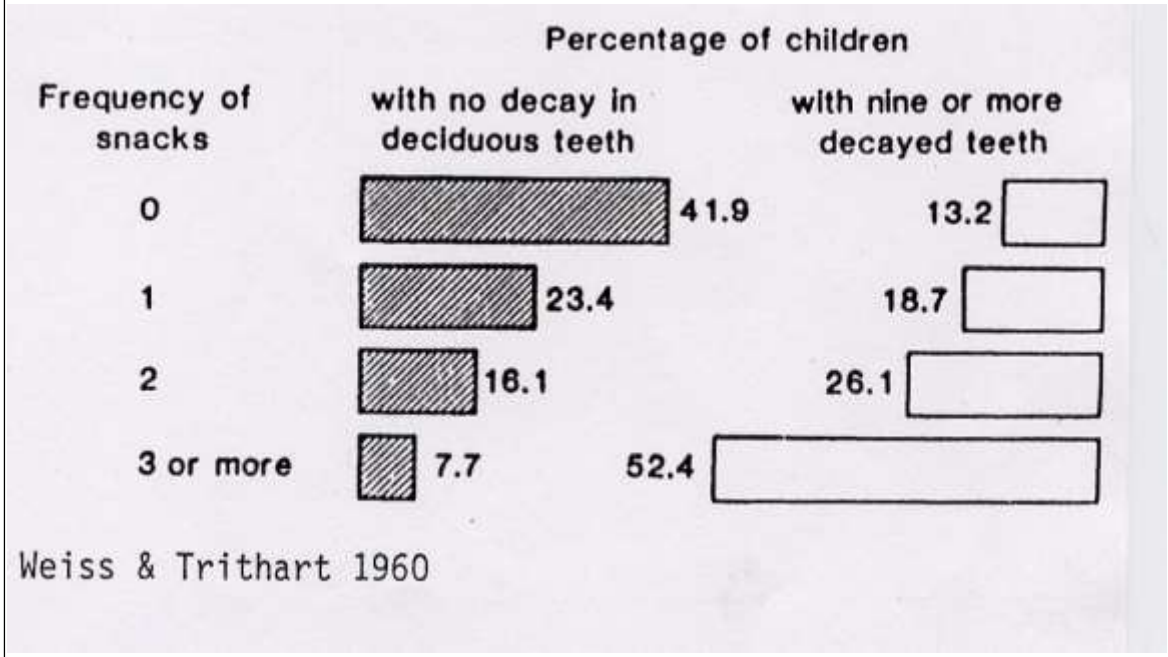
DMFT of children aged 3-14 yrs

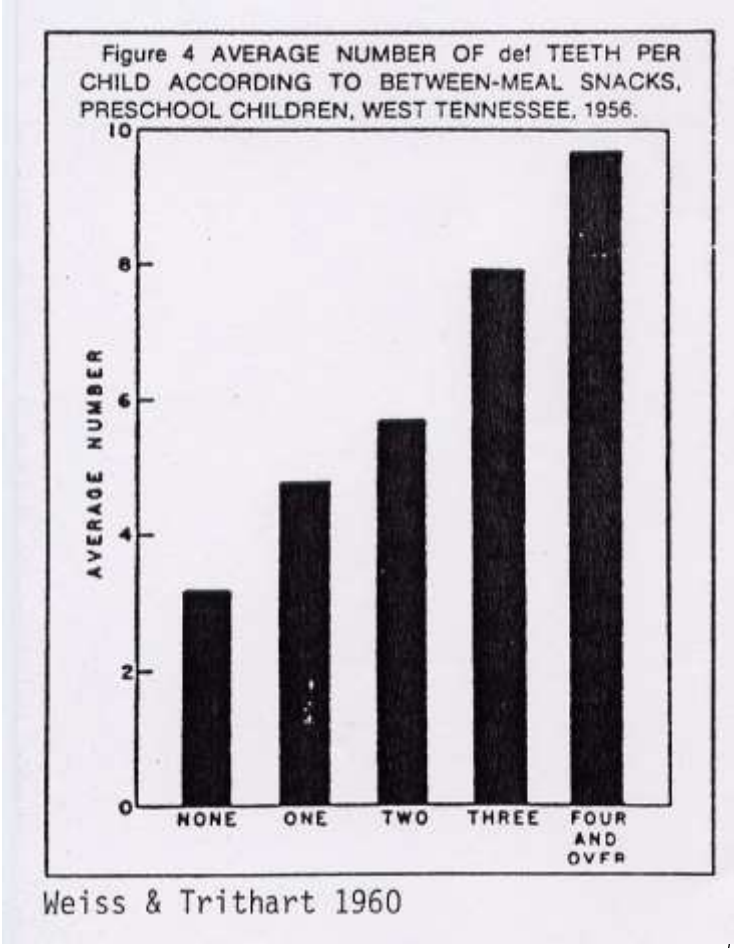


Lilienthal et al *Med J Aust*, June 1953


DMF
Teeth
15
10
5
State Schools
Australia
Hopewood
House
5
10
15
Age in years

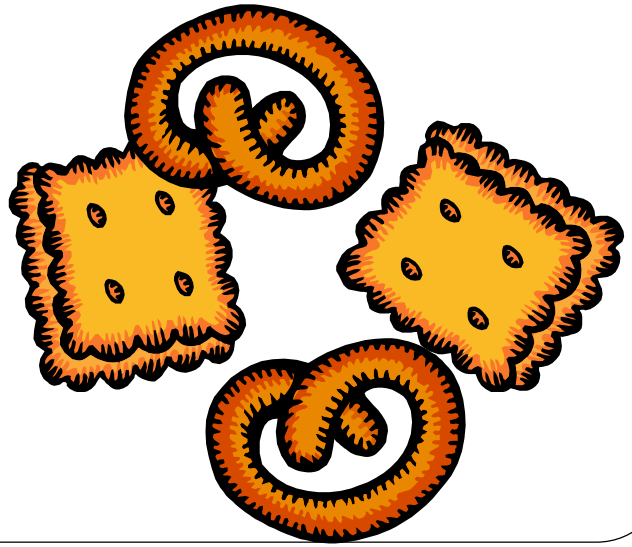
Weiss RL, Trithart. Between meal eating habits and dental caries experience in preschool children. ***American Journal of Public Health*** 50:1097-1104, 1960.





CARIOGENIC FOODS

- Promote formation of caries
- Fermentable carbohydrates, those that can be broken down by salivary amylase
- Result in lower mouth pH
- Include crackers, chips, pretzels, cereals, breads, fruits, sugars, sweets, desserts



CARIOSTATIC FOODS

- Foods that do not contribute to decay
- Do not cause a drop in salivary pH
- Includes protein foods, eggs, fish, meat and poultry; most vegetables, fats, sugarless gums

ANTICARIOGENIC FOODS

- Prevent plaque from recognizing an acidogenic food when it is eaten first
- May increase salivation or have antimicrobial activity
- Includes xylitol (sweetener in sugarless gum) and cheese

AAPD DIETARY RECOMMENDATIONS FOR INFANTS, CHILDREN AND ADOLESCENTS

Reeves AF, Rees JM, Schiff M, Hujoel P. Total body weight and waist circumference associated with chronic periodontitis among adolescents in the United States. Arch Pediatr Adolesc Med 2006;160(9):894-9.

Frequent ingestion of sugar-sweetened medications has demonstrated a higher incidence of caries in chronically ill children.

Kenny DJ, Somaya P. Sugar load of oral liquid medications on chronically ill children. J Can Dent Assoc 1989;55(1):43-6.

Cases of vitamin A toxicity have been reported as a result of excessive consumption of candy-like vitamin supplements.

Lam HS, Chow CH, Poon WT, et al. Risk of vitamin A toxicity from candy-like chewable vitamin supplements for children. Pediatrics 2006;118(2):820-4.

Excessive consumption of fruit juice has been associated with small stature in some children.

Dennison BA, Rockwell HL, Baker SL. Excess fruit juice consumption by preschool-aged children is associated withshort stature and obesity. Pediatrics 1997;99(1):15-22.

AAPD DIETARY RECOMMENDATIONS FOR INFANTS, CHILDREN AND ADOLESCENTS

- To help the public make choices for a healthy diet, the USDA and DHHS published Dietary Guidelines for Americans.
  - Eating a variety of nutrient-dense foods and beverages.
  - Balancing foods eaten with physical activity to maintain a healthy body mass index.
  - Maintaining a caloric intake adequate to support normal growth and development and to reach or maintain a healthy weight.
  - Choosing a diet with plenty of vegetables, fruits, and whole grains and low in fat, saturated (especially trans-saturated) fat, and cholesterol.
  - Using sugars and salt (sodium) in moderation.

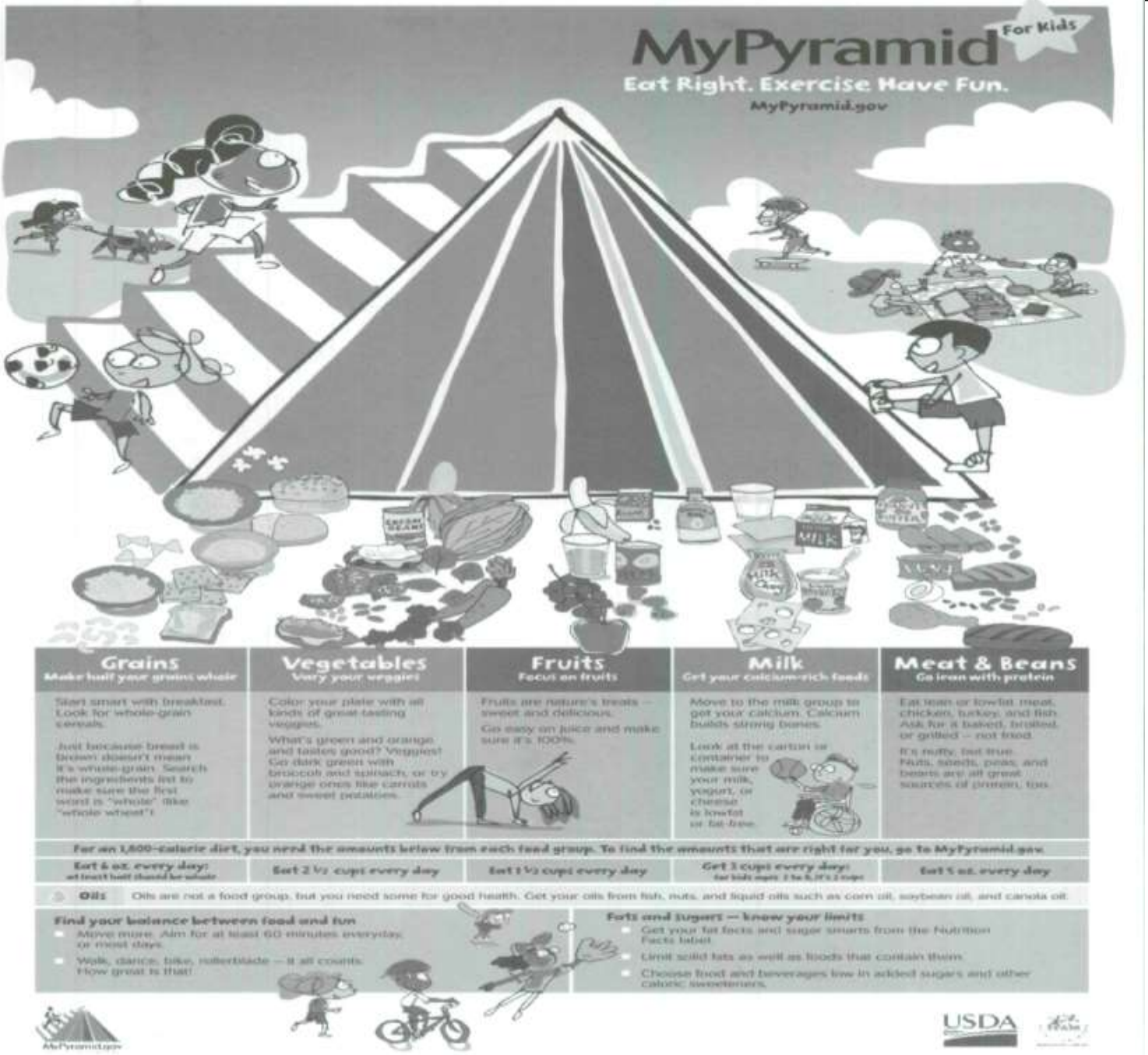


Figure 2. MyPyramid food guidance system: United States Department of Agriculture (USDA) dietary guidelines for American children (source: USDA).

NUTRITIONAL CONSIDERATIONS FOR SPECIAL CHILDREN

- **INTRODUCTION**:
  - The term "children with special health needs" refers to a subset of children who have, or are at risk of developing, chronic conditions, mental disabilities, or health-related problems.7
  - Chronic diseases can pose increased risks to the nutritional status of infants and children. 8
  - It is estimated that as many as 40% of SHCN children are at risk for nutrition problems. 9
- **Decreased appetite:**
  - SHCN children often experience a decrease in appetite and food intake due to pain, surgery, fever, infection, psychological distress, physical impediments, and medications or treatment. 10 , 11, 12
- **Frequency of food intake:**
  - Increased energy needs due to protein wasting and/or hypermetabolism, which require more frequent feedings, are routinely seen in diseases such as congenital heart disease, cystic flbrosis, and human immunodeficiency virus (HIV). 13, 14

- **Parental over-indulgence:**
  - Parental stress: Anxiety, fear, guilt, depression, and helplessness and can compromise effective child-rearing practices.
  - overprotect and overindulge.
- **Poor oral hygiene and prevention:**
  - Poor oral hygiene, low fluoride exposure and altered oral flora are common to most chronic disorders.
  - Infrequent brushing, reduced manual dexterity, and dependence on caregivers.
  - Lower fluoride exposure can result from reduced use of toothpaste, lower water intake, and reduced visits to the dentist.
  - Altered oral flora might be associated with xerostomia.
- **Long-term use of cariogenic medications:**
  - Children's Tylenol® Suspension contains 2 g of high fructose corn syrup per teaspoon (5 mL).
  - Amoxicillin, a common antibiotic, includes more than 5 g of sucrose in a daily dose (15 mL).
  - Digoxin syrup, containing 30% sucrose, and chlorthiazide and spironolactone, containing approximately 20% sucrose.

- **Xerostomia:**
  - Symptom of various medical conditions, a side effect of radiation to the head and neck or a wide variety of medications that may or may not be associated with decreased salivary gland function 15
  - Most of the drugs used to manage attention-deficit hyperactivity disorder can cause xerostomia. 16
  - Xerostomia is also associated with slower clearance of foods from the oral cavity.
  - This allows fermentable carbohydrates to stay in contact with plaque longer, thereby increasing acid production and enhancing enamel demineralization. 17

NUTRITIONAL RECOMMENDATIONS

- **Oral health management:**
  - The American Academy of Pediatrics and the AAPD recommend establishing a dental home by one year of age. 18
- **Oral hygiene management:**
  - The 2-2-2 rule should be used as a guide for how to brush as soon as the teeth erupt. A soft-nylon bristle manual or electric toothbrush should be used for 2 minutes, 2 times a day (after breakfast and before bed), with nothing entering the mouth for 2 hours after spitting without rinsing. 19
  - The caregiver should brush the child's teeth until age 7 or 8 years-old.
  - ADA guidelines encourage the use of a peasized amount of fluoridated toothpaste twice a day, beginning at 2 years-old, with careful supervision. 20
  - For children younger than 2 years-old known to be at high risk for caries, a "smear" of fluoridated toothpaste may be a necessary part of a preventive regimen.
  - Tooth wipes containing the antimicrobial xylitol provide a safe and easy way to clean a child's teeth and mouth after feeding or when brushing is inconvenient 21
- **Antimicrobial products:**
  - Should be used to complement, not replace, mechanical plaque removal.
  - Chlorhexidine can reduce caries among SHCN patients. 22
  - Used as an alcohol-based or water-based mouth rinse. It can also be swabbed on for those children who cannot rinse or spit.

- **Xylitol** is a low-calorie, naturally occurring, and diabetic safe sugar that is not metabolized by cariogenic bacteria.
- Incorporating xylitol into the diet inhibits pH changes and reduces bacterial attachment to teeth 23
- Gums, mints, chewable tablets, lozenges, toothpastes mouthwashes, cough mixtures, and nutraceutical products.
- Use of xylitol gums by primary caregivers has been shown to decrease oral bacterial load and interrupt vertical transmission. 24
- Xylitol products also stimulate salivary flow and aid in the symptomatic treatment of xerostomia sometimes associated with chronic childhood disease. 24

- **Remineralization products:**
  - Fluoride varnish application can slow, arrest, and possibly even reverse the progression of caries. 25
  - Amorphous calcium phosphate (ACP) products, such as RecalDent'" and Novamin®, help replace lost minerals and protect teeth from decay and erosion by providing calcium and phosphate in a soluble form.26
- **Management of pain and discomfort:**
  - Nonpharmacological means of addressing pain and discomfort include sipping cool water, sucking on ice chips, or using ice pops preferably with non-sweetened flavoring. 27

- **Management of xerostomia:**
  - Saliva stimulants or sialagogues.
  - Frequent sipping of sugarless fluids throughout the day and sucking on ice chips can be helpful.
  - Rinsing 4 to 6 times daily with a salt and baking soda solution (half teaspoon of each added to 1 cup of warm water) may help buffer the acidic oral environment.
  - Alcohol containing mouthwashes should be avoided, as they may cause additional drying. 28
  - Flavor enhancers

REFERENCES

1. WHO working group on the growth reference protocol and WHO Task force on methods for the natural regulation of fertility: growth of healthy infants and the timing, type and frequency of complementary foods, Am J Clin Nutr 76:620-627,2002
2. Makrides M et al. Nutritional effect of including egg yolk in the weanling diet of breast fed and formula fed infants: a randomised controlled trial, Am J Clin Nutr 75:1084-1092,2002
3. American Academy of Pediatrics Committee on Nutrition. Policy statement: The use and misuse of fruit juices in pediatrics. Pediatrics 2001;107(5):1210-3. Reaffirmed October, 2006
4. Tinanoff N, Kanellis MJ, Vargas CM. Current under-standing of the epidemiology, mechanisms, and preven-tion of dental caries in preschool children. Pediatr Dent 2002;24(6):543-51.
5. Tinanoff N, Palmer CA. Dietary determinants of dental caries and dietary recommendations for preschool chil-dren. J Public Health Dent 2000;60(3):197-206; discus-sion 207-9
6. Ludwig DS, Peterson KE, Gormaker SL. Relation between consumption of sugar-sweetened drinks and childhoodobesity: A prospective, observational analysis. Lancet 2001;357(9255):505-8.
7. Malik VS, Schulze MB, Hu FB. Intake of sugar-sweetened beverages and weight gain: A systematic review. Am J Clin Nutr 2006;84(2):274-88.
8. Reeves AF, Rees JM, Schiff M, Hujoel P. Total body weight and waist circumference associated with chronic periodontitis among adolescents in the United States. Arch Pediatr Adolesc Med 2006;160(9):894-9.

9. Ireys HT, Nelson RP. New federal policy for children with special health care needs: Implications for pediatricians. Pediatrics 1992;90:321-7.

10. Baer MT, Harris AB. Pédiatrie nutrition assessment: Identifying children at risk. J Am Diet Assoc 1997;97: S107-15

11. Kozlowski B, Powell J. Position of the American Dietetic Association: Nutrition services for children with special health needs. J Am Diet Assoc 1995;95:809-12.

10. Roth-Isigkeit A, Thyen U, Stoven H, Schwarzenberger J, Schmucker P. Pain among children and adolescents: Restrictions in daily living and triggering factors. Pediatrics 2005;l 15:el52-62.

11. Kalinyak K, Ora I. Children with Cancer. In: Ekvall S, Ekvall V, eds. *Pédiatrie Nutrition in Chronic Diseases and Developmental Disorders. 2"" ed. NewYork, NY: Oxford* University Press, Inc; 2005:225-28.

12. Türkei S, Pao M. Late consequences of chronic pédiatrie illness. Psychiatr Clin North Am 2007;30:819-35.

13. Vaisman N, Pencharz PB, Corey M, Canny CJ, Hahn E. Energy expenditure of patients with cystic fibrosis. J Pediatr 1987;111:496-500.

14. Howell RB, Jandinski J, Palumbo P Shey Z, Houpt M. Dental caries in HIV-infected children. Pediatr Dent 1992;14:37O-1.

15. Cuggenheimer J, Moore PA. Xerostomia: Etiology, recognition, and treatment. J Am Dent Assoc 2003; 134: 61-9; quiz 118-9.

16. Friedlander AH, Yagiela JA, Mahler ME, Rubin R. The pathophysiology, medical management, and dental implications of adult attention-deficit/hyperactivity disorder. J Am Dent Assoc 2007; 138:475-82.
17. Boyd LD, Palmer C, Dwyer JT. Managing oral health related nutrition issues of high risk infants and children. J Clin Pediatr Dent 1998;23:31-6
18. Donaldson SS, Wesley MN, DeWys WD, Suskind RM, JafFe N, vanEys J. A study of the ntitritional status of pediatric cancer patients. Am J Dis Child 1981;135:1107-12.
19. Fayle SA, Duggal MS, Williams SA. Oral problems and the dentist's role in the management of paediatric oncology patients. Dent Update 1992; 19:152-6, 58-9.
20. Colecraft E. HIV/AIDS: Nutritional implications and impact on human development. Proc Nutr Soc 2008;67: 109-13.
21. Eldridge K, Gallagher JE. Dental caries prevalence and dental health behaviour in HIV-infected children. Int J Paediatr Dent 2000; 10:19-26.
22. Madigan A, Murray PA, Houpt M, Catalanotto F, Feuerman M. Caries experience and cariogenic markers in HIV-positive children and their siblings. Pediatr Dent 1996; 18:129-36.
23. Rother KI. Diabetes treatment: Bridging the divide. N EngI JMed2007;356:1499-501.
24. Twetman S, Johansson I, Birkhed D, Nederfors T. Caries incidence in young type 1 diabetes meilitus patients in relation to metabolic control and caries-associated risk factors. Caries Res 2002;36:31-5.
25. Lopez ME, CoUoca ME, Paez RG, Schallmach JN, Koss MA, Chervonagura A. Salivary characteristics of diabetic children. Braz Dent J 2003; 14:26-31.
26. Cederbaum S. Phenylketonuria: An update. Curr Opin Pediatr 2002; 14:702-6.

THANK YOU