

Nutrition in childhood

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Outline

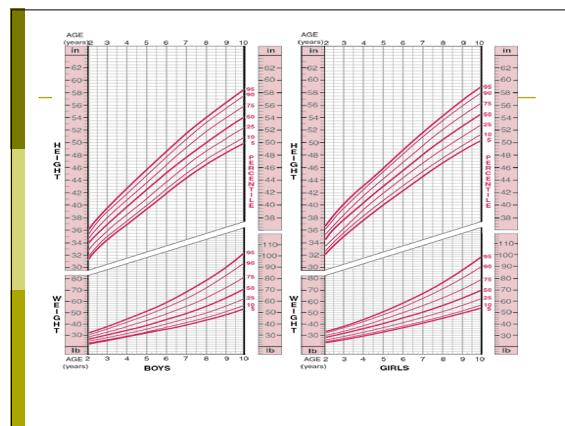
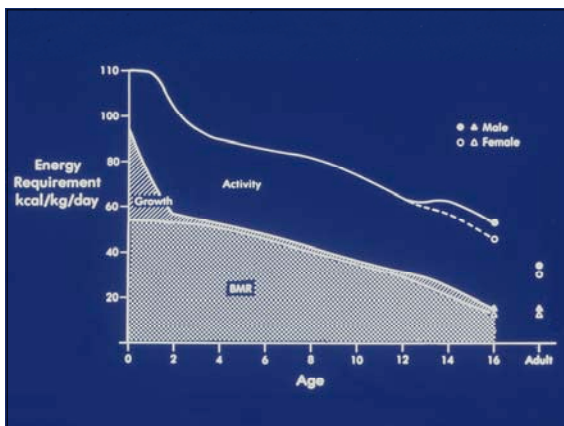
- ▣ Nutritional assessment in childhood
- ▣ Assessment for malnutrition and obesity
- ▣ Nutrition aspects in infancy, toddlers, preschoolers, school-age children and adolescents

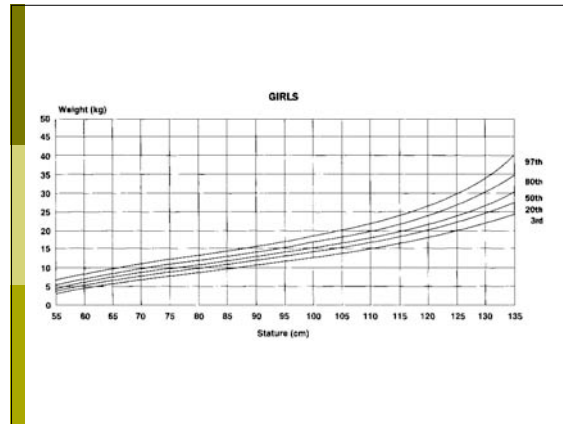
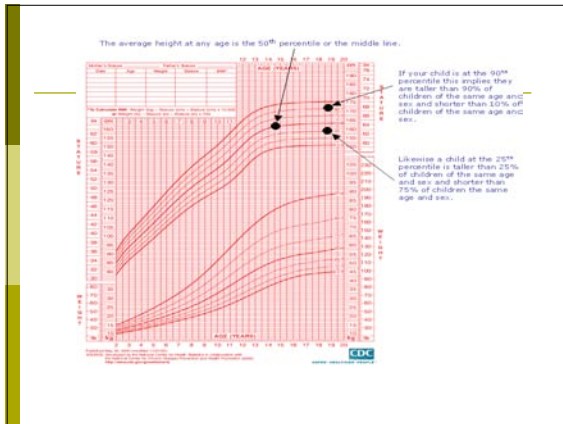
Nutritional Assessment

- ▣ Essential component of the H@P in children
- ▣ The normal and abnormal pattern of growth and the changes in body composition in children need to be recognized

Normal Growth Rates in Children

Age Group	Height Velocity	Weight Velocity
Infancy (1 st yr)	25 cm/yr	7 kg/yr
Toddler (2 nd /3 rd yr)	11cm/yr	2.2 kg/yr
Preschool/school Age	6 cm/yr	2.5 kg/yr
Adolescent	3-4 cm/6 mo	6-7 kg/6 mo





- ### Nutritional Assessment
- Weight-for-height and height-for-age ratio are good indicator for malnutrition risks
 - General guidelines:
 - Height-for-age ratio less than 10th%
at risk for chronic malnutrition
 - Weight-for-height ratio less than 10%
at risk for acute malnutrition
 - Weight-for-height ratio greater than 90%
at risk for obesity

- ### Definitions
- Weight deficit (%):

$$\frac{\text{Actual weight (kg)} - \text{Expected Weight (kg)}}{\text{Expected Weight (kg)}} \times 100$$
 - Height deficit (%):

$$\frac{\text{Actual height (cm)} - \text{Expected height (cm)}}{\text{Expected height (cm)}} \times 100$$
 at 50% for chronological age

Degree of Malnutrition

Criteria	0 Normal	1 Mild	2 Moderate	3 Severe
Wt/Ht (%)	≥90	<90	<80	<70
Ht/age (%)	≥95	<95	<90	<85

- ### Protein-Energy Malnutrition
- Common problem in developing countries
 - Inadequate caloric intake
 - Deficiencies in dietary energy and protein
 - Kwashiorkor (protein deficiency)
 - Marasmus (energy deficiency)



Marasmus

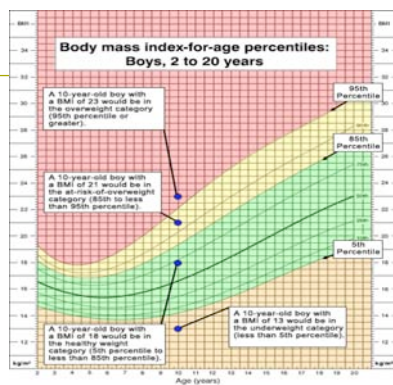
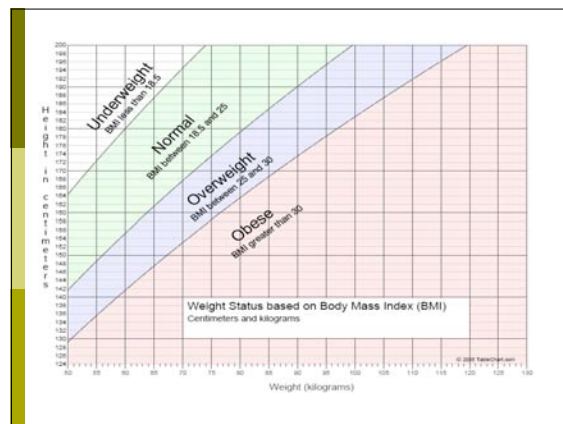
- Generalized muscle wasting and absence of subcutaneous fat
- Cachectic appearance
- Dry skin, no turgor, thin, sparse, brittle hair, face of elderly person
- Hypothermia, slow heart rate, hypotension

Kwashiorkor

- Insufficient intake of protein, diet high in carbohydrate
- Children frequently fat-appearing ("sugar baby")
- Soft, pitting edema, dermatosis
- Changes in hair texture
- Hepatomegaly (fatty infiltration)
- More susceptible to infections
- Height may be normal or stunted
- Higher mortality rate than in marasmus

Body Mass Index (BMI)

- The best indicator of adiposity in children and adolescent
- Calculation: weight (kg)/ square of height in meters (kg/m²)
- All children should have their BMI calculated periodically



Nutrition in Infancy

- Water: 100-150ml/kg/day
- Protein: 2-3gm/kg/day
- Lipids: 3.8-6.0 gm/kg/day (MCT and EFA)
- Carbohydrate: 40%-50% of total calories
- Calcium: 400-600mg/day
- Iron: 6-10mg/day
- Fluoride, vitamin D, vitamin K

Weight Gain in Infants

Age(months)	Gm/day
0-3	25-39
4-6	20
7-12	15
12-18	8
18-24	6

Recommendations for Infants

- ❑ The WHO recommends human milk as the exclusive nutrient source for feeding full-term infants during the first 6 months after birth
- ❑ Regardless of when complementary foods are introduced, breastfeeding should be continued through the first 12 months

Breast Milk Content

- ❑ Human milk contains protective antibodies against enteric infections
- ❑ Caloric density is the same in breast milk and regular infant formulas(20kcal/oz)
- ❑ Fat absorption is more efficient in breastfed infants when compare to infant formulas

Breast Milk/Formula Content

- ❑ Human milk has higher concentration of essential fatty acid
- ❑ Formula has higher protein concentration (1.5g/dl in formula vs.0.9g/dl in breast milk)
whey/casein in human milk- 80:20
whey/casein in formula-18:82
- ❑ Whey protein promotes gastric emptying
- ❑ Whey protein have more lactoferrin and secretory immunoglobulin A

Breast Milk/Formula Content

- ❑ Lactose content is equal in breast milk and infant formula
- ❑ Calcium/Phosphorus ratio in human milk is higher compared to formula (2:1 vs. 1.5:1)
- ❑ Human milk has lower iron concentration but iron from human milk is more bio-available

Infection and Breast Milk

- ❑ Human milk may be a source of CMV
- ❑ Human milk is protective against enteropathogenic E.coli and other GI pathogens. This protection is greatest during the infant's first 3 months of life and declines with increasing age
- ❑ Human milk is not protective against HSV
- ❑ Breastfeeding is contraindicated in HIV infection, except in underdeveloped countries
- ❑ Human milk does not protect against M.tuberculosis

Contraindicated in Nursing Mothers

- ❑ Amantadine
- ❑ Amiodarone
- ❑ Antineoplastic agents
- ❑ Chloramphenicol
- ❑ Iodide
- ❑ Lamotrigine
- ❑ Lithium
- ❑ Metoclopramide
- ❑ Metronidazole
- ❑ Salicylates
- ❑ chlorpromazine
- ❑ Fluoxetine
- ❑ Haloperidol
- ❑ Clofazimine
- ❑ Psychotropic drugs
- ❑ Acebutolol
- ❑ Atenolol
- ❑ Bromocriptine
- ❑ Clemastine
- ❑ Ergotamine
- ❑ phenobarbital
- ❑ Primadone
- ❑ Alcohol
- ❑ Drugs of abuse

Counseling for Breast Feeding

What would be the most crucial information that you will give to a mother in order to convince her to choose breastfeeding instead of formula feeding?

Infant Benefits of Breastfeeding

- ❑ Protein in breast milk is more easily digested than protein in infant's formula
- ❑ Human milk protein promotes more rapid gastric emptying
- ❑ Fat absorption from human milk is more efficient when compared to formula
- ❑ Many factors in human milk may stimulate gastrointestinal growth and motility as well as enhance the maturity of the gastrointestinal track
- ❑ Human milk contains specific protein involved in host defense

Infant Benefits, cont.

- ❑ Infants who are breastfed for at least 13 weeks had significantly less gastrointestinal and respiratory illnesses
- ❑ Breast milk appears to be protective against some food allergies during infancy and early childhood
- ❑ Maternal-infant bonding is enhanced during breastfeeding
- ❑ Improved long-term cognitive and motor abilities in full term infants have been directly correlated with duration of breastfeeding

Mother Benefits

- ❑ Postpartum weight loss and uterine involution may be more rapid in women who breastfeed
- ❑ Exclusive breastfeeding delays the resumption of normal ovarian cycles and return of fertility in most mothers
- ❑ Epidemiological studies have identified a decreased incidence of premenopausal breast cancer and ovarian cancer in women who have lactated

Infant Formulas

- ❑ Cow milk-based
- ❑ Soy-based
- ❑ Protein hydrolysate
- ❑ Elemental

Characteristics of Cow Milk-Based Formulas

- Caloric density: 20cal/oz
- Protein: casein/whey (80/20)
- Carbohydrate: lactose
- Fat: palm oil, coconut oil, soy-oil, safflower oil

Cow's Milk-Based Formulas

- Examples:
 - Similac
 - Enfamil
 - Lactofree
 - Neocare
 - Carnation Follow-up

Characteristics of Soy-Based Formulas

- Caloric density: 20cal/oz
- Protein: soy protein with added methionine
- Carbohydrate: sucrose, corn syrup solids, glucose polymers
- Fat: as in cow milk-based formula

Indications for Soy Protein-Based Formulas

- Healthy term infants as the alternative to cow milk-based formula
- Galactosemia
- Lactose intolerance
- IgE-mediated allergy to cow milk
- Parents seeking a vegetarian-based diet for a term infant

Contraindication for Soy Protein-Based Formulas

- Preterm infants with birth weight <1800g
- Prevention of colic or allergy
- Cow milk protein induced enterocolitis or enteropathy

Hydrolysate Formulas

- Caloric density: 20cal/oz
- Protein: Casein or whey hydrolysate
- Carbohydrate: Sucrose, corn syrup solids, cornstarch, tapioca starch
- Fat: Medium chain triglycerides and vegetable oil

* The more extensive hydrolysis, the lesser the antigenicity and the greater the price

Indications for Protein Hydrolysate Formulas

- ❑ Intolerance to cow milk and soy protein formula
- ❑ Fat malabsorption
- ❑ Short gut syndrome
- ❑ Severe chronic diarrhea
- ❑ Liver disorders (cholestasis, biliary atresia, cystic fibrosis)

Disadvantages of Hydrolysate Formulas

- ❑ Poor taste (presence of sulfated amino acids)
- ❑ Greater cost
- ❑ High osmolality

Protein Hydrolysate Formulas

❑ Examples:

Alimentum

Nutramigen

Progestamil

Characteristics of Elemental Formulas

- ❑ Caloric density: 20cal/oz
- ❑ Protein: free amino acids
- ❑ Carbohydrate: Glucose polymers, sucrose, modified starch
- ❑ Fat: vegetable oil, medium chain triglycerides

Indication for Elemental Formula

- ❑ Severe food allergy
- ❑ Malabsorption
- ❑ Transition from Total Parenteral Nutrition

Elemental Formulas

❑ Examples:

Neocate (Infants formula)

Elecare (Pediatric formula)

Vivonex (Pediatric formula)

Whole Cow Milk

- Human milk or formula until 1 year of age
- Cow milk has
 - Less iron, linoleic acid, vitamin E
 - Excessive sodium, potassium, protein
 - Increased incidence of GI blood loss
 - Low iron content and iron bioavailability
- Low-fat and non-fat milks are inappropriate in the first two years of life

Complementary Feeding

- Can be introduced between ages 4 and 6 months
- Introduce one new food at the time.
- At least 1 week interval between new foods introduction
- No evidence to support introducing food in a particular order

Complementary Feedings, cont.

- Fruit juice should not be introduced to infants younger than 6 months of age
- Intake should be limited to 6-8oz/day
- Intake of more than 250cc of juice per day can lead to diarrhea (high fructose and sorbitol content of fruit juice)

Complementary Feeding, cont.

- No need for complementary foods for the first 6 months of life in infants fed iron-fortified formula
- Iron-fortified formula and complementary food in the first year of life will prevent deficiencies of iron, zinc and vitamin D
- Breastfed and formula-fed infants should have hemoglobin tested at 9 to 12 months of age

Complementary Feeding, cont.

- Breast-fed infants need iron supplement starting at 4 to 6 months of life
- Iron-fortified infants cereal and meats are good source of iron
- If iron intake not sufficient, elemental iron should be started at 1mg/kg/d
- An average of 2 servings (½ oz or 15g of dry cereal per serving) meet the daily iron requirements
- Infants who are exclusively breastfed beyond 6 months of life should be supplemented with 200 U of vitamin D daily

Complementary Feeding, cont.

- Neither breastfed or formula-fed infants require extra water
- Whole milk should be avoided in the first year of life.
- Complementary foods should not be prepared with added salt or sugar
- Hot dogs, nuts, grapes, raisins, raw carrots, popcorn and rounded candies should be avoided in children under age of 4 years to prevent the risk of aspiration

Nutrient Needs in Childhood

Age	Kcal	Kcal	Grams	Protein
	Daily	Per kg	Daily	Per kg
1-3 yrs	1300	102	16	1.2
4-6 yrs	1800	90	24	1.1
7-10	2000	70	28	1.0

Dietary Supplements

- ❑ Not recommended for healthy children
- ❑ Supplements needed:
 - > Anorexia, inadequate appetite
 - > Chronic disease
 - > Neglected or abuse children
 - > Vegetarian diet without adequate dairy product
 - > Failure to thrive
 - > Children and adolescent without regular sun exposure, ingestion of less than 500ml/d of vitamin D

Food Pyramid for Children



Dietary Fat

- ❑ No fat restriction for children less than 2y
- ❑ Nonfat and low-fat milk not recommended in the 1st 2 years of life
- ❑ Fat intake should be decreased during toddlers years, to provide 30% of total energy
- ❑ Lower limit of energy from fat should be 20%

Dietary Guidelines in Childhood

- ❑ Structured 3 meals and 2 snacks
- ❑ Adults should decide when food is offered
- ❑ Eating should occur in a designated area with the developmentally appropriate chair
- ❑ No grazing between meals
- ❑ For preschoolers offer 1 tablespoon of each food for every year of age
- ❑ Snacks should be considered mini-meals

Adolescent Nutrition

- ❑ Recommended daily allowances (RDA) for energy based on the median energy intake
- ❑ Assessment of energy needs should consider appetite, growth, activity and weight gain in relation to deposition of subcutaneous fat
- ❑ Restricted food intake in physically active adolescents results in diminished growth, drop in basal metabolic rate and amenorrhea
- ❑ Requirements for energy, calcium, nitrogen and iron determined by increases in Lean Body Mass

Nutritional Concerns in Adolescence

- ❑ The low energy intake creates difficulties in planning diets with adequate levels of nutrients
- ❑ RDA for energy do not include a safety factor for increased energy needs (illness)
- ❑ Protein needs correlate more with growth pattern than with chronological age
- ❑ Due to accelerated muscular and skeletal growth, calcium need is higher

Nutritional Needs in Adolescents

	Age-yrs	Kcal/day	Kcal/kg	Protein Gm/day
Females	11-14	2200	47	46 Gm
	15-18	2200	40	44
	19-24	2200	38	46
Males	11-14	2500	55	45
	15-18	3000	45	59
	19-24	2900	40	58

Nutrition Concerns in Adolescents

- ❑ Need for iron is increased to sustain the rapidly enlarging LBM and hemoglobin mass
- ❑ Iron needed to offset menstrual losses
- ❑ Zinc is essential for growth and sexual maturation
- ❑ Growth retardation and hypogonadism have been reported in adolescent boys with Zinc deficiency

Nutrition Concerns in Adolescents

- ❑ Vegetarian adolescents at risk for deficiencies of vitamin D, B 12, riboflavin, protein, calcium, iron, zinc and trace elements
- ❑ Dental caries are common (low fluoride intake, high carbohydrate intake)
- ❑ NHANES reports obesity in 14% of adolescent ages 12-19
- ❑ Chronic disease in adolescent may affect nutritional status

Pregnancy in Adolescence

- ❑ More nutritional needs (growing adolescent and fetal demand on nutrients)
- ❑ Growing gravidas gain more weight than non growing adolescent
- ❑ Growing adolescents have smaller babies
- ❑ Poor eating habits, vegetarian diet may contribute to nutritional deficiencies
- ❑ Folate and iron supplementation should be recommended routinely

Refeeding Syndrome

- ❑ Risk in moderate to severely malnourished children
- ❑ Stimulation of insulin production
- ❑ Influx of intracellular ions to the cells (phosphorus, potassium, magnesium)
- ❑ Severe extracellular hypophosphatemia, hypokalemia, hypomagnesemia
- ❑ Symptoms: CHF, seizures, coma, respiratory distress
- ❑ Start refeeding at 40%-50% of estimated caloric goal
- ❑ Check levels 2-3 times daily initially
- ❑ Phosphorus supplementation may be necessary