

Nutrition in Infancy and Childhood

Infant Nourishment Part 2

- ### Infant Nourishment
- Objectives:
- To discuss critical nourishment issues for infants to support appropriate growth and development
 - To describe the influence of specific nutrients on growth and development
 - To describe typical patterns of infant nourishment



- ### Nutritional Influences on 'Growth'
- Growth & protein-energy ratio
 - Growth & protein quality
 - Growth & fluid requirements
 - Growth & specific nutrient deficiency

Protein content of milks

• Food	Pro (gm/oz)
• Human milk	0.3
• Infant formulas	0.5
• Infant soy formulas	0.5
• Homogenized milk	1.0

Estimated requirements for energy & protein

Age (mo)	Energy kcal/kg/day	Protein gm/kg/day
0-1	115	1.98
1-2	112	1.71
2-3	100	1.46
4-5	94	1.18
5-6	92	1.18
9-12	92	1.14

Formula intake varies widely and supports growth

Age	10 th	50 th	90 th
1 mo	14	20	28
2 mo	23	28	34
3 mo	25	31	40
4 mo	27	31	39
5 mo	27	34	45
6 mo	30	37	50

Water requirements

Age	Water req (ml/kg/day)	Wt(kg)	Intake (ml)
10 da	125-150	3	375-450
3 mo	140-160	5	700-800
6 mo	130-155	8	1040-1240
1 yr	125-135	10	1200-1350
2 yr	115-125	15	1725-1875

Fluid needs vary with age, ambient temp, etc
Does not include cola, juice, etc

Water- prudent recommendation

- 1.5 ml/kcal of energy expenditure of infants
- Criteria for recommendation
 - large surface area per unit of body weight
 - Higher %age of body water
 - High rate of water turnover
 - Limited capacity of kidneys to handle solute load from high protein intakes required for growth
 - Susceptibility to dehydration
 - Inability to express thirst

Recommendation corresponds to water-energy ratio in human milk and formulas

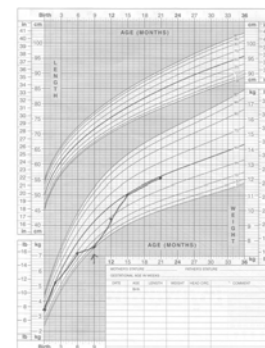
‘Growth’ and Specific Nutrients

- Energy
- Protein
- Water
- Calcium
- Zinc
- Iron
- Vitamin B12
- Vitamin D
- Vitamin A
- Folate
- Vitamin C
- Biotin
- Chloride
- Thiamine

Calcium, zinc, iron

- Deficiency (in the presence of adequate intake of other nutrients) leads to growth failure

Iron deficiency anemia



Vitamin B12

- No reports of overt toxicity
- Overt deficiency documented among infants and children who are fed no animal foods & are not supplemented
- 15 mo old infant
- Breastmilk only, 10 x/day
- Appeared well-nourished
- Refused solids
- Demonstrated developmental delay
- < blood B12, folate, Fe

Vitamin B12

- Mother, appeared well-nourished
- taking extra Vit A, 100ug B12, 3-4000mg Vit C/day
- Reluctant to D/C breastfeeding
- Worried re: intro of solids, allergies
- Infant treatment
 - supplemented
 - folic acid, iron
 - 1000 ugB12 IM
 - PolyViFlor
- Infant outcome
 - fully recovered

Vitamin D

- Most toxic of fat soluble vitamins
- Infants susceptible to toxicity
- Signs - cerebral, cardiovascular, renal damage
- Problems with excess supplementation
- 3-4000IU/day = hypercalcemia
- Excess Vit D = calcium deposits in soft tissue, can =>irreversible kidney damage

Vitamin D deficiency rickets

- At risk:
 - Long term breast feeding, w/o suppl
 - Dark skinned children w limited exposure to sunlight
 - No animal products, no supplementation, no fortified milk
- Classic symptoms of deficiency
 - delayed motor function
 - hypotonia
 - bowing of legs
 - abnormal gait
 - saber shins

Vitamin D deficiency rickets

- Recommendation
 - Infants = 200 IU/day minimum beginning in 1st 2 mo of life
- Toxicity
 - 3000-4000 IU/day

Vitamin A

Recommendation= 1000 IU/day

- Deficiency
 - night blindness
 - skin lesions, hair loss, blurred vision, diarrhea
 - liver, kidney, bone damage
- Toxicity
 - 3000 supplemented RE (10,000 IU/day) daily for a year
 - Infant who was fed chicken livers daily
 - Infants who receive adult supplements

Vitamin A

- A. 7 mo old twins with irritability, vomiting, bulging fontanels
 - Intake: 4 oz chicken liver/day for 4 mo
- B. Infant fed 18,500 IU daily for 1 mo
 - Liver = 15,000 IU/oz
 - Vitamins = 3600 IU
 - Formula = 400 IU
 - Carrots, squash = 4000 IU provitamin A

Recommendation: infants: 1000 IU/day
Toxicity: 3000ugRE (10,000IU)/day for a year

Ascorbic acid

- Deficiency
 - scurvy
- Excess
 - nausea, diarrhea
- Recommendation:
 - Infants = 35 mg
- Toxicity
 - 1-2 gm/day
- Chewables
 - dental enamel erosion?

Folate, Vitamin C, Biotin, Chloride, Thiamine

- Single nutrient deficiency in infant formulas have led to growth failure, neurological damage and death



What are the nutritional recommendations for infants and toddlers?

- Breast milk or formula provides adequate nutrition up to the age of one year.
 - Breast milk has important immunogenic properties
- Solid food are introduced beginning at 4-6 months- developmental readiness
- 'Least-allergic' foods introduced first
 - e.g., rice cereal
 - additional foods added gradually, one at a time.
- Whole cow's milk can be used after age 1 year.

Supplements for the first 6 months

- Breast milk
 - Vitamin D = 400 IU
 - Fluoride = 0.01-0.25 mg
- Commercial infant formula
 - fluoride= none if in water or 0.25 mg
 - iron+ 5-10 mg at 4 mo..

Children for whom Vitamin and Mineral Supplements are Recommended for Children-

- particularly at risk for limited nutrient intake
- with milk allergy or lactose intolerance
 - ↓ riboflavin, Vit D, calcium
- exclusively fed goat's milk
 - ↓ folacin
- semi-synthetic diets
- whose families have chosen to be vegetarian or vegan
- with restricted variety - by personal choice

Introducing Solid Foods

- Why introduce solids?
 - Develop oral motor skills, add nutrients
- Foods to support developmental progress-Which foods? When to add?
 - Cereal, fruits, vegetables, juices, crackers
- Foods to provide specific nutrients
 - Calcium, iron, protein, vitamin C, vitamin D
- Oral health concerns

Potential disadvantages of early introduction of solid foods

- Poor oral motor coordination
- Insufficient energy and nutrient replacement for breastmilk or infant formula
- Increased risk of food allergies
- Disturbance of appetite regulation, may encourage overfeeding
- May increase the infant's desire for sugar and salt intake later in life

Consequences of too early weaning

- Risk of increased morbidity due to diarrhea and food allergies
 - due to intestinal immaturity
- Decreased breastmilk production
 - displaced by weaning foods
- Malnutrition
 - due to diarrheal disease

Consequences of delayed weaning

- Faltering growth
 - breast milk alone provides inadequate energy
- Depressed immunity
 - due to inadequate energy & protein intake
- Increased diarrheal disease
 - due to depressed immunity
- Malnutrition
 - due to inadequate energy, diarrheal disease
- Micronutrient deficiencies
 - due to inadequate dietary intake, increased needs with infection

Food Patterns - Appropriate Energy Intakes

Age	2 mos	4-6 mo	9-12 mo	1-3 yrs
Energy (kcal)	500	750	850	1000
Appropriate milks	28-32 oz human milk or formula	28 oz human milk or formula	24 oz human milk or formula	24 oz milk
Appropriate foods		4 TB dry cereal 4 oz fruit juice 4 TB chopped fruit 5 TB vegetable 5 TB strained fruit	4 TB dry cereal 4 oz fruit juice 4 TB chopped fruit 4 TB chopped vegetable 6 TB chopped meat 1/2 sl toast 2 TB ice cream 2 graham crackers	4-24 c dry cereal 8-8 oz fruit juice med apple sm banana 1/2 c green beans 1 oz lean hamburger 1/2 c macaroni & cheese 1 TB peanut butter 1 tsp jelly 1 slice bread 1 graham cracker 1/3 c ice cream

Foods as sources of iron

Food	Measure	Iron (mg)
Iron-fortified formula	8 oz	2.9
Infant cereal, rice	1 TB	1.7
Strained meats with vegetables	2 TB	0.1
Strained beef	2 TB	0.5
Meats	2 oz	1.2
Egg	1	0.7
Peanut butter	1 TB	0.3
Bread, enriched, white	1 slice	0.7
Macaroni, enriched, cooked	1/2 c	0.5
Vegetables	1/4 c	0.2
Fruits	1/4 c	0.1
CherryOs	1/4 c	1.2
Rice Chex	1/4 c	1.0

