Lifecycle Nutrition Part I
Pregnancy to Adolescence

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Learning Objectives - Pregnancy

- List the lifestyle factors that predict a successful pregnancy outcome.
- Describe the physiological changes and processes during pregnancy and breastfeeding.
- Describe the special nutritional needs of pregnant and lactating women, summarize factors that put them at risk for nutritional deficiencies, and plan a nutritious diet for them.
- Discuss nutrition-related problems that can occur during pregnancy and lactation and suggest techniques for coping with these problems.

Learning Objectives – Infancy to Adolescence

- Describe normal growth and development during infancy, childhood, and adolescence and the effect of nutrition on growth and development.
- List the nutritional needs and feeding of infants, children, and adolescents.
- Explain the factors that affect the food intake of children and adolescents.
- Describe the nutrition-related problems that may occur during the growing years and their impact on future health.

Pre-Conception

- Many pre-conception practices can be harmful to the fetus
- Women often do not suspect they are pregnant during first few weeks
  - May not seek medical care until 2 – 3 months
- Minimize exposure even prior to conception
- Nutrition is important!!
- ~50% of all pregnancies are unplanned

The First Trimester

- Normal pregnancy: 38-40 weeks
- First 13 to 14 weeks of pregnancy
  - Rapid increase in cell number and size – most organs formed during this stage
  - Nutritional deficiency or toxicity can be harmful to embryo
  - Medication, radiation, trauma can be harmful to embryo
- 26% of pregnancies end in miscarriage, 80% of these losses typically in the first trimester
- Quality of nutritional intake more important than quantity

Fetus at 7 weeks gestation (Babycenter.com)

The Second Trimester

- Fetus weighs about 1 ounce
  - Begins to look more like an infant
- Still susceptible to toxin exposure
- Preparation for lactation
  - Increase in milk-producing cells
  - Deposit of fat tissue including 2 to 4 pounds of fat in breast tissue
- Nutritional deficiency at this time affects mother's ability to breastfeed

Fetus at 20 weeks gestation (Babycenter.com)

The Third Trimester

- Rapid growth – increases most during the last trimester
  - Fetus doubles in length
  - Weight increases 3 to 4 times
- Transfer of fat, calcium, and iron to fetus during the last month
- Fetus may deplete mother's store of iron if her iron intake is low
- Full-term fetus weighs 7 to 9 lbs, 20 inches long

Fetus at 34 weeks gestation (Babycenter.com)

What Defines a Successful Pregnancy?

- Mother's physical and emotional health protected
- Infant success criteria:
  1. Gestation > 37 weeks
     - Sufficient lung development
     - As gestation ↑, health risk ↓
  2. Birth weight > 5.5 pounds

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LBW and SGA

- Low birth weight (LBW)
  - Less than 5.5 pounds
  - Usually due to preterm birth
  - Increased medical costs
- Small for gestational age (SGA)
  - Full-term or preterm babies
  - Weigh less than expected for length of gestation → insufficient growth
  - More likely to have medical complications

Determinants of Success

- Prenatal care
- Maternal age
  - Ideal = 20 – 35 years
- Closely spaced and multiple births
- Exposure to toxic agents
- Food safety
- Pre-pregnancy BMI
- Nutritional status

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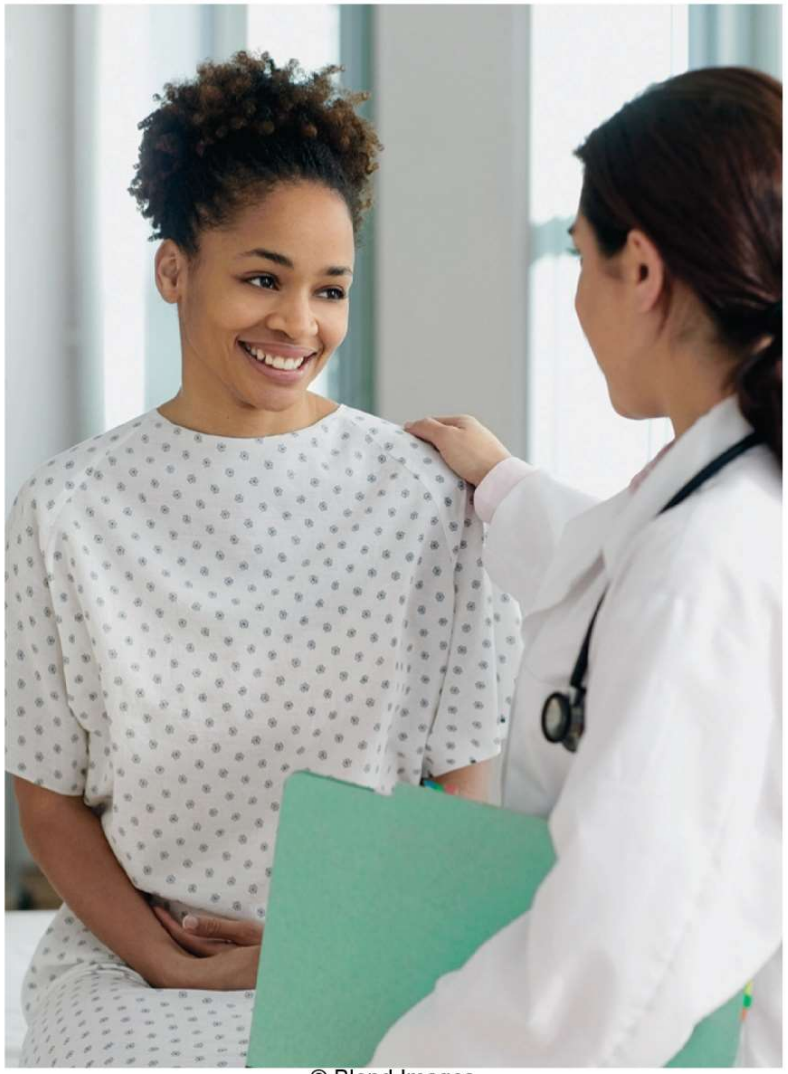

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Pre-pregnancy BMI

Aim for healthy body weight prior to conception

- Infants born to over/underweight women are more likely to have problems

Obese women

- Infants have increased risk of birth defects, death early in life, obesity in childhood
- Moms risk high blood pressure, gestational diabetes, difficult deliveries

Underweight women

- Infants more likely to be low birth weight, premature
- Moms have lower nutrient stores (iron)

Nutritional Status

- Good nutrition
  - Supports fetal growth
  - Improves pregnancy outcomes, prevents birth defects
- Inadequate calories (≤ 1000 kcal) greatly restricts fetal growth and development

Women, Infants and Children (WIC)

Low socioeconomic status associated with problems in pregnancy

- Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) provides health assessments and food vouchers

Energy Needs During Pregnancy

- 1st trimester
  - Balanced and adequate diet
- 2nd and 3rd trimester
  - 350-450 extra kcal per day
- Appropriate weight gain is the best predictor of outcome

Recommended Weight Gain During Pregnancy

- 2 - 4 lb. weight gain during 1st trimester, 0.8 - 1 lb. / week thereafter

Prepregnancy BMI Category	Total Weight Gain* (pounds)	(kilograms)
Low (BMI less than 18.5)	28 to 40	12.5 to 18
Normal (BMI 18.5 to 24.9)	25 to 35	11.5 to 16
High (BMI 25.0 to 29.9)	15 to 25	7 to 11.5
Obese (BMI greater than 30.0)	11 to 20	5 to 9

Protein, Carbohydrate, and Water Needs

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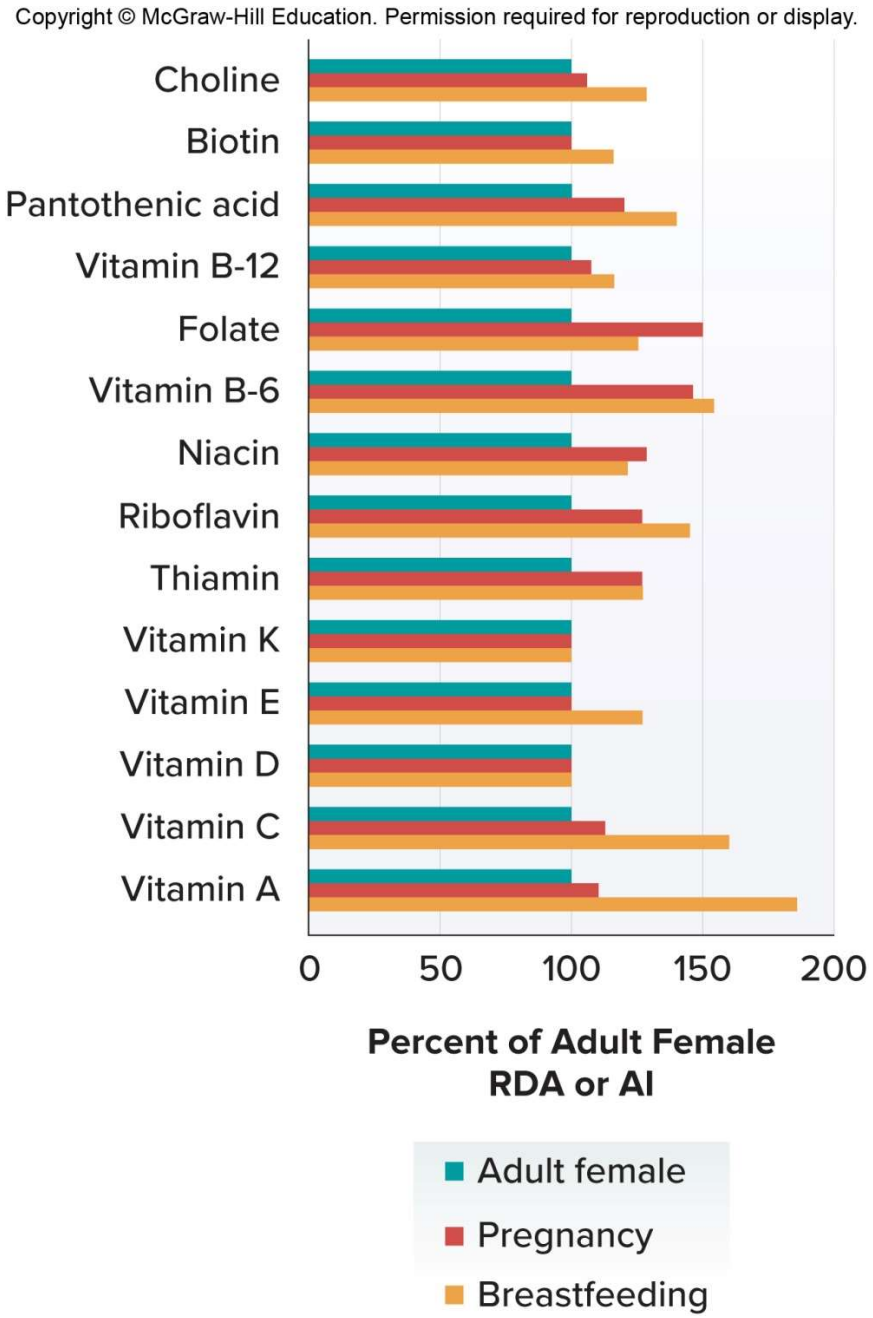
- RDA for protein
  - Additional 25 grams per day
  - Many (nonpregnant) women already consume recommended amount
- RDA for carbohydrate
  - Increases to 175 grams per day
  - Most women exceed this amount
- Adequate intake for total water
  - Pregnancy: 3 liters (~12-1/2 cups) per day
  - Breastfeeding: 3.8 liters (16 cups) per day

Lipid (Fat) Recommendations

- 20-35% of total calories from fat
  - 10% or less from saturated fat
  - Avoid trans fat
- Omega-6 and omega-3 required for fetal growth, brain, eye development
  - 13 g/day Omega-6
  - 1.4 g/day Omega-3
- Consume fatty fish 2x/week, BUT
  - Avoid tilefish, swordfish, shark, king mackerel, largemouth bass
  - Limit albacore tuna to 6 oz./week
  - Limit total intake to 12 oz./week

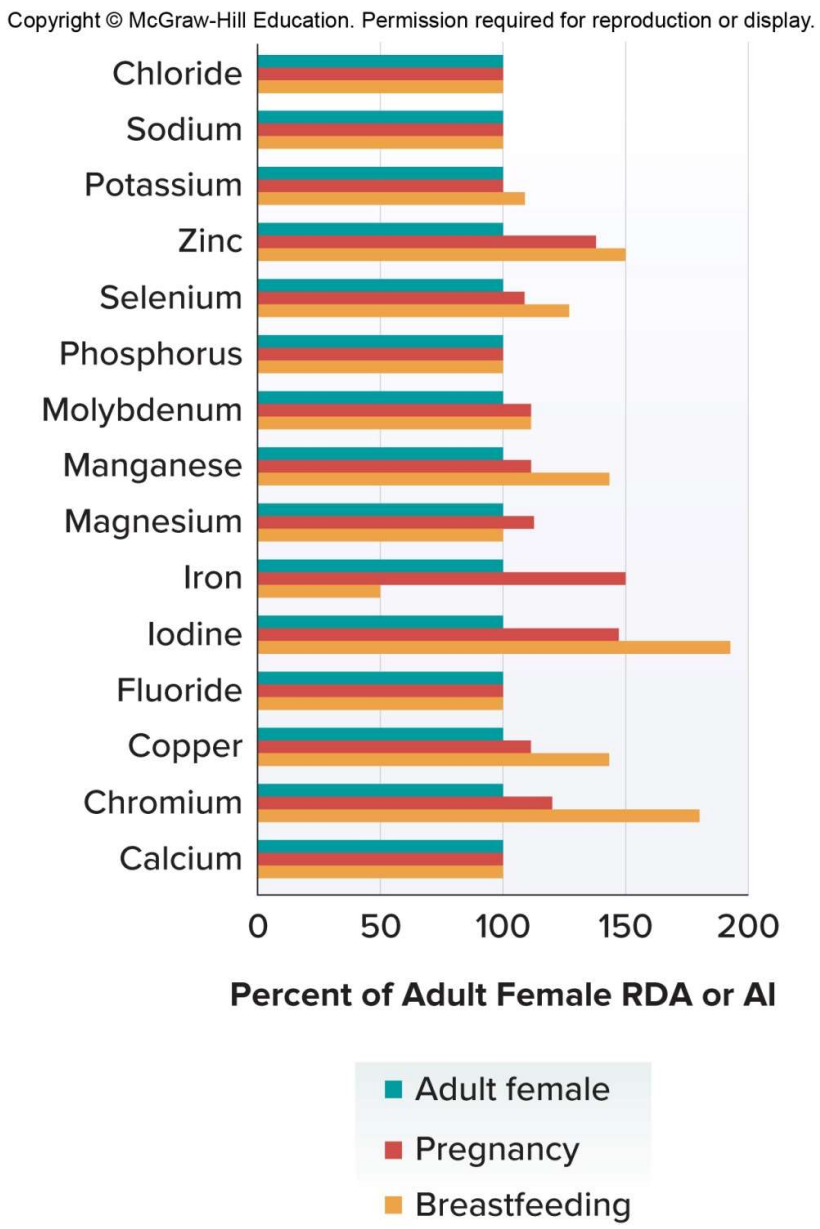
Vitamin Needs

- Vitamin RDAs/AIs increase during pregnancy
  - **Folate** (600 mcg/day) needed for:
    - Synthesis of DNA for fetal and maternal growth
    - Prevention of neural tube defects
    - ↑ red blood cell formation
  - **Vitamin D** (RDA = 15 mcg/day; 600 IU)
    - Dietary intake often insufficient
    - Experts recommend 25 mcg/day (1000 IU)



Mineral Needs

- Mineral needs generally increased during pregnancy
- **Iron** (27 mg/day)
  - Screen for iron deficiency
  - Provide iron supplements if deficient
- **Zinc** (11 mg/day) to support growth and development
- Adequate intake of calcium



Iron Needs

- Need increases to support woman's increased blood volume, build fetus's iron stores
- Iron supplements can cause decreased appetite, nausea, constipation
  - Take between meals, before bed
  - Be aware of nutrient-nutrient interaction
  - Maximize bioavailability (vitamin C)
- Possible effects of iron-deficiency anemia
  - Preterm delivery
  - Low birth weight
  - Fetal death

Use of Prenatal Vitamin and Mineral Supplements

- Dietary intakes of pregnant women generally adequate
- Prenatal supplements routinely prescribed
  - folic acid and iron
  - may be advantageous for reducing LBW and SGA births
- Vitamin A should not exceed 3000 µg RAE/day
  - Teratogenic effect in high doses
  - Facial, cardiac, and other defects

- Recommended especially if
  - living in poverty
  - teenagers
  - inadequate diet
  - carrying multiple fetuses
  - smoke or use alcohol or illegal drugs
  - vegan

Physical Activity

- 30 min/day of moderate-intensity physical activity minimum
- Consult physician about possible limitations
  - High risk pregnancies may need to restrict activities

Breastfeeding

- AAP and AND recommend exclusive breastfeeding for first 6 months of life
  - Breast milk + complementary foods for 1 year
  - WHO recommends 2 years
- Almost all women are physically capable
  - Main barriers: lack of knowledge, support, experience
- Monitoring of breastfed infants important
  - Risk of dehydration

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Human Milk Production

- Breasts form milk-producing cells during pregnancy
  - Lobules: saclike structures in the breast that store milk
- Hormones stimulate changes in breast
  - Prolactin stimulates ability to make milk
  - Oxytocin causes contraction of tissues to release milk from storage
- Human milk contains proteins, fats, and enzymes
  - Synthesized in breast tissue and from mother's blood and diet (fats)

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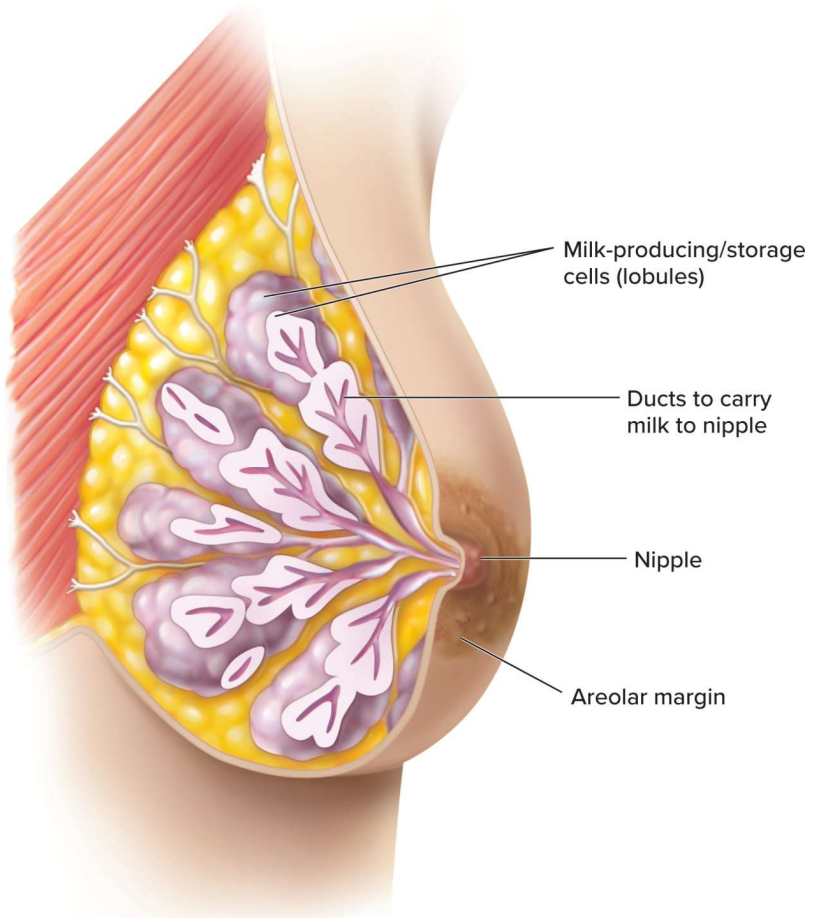


Well-Nourished Breastfed Infant

1. Infant has 3 to 5 wet diapers a day in first few days of life, increases to 6-8 after first week of life
2. Shows normal weight gain
3. Pass several stools per day

In addition:

- Softening of breast tissue during the feeding
  - Indicates milk is being consumed
- Consult primary care provider if infant not consuming enough

Human Milk > Cow's Milk

- Unless altered, cow's milk never used until at least 12 months
  - Too high in minerals and protein, not enough carbohydrate
  - Protein harder to digest, triggers allergies
- Human milk higher in CHO, lower in minerals and protein than cow's milk
- Easily digested proteins (human milk)
- Contains healthy fats for brain development, central nervous system and eyes.
  - High linoleic acid
  - Cholesterol content
  - Omega 3 fats

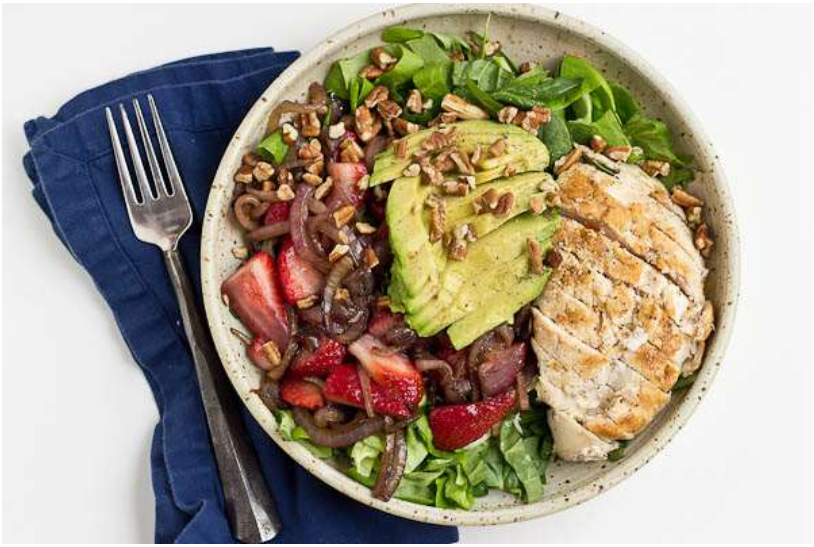
Photo: epidemicanswers.org

Additional Water or Juice?

- Human milk: Provides adequate hydration for baby
- AAP advises against supplemental water or juice during first 6 months
- Too much water
  - Leads to brain disorders
  - Causes low blood sodium

Lactation Nutritional Needs

- Most substances ingested are secreted into mother's milk
- Milk production requires ~670 kcal/day
- Kcal difference will contribute to mother's gradual weight loss
  - Post pregnancy weight loss 1 – 4 lbs./month
- Continue adequate calories, fluids and restricting alcohol, high mercury fish and other substances that can pass into milk



Environmental Contaminants in Breast Milk

Measures to prevent contaminants:

1. Consume a variety of foods within each food group
2. Avoid freshwater fish from polluted water and high mercury seafood
3. Carefully wash and peel fruits and vegetables
4. Remove fatty edges from meats
5. Choose organic produce from dirty dozen list if within means

Photo: ModernFarmer.com

The Growing Infant

- Rapid growth rate
- Weight
  - Doubles by 4–6 months
  - Triples by 1 year
- Length
  - Increases by 9-11 inches in the first year
- Nutrients needed to support proper growth
  - Calories, protein, calcium, iron, zinc, and other nutrients
- Inadequate nutrition (including fat) can inhibit growth
  - Overnutrition more prevalent in North America

Photo: BabyCenter.com

Effects of Undernutrition

- Growth is an indicator of nutritional health
  - Short term: weight
  - Long term: length
- Eating poor diet during stages of infancy or childhood hampers cell division
- Smaller in size (height and weight)
- Adequate diet later won't compensate for lost growth
- Death, in severe cases

Assessment of Growth

- Growth charts
  - Height and weight correspond to a percentile
  - 50th percentile is considered average
- Head circumference
  - Brain growth is fastest in infancy
- Over- and underfeeding
  - Overfeeding increases number of adipose cells
  - Underfeeding may affect organ development
  - Unwise to restrict diet

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Birth to 36 months: Boys
Length-for-age and Weight-for-age percentiles

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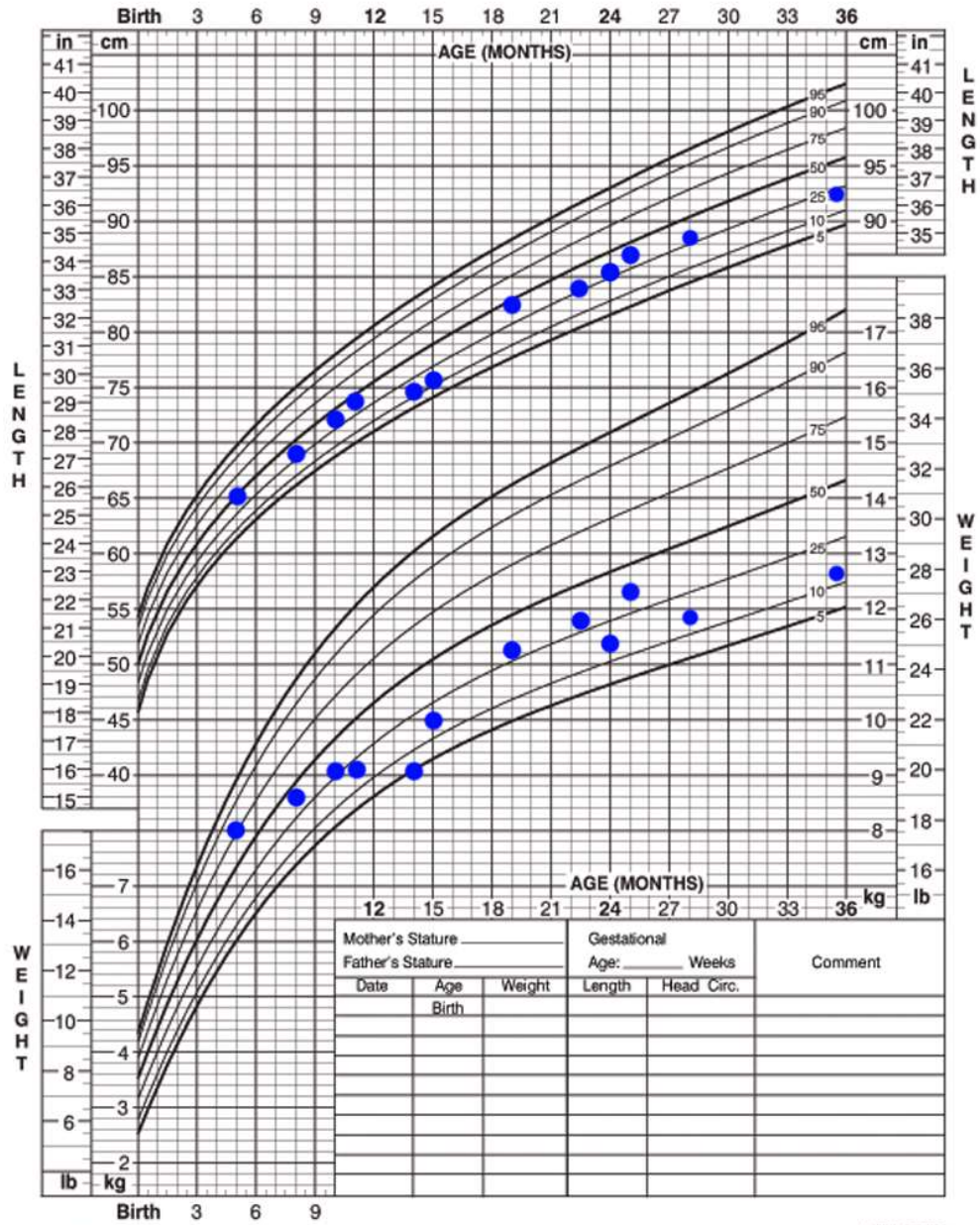

Published May 30, 2000 (modified 4/20/01).
SOURCE: Developed by the National Center for Health Statistics in collaboration with the National Center for Chronic Disease Prevention and Health Promotion (2000).
http://www.cdc.gov/growthcharts

CDC
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Failure to Thrive

- About 5% to 10% infants and children do not grow as expected
- **Failure to thrive** is defined as decelerated or arrested physical growth and is associated with abnormal growth and development.
- Can have specific medical cause (heart issues, infection)
- 80% have no apparent disease
  - Poverty, food insecurity
  - Poor parent-infant interactions
  - Parent inexperience with infant feeding
- Infants need
  - Physical contact, eye contact
  - Proper nutrition without restrictions

Calorie Needs

- Highest energy needs per unit of body weight
  - Rapid growth and high metabolic rate
- ~700 kcal/day for a 6 month old child
  - 47 kcal/lb, compared to 16 kcal/lb for 20 year old woman
- Breast milk, formula provide sufficient kcals up to 6 months

Age	EER Equation
0 to 3 months	(89 kcal × weight in kilograms) + 75
4 to 6 months	(89 kcal × weight in kilograms) – 44
7 to 12 months	(89 kcal × weight in kilograms) – 44
13 to 35 months	(89 kcal × weight in kilograms) – 80

Carbohydrate Needs

- Age 0-6 months
  - 60 grams/day
- Age 7-12 months
  - 95 grams/day
- Based on typical intake of human milk by breastfed infants plus introduction of solid foods @ 6 months
- No AI for fiber < 2 years
  - Work up to ~ 5 g/day between 6 months and 1 year

Photo: BabyCenter.com

Protein Needs

- 9 - 11 grams/day (based on age)
- Half should be from essential amino acids
- Breast milk, formula provide sufficient protein
- High protein diet
  - Stress on kidneys
  - Excess nitrogen and minerals exceed abilities of immature kidneys

Photo: KinderSay.com

Fat Needs

- 30 grams /day
  - 15% of total fat should be essential fatty acids
  - DHA, arachidonic acid supplied by human milk, formula
- Vital to nervous system development (brain, eyes)
  - Half of the energy supplied by breast milk and formula comes from fat
  - Restriction of fat intake not advised under 2 years