Chapter 13: Life Cycle
Nutrition: Mother and Infant

PowerPoint Lectures for
Nutrition: Concepts and Controversies, eleventh edition
Frances Sizer and Ellie Whitney

Lectures by Judy Kaufman, Ph.D.
All people need the same nutrients, but the amounts we need change as we move through life.

Both parents can prepare in advance for a healthy pregnancy.
Pregnancy: The Impact of Nutrition on the Future

• A pregnant woman must understand that her nutrition today is critical to the health of her future child throughout life.

• The nutrient demands of pregnancy are extraordinary.
Preparing for Pregnancy

• Before she becomes pregnant, a woman must establish eating habits that will optimally nourish both the growing **fetus** (8 weeks - birth) and herself.

• The **embryo** (3 week - 8 week) undergoes significant and rapid developmental changes that depend on good nutrition.

• Certain lifestyles can impair **fertility**.
Prepregnancy Weight

• A woman who starts out underweight and who fails to gain sufficiently during pregnancy is likely to have a low-birthweight baby (< 5 ½ pounds).

• Low birthweight babies are associated with:
  – Lower adult IQ, short stature, chronic diseases
Other causes of low birth

- Heredity
- Disease conditions
- Smoking
- Drug use
- Unknown reason
Prepregnancy Weight

- Obese women are also urged to strive for healthy weight gains *before* pregnancy.
- Babies born to obese mothers are more likely to have heart defects, neural tube defects, and other problems.
• A major reason the mother’s nutrition before pregnancy is so crucial is that it determines whether her **uterus** will be able to support the growth of a healthy **placenta** during the first month of **gestation**.

• The placenta also produces hormones that act in many ways to maintain pregnancy and prepare the mother’s breasts for **lactation**.
A Healthy Placenta and Other Organs

In the placenta, maternal blood vessels lie side by side with fetal blood vessels that reach the fetus through the umbilical cord.

The arrows indicate the direction of blood flow.

Fingerlike projections containing fetal blood vessels extend into the pool of mother’s blood. No actual mingling of fetal and maternal blood occurs, but substances pass back and forth.

Thus, oxygen and nutrients from the mother’s blood enter fetal vessels, and waste products are removed.

Mother’s veins carry fetal wastes away.

Mother’s arteries bring fresh blood with oxygen and nutrients to the fetus.
The Events of Pregnancy

• The newly fertilized ovum, called a zygote, begins as a single cell and divides many times during the days after fertilization.

• Within 2 weeks, the zygote embeds itself in the uterine wall in a process known as implantation.

• Adverse influences such as drug abuse, smoking and malnutrition can lead to abnormalities such as neural tube defects.
The 40 or so weeks of pregnancy are divided into thirds, each of which is called a trimester.
A Note about Critical Periods

- Each organ and tissue type grows with its own characteristic pattern and timing.
- The development of each takes place only at a certain time—the critical period.
- If the development of an organ is limited during a critical period, recovery is impossible.
A Note about Critical Periods

<table>
<thead>
<tr>
<th>TABLE 13-1</th>
<th>Factors Placing Pregnant Women at Nutritional Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Women likely to develop nutrient deficiencies and pregnancy complications include those who:</td>
<td></td>
</tr>
<tr>
<td>- Are young (adolescents).</td>
<td></td>
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<tr>
<td>- Have had many previous pregnancies (3 or more to mothers under age 20; 4 or more to mothers age 20 or older).</td>
<td></td>
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<tr>
<td>- Have short intervals between pregnancies (&lt;18 months).</td>
<td></td>
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<tr>
<td>- Have a history of poor pregnancy outcomes.</td>
<td></td>
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<tr>
<td>- Lack nutrition knowledge, have too little money to purchase adequate food, or have too little family support.</td>
<td></td>
</tr>
<tr>
<td>- Consume an inadequate diet due to food faddism, preferences, weight-loss “dieting,” uninformed vegetarianism, or eating disorders.</td>
<td></td>
</tr>
<tr>
<td>- Smoke cigarettes or use alcohol or illicit drugs.</td>
<td></td>
</tr>
<tr>
<td>- Are lactose intolerant or suffer chronic health conditions requiring special diets.</td>
<td></td>
</tr>
<tr>
<td>- Are underweight or overweight at conception.</td>
<td></td>
</tr>
<tr>
<td>- Are carrying twins or triplets.</td>
<td></td>
</tr>
<tr>
<td>- Gain insufficient or excessive weight during pregnancy.</td>
<td></td>
</tr>
<tr>
<td>- Have a low level of education.</td>
<td></td>
</tr>
</tbody>
</table>
Increased Need for Nutrients

The increased need for iron in pregnancy cannot be met by diet or by existing stores. Therefore, iron supplements are recommended during the 2nd and 3rd trimesters.
Calorie Increases

- **2nd Trimester**
  340 calories

- **3rd Trimester**
  450 calories
• Pregnancy brings physiological adjustments that demand increased intakes of energy and nutrients.

• A balanced diet that includes more nutrient-dense foods from the five food groups can help to meet these needs.
Of Special Interest: Folate and Vitamin $B_{12}$

- Due to their key roles in cell reproduction, folate and vitamin $B_{12}$ are needed in large amounts during pregnancy.

- Folate plays an important role in preventing neural tube defects.
  - One type is **anecephaly**, when the brain fails to develop,
  - Another is **spina bifida**, when the membranes covering the spinal cord protrude from the sac.
  - Neural tube develops to form the brain and spinal cord
Of Special Interest: Folate and Vitamin $B_{12}$

Normally, the bony central chamber closes fully to encase the spinal cord and its surrounding membranes and fluid. In spina bifida, the two halves of the slender bones that should complete the casement of the cord fail to join.

In the serious form shown here, membranes and fluid have bulged through the gap and nerves are exposed, invariably leading to some degree of paralysis and often to mental retardation.
### Rich Folate Sources

<table>
<thead>
<tr>
<th>Natural Folate Sources</th>
<th>Folate Amounts (μg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liver (3 oz)</td>
<td>221 μg</td>
</tr>
<tr>
<td>Lentils (½ c)</td>
<td>179 μg</td>
</tr>
<tr>
<td>Chickpeas or pinto beans (½ c)</td>
<td>145 μg</td>
</tr>
<tr>
<td>Asparagus (½ c)</td>
<td>131 μg</td>
</tr>
<tr>
<td>Spinach (1 c raw)</td>
<td>131 μg</td>
</tr>
<tr>
<td>Avocado (½ c)</td>
<td>45 μg</td>
</tr>
<tr>
<td>Orange juice (1 c)</td>
<td>74 μg</td>
</tr>
<tr>
<td>Beets (½ c)</td>
<td>68 μg</td>
</tr>
<tr>
<td>Multi-Grain Cheerios Plus cereal (1 c)</td>
<td>400 μg&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Product 19 cereal (1 c)</td>
<td>400 μg&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Total cereal (1 c)</td>
<td>400 μg&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Pasta, cooked (1 c)</td>
<td>110 μg</td>
</tr>
<tr>
<td>Rice, cooked (1 c)</td>
<td>134 μg</td>
</tr>
<tr>
<td>Bagel (1 small whole)</td>
<td>75 μg</td>
</tr>
<tr>
<td>Waffles, frozen (2)</td>
<td>36 μg</td>
</tr>
<tr>
<td>Bread, white (1 slice)</td>
<td>28 μg</td>
</tr>
</tbody>
</table>

<sup>a</sup>Folate amounts for these and 2,000 other foods are listed in the Table of Food Composition in Appendix A.

<sup>b</sup>Folate in cereals varies; read the Nutrition Facts panel of the label.
Calcium, Magnesium, Iron, and Zinc

- Among the minerals, *calcium*, *phosphorus*, and *magnesium* are in great demand during pregnancy because they are necessary for normal development of the bones and teeth.

- During pregnancy, the body avidly conserves iron and absorption increases up to threefold.
  - Iron needs of fetus have priority over mother.
Zinc, required for protein synthesis and cell development, is vital during pregnancy.
Women most likely to benefit from prenatal multivitamin-mineral supplements during pregnancy include those who do not eat adequately, those carrying twins or triplets, and those who smoke cigarettes or are alcohol or drug abusers.
Food Assistance Programs

- Food assistance programs such as **Special Supplemental Food Program for Women Infants and Children (WIC)** can provide nutritious food for pregnant women of limited financial means.

- USDA program

- Low income pregnant and lactating women

- Women w/infants and/or preschoolers

- Coupons for specific foods that are considered to have necessary nutrients
How Much Weight Should a Woman Gain during Pregnancy?

- Weight gain is essential for a healthy pregnancy.

- A woman’s prepregnancy BMI, her own nutrient needs, and the number of fetuses she is carrying help to determine appropriate weight gain.
# How Much Weight Should a Woman Gain during Pregnancy?

<table>
<thead>
<tr>
<th>Prepregnancy Weight</th>
<th>For single birth</th>
<th>For twin birth</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Underweight (BMI &lt; 18.5)</strong></td>
<td>28 to 40 lb</td>
<td>Insufficient data to make recommendation</td>
</tr>
<tr>
<td></td>
<td>(12.5 to 18.0 kg)</td>
<td></td>
</tr>
<tr>
<td><strong>Healthy weight (BMI 18.5 to 24.9)</strong></td>
<td>25 to 35 lb</td>
<td>37 to 54 lb</td>
</tr>
<tr>
<td></td>
<td>(11.5 to 16.0 kg)</td>
<td>(17.0 to 25.0 kg)</td>
</tr>
<tr>
<td><strong>Overweight (BMI 25.0 to 29.9)</strong></td>
<td>15 to 25 lb</td>
<td>31 to 50 lb</td>
</tr>
<tr>
<td></td>
<td>(7.0 to 11.5 kg)</td>
<td>(14.0 to 23.0 kg)</td>
</tr>
<tr>
<td><strong>Obese (BMI ≥30)</strong></td>
<td>11 to 20 lb</td>
<td>25 to 42 lb</td>
</tr>
<tr>
<td></td>
<td>(5.0 to 9.0 kg)</td>
<td>(11.0 to 19.0 kg)</td>
</tr>
</tbody>
</table>
Should Pregnant Women Be Physically Active?

- Physically fit women can continue to be physically active throughout pregnancy.
- Pregnant women should be cautious in their choices of activities.
<table>
<thead>
<tr>
<th><strong>DO</strong></th>
<th><strong>DON’T</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Do exercise regularly (at least three times a week).</td>
<td>Don’t exercise vigorously after long periods of inactivity.</td>
</tr>
<tr>
<td>Do warm up with 5 to 10 minutes of light activity.</td>
<td>Don’t exercise in hot, humid weather.</td>
</tr>
<tr>
<td>Do 30 minutes or more of moderate physical activity on most, if not all, days of the week.</td>
<td>Don’t exercise when sick with fever.</td>
</tr>
<tr>
<td>Do cool down with 5 to 10 minutes of slow activity and gentle stretching.</td>
<td>Don’t exercise while lying on your back after the first trimester of pregnancy or stand motionless for prolonged periods.</td>
</tr>
<tr>
<td>Do drink water before, after, and during exercise.</td>
<td>Don’t exercise if you experience any pain or discomfort.</td>
</tr>
<tr>
<td>Do eat enough to support the additional needs of pregnancy plus exercise.</td>
<td>Don’t participate in activities that may harm the abdomen or involve jerky, bouncy movements.</td>
</tr>
<tr>
<td>Do rest adequately.</td>
<td>Don’t scuba dive.</td>
</tr>
</tbody>
</table>
Teen Pregnancy

• Each year in the U.S. more than 400,000 infants are born to adolescent girls.

• Of all the population groups, pregnant teens have the highest nutrient needs and an increased likelihood of having problem pregnancies.

• Teenagers have a hard time meeting their own nutritional needs.

• Deficiencies in B12, D, folate, iron
Why Do Some Women Crave Pickles and Ice Cream While Others Can’t Keep Anything Down?

• Food cravings usually do not reflect physiological needs, and some may interfere with nutrition.

• Nausea arises from hormonal changes of pregnancy.
Some Cautions for the Pregnant Woman

• Some choices that pregnant women make or substances they encounter can harm the fetus, sometimes severely.
Cigarette Smoking

- A surgeon general’s warning states that parental smoking can kill an otherwise healthy fetus or newborn.
  - Nicotine and cyanide in cigarettes are toxic to the fetus
  - Smoking limits the oxygen delivered to the fetus
  - Can damage fetal chromosomes
  - Risk of low-birthweight baby
  - Increased risk of sudden infant death syndrome (SIDS)
  - Even environmental tobacco smoke is unhealthy
Medicinal Drugs and Herbal Supplements

- Medicinal drugs taken during pregnancy can cause serious birth defects.
- Herbal supplements have not been adequately tested for safety or effectiveness during pregnancy.
Drugs of Abuse

- Illicit drugs such as marijuana and cocaine can cause serious health problems, including nervous system disorders to the fetus.
- Infants born to mothers who use crack and other forms of cocaine face low birthweight, heartbeat abnormalities, the pain of withdrawal or even death.
• Infants and young children of pregnant women exposed to lead show signs of delayed mental and psychomotor development.

• Mercury in some fatty fish can damage the developing brain and nervous system of the fetus.
Vomiting and diarrhea caused by foodborne illnesses can leave a pregnant woman exhausted and dangerously dehydrated.

- **Listeriosis** (bacteria found in soil and water) can cause miscarriage, stillbirth, or severe damage to the fetus.
  - Pregnant women should avoid unpasteurized cheeses, undercooked meat, smoked meats.
Many vitamins are toxic when taken in excess, and minerals are even more so.

- A single megadose of vitamin A has caused birth defects.
Dieting

- Weight-loss dieting, even for short periods, is hazardous during pregnancy.
- Low-carbohydrate diets or fasts that cause ketosis deprive the fetal brain of needed glucose and may impair its development.
- Energy restriction during pregnancy is dangerous, regardless of the woman’s prepregnancy weight or the amount of weight gained the previous month.
Sugar Substitutes

• Artificial sweeteners have been studied extensively and found to be acceptable during pregnancy if used within the FDA’s guidelines.
  – Women with phenylketonuria (PKU) should not use aspartame.
  – Genetic disease
  – Body's inability to handle the amino acid phenylalanine
Caffeine

• Research studies
  – Have not indicated that caffeine (even in high doses) causes birth defects in human infants.
  – Have found that moderate caffeine intake (3 cups of coffee a day) during pregnancy has no effect on infant birthweight or length of gestation.
Drinking during Pregnancy

- Alcohol is the most hazardous drug to future generations because it is legally available, heavily promoted, and widely abused.
Alcohol’s Effects

• Women of childbearing age need to know about alcohol’s harmful effects on a fetus.

• Alcohol crosses the placenta freely and is directly toxic. Alcohol:
  
  • Limits oxygen delivery to the fetus
  
  • Slows cell division which can cause abnormalities in organs
  
  • Affects fetal brain cell division
  
  • Interferes with nutrient transport to fetus
  
  • Before fertilization, alcohol can damage the ovum or sperm, leading to abnormalities in the child
Fetal Alcohol Syndrome

- Abstinence from alcohol is critical to prevent irreversible damage to the fetus.

- **Fetal alcohol spectrum disorder (FASD)** is having a few of the symptoms.

- **Fetal alcohol syndrome (FAS)** is at the most severe end of the spectrum when all symptoms are seen.
Fetal Alcohol Syndrome

- A child with FAS
• Despite the warnings 1 out of 10 pregnant women drinks alcohol sometime during pregnancy.

• 1 out of 50 report “frequent” drinking (seven or more drinks per week)

• Abstinence from alcohol is critical to prevent irreversible damage to the fetus.
Troubleshooting

Disease during pregnancy can endanger the health of the mother and fetus.

If discovered early, many diseases can be controlled--another reason early prenatal care is recommended.
• **Gestational diabetes** is a pregnancy-related form of diabetes.
  
  – Usually resolves after delivery but some women go on to develop type 2 diabetes.
  
  – Can lead to fetal or infant sickness or death.
  
  – More commonly leads to surgical birth and high infant birthweight.
  
  – All women are screened for this during the first trimester.
Hypertension in pregnancy may signal the onset of **preeclampsia**, a condition characterized by high blood pressure, protein in the urine and edema (especially in the hands and face).

Affects all the mother’s organs and can progress to eclampsia, which can be fatal.
Lactation

- A woman decides to feed her baby breast milk, infant formula, or both.
- These are the only foods recommended for the first four to six months of life.
A nursing mother produces about 25 ounces of milk a day.

Volume of milk produced depends on the infant's needs.

Producing this milk costs a woman almost 500 calories per day above her regular need during the first six months of lactation.

- She should eat an extra 330 calories of food and the other 170 calories can be drawn from her fat stores.
If a woman doesn’t eat well enough, will this affect the quality of the milk she produces?

1. Yes
2. No

Answer: The effect deprivation of the mother is to reduce the quantity, not the quality, of her milk.
No

• If will reduce the quantity (how much milk she produces)
Lactating women need extra fluid and enough energy and nutrients to make sufficient milk each day.

It is worth repeating, that the effect of nutritional deprivation of the mother is to reduce the *quantity*, not the *quality*, of her milk.
When Should a Woman Not Breastfeed?

- Breastfeeding is not advised if the mother’s milk is contaminated with alcohol, drugs, or environmental pollutants.
- Most ordinary infections such as colds have no effect on breastfeeding.
- Where safe alternatives are available, HIV-infected women should not breastfeed their infants.
Feeding the Infant

• Early nutrition affects later development, and early feedings establish eating habits that influence nutrition throughout life.
Nutrient Needs

Graph showing the relationship between weight (lb) and age (yr). The graph indicates an upward trend with age, starting at approximately 3 lb at age 0 and increasing to about 40 lb by age 5.
## Table 13-6: Infant and Adult Heart Rate, Respiration Rate, and Energy Needs Compared

<table>
<thead>
<tr>
<th></th>
<th>Infants</th>
<th>Adults</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heat rate (beats/minutes)</td>
<td>120 to 140</td>
<td>70 to 80</td>
</tr>
<tr>
<td>Respiration rate (breaths/minute)</td>
<td>20 to 40</td>
<td>15 to 20</td>
</tr>
<tr>
<td>Energy needs (cal/body weight)</td>
<td>45/lb (100/kg)</td>
<td>&lt;18/lb (&lt;40/kg)</td>
</tr>
</tbody>
</table>
Nutrient Needs

Graph showing nutrient needs for a male 20 years old, 5 times as much per pound as an adult male, and 10 times as much per pound.

- Energy
- Protein
- Vitamin A
- Vitamin D
- Vitamin E
- Vitamin C
- Folate
- Niacin
- Riboflavin
- Thiamin
- Vitamin B₆
- Vitamin B₁₂
- Calcium
- Phosphorus
- Magnesium
- Iodine
- Iron
- Zinc

Key:
- Green: 20-year-old male (160 lb)
- Purple: 5-month-old infant (16 lb)

Vitamin D recommendations for an infant are 10 times greater per pound of body weight than those for an adult male.
Pound for pound, niacin recommendations for an infant and an adult male are similar.
Infants’ rapid development depends on adequate nutrient supplies, including water from breast milk or formula.

After six months of age, the energy saved by slower growth is spent on increased activity.
**Why Is Breast Milk So Good for Babies?**

**Table 13-7 Benefits of Breastfeeding**

**FOR INFANTS:**
- Provides the appropriate composition and balance of nutrients with high bioavailability.
- Provides hormones that promote physiological development.
- Improves cognitive development.
- Protects against a variety of infections.
- May protect against some chronic diseases, such as diabetes (type 1) and hypertension, later in life.
- Protects against food allergies.

**FOR MOTHERS:**
- Contracts the uterus.
- Delays the return of regular ovulation, thus lengthening birth intervals. (It is not, however, a dependable method of contraception.)
- Conserves iron stores (by prolonging amenorrhea).
- May protect against breast and ovarian cancer.

**OTHER:**
- Provides cost savings from not needing medical treatment for childhood illnesses or time off work to care for sick children.
- Provides cost savings from not needing to purchase formula (even after adjusting for added foods in the diet of a lactating mother).
- Provides environmental savings to society from not needing to manufacture, package, and ship formula or dispose of packaging.
Breastfeeding is a natural extension of pregnancy – the mother’s body continues to nourish the infant.

- The American Dietetic Association (ADA) and American Association of Pediatrics recognize exclusive breastfeeding for 6 months, and breastfeeding with complementary foods for at least 12 months, as an optimal feeding pattern for infants.
Breastfeeding Tips

• Breast milk is more easily and completely digested than infant formula, so breastfed infants usually need to eat more frequently than formula-fed infants do.

• During the first few weeks, the newborn will need approximately 8 to 12 feedings a day, on demand.

• As the infant gets older, there are longer intervals between feedings.
Energy Nutrients in Breast Milk

Breast milk:
- Protein: 6%
- Fat: 55%
- Carbohydrate: 39%

Recommended adult diets:
- Protein: 21%
- Fat: 26%
- Carbohydrate: 53%
For infants, breast milk is the most nearly perfect food.

The carbohydrate in breast milk is lactose.

Contains a generous proportion of the essential fatty acids as well as their longer-chain derivatives, arachidonic acid and DHA.

The protein is largely alpha-lactalbumin and lactoferrin.
• With the exception of vitamin D, the vitamin content of the breast milk of a well-nourished mother is ample.

• The AAP recommends a vitamin D supplement for exclusively breast-fed infants.

• At six months of age, an exclusively breast-fed baby needs additional iron.

• If the water supply is low in fluoride, fluoride supplementation is needed after 6 months.
During the first two or three days of lactation, the breasts produce **colostrum**, a premilk substance containing antibodies and white cells from the mother’s blood.

Breastfed infants may have:

- Less allergies
- Less CVD
- Lower blood cholesterol
- Less ear and respiratory infections
Other Potential Benefits

• May protect against obesity in childhood and later years.
• May have a positive effect on later intelligence.
Formula Feeding

• Infant formulas are designed to resemble breast milk and must meet an AAP standard for nutrient composition.

• Special formulas are available for premature infants, allergic infants, and others.

• Formulas should be replaced with milk after the baby’s first birthday.
<table>
<thead>
<tr>
<th>CONTENT</th>
<th>MATURE HUMAN MILK</th>
<th>FORTIFIED INFANT FORMULA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy (cal/L)</td>
<td>680</td>
<td>680</td>
</tr>
<tr>
<td>Protein (% of cal)</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>Fat (% of cal)</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Carbohydrate (% of cal)</td>
<td>42</td>
<td>43</td>
</tr>
<tr>
<td>Iron (mg/L)</td>
<td>0.5</td>
<td>4–12</td>
</tr>
<tr>
<td>Vitamin A (μg/L)</td>
<td>675</td>
<td>660</td>
</tr>
<tr>
<td>Niacin (mg/L)</td>
<td>1.5</td>
<td>7.1</td>
</tr>
<tr>
<td>Vitamin D (μg/L)</td>
<td>0.5</td>
<td>10</td>
</tr>
<tr>
<td>Inositol (mg/L)</td>
<td>149</td>
<td>32</td>
</tr>
</tbody>
</table>

The infant thrives on formula offered with affection
Advertisers of infant formulas often strive to create the illusion that formula is identical to human milk.

No formula can match the nutrients, agents of immunity, and environmental information conveyed to infants through human milk, but the ads are convincing.

Formula-fed infants in developed nations are healthy and grow normally but they miss out on advantages of breast milk.
### Ten Steps to Successful Breastfeeding

To promote breastfeeding, every maternity facility should:

- Develop a written breastfeeding policy that is routinely communicated to all health-care staff.
- Train all health-care staff in the skills necessary to implement the breastfeeding policy.
- Inform all pregnant women about the benefits and management of breastfeeding.
- Help mothers initiate breastfeeding within ½ hour of birth.
- Show mothers how to breastfeed and how to maintain lactation, even if they need to be separated from their infants.
- Give newborn infants no food or drink other than breast milk, unless medically indicated.
- Practice rooming-in, allowing mothers and infants to remain together 24 hours a day.
- Encourage breastfeeding on demand.
- Give no artificial nipples or pacifiers to breastfeeding infants.\(^a\)
- Foster the establishment of breastfeeding support groups and refer mothers to them at discharge from the facility.

\(^a\)Compared with nonusers, infants who use pacifiers breastfeed less frequently and stop breastfeeding at a younger age.

*Source: United Nations Children’s Fund, the World Health Organization, the Breastfeeding Hospital Initiative Feasibility Study Expert Work Group, and Baby Friendly U.S.A.*
An Infant’s First Foods

• With the first birthday comes the possibility of tasting whole, unmodified cow’s milk for the first time.
• Foods may be started gradually beginning sometime between four and six months of age.
# When to Introduce Solid Food

## Infant Development and Recommended Foods

Note: Because each stage of development builds on the previous stage, the foods from an earlier stage continue to be included in all later stages.

<table>
<thead>
<tr>
<th>AGE (MO)</th>
<th>FEEDING SKILL</th>
<th>FOODS INTRODUCED INTO THE DIET</th>
</tr>
</thead>
<tbody>
<tr>
<td>0–4</td>
<td>Turns head toward any object that brushes cheek. Initially swallows using back of tongue; gradually begins to swallow using front of tongue as well. Strong reflex (extrusion) to push food out during first 2 to 3 months.</td>
<td>Feed breast milk or infant formula.</td>
</tr>
<tr>
<td>4–6</td>
<td>Extrusion reflex diminishes, and the ability to swallow nonliquid foods develops. Indicates desire for food by opening mouth and leaning forward. Indicates satiety or disinterest by turning away and leaning back. Sits erect with support at 6 months. Begins chewing action. Brings hand to mouth. Grasps objects with palm of hand.</td>
<td>Begin iron-fortified cereal mixed with breast milk, formula, or water. Begin pureed vegetables and fruits.</td>
</tr>
<tr>
<td>Age Range</td>
<td>Skills</td>
<td>Foods and Drinks</td>
</tr>
<tr>
<td>-----------</td>
<td>------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>6–8</td>
<td>Able to feed self with fingers.</td>
<td>Begin mashed vegetables and fruits.</td>
</tr>
<tr>
<td></td>
<td>Develops pincher (finger to thumb) grasp</td>
<td>Begin plain baby food meats.</td>
</tr>
<tr>
<td></td>
<td>Begins to drink from cup.</td>
<td>Begin plain, unsweetened fruit juices from cup.</td>
</tr>
<tr>
<td>8–10</td>
<td>Begins to hold own bottle.</td>
<td>Begin breads and cereals from table.</td>
</tr>
<tr>
<td></td>
<td>Reaches for and grabs food and spoon.</td>
<td>Begin yogurt.</td>
</tr>
<tr>
<td></td>
<td>Sits unsupported.</td>
<td>Begin pieces of soft, cooked vegetables and fruit from table.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gradually begin finely cut meats, fish, casseroles, cheese, eggs, and legumes.</td>
</tr>
<tr>
<td>10–12</td>
<td>Begins to master spoon, but still spills some.</td>
<td>Add variety. Gradually increase portion sizes.</td>
</tr>
</tbody>
</table>

*Portions of foods for infants and young children are smaller than those for an adult. For example, a grain serving might be \( \frac{1}{2} \) slice of bread instead of 1 slice, or \( \frac{1}{4} \) cup rice instead of \( \frac{1}{2} \) cup.*

Iron ranks highest on the list of nutrients needing attention in infant nutrition.

Excessive milk consumption can displace iron-rich foods and lead to iron-deficiency anemia, popularly called milk anemia.

To prevent vitamin C deficiency:

- Many fruit juices (4-6 ounces per day)
Foods to Provide Iron and Vitamin C

• To prevent iron deficiency:
  • Breast milk
  • Iron-fortified formula
  • Iron-fortified cereals
  • Meat or legumes

Foods such as iron-fortified cereals and formulas, mashed legumes, and strained meats provide iron.
Physical Readiness for Solid Foods

- When the baby can sit up, can handle finger foods, and is teething, hard crackers and other finger foods may be introduced under the watchful eye of an adult.

- Avoid foods that are choke hazards.
To prevent allergy and to facilitate its prompt identification should it occur, experts recommend introducing single-ingredient foods, one at a time, in small portions, and waiting up to four to five days before introducing the next food.
Choice of Infant Foods

• Commercial baby foods in the U.S. and Canada are safe, and except for mixed dinners with added starch fillers and heavily sweetened desserts, they have high nutrient density.
Foods to Omit

- Sweets of any kind (including baby food “desserts”) have no place in a baby’s diet.
- Honey and corn syrup should never be fed to infants because of the risk of botulism.
Children love to eat what their families eat.
Looking Ahead

• The first year of life is the time to lay the foundation for future health.

• From the nutrition standpoint, the problems most common in later years are obesity and dental disease.

• It is important in the first year to encourage eating habits that will support continued normal weight as the child grows.
Looking Ahead

• Nursing bottle syndrome in an early stage
Nursing bottle syndrome--an extreme example. The upper teeth have decayed all the way to the gum line.
• Sucking bottle for long periods of time pushes the normal jaw line out of shape and causes a bucktoothed profile

• Upper teeth are coated w/carb rich fluid that enables acid producing bacteria to grow

• Bacteria dissolves tooth material
Food Feature: Mealtimes with Infants

- Foster a sense of autonomy.
- Discourage unacceptable behavior.
- Let the child explore and enjoy food.
- Don’t force food on children.
- Limit sweets strictly.
Controversy: *Childhood Obesity and Early Development of Chronic Diseases*

- Large numbers of children and adolescents in the U.S. are being diagnosed with obesity and type 2 diabetes.
- 60 million children are overweight in the U.S.
- Childhood obesity rates are increasing all over the world.
Childhood Obesity and Early Chronic Diseases

Type 2 diabetes strikes more children today than ever before and is closely associated with obesity.
The Challenge of Childhood Obesity

- Percentage of Young People Who Are Overweight

![Bar chart showing the percentage of young people who are overweight from 1970 to 2004. The chart includes data for two age groups: 6-11 and 12-19. The key indicates that purple bars represent 6-11 years, and yellow bars represent 12-19 years. The percentage increases significantly from 1970 to 2004 for both age groups.]
Characteristics of Childhood Obesity

• While no group has fully escaped this trend, obese children:
  • Are often female and of non-European descent
  • Have a family history of type 2 diabetes
  • Were born to mothers who had diabetes while pregnant with them
  • Have metabolic syndrome
  • Have a low family income
  • Are sedentary
  • Have parents who are obese
The Influence of Genetics

• Obesity occurs more often among African American, Hispanic, and Native American children.

• Genetics appears to play a *permissive* role – the potential for obesity is inherited but the condition itself will develop only if given a push by environmental factors.
Early Childhood Influences on Obesity

• Much evidence points to the importance of early childhood as a period of influence on obesity development.

• Children learn behaviors from their families, and entire families may be:
  – Eating too much
  – Dieting inappropriately
  – Exercising too little
  – Watching too much television
Early Childhood Influences on Obesity

**Food Factors**
- Frequent snacks consisting of high-energy foods, such as candies, cookies, crackers, fried foods, and ice cream.
- Irregular or sporadic mealtimes; missed meals.
- Eating when not hungry; eating while watching TV or doing homework.
- Fast-food meals more than once per week.
- Frequent meals of fried or sugary foods and beverages.
- Exposure to advertising that promotes high-calorie foods.

**Activity Factors**
- More than an hour of sedentary activity, such as television, each day.
- Less than 20 minutes of physical activity, such as outdoor play, each day.
- No access to recreational facilities.

**Family and Other Factors**
- Overweight family members, particularly parents.
- Low income family.
- Tall for age.
Early Childhood Influences on Obesity

![Bar chart showing the prevalence of obesity (%) in relation to TV hours per day. The chart indicates that higher TV hours are associated with higher prevalence of obesity.](image-url)
• 85% of children with type 2 diabetes are obese

• Risk of developing type 2 diabetes varies among U.S. ethnic groups:
  • 8% of white children
  • 45% of Pima Indians, African American, Asian, and Hispanic children
Early Development of Heart Disease

- Atherosclerosis, which only becomes apparent as heart disease in adulthood, begins in youth.

- Children with the highest risk of developing heart disease:
  - Are sedentary and obese
  - May have diabetes
  - May have high blood pressure
  - May have high blood LDL cholesterol
• Cholesterol testing is recommended for overweight children and adolescents with a family history of heart disease or elevated blood cholesterol.

• Blood cholesterol in children is a good predictor of their future adult cholesterol and like in adults is related to:
  – High saturated fat intake
  – Overweight
  – Sedentary lifestyle
# High Blood Cholesterol

**TABLE C13-1** Cholesterol Values for Children and Adolescents

<table>
<thead>
<tr>
<th>Disease Risk</th>
<th>Total Cholesterol (mg/dL)</th>
<th>LDL Cholesterol (mg/dL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acceptable</td>
<td>&lt;170</td>
<td>&lt;100</td>
</tr>
<tr>
<td>Borderline</td>
<td>170–199</td>
<td>100–129</td>
</tr>
<tr>
<td>High</td>
<td>≥200</td>
<td>≥130</td>
</tr>
</tbody>
</table>

Note: Adult values appeared in Chapter 11.
High Blood Pressure

• Hypertension that develops in the first decades of life, especially in overweight children, tends to worsen if untreated.

• Children with hypertension can lower their blood pressure by:
  • Participating in regular activity
  • Losing weight or maintaining weight as they grow taller
  • Restricting dietary sodium
  • Decreasing intake of caffeinated beverages
Preventing Weight Gain in Children: A Family Affair

• An initial goal is to slow the obese child’s rate of gain – that is, to hold weight steady while the child grows taller.

• Treatment of obesity in adults is notoriously unsuccessful, and so preventing childhood obesity is a national priority.
### Family Lifestyle Changes to Help the Overweight Child

Everyone can benefit when the whole family adopts health-promoting habits such as these:

- Learn and use appropriate food portions.
- Involve children in shopping for and preparing family meals.
- Set regular mealtimes and dine together frequently.
- For other days, plan and provide a wide variety of nutritious snacks that are low in fat and sugar.
- Provide an appropriate nutritious breakfast every day.
- Provide recommended amounts of fruit juices but no more than this amount.
- Limit high-sugar, high-fat foods, including sugar-sweetened soft drinks and fruit flavored punches.
- Set a good example and demonstrate positive behaviors for children to imitate.
- Slow down eating and pause to enjoy table companions; stop eating when full.
- Do not use foods to reward or punish behaviors.
- Involve children in daily active outdoor play or structured physical activities, as a family or with friends.
- Limit television time; set a rule to eliminate television-watching during meals.
- Celebrate family special events and holidays with outdoor activities, such as a softball game, a hike, or a summer swim.
- Keep a calendar of scheduled family meals and activity events where everyone can read it.
- Obtain parent and child nutrition and physical activity education and training or family counseling to guide family-based behavioral and other interventions as needed.
- Work with schools to institute school-wide food and activity policies to support a healthy body weight and prevent obesity (see Chapter 14).

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Diet Moderation, Not Deprivation

• All children should eat an appropriate amount and variety of foods, regardless of their body weight.
**Diet Moderation, Not Deprivation**

**American Heart Association Diet and Activity Guidelines and Strategies for Children**

- Balance dietary calories with physical activity to maintain normal growth.
- Every day, engage in 60 minutes of moderate to vigorous play or physical activity.
- Eat vegetables and fruits daily. Serve fresh, frozen, or canned vegetables and fruits at every meal; limit those with added fats, salt, and sugar.
- Limit juice to recommended levels of intake (4 to 6 ounces per day for children 1 to 6 years of age, 8 to 12 ounces for children 7 to 18 years of age).
- Use vegetable oils (canola, soybean, olive, safflower, or other unsaturated oils) and soft margarines low in saturated fat and *trans* fatty acids instead of butter or most other animal fats in the diet.
- Choose whole-grain breads and cereals rather than refined products; read labels and make sure that “whole grain” is the first ingredient.
- Reduce the intake of sugar-sweetened beverages and foods.
- Consume low-fat and nonfat milk and milk products daily.
- Include 2 servings of fish per week, especially fatty fish such as broiled or baked salmon.
- Choose legumes and tofu in place of meat for some meals.
- Choose only lean cuts of meat and reduced-fat meat products; remove the skin from poultry.
- Use less salt, including salt from processed foods. Read food labels and choose high-fiber, low-salt, low-sugar options.
- Limit the intake of high-calorie add-ons such as gravy, Alfredo sauce, cream sauce, cheese sauce, and hollandaise sauce.
- Serve age-appropriate portion sizes on appropriately sized plates and bowls.

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*These guidelines are for children 3 years of age and older.*

Physical Activity

<table>
<thead>
<tr>
<th>Table C13-4</th>
<th>Suggested Age-Appropriate Physical Activities</th>
</tr>
</thead>
</table>

In general, children of all ages benefit from physical activities focused on enjoyment with family and friends. As children grow, their abilities increase, allowing for more sophisticated activities.

**Infants and toddlers** should be allowed to govern their own safe activities in accordance with their development. Minimally structured, supervised play environments encourage such activities.

**Children aged 4 to 6 years** should be encouraged to play, explore, and experiment in safe, supervised environments. Unorganized play, with activities such as running, throwing, and catching are naturally enjoyable; closely supervised swimming, tumbling, dance, or sports with show-and-tell instruction, and little emphasis on rules or organization, can begin at this age.

**Children aged 6 to 9 years** should be encouraged in free play involving more sophisticated movement and skills, such as dancing, jumping rope, or bicycle riding; they may try certain sports, such as soccer, played with flexible rules, short instruction times, and a focus on enjoyment rather than competition.

**Children aged 9 to 12 years** should continue enjoying leisure activities with friends and family; competitive swimming, advanced dancing, complex games such as basketball, and other sports become possible with increasing comprehension of verbal instruction; yoga and light weight training become appropriate for many older children in this group. Safety remains a primary consideration.

**Older adolescents** often seek out activities with peers, and participation in activities at this age often lasts into adulthood; engagement in more hazardous contact and collision sports, such as football, is ideally based on size and ability rather than on chronological age.

The U.S. Food and Nutrition Board of the Institute of Medicine recently published an updated plan for the prevention of childhood obesity in the U.S.

The plan sets goals for government, industry and media, communities, schools, and families for promoting healthful eating and physical activity in the nation’s children.