Lifecycle Nutrition

Pregnancy and Lactation
Infants, Children and Adolescents
Older Adults
Building a Healthy Baby

Pregnancy

- Nutrition before and during pregnancy can have a significant effect on the outcome of pregnancy.

- A woman’s nutritional status can greatly influence the outcome of her pregnancy as most fetal tissues and organs develop within the first two months of pregnancy.

- Women of childbearing age should focus on consuming high nutrient dense foods and should possibly consider supplements to meet nutrient needs.

- Men’s nutritional status can also impact fertility.
Growth and Development

- Placental development
  - Metabolically active organ
    - Requires energy and nutrients
    - Produces hormones
  - Develops in uterus
    - Amniotic sac and umbilical cord
  - Expelled during childbirth
  - Interweaving of fetal and maternal blood vessels
The Placenta and Associated Structures

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

Fingerlike projections (called placental villi) contain fetal blood vessels and 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.
Stages of Embryonic and Fetal Development

1. A newly fertilized ovum is called a **zygote** and is about the size of a period at the end of this sentence. Less than one week after fertilization, these cells have rapidly divided multiple times and are ready for implantation.

2. After implantation, the placenta develops and begins to provide nourishment to the developing embryo. An **embryo** 5 weeks after fertilization is about \( \frac{1}{2} \) inch long.

3. A **fetus** after 11 weeks of development is just over an inch long. Notice the umbilical cord and blood vessels connecting the fetus with the placenta.

4. A **newborn infant** after nine months of development measures close to 20 inches in length. From 8 weeks to term, this infant grew 20 times longer and 50 times heavier.
Fetal Development

○ **Critical Stages of development**
  - Cellular activities for normal embryonic development occur at specific times
  - Adequate nutrients are needed for proper cell division
  - Development of organs and tissues are most vulnerable to nutrient deficiencies of toxicities
    ○ Folate
    ○ Vitamin A
    ○ Abnormal blood glucose
  - Critical stages occur throughout pregnancy
Critical Stages of Development

Key:
- Purple: Critical development
- Green: Continued development

- Central nervous system
- Heart
- Ears
- Eyes
- Legs and arms
- Teeth
- Palate
- External genitalia

Weeks of gestation

Embryo

Fetus

Term
Critical Stages of Development
Adverse Effects

- Neural tube defects
  - Two common types
    - Anacephaly
    - Spina bifida
  - Cause is unknown
  - Risk factors
    - History of neural tube defects
    - Diabetes
    - Epilepsy Medication
    - Obesity
  - Folate supplementation
Neural Tube Development

At 4 weeks, the neural tube has yet to close (notice the gap at the top).

At 6 weeks, the neural tube (outlined by the delicate red vertebral arteries) has successfully closed.
Spina Bifida
Critical Stages of Development
Adverse Effects

- Chronic diseases
  - Adverse influences at critical times during fetal development
    - Malnutrition – type 2 diabetes
    - Inadequate growth during placental & gestational development – hypertension
- Fetal programming
  - Mother’s nutrition may change gene expression in fetus
  - May impact future generations
Weight Gain

- Pre-pregnancy weight
  - Underweight more likely to give birth to low birth weight baby
  - Overweight more likely to develop medical problems during pregnancy
- Recommended Weight Gain
  - Underweight (BMI <19) 28-40 pounds
  - Normal (BMI 19-25) 25-35 pounds
  - Overweight (BMI 25-30) 15-25 pounds
  - Obese (BMI >30) 15 pound minimum
Components of Weight Gain

<table>
<thead>
<tr>
<th>Component</th>
<th>Weight gain (lb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase in breast size</td>
<td>2</td>
</tr>
<tr>
<td>Increase in mother’s fluid volume</td>
<td>4</td>
</tr>
<tr>
<td>Placenta</td>
<td>1 1/2</td>
</tr>
<tr>
<td>Increase in blood supply to the placenta</td>
<td>4</td>
</tr>
<tr>
<td>Amniotic fluid</td>
<td>2</td>
</tr>
<tr>
<td>Infant at birth</td>
<td>7 1/2</td>
</tr>
<tr>
<td>Increase in size of uterus and supporting muscles</td>
<td>2</td>
</tr>
<tr>
<td>Mother’s necessary fat stores</td>
<td>7</td>
</tr>
</tbody>
</table>

Total weight gain: 30 lb
Rate of Weight Gain

- **1\textsuperscript{st} trimester**
  - 3.5 pounds

- **2\textsuperscript{nd} and 3\textsuperscript{rd} trimester**
  - 1 pound per week

- Weight gain should be smooth and progressive
Nutrient Requirement in Pregnancy

- Complete worksheet
Nutrient Needs During Pregnancy

- Energy (300 kcals 2\textsuperscript{nd}/3\textsuperscript{rd} trimester)
- Protein (25 grams/day)
- Essential Fatty Acids (omega 3 and 6)
- Vitamins and Minerals
  - Most all increase during pregnancy
  - Pay attention to those required for cell growth and DNA synthesis
    - Folate, Vitamin B12, Iron, Zinc
  - Bone formation
    - Calcium, Vitamin D
What is a Healthy Diet for Pregnancy?

- Use Food Pyramid as a Base
- Eat Regularly; Enjoy food and Mealtimes
- Supplements
- Avoid Alcohol and Illicit Drugs
- Limit Soda and Caffeine
- Exercise Daily
Nutrition Related Pregnancy Problems

- Nausea and Vomiting
- Heartburn
- Constipation
- Gestational Diabetes
- Hypertension
- Fluid Retention
# High Risk Pregnancies

## TABLE 15-3 High-Risk Pregnancy Factors

<table>
<thead>
<tr>
<th>Factor</th>
<th>Condition That Raises Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maternal weight</td>
<td>Prepregnancy BMI either $&lt;18.5$ or $\geq 25$</td>
</tr>
<tr>
<td>• Prior to pregnancy</td>
<td>Insufficient or excessive pregnancy weight gain</td>
</tr>
<tr>
<td>• During pregnancy</td>
<td>Nutrient deficiencies or toxicities; eating disorders</td>
</tr>
<tr>
<td>Maternal nutrition</td>
<td>Poverty, lack of family support, low level of education, limited food available</td>
</tr>
<tr>
<td>Socioeconomic status</td>
<td>Smoking, alcohol or other drug use</td>
</tr>
<tr>
<td>Lifestyle habits</td>
<td>Teens, especially 15 years or younger; women 35 years or older</td>
</tr>
<tr>
<td>Age</td>
<td>Many previous pregnancies (3 or more to mothers under age 20; 4 or more to mothers age 20 or older)</td>
</tr>
<tr>
<td>Previous pregnancies</td>
<td>Short or long intervals between pregnancies ($&lt;18$ months or $&gt;59$ months)</td>
</tr>
<tr>
<td>• Number</td>
<td>Previous history of problems</td>
</tr>
<tr>
<td>• Interval</td>
<td>Twins or triplets</td>
</tr>
<tr>
<td>• Outcomes</td>
<td>Low- or high-birthweight infants</td>
</tr>
<tr>
<td>Multiple births</td>
<td>Development of gestational hypertension</td>
</tr>
<tr>
<td>Birthweight</td>
<td>Development of gestational diabetes</td>
</tr>
<tr>
<td>Maternal health</td>
<td>Diabetes; heart, respiratory, and kidney disease; certain genetic disorders; special diets and medications</td>
</tr>
</tbody>
</table>
High-Risk Pregnancies

- Malnutrition and pregnancy
  - Fertility
    - Viable sperm
    - Sexual interest
    - Amenorrhea
  - Early pregnancy
    - Placenta development
  - Fetal development
    - Consequences
- Food Assistance Program: WIC
Lifestyle Factors Affect Pregnancy

- Alcohol
- Smoking
- Prescription and OTC Drugs
- Environmental Contaminants
- Food Borne Illness
- Caffeine
- Dieting
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.
  - Limits oxygen delivery to the fetus
  - Slows cell division -- 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

- **Cause**
  - **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.
Head
Small head size

Forehead
Narrow, receding forehead

Nose
Short, upturned nose
Flattened nose bridge

Jaw
Underdeveloped jaw
Receding chin
Receding or flattened upper jaw

Eyes
Extra skin folds on eyelids
Drooping eyelids
Downward slant of eyes
Unusually small eyes and/or eye openings
Short-sightedness
Inability to focus ("wandering eyes")

Ears
Uneven in placement and size
Poorly formed outer ear
Backward curve

Lips
Absence of groove in upper lip; flat upper lip
Thin upper lip
Effects of Alcohol on Brain Development
6 week old baby brains
A child with FAS
Food Safety Concerns

- Food Borne Illness
  - Listeria
  - Methylmercury
  - Toxoplasma

- Lifetime Food Handling Tips
  - Clean
  - Separate
  - Cook
  - Chill
Nutrition During Lactation

- Energy – similar to pregnancy
- Protein – similar to pregnancy
- Vitamins/Minerals –
  - Similar to pregnancy
  - Inadequacies will reduce quantity not quality of milk
- Fluids
  - Adequate fluids needed to prevent dehydration
Benefits of Breastfeeding

- **Nutrient Composition**
  - Carbohydrate is lactose.
  - High fat including generous proportion of the essential fatty acids including DHA
  - Protein is largely *alpha-lactalbumin* and lactoferrin.
Energy Nutrients in Breast Milk

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

- Recommended adult diets:
  - Protein: 21%
  - Fat: 26%
  - Carbohydrate: 53%
Benefits of Breastfeeding

- Protective factors
  - Immunological factors
    - Antibodies
    - Bifidus factors
    - Lactoferrin
    - Lactadherin
    - Growth factor
    - Lipase enzyme
  - Allergies
  - Obesity
Benefits of Breastfeeding

- Infant
  - Correct nutrient balance
  - Hormones for growth/development
  - Improves cognitive development
  - Protects against infections
  - May protect against chronic diseases
  - May protect against food allergies
Benefits of Breastfeeding

- **Mother**
  - Uterine Contraction
  - Delays regular ovulation
  - Conserve iron stores
  - May protect against breast/ovarian cancer
Benefits of Breastfeeding

- Other
  - Cost savings to family
  - Reduced medical expenses
  - Reduced environmental pollution
Vitamins and Minerals in Breast Milk

- Adequate except Vitamin D
- Supplements recommended by AAP
- Iron supplementation at six months
- Fluoride supplementation after 6 months if water content is low
Factors Affecting Breast Milk

- Mothers Diet
- Alcohol
- Prescription medications
- Drugs
- Smoking
- Caffeine
Formula Feedings

- Designed to resemble breast milk
- Must meet an AAP standard for nutrient composition.
- Special formulas are available for premature infants, allergic infants, and others.
- Formulas should be replaced with whole milk after the baby’s first birthday.
Problems with Formula Feeding

Baby Bottle Syndrome
Infancy

- Energy Needs
  - High requirements – double that of an adult based on body weight
    - i.e. 40 kcal/pnd vs 100 kcal/pnd
  - Double weight at 6 month
  - Triple birth weight at 1 year
- Growth charts reliable indicator of normal growth rate
Introducing Solid Foods

- Between 4 to 6 months of age
- Nutritional needs
  - Iron
  - Vitamin C
  - Prevent excessive milk intake
- Physical readiness
  Baby can sit up, handle finger foods,
  If teething, hard crackers and other finger foods may be introduced cautiously
- Avoid foods that are choke hazards.
<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.</td>
<td>Feed breast milk or infant formula.</td>
</tr>
<tr>
<td></td>
<td>Initially swallows using back of tongue; gradually begins to swallow using</td>
<td></td>
</tr>
<tr>
<td></td>
<td>front of tongue as well.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Strong reflex (extrusion) to push food out during first 2 to 3 months.</td>
<td></td>
</tr>
<tr>
<td>4–6</td>
<td>Extrusion reflex diminishes, and the ability to swallow nonliquid foods</td>
<td>Begin iron-fortified cereal mixed with breast milk,</td>
</tr>
<tr>
<td></td>
<td>develops.</td>
<td>formula, or water.</td>
</tr>
<tr>
<td></td>
<td>Indicates desire for food by opening mouth and leaning forward.</td>
<td>Begin pureed vegetables and fruits.</td>
</tr>
<tr>
<td></td>
<td>Indicates satiety or disinterest by turning away and leaning back.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sits erect with support at 6 months.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Begins chewing action.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Brings hand to mouth.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Grasps objects with palm of hand.</td>
<td></td>
</tr>
</tbody>
</table>
| 6–8          | Able to feed self with fingers.  
|             | Develops pincher (finger to thumb) grasp  
|             | Begins to drink from cup.  
| 8–10        | Begins to hold own bottle.  
|             | Reaches for and grabs food and spoon.  
|             | Sits unsupported.  
| 10–12       | Begins to master spoon, but still spills some.  
|             | Begin mashed vegetables and fruits.  
|             | Begin plain baby food meats.  
|             | Begin plain, unsweetened fruit juices from cup.  
|             | Begin breads and cereals from table.  
|             | Begin yogurt.  
|             | Begin pieces of soft, cooked vegetables and fruit from table.  
|             | Gradually begin finely cut meats, fish, casseroles, cheese, eggs, and legumes.  
|             | Add variety. Gradually increase portion sizes. 

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

Foods to Provide

- Home made table foods ideal
- Commercial baby foods in the U.S. and Canada are safe,
- Limit:
  - mixed dinners with added starch fillers
  - heavily sweetened desserts
- Avoid:
  - Sweets in a baby’s diet
  - Honey and Corn Syrup - botulism
Toddlin’ Around

Children love to eat what parents eat

Model good nutrition habits from an early age
**Table 13-11  Meal Plan for a 1-Year-Old**

<table>
<thead>
<tr>
<th>Breakfast</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>½ c iron-fortified unsweetened cereal</td>
<td></td>
</tr>
<tr>
<td>¼ c whole milk (with cereal)</td>
<td></td>
</tr>
<tr>
<td>½ c orange juice</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Morning snack</th>
<th>Afternoon snack</th>
</tr>
</thead>
<tbody>
<tr>
<td>½ c yogurt</td>
<td>½ c whole milk</td>
</tr>
<tr>
<td>¼ c fruit&lt;sup&gt;a&lt;/sup&gt;</td>
<td>½ slice whole-wheat toast</td>
</tr>
<tr>
<td></td>
<td>1 tbs apple butter</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Lunch</th>
<th>Dinner</th>
</tr>
</thead>
<tbody>
<tr>
<td>½ c whole milk</td>
<td>½ c whole milk</td>
</tr>
<tr>
<td>½ c vegetables&lt;sup&gt;b&lt;/sup&gt;</td>
<td>2 oz chopped meat or well-cooked</td>
</tr>
<tr>
<td>1 egg or ¼ c tofu</td>
<td>mashed legumes</td>
</tr>
<tr>
<td>½ c noodles</td>
<td>¼ c potato, rice, or pasta</td>
</tr>
<tr>
<td></td>
<td>½ c vegetables&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>¼ c fruit&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>a</sup>Include citrus fruits, melons, and berries.

<sup>b</sup>Include dark green, leafy, and deep yellow vegetables.
Encouraging Good Nutrition Habits

- Foster a sense of autonomy.
- Discourage unacceptable behavior.
- Let the child explore and enjoy food.
- Don’t force food on children.
- Limit sweets strictly.