Chapter 9: Energy Balance and Healthy Body Weight

PowerPoint Lectures for
Nutrition: Concepts and Controversies, eleventh edition
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Lectures by Judy Kaufman, Ph.D.
Energy Balance and Healthy Body Weight

Are you pleased with your body weight?

1. Yes

2. No
Both **overweight** and **underweight** present risks to health.

It isn’t your weight you need to control; it’s the fat in your body in proportion to the lean – your **body composition**.

**body composition**: Proportions of muscle, bone, fat, and other tissue that make up a person's total weight.

The problem of underweight is not as prevalent as overweight, but also poses health threats.
The Problems of Too Little or Too Much Body Fat

- Obesity in the U.S. is an escalating epidemic
- 68% of U.S. adults are overweight
- 35% of adults are obese
- 17% of children and adolescents are obese.
Increasing Prevalence of Obesity

1998: Most states had obesity prevalence rates of less than 20 percent.

2008: Most states had prevalence rates of greater than 25 percent, with six states reporting prevalence rates greater than or equal to 30 percent.

Key:
- 10%–14%
- 15%–19%
- 20%–24%
- 25%–29%
- ≥ 30%
Deficient body fatness threatens survival during a famine or during diseases.

* going w/out food to run tests
* surgery

Underweight also increases the risk for any person fighting a wasting disease.

* people w/cancer often die from starvation rather than the disease
What Are The Risks From Overweight?

Most obese people suffer illnesses, and obesity is considered a **chronic disease**: long lasting, degenerative

An estimated 300,000 people in the U.S. die each year from obesity-related diseases

$147 billion spent on obesity related health care.

Obesity raises the risk of these conditions/diseases:

- Hypertension
- Heart disease
- Stroke
- Diabetes
- Hernias

Flat feet
Sleep apnea and problems
Some cancers
High accident rate
Arthritis
Central Obesity - excess fat in the abdomen and around the trunk.

Visceral fat/intra-abdominal fat: fat stored within abdominal cavity in association with the internal abdominal organs.

- Located deep within the central abdominal area of the body
- Raises the risks of
  - Hypertension
  - Heart disease
  - Stroke
  - Diabetes
Central Obesity

- subcutaneous fat
- abdominal muscle layer
- visceral fat
- intestines
Why is central obesity bad for the heart?

- Visceral fat is readily increased in the bloodstream.
- Contributes to the blood's daily burden on cholesterol carrying lipoproteins (LDL - carry lipids in the blood) thus increasing risk of heart disease.
- LDL is larger, lighter and richer in cholesterol.
- Too much LDL in blood is a sign of high risk of heart attack.
Why is this bad for the heart?

- Too much fat in the abdomen activates a succession of metabolic events that lead to inflammation.
- Chronic inflammation has been linked with heart disease and other chronic diseases.
Factors affecting body fat distribution:

- Gender
- Menopause
- Smoking
- Alcohol intake
- Physical activity
Obesity experts evaluate risks to health from obesity using 3 indicators:

1. BMI, body mass index

   \[ \text{weight (lbs)} \times 703 \div \text{height (in)}^2 \]

2. Waist circumference

   central body fat in proportion to total body fat

3. Disease risk profile and family medical history

   personal factors such as diagnosis of hypertension...
### Table 9-1: Chronic Disease Risks According to BMI Values and Waist Circumference

The degree of risk is heightened by the presence of specific diseases, other risk factors (such as elevated blood LDL cholesterol, as described in Chapter 11), or smoking.

<table>
<thead>
<tr>
<th>BMI</th>
<th>Waist ≤ 40 in. (Men) or ≤ 35 in. (Women)</th>
<th>Waist ≥ 40 in. (Men) or ≥ 35 in. (Women)</th>
</tr>
</thead>
<tbody>
<tr>
<td>18.5 or less</td>
<td>Underweight</td>
<td>Low</td>
</tr>
<tr>
<td>18.5–24.9</td>
<td>Normal</td>
<td>Low</td>
</tr>
<tr>
<td>25.0–29.9</td>
<td>Overweight</td>
<td>Increased</td>
</tr>
<tr>
<td>30.0–34.9</td>
<td>Obese, class I</td>
<td>High</td>
</tr>
<tr>
<td>35.0–39.9</td>
<td>Obese, class II</td>
<td>Very high</td>
</tr>
<tr>
<td>40 or greater</td>
<td>Extremely obese, class III</td>
<td>Extremely high</td>
</tr>
</tbody>
</table>

*aNote: Additional risk factors such as blood pressure, blood sugar levels, and family history may also contribute to overall health risk.*
Fit people are healthier than unfit people of the same body fatness.

Being active – even if overweight – is healthier than being sedentary.
Social and Economic Costs of Obesity

- Over-fatness presents social and economic handicaps as well as physical ills.
- Judging people by their body weight is a form of prejudice in our society.
- Overweight people are...
  - judged on their appearance than their character
  - less sought after for romance
  - less often hired
  - less often admitted to college
  - pay higher insurance premiums
  - pay more for clothing
The Body’s Energy Balance

- When more food is consumed than is needed, excess fat accumulates in the fat cells in the body’s adipose tissue where it is stored.

- When energy supplies run low, stored fat is withdrawn.

Change in energy stores = energy in – energy out
Energy In and Energy Out

- The energy in foods and beverages is the only contributor to the “energy in” side of the equation.

- The “energy out” side is more difficult to determine and has to do with lifestyle and metabolism.

- 1 lb body fat = 3,500 calories
Balancing food energy intake with physical activity can add to life’s enjoyment
How Many Calories Do I Need Each Day?

- You need enough calories each day to cover your energy expenditure.
  - honest food journal for a 7 days

- Two major components of the "energy out" side of the body's energy budget are **basal metabolism** and **voluntary activities**.

1. **basal metabolism** - body's work that goes on all the time w/out our awareness.
   - circulation, respiration, temp. maintenance, nerve activity
   - 2,000 calories (1,000-1,600) to support basal metabolism
2. **voluntary activities** - intentional activities

   - walking, running, swimming

3. **thermic effect of food** - the body's speeded up metabolism in response to having eaten a meal.

   energy used by our bodies in order to consume (bite, chew and swallow) and process (digest, transport, metabolize and store) food. We "expend energy" by burning calories.
You **can't** speed up your **Basal Metabolic Rate**; the rate at which your body uses energy to support its basal metabolism.

You **can** speed up your voluntary activities

After consistently doing so then your BMR will also increase

Do endurance and strength activities
Components of Energy Expenditure

25–50% physical activity

5–10% thermic effect of food

50–65% BMR
The DRI committee provides a way of estimating EER values for individuals. The equation includes:

- Gender
- Age – BMR declines by an average of 5 percent per decade
- Physical activity
- Body size and weight
- Growth
Body Weight Versus Body Fatness

- For most people, weighing on a scale provides a convenient and accessible way to measure body fatness.
- Researchers and healthcare providers rely on more accurate assessments.
BMI correlates significantly with body fatness but does not measure body composition or fat distribution.

To determine your BMI:

\[
\frac{\text{weight (lbs) } \times 703}{\text{height (in)}^2}
\]
Your weight should fall within the range that best supports your health.

General guideline

- BMI < 18.5 underweight
- BMI 18.5 to 24.9 normal weight
- BMI 25 to 29.9 overweight
- BMI > 30 obese
The BMI standards are not accurate for athletes
What are the drawback of BMI Values?

1. They fail to indicate how much of a person's weight is fat.

2. Where is the fat located?
   - Athletes: muscles increase their BMI values
   - Pregnant/lactating women: increased weight is normal during childbearing
   - Adults over 65: data collected from younger people b/c people grow shorter w/age
Measures of Body Composition and Fat Distribution

- Man: 45% muscle, 25% organs, 15% fat, 15% bone
- Woman: 36% muscle, 24% organs, 27% fat, 13% bone
Do you know your percentage of body fat?

How was it determined?
After you have a body fatness estimate, the question arises: What is the “ideal” body fat for a body to have?

- Ideal for what? Society’s approval or health?
  - For health: Men between 12 and 20 percent body weight as fat
  - Women between 20 and 30 percent body weight as fat

Varies according to gender, lifestyle and stage of life
The Mystery of Obesity

- Why do some people get fat?
- Why do some stay thin?
- Is weight controlled by heredity?
- Is it eating habits?
Eating behavior seems to be regulated by signals that fall into two broad categories:

- “go” mechanisms that stimulate eating and “stop” mechanisms that suppress eating.
**Why Did I Eat That?**

1. **Physiological influences**
   - Empty stomach.
   - Gastric contractions.
   - Absence of nutrients in small intestine.
   - Digestive tract hormones.
   - Endorphins (the brain’s pleasure chemicals) are triggered by the smell, sight, or taste of foods, enhancing the desire for them.

2. **Sensory influences**
   - Thought, sight, smell, sound, taste of food, heighten appetite.

3. **Cognitive influences**
   - Presence of others, social stimulation.
   - Perception of hunger, awareness of fullness.
   - Favorite foods, foods with special meanings.
   - Time of day.
   - Abundance of available food.

4. **Postingestive influences** (after food enters the digestive tract)
   - Food in stomach triggers stretch receptors.
   - Nutrients in small intestine elicit nervous and hormonal signals informing the brain of the fed state.

5. **Postabsorptive influences** (after nutrients enter the blood)
   - Nutrients in the blood signal the brain (via nerves and hormones) about their availability, use, and storage.
   - As nutrients dwindle, so does satiety.
   - Hunger develops.

6. **Hunger and Appetite**

7. **Seek food and start meal**

8. **Satiety: Several hours of other activities**

9. **Satiation: End meal**

10. **Keep eating**
What is the difference between *hunger* and *appetite*?

- **Hunger** – the physical need for food
- **Appetite** – the psychological desire for food
  
  Can you experience appetite without hunger?
Hunger is stimulated by an absence of food in the digestive tract.

**Ghrelin** is a hormone produced by the stomach and signals the hypothalamus of the brain to stimulate eating.

Prevents people from starving.
**Satiation** occurs when the digestive organs signal the brain that enough food has been consumed.

**Satiety** is the feeling of fullness that lasts until the next meal.

Hunger outweighs satiety in the appetite control system.
Leptin: A Satiety Hormone

The adipose tissue hormone **leptin** suppresses the appetite in response to a gain in body fat.

The mouse on the right is genetically obese – it lacks the gene for producing leptin. The mouse on the left is also genetically obese but remains lean because it receives leptin injections.
Leptin- appetite suppressing hormone produced in fat cells

- Leptin travels to the brain via bloodstream
- Linked with the reduction of appetite and body fatness
- Suppresses appetite and food intake between meals
- Lack of sleep reduces leptin and increases ghrelin
- Gain in body fat stimulates leptin = reduction of food consumption
- Fat loss suppresses leptin and stimulates ghrelin = more food consumption
- Some obese people can't produce leptin
- Most obese people produce enough but do not respond normally to its effects - *leptin resistance*
Some foods may confer greater satiety than others, but these effects are not yet well established scientifically.
Metabolic theories attempt to explain obesity on the basis of molecular functioning.

Quacks often exploit these theories for profit.
# Selected Metabolic Theories of Obesity

## Table 9-4 Selected Theories of Metabolic Causes of Obesity

<table>
<thead>
<tr>
<th>Theory</th>
<th>Mechanism of Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enzyme theory</td>
<td>Excess fat storage may stem from elevated concentrations of an enzyme, lipoprotein lipase (LPL), that enables fat cells to store triglycerides. The more LPL, the more easily fat cells store lipid. The fat cells of obese people contain more LPL than the fat cells of lean people.</td>
</tr>
<tr>
<td>Fat cell number theory</td>
<td>Body fatness is determined by both the number and the size of fat cells. Fat cells increase in number during the growing years, tapering off in adulthood.</td>
</tr>
<tr>
<td>Fetal programming theory</td>
<td>The children of mothers who either starved or were obese during their pregnancies more often grow to be overweight or obese themselves. An energy-lean or an energy-rich prenatal environment may influence fetal genetic expression for enzymes involved in energy metabolism: the underfed fetus adapts by producing more energy-conserving metabolic systems; the richly supplied fetus may adapt by producing more fat-storing enzymes and cells.</td>
</tr>
<tr>
<td>Thermogenesis I: Energy-wasting proteins and brown fat theory</td>
<td>Proteins control the body’s heat production, or thermogenesis. A type of adipose tissue, brown fat, has abundant energy-wasting proteins that specialize in converting chemical energy to heat. Brown fat is more abundant in lean animals than in fat ones. Human infants have abundant brown fat, but the amount dwindles with age.</td>
</tr>
<tr>
<td>Thermogenesis II: Adaptive thermogenesis theory</td>
<td>Many tissues, such as muscle, spleen, and bone marrow, convert stored energy into heat in response to cold temperature, physical conditioning, overfeeding, starvation, trauma, and other stress. Genetic inheritance is thought to determine the efficiency of this system.</td>
</tr>
<tr>
<td>Thermogenesis III: Diet-Induced thermogenesis theory</td>
<td>The thermic effect of food varies between obese and nonobese people. In lean people who have just eaten a meal, energy use speeds up for a while, but in many obese people, no change in energy use occurs after eating. In theory, this small difference in energy expenditure may account for an accumulation of body fat, but overweight people often spend more energy each day than lean people do because their heavier bodies require more energy to move and maintain.</td>
</tr>
</tbody>
</table>
### Lies and Truths about Weight Loss Fads

<table>
<thead>
<tr>
<th>Lie</th>
<th>Truth</th>
</tr>
</thead>
<tbody>
<tr>
<td>You’ll lose weight fast without counting calories or exercising because the diet or product alters metabolism.</td>
<td>No known trick of metabolism produces significant weight loss without diet or exercise.</td>
</tr>
<tr>
<td>On this diet, you can eat all you want and still lose weight.</td>
<td>Unless the diet is composed entirely of celery or lettuce, basic laws governing energy disproves this claim—energy consumed must be used to fuel the body or stored as fat.</td>
</tr>
<tr>
<td>You’ll never regain the weight, even after you stop using the diet or product.</td>
<td>Maintenance of a new lower weight requires life-long changes in diet and exercise.</td>
</tr>
<tr>
<td>Lose more than 3 pounds per week without medical supervision.</td>
<td>Weight loss in this range carries substantial risks to health and even to life, making medical supervision prudent.</td>
</tr>
<tr>
<td>This product is 100% successful in producing weight loss.</td>
<td>The causes of obesity are multiple, and even prescription medications and stomach-shrinking surgeries are not 100% effective.</td>
</tr>
<tr>
<td>You’ll lose weight just by wearing the product or rubbing it on the skin.</td>
<td>No over-the-counter patch, cream, wrap, ring, bracelet, other jewelry, shoe inserts, or other gimmick is known to cause loss of weight or fat.</td>
</tr>
<tr>
<td>Reset your genetic code to be thin.</td>
<td>You inherited your genes and no diet can alter them.</td>
</tr>
<tr>
<td>Stress hormones make you fat.</td>
<td>Supplements sold to block stress hormones and produce weight loss do neither.</td>
</tr>
<tr>
<td>High-protein diets are so popular because they are the best way to lose weight.</td>
<td>See this chapter's Consumer Corner.</td>
</tr>
<tr>
<td>High-protein diets energize the brain.</td>
<td>The brain depends on carbohydrate for energy.</td>
</tr>
<tr>
<td>Dietitians know nothing about “modern” nutrition.</td>
<td>Dietitians are, by training and experience, nutrition experts who rely on scientific approaches and cannot be swayed by the claims of quacks.</td>
</tr>
</tbody>
</table>
A person’s genetic inheritance greatly influences, but does not ensure, the development of obesity.

- For someone with at least one obese parent, the chance of becoming obese is estimated to fall between 30 and 70 percent.
Outside-the-Body Causes of Obesity

Studies of human behavior identify stimuli that lead to overeating.

People can override signals of satiety and hunger and eat whenever they wish.
**External Cues to Overeating**

- **Variety** and **availability** are strong influences to eat when not hungry.

- Stress can cause overeating, especially of **comfort foods**.

- **External stimuli** promote eating, such as the time of day "I'm not hungry but it's time to eat."

- **Large portions** encourage overeating.
High-calorie foods are relatively inexpensive, widely available, heavily advertised and wonderfully delicious, but a steady diet of them correlates with obesity.
Some people may be obese, not because they eat too much, but because they move too little.

- In what ways do you spend your leisure time?
### TABLE 9-6: Energy Spent in Activities

To determine the calorie cost of an activity, multiply the number listed by your weight in pounds. Then multiply by the number of minutes spent performing the activity. Example: Jessica (125 pounds) rode a bike at 17 mph for 25 minutes: \(0.057 \times 125 = 7.125; 7.125 \times 25 = 178.125\), or about 180 calories.

<table>
<thead>
<tr>
<th>ACTIVITY</th>
<th>CAL/LB BODY WEIGHT/MIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aerobic dance (vigorous)</td>
<td>0.062</td>
</tr>
<tr>
<td>Basketball (vigorous, full court)</td>
<td>0.097</td>
</tr>
<tr>
<td>Bicycling</td>
<td></td>
</tr>
<tr>
<td>13 mph</td>
<td>0.045</td>
</tr>
<tr>
<td>15 mph</td>
<td>0.049</td>
</tr>
<tr>
<td>17 mph</td>
<td>0.057</td>
</tr>
<tr>
<td>19 mph</td>
<td>0.076</td>
</tr>
<tr>
<td>21 mph</td>
<td>0.090</td>
</tr>
<tr>
<td>23 mph</td>
<td>0.109</td>
</tr>
<tr>
<td>25 mph</td>
<td>0.139</td>
</tr>
<tr>
<td>Canoeing (flat water, moderate pace)</td>
<td>0.045</td>
</tr>
<tr>
<td>Cross-country skiing</td>
<td></td>
</tr>
<tr>
<td>8 mph</td>
<td>0.104</td>
</tr>
<tr>
<td>Golf (carrying clubs)</td>
<td>0.045</td>
</tr>
<tr>
<td>Handball</td>
<td>0.078</td>
</tr>
<tr>
<td>Horseback riding (trot)</td>
<td>0.052</td>
</tr>
<tr>
<td>Rowing (vigorous)</td>
<td>0.097</td>
</tr>
<tr>
<td>Running</td>
<td></td>
</tr>
<tr>
<td>5 mph</td>
<td>0.061</td>
</tr>
<tr>
<td>6 mph</td>
<td>0.074</td>
</tr>
<tr>
<td>7.5 mph</td>
<td>0.094</td>
</tr>
<tr>
<td>9 mph</td>
<td>0.103</td>
</tr>
<tr>
<td>10 mph</td>
<td>0.114</td>
</tr>
<tr>
<td>11 mph</td>
<td>0.131</td>
</tr>
<tr>
<td>Soccer (vigorous)</td>
<td>0.097</td>
</tr>
<tr>
<td>Studying</td>
<td>0.011</td>
</tr>
<tr>
<td>Swimming</td>
<td></td>
</tr>
<tr>
<td>20 yd/min</td>
<td>0.032</td>
</tr>
<tr>
<td>45 yd/min</td>
<td>0.058</td>
</tr>
<tr>
<td>50 yd/min</td>
<td>0.070</td>
</tr>
<tr>
<td>Table tennis (skilled)</td>
<td>0.045</td>
</tr>
<tr>
<td>Tennis (beginner)</td>
<td>0.032</td>
</tr>
<tr>
<td>Walking (brisk pace)</td>
<td></td>
</tr>
<tr>
<td>3.5 mph</td>
<td>0.035</td>
</tr>
<tr>
<td>4.5 mph</td>
<td>0.048</td>
</tr>
<tr>
<td>Weight lifting</td>
<td></td>
</tr>
<tr>
<td>light-to-moderate effort</td>
<td>0.024</td>
</tr>
<tr>
<td>vigorous effort</td>
<td>0.048</td>
</tr>
<tr>
<td>Wheelchair basketball</td>
<td>0.084</td>
</tr>
<tr>
<td>Wheeling self in wheelchair</td>
<td>0.030</td>
</tr>
</tbody>
</table>
The three lifestyle components leading to healthy body weight are diet, physical activity, and behavior change.
How The Body Loses and Gains Weight

- The body’s energy balance is straightforward.

- The type of tissue lost or gained depends on how you go about losing or gaining it.

To maintain weight, energy intake = energy out
Eating periodically, storing fuel, and then using up that fuel between meals is a great advantage.

If a person eats a balanced diet that meets protein and carbohydrate needs, and moderately restricts calories, the body will use stored fat for energy. Gradual weight loss will occur.
If a person goes without food for 3 days, the body makes several adjustments:

- Less than a day into the fast, the liver’s glycogen is used up.
- Where can the body obtain glucose to keep its nervous system going?
- Not from fat, because fat cannot be converted to glucose.
- Not from muscle glycogen, because they keep it for their own use.
The Body’s Response to Fasting

- The body sacrifices the protein in its lean tissue to supply raw materials from which to make glucose.

- If the body were to continue consuming its lean tissue unchecked, death would occur in about 10 days. (Death occurs when either fat stores are depleted or half the body’s lean tissue is gone.)

- To prevent death, the body converts fat to ketones to help feed the nervous system and help spare tissue protein.
After about 10 days of fasting, the brain and nervous system can meet most of their energy needs using *ketone bodies*- acidic fat related compounds that arise from incomplete breakdown of fat when carbs are not available.

Thanks to *ketosis* (ketone bodies add up in the blood), a healthy person starving with average body fat content can live totally without food for as long as six to eight weeks.
The Body’s Response to Fasting

Fasting is not the best way to lose weight.

- Ketosis upsets the acid-base balance of the blood
- Fasting promotes excessive mineral losses in urine
- Intestinal lining loses its integrity
- Lean tissue is lost
- Metabolism slows down
- Promotes slower weight loss and slower fat loss than a diet that moderately restricts calories
Any diet too low in carbohydrate brings about a response that is similar to fasting.

To prevent ketosis and spare body protein, the DRI committee sets a minimum intake of carbohydrate at 130 grams per day, but recommends much more for health.
People who have healthy body weight consume more, not less, carbohydrate-rich foods.
The Body’s Response to Fasting

**When a person overeats (feasting):**

<table>
<thead>
<tr>
<th>Food component</th>
<th>Is broken down in the body to:</th>
<th>And then ends up as:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbohydrate</td>
<td>Glucose</td>
<td>Liver and muscle glycogen stores</td>
</tr>
<tr>
<td>Fat</td>
<td>Fatty acids</td>
<td>Body fat stores</td>
</tr>
<tr>
<td>Protein</td>
<td>Amino acids (first used to replace body proteins)</td>
<td>Nitrogen lost in urine</td>
</tr>
</tbody>
</table>
When a person draws on stores (fasting):

Storage component: Liver and muscle glycogen stores → Body fat stores

Is broken down in the body to: Glucose → Fatty acids

And then used for: Energy
If the fast continues beyond glycogen depletion:

**Body component:**
- Body protein
- Body fat

**Is broken down in the body to:**
- Amino acids
- Fatty acids

**And then converted to:**
- Glucose
- Nitrogen and some ketone bodies lost in urine
- Ketone bodies

**Energy**
Consumer Corner: Popular High-Protein, Low-Carbohydrate Diets

Names of these diets include:

- Atkins New Revolution
- The Zone Diet
- Calories Don’t Count
- Protein-Power Diet
### Table 9-7: Claims and Science Concerning High-Protein Diets

**Claim:** Restricting carbohydrates will shift metabolism to cause weight loss.  
**Science:** Weight loss follows restricted food energy intake or increased energy output; restricting carbohydrates without reducing calories does not produce weight loss.

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**Claim:** Eating more protein makes people lean.  
**Science:** In population studies, the higher the protein intake, the higher the BMI.

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**Claim:** Insulin release causes obesity and disease.  
**Science:** Insulin helps to transport glucose into cells and to store excess nutrients, including fat. Insulin cannot cause fat storage and weight gain in a person whose energy budget is balanced.

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**Claim:** High-protein foods cause greater energy expenditure.  
**Science:** The thermic effect of food is slightly higher for protein than for carbohydrate or fat, but the increase is so slight as to be insignificant to weight-loss efforts.

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Consumer Corner: Popular High-Protein, Low-Carbohydrate Diets

What do studies find?

- Some report higher BMI values among those consuming the high-protein diet.
- Some report more weight lost on low-carbohydrate diets in the first few months but the advantage evaporates at six months after starting the diet.
  - Weight lost initially on a low-carbohydrate diet is mostly water and glycogen.
  - Diet records indicate fewer calories are eaten by people starting a low-carbohydrate diet.
Low-carbohydrate diets are also high in protein and fat.

- A steady diet of high-fat foods, especially those high in saturated fat and cholesterol, raises the risk of heart disease.
  - It is not clear what effect these diets have on LDL cholesterol.
- There are links between high-protein diets and increased risks of osteoporosis, kidney disease, cancer, and obesity.
Claims that weight and health are best served by eliminating or greatly reducing intakes of whole grains, vegetables, fruits, and other nutritious foods are baseless.

To omit those foods is to eliminate nutrients, phytochemicals, and fibers all with proven health benefits.
When energy balance is positive,

- carbohydrate is converted to glycogen or fat
- protein is converted to fat
- food fat is stored as fat
- alcohol delivers calories and encourages fat storage
Each gram of alcohol presents 7 calories of energy to the body.
What Diet Strategies Are Best for Weight Loss?

- Setting goals
- Keeping records
- Plan a healthy diet for the long run, not a fad diet
What Diet Strategies Are Best for Weight Loss?

Choose realistic calorie intakes

<table>
<thead>
<tr>
<th>FOOD GROUP</th>
<th>1,000 CALORIES</th>
<th>1,200 CALORIES</th>
<th>1,400 CALORIES</th>
<th>1,600 CALORIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fruit</td>
<td>1 c</td>
<td>1 c</td>
<td>1 1/2 c</td>
<td>1 1/2 c</td>
</tr>
<tr>
<td>Vegetables</td>
<td>1 c</td>
<td>1 1/2 c</td>
<td>1 1/2 c</td>
<td>2 c</td>
</tr>
<tr>
<td>Grains</td>
<td>3 oz</td>
<td>4 oz</td>
<td>5 oz</td>
<td>5 oz</td>
</tr>
<tr>
<td>Meat and Legumes</td>
<td>2 oz</td>
<td>3 oz</td>
<td>4 oz</td>
<td>5 oz</td>
</tr>
<tr>
<td>Milk</td>
<td>3 c</td>
<td>3 c</td>
<td>3 c</td>
<td>3 c</td>
</tr>
<tr>
<td>Oils</td>
<td>3 tsp</td>
<td>3 tsp</td>
<td>3 tsp</td>
<td>4 tsp</td>
</tr>
</tbody>
</table>

These intakes allow most people to lose weight and still meet their nutrient needs with careful, nutrient-dense food selections. Note that the discretionary calorie allowance for these patterns is about 100 calories.

Note: The USDA Food Guide patterns for 1,000, 1,200, and 1,400 calories were designed for children and provided 2 cups milk. They were modified here to include an additional cup of milk, as 3 cups per day is recommended for all adults.
What Diet Strategies Are Best for Weight Loss?

- Balance carbohydrates, fats, and proteins
- Manage portion sizes
- Use the concept of **energy density** - measure of energy provided by food relative to its weight.
  - High energy density = overweight
- Not the same as **nutrient density** - nutrients per calorie.
- Select foods low in energy density b/c they have more water & fiber and have less fat.
What Diet Strategies Are Best for Weight Loss?

**HIGHER ENERGY DENSITY**

- Caesar salad; croutons (fast-food size).
- **500 calories**
- **280 g total weight**
- **1.78 energy density**

- Large hot dog on bun; ½ c potato salad.
- **650 calories**
- **265 g total weight**
- **2.45 energy density**

**LOWER ENERGY DENSITY**

- Mixed salad with 3 oz chicken breast, mixed vegetables, almonds, cranberries, and 3 tbs low-calorie dressing; whole-wheat dinner roll with 1.5 oz lean ham.
- **500 calories**
- **570 g total weight**
- **0.88 energy density**

- Homemade, very lean (8% fat), 3-oz hamburger on whole-wheat bun; grilled vegetables with 1 tsp margarine; ½ c pork and beans; slice watermelon.
- **650 calories**
- **810 g total weight**
- **0.8 energy density**
What Diet Strategies Are Best for Weight Loss?

- Consider milk and milk products
  higher calcium and diary intakes is related to lower central body fatness
- Demonstration diet
What Diet Strategies Are Best for Weight Loss?
What Diet Strategies Are Best for Weight Loss?

- **Meal spacing**
- 3 meals a day is a standard
- You can have more if you reduce the portions
- Make sure it's from mild hunger not appetite
- Don't skip breakfast; it reduces food intake all day
- Consuming more than 1/2 of calories after 7pm (night eating syndrome) is harder to lose weight
Physical Activity for Weight Loss

- Physical activity greatly augments diet in weight-loss efforts.
- Improvements in health and body composition follow an active lifestyle.
What Strategies Are Best for Weight Gain?

- Weight gain requires a diet of calorie-dense foods, eaten frequently throughout the day.
- Physical activity builds lean tissue, and no special supplements can speed the process.
- Eat more calories to gain muscle and fat
# Drugs and Surgery to Treat Obesity

## Table 9.11: Pharmaceutical Treatments of Obesity

<table>
<thead>
<tr>
<th>Prescriptions Drugs</th>
<th>Actions</th>
<th>Known Side Effects</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sibutramine</td>
<td>Suppresses appetite.</td>
<td>Dry mouth, headache, constipation, insomnia, and high blood pressure&lt;sup&gt;b&lt;/sup&gt;</td>
<td>The FDA advises those with high blood pressure against its use; others should monitor their blood pressure.</td>
</tr>
<tr>
<td>Orlistat (see below)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Prescription Drugs

- **Sibutramine**
  - Trade name: Meridia
  - Suppresses appetite.
  - Dry mouth, headache, constipation, insomnia, and high blood pressure.<sup>b</sup>
  - The FDA advises those with high blood pressure against its use; others should monitor their blood pressure.

### Over-the-Counter Drugs

- **Benzocaine**
  - Trade names: Diet Ayds (candy) or Slim Mint (gum)
  - Anesthetizes the tongue, reducing taste sensations
  - None known
  - Few over-the-counter weight-loss medications have FDA approval.

- **Orlistat<sup>c</sup>**
  - Trade name: alli<sup>c</sup> (prescription name: Xenical)
  - Inhibits pancreatic lipase activity, thus blocking dietary fat absorption by about 30%.
  - Gas, frequent loose bowel movements, and reduced absorption of fat-soluble vitamins
  - Most effective with a nutritionally balanced, reduced-calorie, low-fat diet

- **Phenylpropanolamine (PPA) (also called nor-ephedrine)**
  - Appetite suppressant; nasal and sinus decongestant
  - Dry mouth, rapid pulse, nervousness, sleeplessness, hypertension, irregular heartbeat, kidney failure, liver damage, liver failure, seizures, and hemorrhagic strokes (bleeding in the brain)
  - The FDA has removed PPA from drug products and has warned consumers not to consume products containing it (check labels).
<table>
<thead>
<tr>
<th>OTHER PRODUCTS</th>
<th>Enhances effects of the stress hormone nor-epinephrine, including reduced appetite.</th>
<th>Nervousness, headache, insomnia, dizziness, palpitations, skin flush, serious heart problems; almost 1,400 reported adverse events, including death</th>
<th>Prohibited in the United States and Canada, but available via the Internet. Consumers owning products should stop taking them (check labels).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ephedrine, ephedra, or ma huang</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bitter orange extract</td>
<td>Often a replacement for ephedrine, this stimulant mimics ephedra in chemical composition and function.</td>
<td>High blood pressure; increased risk of heart arrhythmias, heart attack, stroke</td>
<td>The FDA has currently taken no action against bitter orange extract.</td>
</tr>
<tr>
<td>Trade names: Xenadrine EFX, Metabolife Ultra, NOW Diet Support</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>“Carb blockers,” “fat blockers,” “binders,” chromium picolinate, chitosan, many others</td>
<td>None known</td>
<td>Not studied</td>
<td>The FDA and the Federal Trade Commission have begun taking action against such products falsely claimed to produce weight or fat loss.</td>
</tr>
</tbody>
</table>

*aFor answers to drug-related questions, call FDA Information toll free: (888) 463-6332 or visit www.fda.gov.
*bSibutramine may also be associated with memory impairment.
*cOrlistat (60 mg) was approved for over-the-counter sales in 2007 under the trade name *alli* (pronounced AL-eye). Prescription strength (120 mg) Orlistat is sold as Xenical.
The effectiveness of herbal products and other gimmicks has not been demonstrated, and they may prove dangerous.
Once I’ve Changed My Weight, How Can I Stay Changed?

People who succeed at maintaining lost weight keep to their eating routines, keep exercising, and keep track of calorie and fat intakes and body weight.

The more traits related to positive self-image and self-efficacy a person possesses or cultivates, the more likely that person will succeed.
Supporting diet and exercise is behavior therapy

- Involves changing behaviors and thought processes
- Based on the knowledge that habits drive behaviors
<table>
<thead>
<tr>
<th>TABLE 9-12</th>
<th>Applying Behavior Modification to Control Body Fatness</th>
</tr>
</thead>
</table>

1. Eliminate inappropriate eating cues:
   - Don’t buy problem foods.
   - Eat only in one room at the designated time.
   - Shop when not hungry.
   - Avoid vending machines, fast-food restaurants, and convenience stores.
   - Turn off the television, video games, and computer.

2. Suppress the cues you cannot eliminate:
   - Serve individual plates; don’t serve “family style.”
   - Measure your portions; avoid large servings or packages of food.
   - Make small portions look large by spreading them over the plate.
   - Create obstacles to consuming problem foods—wrap them and freeze them, making them less quickly accessible.
   - Control deprivation; plan and eat regular meals.
   - Likewise, plan to spend only one hour in sedentary activities, such as watching television or using a computer.

3. Strengthen cues to appropriate eating and exercise:
   - Share appropriate foods with others.
   - Store appropriate foods in convenient spots in the refrigerator.
   - Learn appropriate portion sizes.
   - Plan appropriate snacks.
   - Keep sports and play equipment by the door.
4. Repeat the desired eating and exercise behaviors:
   - Slow down eating—put down utensils between bites.
   - Always use utensils.
   - Leave some food on your plate.
   - Move more—shake a leg, pace, stretch often.
   - Join groups of active people and participate.

5. Arrange or emphasize negative consequences for inappropriate eating:
   - Ask that others respond neutrally to your deviations (make no comments—even negative attention is a reward).
   - If you slip, don’t punish yourself.

6. Arrange or emphasize positive consequences for appropriate eating and exercise behaviors:
   - Buy tickets to sports events, movies, concerts, or other nonfood amusement.
   - Indulge in a new small purchase.
   - Get a massage; buy some flowers.
   - Take a hot bath; read a good book.
   - Treat yourself to a lesson in a new active pursuit such as horseback riding, handball, or tennis.
   - Praise yourself; visit friends.
   - Nap; relax.
Controversy: The Perils of Eating Disorders

About 5 million people in the U.S., mostly females, suffer from the eating disorders anorexia nervosa and bulimia nervosa.

Many more suffer from binge eating disorder or related conditions.

85% of eating disorders start during adolescence.
Anorexia nervosa
**Controversy: The Perils of Eating Disorders**

<table>
<thead>
<tr>
<th><strong>TABLE C9-1</strong> Eating Disorder Terms</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>anorexia nervosa</strong> an eating disorder characterized by a refusal to maintain a minimally normal body weight, self-starvation to the extreme, and a disturbed perception of body weight and shape; seen (usually) in teenage girls and young women (<em>anorexia</em> means “without appetite”; <em>nervos</em> means “of nervous origin”).</td>
</tr>
<tr>
<td><strong>binge eating disorder</strong> an eating disorder whose criteria are similar to those of bulimia nervosa, excluding purging or other compensatory behaviors.</td>
</tr>
<tr>
<td><strong>bulimia</strong> (byoo-LEEM-ee-uh) <em>nervosa</em> recurring episodes of binge eating combined with a morbid fear of becoming fat; usually followed by self-induced vomiting or purging.</td>
</tr>
<tr>
<td><strong>cathartic</strong> a strong laxative.</td>
</tr>
<tr>
<td><strong>cognitive therapy</strong> psychological therapy aimed at changing undesirable behaviors by changing underlying thought processes contributing to these behaviors; in anorexia, a goal is to replace false beliefs about body weight, eating, and self-worth with health-promoting beliefs.</td>
</tr>
<tr>
<td><strong>eating disorder</strong> a disturbance in eating behavior that jeopardizes a person’s physical or psychological health.</td>
</tr>
<tr>
<td><strong>emetic</strong> (em-ETT-ic) an agent that causes vomiting.</td>
</tr>
<tr>
<td><strong>female athlete triad</strong> a potentially fatal triad of medical problems seen in female athletes: disordered eating, amenorrhea, and osteoporosis.</td>
</tr>
</tbody>
</table>
Risk factors among athletes include:

- Adolescence
- Pressure to excel at chosen sport
- Focus on achieving “ideal weight” or body fat percentage
- Participation in sports that emphasize a lean appearance
- Unhealthy, unsupervised weight-loss dieting at an early age
The female athlete triad:

- Disordered eating
- Amenorrhea
- Osteoporosis

Eating Disorder
- Restrictive dieting (inadequate energy and nutrient intake)
- Overexercising
- Weight loss
- Lack of body fat

Osteoporosis
- Loss of calcium from bones

Amenorrhea
- Diminished hormones
On average, wrestlers, gymnasts, and figure skaters strive to be too thin.

Muscle dysmorphia – a weight gain problem, in which young men with well-muscled bodies falsely see themselves as underweight and weak.

- Can lead to obsessive weighing, excessive exercise, overuse of special diets or protein supplements, or even steroid abuse.
### Tips for Combating Eating Disorders

#### General Guidelines
- Never restrict food intakes to below the amounts suggested for adequacy by the USDA Food Guide (Chapter 2).
- Eat frequently. People often do not eat frequent meals because of time constraints, but eating can be incorporated into other activities, such as snacking while studying or commuting. The person who eats frequently never gets so hungry as to allow hunger to dictate food choices.
- If not at a healthy weight, establish a reasonable weight goal based on a healthy body composition. (Chapter 9 provides help in doing so.)
- Allow a reasonable time to achieve the goal. A reasonable rate for losing excess fat is about 1% of body weight per week.
- Establish a weight-maintenance support group with people who share interests.

#### Specific Guidelines for Athletes and Dancers
- Replace weight-based or appearance-based goals with performance-based goals.
- Remember that eating disorders impair physical performance. Seek confidential help in obtaining treatment if needed.
- Restrict weight-loss activities to the off-season.
- Focus on proper nutrition as an important facet of your training, as important as proper technique.
**Anorexia Nervosa**

- Women with anorexia nervosa see themselves as fat, even when they are dangerously underweight.
# Anorexia Nervosa

## Table C9-3 Criteria for Diagnosis of Anorexia Nervosa

A person with anorexia nervosa demonstrates the following:

A. Refusal to maintain body weight at or above a minimal normal weight for age and height, e.g., weight loss leading to maintenance of body weight less than 85% of that expected; or failure to make expected weight gain during period of growth, leading to body weight less than 85% of that expected.

B. Intense fear of gaining weight or becoming fat, even though underweight.

C. Disturbance in the way in which one’s body weight or shape is experienced; undue influence of body weight or shape on self-evaluation, or denial of the seriousness of the current low body weight.

D. In females past puberty, amenorrhea, i.e., the absence of at least three consecutive menstrual cycles. (A woman is considered to have amenorrhea if her periods occur only following hormone, e.g., estrogen, administration.)

Two types of anorexia nervosa include:

- **Restricting type:** during the episode of anorexia nervosa, the person does not regularly engage in binge eating or purging behavior (i.e., self-induced vomiting or the misuse of laxatives, diuretics, or enemas).

- **Binge eating/purging type:** during the episode of anorexia nervosa, the person regularly engages in binge eating or purging behavior (i.e., self-induced vomiting or the misuse of laxatives, diuretics, or enemas).

Physical Perils

- Anorexia nervosa brings the same damage as classic protein-energy malnutrition.
Treatment requires a multidisciplinary approach that addresses food and weight and also involves relationships with oneself and others.

1,000 women die each year, mostly from heart abnormalities brought on by malnutrition or from suicide.
**Bulimia Nervosa**

**Table C9-4**  Criteria for Diagnosis of Bulimia Nervosa

A person with bulimia nervosa demonstrates the following:

A. Recurrent episodes of binge eating. An episode of binge eating is characterized by both of the following:
   1. Eating, in a discrete period of time (e.g., within any two-hour period), an amount of food that is definitely larger than most people would eat during a similar period of time and under similar circumstances, and,
   2. A sense of lack of control over eating during the episode (e.g., a feeling that one cannot stop eating or control what or how much one is eating).

B. Recurrent inappropriate compensatory behavior in order to prevent weight gain, such as self-induced vomiting; misuse of laxatives, diuretics, enemas, or other medications; fasting; or excessive exercise.

C. Binge eating and inappropriate compensatory behaviors that both occur, on average, at least twice a week for three months.

D. Self-evaluation unduly influenced by body shape and weight.

E. The disturbance does not occur exclusively during episodes of anorexia nervosa.

Two types:

- **Purging type:** the person regularly engages in self-induced vomiting or the misuse of laxatives, diuretics, or enemas.
- **Nonpurging type:** the person uses other inappropriate compensatory behaviors, such as fasting or excessive exercise, but does not regularly engage in self-induced vomiting or the misuse of laxatives, diuretics, or enemas.

Bulimia Nervosa

A typical binge consists of easy-to-eat, low-fiber, smooth-textured, high-calorie foods
Physical and Psychological Perils:

- Abnormal heart rhythms
- Swollen neck glands
- Urinary tract infections
- Irritation and infection of the throat
- Tears of the stomach and/or esophagus
- Dental caries
- Shame, guilt
### Treatment of Bulimia Nervosa

**TABLE C9-5: Diet Strategies for Combating Bulimia Nervosa**

**PLANNING PRINCIPLES:**
- Plan meals and snacks; record plans in a food diary prior to eating.
- Plan meals and snacks that require eating at the table and using utensils.
- Refrain from eating “finger foods.”
- Refrain from “dieting” or skipping meals.

**NUTRITION PRINCIPLES:**
- Eat a well-balanced diet and regularly timed meals consisting of a variety of foods.
- Include raw vegetables, salad, or raw fruit at meals to prolong eating times.
- Choose whole-grain, high-fiber breads, pasta, rice, and cereals to increase bulk.
- Consume adequate fluid, particularly water.

**OTHER TIPS:**
- Choose meals that provide protein and fat for satiety, and bulky, fiber-rich carbohydrates for immediate feelings of fullness.
- Try including soups and other water-rich foods for satiety (water contents of foods are listed in Appendix A).
- Consume the amounts of food specified in the USDA Food Guide (Chapter 2 and Appendix E).
- For convenience (and to reduce temptation) select foods that naturally divide into portions. Select one potato, rather than rice or pasta that can be overloaded onto the plate; purchase yogurt and cottage cheese in individual containers; look for small packages of precut steak or chicken; choose frozen dinners with metered portions.
- Include 30 minutes or more of physical activity on most days—exercise may be an important tool in controlling bulimia.
A person with a binge eating disorder demonstrates the following:

A. Recurrent episodes of binge eating. An episode of binge eating is characterized by both of the following:
   1. Eating, in a discrete period of time (e.g., within any two-hour period) an amount of food that is definitely larger than most people would eat in a similar period of time under similar circumstances.
   2. A sense of lack of control over eating during the episode (e.g., a feeling that one cannot stop eating or control what or how much one is eating).

B. Binge eating episodes are associated with at least three of the following:
   1. Eating much more rapidly than normal.
   2. Eating until feeling uncomfortably full.
   3. Eating large amounts of food when not feeling physically hungry.
   4. Eating alone because of being embarrassed by how much one is eating.
   5. Feeling disgusted with oneself, depressed, or very guilty after overeating.

C. The binge eating causes marked distress.

D. The binge eating occurs, on average, at least twice a week for six months.

E. The binge eating is not associated with the regular use of inappropriate compensatory behaviors (e.g., purging, fasting, excessive exercise) and does not occur exclusively during the course of anorexia nervosa or bulimia nervosa.

Eating Disorders in Society

Eating disorders may have many causes

- Sociocultural
- Psychological
- Heredity
- Neurochemical