

Chapter 7
Energy Balance and Obesity:
A Nation Out of Balance

Hewlings/Medeiros

PowerPoint presentation created by
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Obesity Trends* Among U.S. Adults
BRFSS, 1990, 1998, 2006
(*BMI ≥30, or about 30 lbs. overweight for 5'4" person)

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Introduction

Approximately 66% of American adults are overweight or obese.

Increased risk of:

- Hypertension
- Type 2 diabetes
- Coronary disease
- Gallbladder disease
- Dyslipidemia
- Stroke
- Osteoarthritis
- Sleep apnea
- Certain cancers

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Energy Balance

- “State in which energy intake, in the form of food and/or alcohol, matches the energy expended, primarily through basal metabolism and physical activity”
- Positive energy balance
 - Energy intake > energy expended
 - = weight gain
- Negative energy balance
 - Energy intake < energy expended
 - = weight loss

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Calories In



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Increasing Portion Sizes

20 Years Ago



85 calories, 6.5 ounces

Today



250 calories, 20 ounces

CALORIE DIFFERENCE: 165 calories

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Beware of the "Large"

- A small 2.6-oz. serving of McDonald's french fries is 250 calories.
- A medium 4-oz. serving of McDonald's french fries is 380 calories.
- A large 6-oz. serving of McDonald's french fries is 570 calories.



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Dining out



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Correct Portion Sizes

- A 3-ounce portion of meat or a 3-ounce equivalent in MyPyramid
- An adequate portion size for one meal



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Calories Burned

- Resting energy expenditure
- Physical activity
- Thermic effect of food

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Resting Energy Expenditure

- The minimum energy expended to keep a resting, awake body alive
- ~60–70% of the total energy needs
- Heartbeat, respiration, body temperature
- Varies between individuals
 - Lean body mass

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Influences on Resting Energy Expenditure

- Muscle mass
- Body surface area (weight, height)
- Gender
- Body temperature
- Thyroid hormone
- Age
- Intake (kcal)
- Pregnancy
- Use of caffeine and tobacco

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Physical Activity

- Increases energy expenditure beyond BMR
- Varies widely among individuals
- More activity, more energy burned
- Increases muscle mass
- Lack of activity is the major cause of obesity.

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Thermic Effect of Food (TEF)

- Energy used to digest, absorb, and metabolize food nutrients
- ~10% total calories consumed
- TEF is higher for CHO and protein than fat
 - Less energy is used to transfer dietary fat into adipose stores

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How do you know how many calories you need?

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Harris-Benedict Equation

- Estimates resting energy needs
- Considers height, weight, age, and gender
- For men:
 $66.5 + (13.8 \times (\text{kg})) + (5 \times (\text{cm})) - (6.8 \times (\text{age in yr.}))$
- For women:
 $655.1 + (9.6 \times (\text{kg})) + (1.8 \times (\text{cm})) - (4.7 \times (\text{age in yr.}))$

Can calculate online:
<http://www.dietitian.com/lbw/lbw.html>
<http://www.bcm.edu/cnrc/caloriesneed.htm>

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Sample Calculations

- Man: 21 yr., 5'10" (171 cm), 155 lbs. (70 kg)
 $66.5 + (13.8 \times (70 \text{ kg})) + (5 \times (171 \text{ cm})) - (6.8 \times (21)) = 1,745 \text{ kcal/day}$
- Woman: 21 yr., 5'10" (171 cm), 155 lbs. (70 kg)
 $655.1 + (9.6 \times (70 \text{ kg})) + (1.8 \times (171 \text{ cm})) - (4.7 \times (21)) = 1,536 \text{ kcal/day}$

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What Is a Healthy Body Weight?

- Based on how you feel, weight history, fat distribution, family history of obesity-related disease, current health status, and lifestyle
- Current height/weight standards only provide guides

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Body Mass Index (BMI)

- The standard
- Does not consider % fat

$$\frac{\text{Body wt (in kg)}}{[\text{Ht (in m)}]^2} \text{ OR } \frac{\text{Body wt (in lbs.)} \times 704.5}{[\text{Ht (in inches)}]^2}$$

Health risks increase when BMI is > 25.



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Overweight and Obesity Defined by BMI

- **Underweight = BMI < 18.5**
- Healthy weight = BMI 18.5–24.9
- Overweight = BMI 25–29.9
- Obese = BMI 30–39.9
- Severely obese = BMI > 40

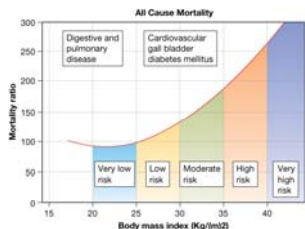
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Body Composition

- Can measure % body fat
- Most accurate
- Excessive amount of body fat
 - Women with > 30–35% body fat
 - Men with > 25% body fat
- Increased risk for health problems

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Relationship between BMI and Cardiovascular Disease Mortality



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Estimating Body Composition



- Underwater weighing
 - Most accurate
 - Fat is less dense than lean tissue.
 - Use equations

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Estimating Body Composition


- The Bod Pod



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Estimating Body Composition

- Bioelectrical Impedance
 - Low-energy current to the body that measures the resistance to electrical flow
 - Fat is resistant to electrical flow; the more the resistance, the more body fat you have.
- Skin Folds



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Body Fat Distribution Influences Disease Risk

- Upper-body (android) obesity - "apple shape"
- Lower-body (gynecoid) obesity - "pear shape"




GREATER DISEASE RISK

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Waist Circumference

- Just as good as waist-to-hip ratio
- Better than BMI alone
- Disease risk increases with waist:
40 inches for men, 35 in for women.



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What Causes Obesity?

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Why Do You Eat?

- **Hunger**
 - Physiological (internal) drive to eat
 - Controlled by internal body
- **Appetite**
 - Psychological (external) drive to eat
 - Often in the absence of hunger
 - e.g., seeing/smelling fresh baked chocolate chip cookies

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Satiety Regulator

- **The hypothalamus**
 - When feeding cells are stimulated, they signal you to eat.
 - When satiety cells are stimulated, they signal you to stop eating.
- **Sympathetic nervous system**
 - When activity increases, it signals you to stop eating.
 - When activity decreases, it signals you to eat.

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Influenced by Body Composition

Leptin

- A hormone produced by the adipose tissue
- Increases with larger fat mass (and decreases desire to eat)
- Decreases with lower fat mass (and enhances desire to eat)
- Acts to decrease activity of neuropeptide Y

Neuropeptide Y

- Increases food intake
- Reduces energy expenditure

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Hormonal Influence

- Endorphins
 - Natural body tranquilizer that can prompt you to eat
- CCK
 - Along with gastrointestinal distention, decreases hunger (and desire to eat)
- Serotonin
 - Neurotransmitter that is released as a result of carbohydrate intake
 - High levels appear to decrease desire to eat carbohydrates and induce calmness.

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Hormonal Influence

Nutrient receptors

- In small intestine
- Elicit feeling of satiety
- Communicate with the brain via nerves
- Inform brain of the presence of nutrients in the small intestine
- Feeling of satiety with the infusing of carbohydrates or fats in the small intestine

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Nutrients' Influence

- Presence of energy-yielding nutrients registers satiety in the brain.
- Apolipoprotein A-IV on the chylomicrons signals satiety in the brain.
- Absence of these nutrients will signal hunger.

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Why We Eat

- Appetite is affected by a variety of external forces.
- A combination of internal and external signals drive us to eat.
- Not a perfect system; desire to eat can be overwhelming.

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Causes of Obesity

Nature debate: i.e., genetics

- Identical twins raised apart have similar weights.
- Genetics accounts for ~40 percent of weight differences.
- Genes affect metabolic rate, fuel use, and brain chemistry.
- Thrifty metabolism gene allows for more fat storage to protect against famine.

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Causes of Obesity

Nurture debate

- Environmental factors influence weight.
- Learned eating habits
- Activity factor (or lack of)
- Poverty and obesity
- Female obesity is rooted in childhood obesity.
- Male obesity appears after age 30.

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Causes of Obesity

- Obesity is nurture allowing nature to express itself.
- Location of fat is influenced by genetics.
- A child with no obese parents has a 10 percent chance of becoming obese.
- A child with one obese parent has a 40 percent chance.
- A child with two obese parents has an 80 percent chance.

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Causes of Obesity

- Those at risk for obesity may face a lifelong struggle with weight.
- BUT: Genes do not control destiny.
- Increased physical activity and moderate intake can promote healthy weight.

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Causes of Obesity: Set Point Theory

- Weight is closely regulated by the body.
- Genetically predetermined body weight
- Body resists weight change.
- Leptin assists in weight regulation.
- Weight returns after weight loss.
- Reduction in energy intake results in lower metabolic rate.
- Ability to shift the set point weight

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Causes of Obesity: Hyperplasia/Hypertrophy

- Hyperplasia
 Increase in total number of cells
- Hypertrophy
 Increase in cell size

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Weight Loss: What Doesn't Work?

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Dieting

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Dieting Can Be Hazardous to Your Health

- Can be bad for self esteem
- Increase risk for eating disorders
- Weight regained consists of a higher percentage of body fat than before.
- Less healthy than before dieting
- DIET is a four-letter word.
- Prevention is KEY.

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Why Diets Don't Work

- Obesity is a chronic disease.
 - Treatment requires long-term lifestyle changes.
- Dieters are misdirected.
 - More concerned about weight loss than healthy lifestyle
 - Unrealistic weight expectations

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Why Diets Don't Work

- Fluid is usually the first weight lost on diet.
- Then loss in lean body tissue, especially on starvation diet with no exercise = lower BMR
- Very little fat is usually lost during weight loss.

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Lifestyle Versus Weight Loss

- Prevention of obesity is easier than curing.
- Balance energy in(take) with energy out(put).
- Focus on improving dietary habits.
- Focus on increasing physical activities.

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Tips for Spotting "Quackery"

- Twenty-five ways to spot quackery
– <http://www.quackwatch.org/01QuackeryRelatedTopics/spotquack.html>
- How to spot a quacky website
– <http://www.quackwatch.org/01QuackeryRelatedTopics/quackweb.html>
- Seven signs of bogus science
– <http://www.quackwatch.org/01QuackeryRelatedTopics/signs.html>

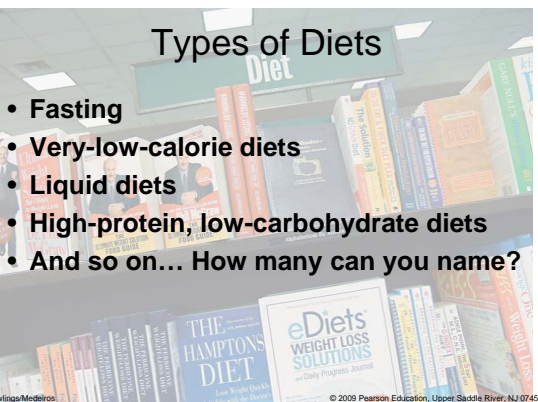
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Types of Diets

- Fasting
- Very-low-calorie diets
- Liquid diets
- High-protein, low-carbohydrate diets
- And so on... How many can you name?



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Surgery



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What Does Work?

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Sound Weight-Loss Program

- Meets nutritional needs, except for kcal
 - Density very important
- Slow and steady weight loss
- Adapted to individuals' habits and tastes—is realistic
- Improves overall health
- Focuses on health
- Contains common foods
- Fits into any social situation
- Changes eating problems/habits
- Contains enough kcal to minimize hunger and fatigue
 - No starvation diets
- Includes exercise

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Cutting Back

- Control calorie intake by being aware of kcal and fat content of foods
- “Fat free” does not mean “calorie free” (or “all you can eat”)
- Cut empty calories
 - Look at beverages first
- Control portion size
- Prevent becoming “ravenous”
- Read food labels
- Estimate kcal using MyPyramid or diet analysis

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Portion Sizes

Big Mac, a large order of fries, a baked apple pie, and a large Coke

A fast-food meal consisting of a Big Mac, a large order of fries, a baked apple pie, and a large Coke.

You'll be consuming:

- ✓ 1,701 calories
- ✓ 72 grams of fat
- ✓ 1,630 milligrams of sodium

VS.

A regular burger, small fries, and small Coke

A fast-food meal consisting of a regular burger, small fries, and a small Coke.

You'll be consuming:

- ✓ 640 calories
- ✓ 20 grams of fat
- ✓ 700 milligrams of sodium

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Regular Physical Activity

- Exercise very important for maintenance and prevention of weight loss
- Increases energy expenditure
- Duration and Intensity
- Make it a part of schedule

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What It Takes to Lose a Pound

- Body fat contains 3,500 kcal per pound
- Fat storage (body fat plus supporting lean tissues) contains 2,700 kcal per pound
- Must have an energy deficit of 2,700–3,500 kcal to lose a pound per week

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Do the Math

To lose one pound, you must create a deficit of 2700–3500 kcal.

To lose a pound in 1 week (7 days), try cutting back on your kcal intake and increase physical activity so that you create a deficit of 400–500 kcal per day.


$$\begin{array}{|c|} \hline -500 \text{ kcal} \\ \hline \text{day} \\ \hline \end{array} \times \begin{array}{|c|} \hline 7 \text{ days} \\ \hline \text{week} \\ \hline \end{array} = \begin{array}{|c|} \hline -3,500 \text{ kcal} \\ \hline \end{array} = 1 \text{ pound of weight loss} \\ \text{in 1 week}$$

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Volume Eating



Eating fewer calories doesn't have to mean eating less food.

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Behavior Modification

- Modify problem (eating) behaviors
- Chain-breaking
- Stimulus control
- Cognitive restructuring
- Contingency management
- Self-monitoring

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Chain-Breaking

- Breaking the link between two behaviors
- These links can lead to excessive intake



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Stimulus Control

- Altering the environment to minimize the stimuli for eating
- Puts you in control of temptations

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Cognitive Restructuring

- Changing your frame of mind regarding eating
- Replace eating due to stress with “walking”

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Contingency Management

- Forming a plan of action in response to a situation
- Rehearse in advance appropriate responses to pressure of eating at parties

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Self-Monitoring

- Tracking foods eaten and conditions affecting eating
- Helps you understand your eating habits

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Weight Maintenance

- Prevent relapse
 - Occasional lapse is fine, but take charge immediately.
 - Allow room for sweets and favorites
 - Continue to practice newly learned behavior
 - Requires “motivation, movement, and monitoring”
- Have social support
 - Encouragement from friends/family/professionals

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Should Schools and States Be Involved?

- Determining BMI in schools?



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Should Employers Be Involved?



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Underweight Is Also a Problem

- 15–25% below IBW
- BMI of <18.5
- Associated with increased deaths, menstrual dysfunction, pregnancy complications, slow recovery from illness/surgery, osteoporosis, malnutrition, GI problems

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Treatment for Underweight

- Intake of energy-dense foods (energy input)
- Encourage frequent meals and snacks
- Reduce activity if severe (energy output)
- Weight training
- Theoretically, to gain a pound you need a total excess intake of 2,700–3,500 kcal

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