Chapter 8

Energy Balance and Body Composition

Studying = 1 or 2 kcalories/minute

Objectives for Chapter 8

• Identify components of energy requirement
• Identify the BMI numbers that indicate healthy, overweight, and obese.
• Know factors that affect basal metabolic rate.
• Describe the difference between hunger and appetite.
• Discuss the consequences of eating disorders.

Energy Balance
What Is Energy Balance and What Determines Energy Needs?

Energy balance is “calories in” versus “calories out.”

- **Positive energy balance**: consume more calories than expend, leads to fat storage, weight gain
- **Negative energy balance**: calorie intake falls short of needs, leads to weight loss

Energy Balance and Imbalances

What Are the Effects of an Energy Imbalance?

Too few calories can cause underweight.

- Stored glycogen and fat are used as fuel sources.
  - Amino acids from body protein breakdown can be used to make glucose
  - Liver glycogen depleted in 2-3 days
  - Ketone bodies generated from incomplete breakdown of fat
  - Fat stores and about 1/3 of lean tissue mass depleted in about 60 days, resulting in death
What Are the Effects of an Energy Imbalance?

Too many calories can cause overweight.
- Excess calories stored as fat, regardless of source
  - Limited capacity to store glucose as glycogen
  - Can't store extra protein
  - Unlimited capacity to store fat
    - Body contains about 35 billion fat cells, which can expand.

Measuring Energy From Food

How do we measure energy from food eaten
- Bomb calorimetry
  - Food is burned
  - Chemical bonds are broken
  - Energy is released in the form of heat
- Calories can be calculated by gram of fat, protein, and carbohydrate in food

How Calories Do I need Daily

Energy needs are different for everyone.
Energy needs comprised of:
1. Basal metabolism Rate (BMR)
   - Minimum energy needed to keep you alive (meet basic physiological needs)
   - Makes up about 60% total energy needs
   - Many factors affect BMR
   - To calculate your BMR:
     • Male = 1 kcal per kg X 24
     • Female = 0.9 kcal per kg X 24
What Determines Energy Needs?

2. The thermic effect
   – Amount of calories expended to digest, absorb, and process food (about 10% of calories in food eaten)
     • Carbohydrate 5-10%
     • Fat 0-5%
     • Protein 20-30%
     • Alcohol 15-20%

3. Physical activity increase your energy needs.
   – Sedentary people expend less than ½ energy of BMR in physical activity
   – Very active athletes can expend twice BMR

The Three Components of Your Energy Needs

Factors Affecting BMR

• Aging decrease BMR by 5% per decade
• Height – the taller, the higher the BMR
• Gender – men have higher BMII than women
• Growth increases BMR.
• Body composition (lean body mass increases BMR)
• Fever increases BMR.
• Stress increases BMR.
• Caffeine increases BMR
Factors Affecting BMR

• Environmental temperature - both heat and cold raise BMR
• Smoking increases BMR
• Fasting/starvation slows BMR.
• Malnutrition slows BMR.
• Hormones
  – Thyroid hormones can increase or decrease BMR.
  – Premenstrual hormones can increase BMR.
• Sleep slows BMR.

Healthy Body Weight

Criteria for health weight:
• Body composition
  – Body weight = fat + lean tissue (including water)
• Body fat percentages
  • Men 13-21%
  • Women 23-31%
  • Male athletes 5 – 10%
  • Female athlete 15 – 20%

Healthy Body Weight

• Body mass index (BMI)
  – an index of a person’s weight in relation to height
  – Correlate height and weight with risks to health
  – Useful in evaluating health risks of obesity
  – Overweight is a BMI above 25
  – Underweight is a BMI below 18.5
  – Obese is a BMI above 30
  – Average BMI in USA is 26.5
Healthy Body Weight

BMI = \frac{\text{weight (lbs)} \times 703}{\text{height squared (in}^2\text{)}}

- BMI > 25 is overweight: modest increase in risk of dying from diseases
- > 30 is obese: 50 – 100% higher risk of dying prematurely compared to healthy weight
- < 18.5 is underweight, can also be unhealthy
- The ref male is 154lbs, BMI 22.5, 5’10” tall
- The ref female is 126lbs, BMI of 21.5, 5’4” tall
- BMI failed to measure body composition and fat distribution.

Distribution of Body Weights in U.S. Adults
Body Fat Distribution

- **Intra-abdominal fat**
  - Central obesity (apple shape)
  - Presents greater risk to health
  - Higher risk of premature death
  - Increase risk of heart disease and diabetes
- **Fat around the hips and thighs, (Pear shape)**
  - Common with women
- **Relatively harmless**
- **Waist circumference**
  - Men ≥40 inches
  - Women ≥35 inches
How do we measure body fat

- Skinfold – use calipers
- Underwater weighing - See how much water is displaced
- Bioelectrical impedance
  - Electrical current that is sent through the body

Skinfold – calipers

Underwater weighing
Bioelectrical impedance

Body Weight, Body Composition, and Health

• Health Risks Associated with Body Weight and Body Fat
  – Health Risks of Underweight
    • Cannot handle medical stresses
    • Menstrual irregularities and infertility
    • Pregnancy problems
    • Osteoporosis and bone fractures

What Is Disordered Eating and How Can You Identify It?

• Disordered eating: abnormal and potentially harmful eating behaviors that do not meet specific criteria for eating disorders
• Eating disorders: psychological illnesses that involve specific abnormal eating behaviors and other factors
  – About 11 million in U.S. struggle with eating disorders
    • Most are adolescent or young adult white, middle/upper-middle class females, but increasing in males, minorities, and other age groups
The Female Athlete Triad

1. **Disordered eating habits can develop.**
   - Desire to improve performance
   - Enhance aesthetic appeal of their performance
   - Meet unsuitable weight standards

2. **Amenorrhea**
   - Characterized by low blood estrogen, infertility, and mineral losses from the bone
   - Contributors include excessive training, depleted body fat, low body weight, and inadequate nutrition.
   - Primary amenorrhea – menarche (first menstruation) delayed beyond 16 years of age
   - Secondary amenorrhea – absence of three to six consecutive menstrual cycles

3. **Osteoporosis**
   - Stress hormones compromise bone health.
   - Stress fractures are common bone injuries.
   - Adequate calcium is recommended.

**Other Dangerous Practices of Athletes**
- Food and fluid restrictions to make weight in wrestling
- Muscle dysmorphia is a psychiatric disorder concerning obsession with building body mass.
Anorexia nervosa

Anorexia nervosa results from severe calorie restriction.
- Self-starvation and excessive weight loss
- Intense fear of being “fat”
- Distorted body image: see themselves as fat when underweight
- Health consequences: Electrolyte imbalance (low blood potassium) can be fatal.
- Drops in body temperature, decrease in heart rate and blood pressure, osteoporosis

Bulimia nervosa

Bulimia nervosa involves cycle of binge eating and purging
- Purging can include self-induced vomiting, excessive exercising, strict dieting or fasting, abuse of diet pills, laxatives, and diuretics
  • Vomiting can cause tears in esophagus, swollen parotid glands, tooth decays, gum disease, broken blood vessels in eyes
- Binge eating—excessive kcalories from high-fat, low-fiber and high-carbohydrate foods eaten all at once
- Potentially fatal electrolyte imbalance can also result from bulimia.

Binge-Eating Disorder

Binge eating disorder involves compulsive overeating (without purging).
- Eat in secret, feelings of shame
- Health effects are those associated with obesity.
- Lack of self-control over eating with binges
- Consuming large quantities of food, eating quickly, feeling uncomfortably full, eating alone, and feeling disgusted or guilty
- Occurs at least two times per week for six months
Night eating

Night eating syndrome is a type of eating, sleeping, and mood disorder.
- Majority of calories consumed after evening meal and wakes up at night to eat
  - Most common among obese and associated with low self-esteem, depression, stress

How Are Disordered Eating Behaviors Treated?

- Multidisciplinary teams is most effective approach
  - Psychological, medical, and nutrition professionals
  - Nutritional approaches include:
    - Identifying binge triggers, safe and unsafe foods, hunger and fullness cues using food journals
    - Meal plans to ensure intake of adequate calories and nutrients for anorexia nervosa and to help avoid overeating with bulimia nervosa and binge eating disorder
  - Recovery can be slow; no "quick fix"
    - Greater success if treated in early stages

How Can You Gain Weight Healthfully?

- Gaining weight is as challenging as losing weight.
- Need to add at least 500 calories to daily energy intake for gain of 1 pound/week
  - Choose more energy-dense but nutritious foods from each food group.
    - Examples: waffle instead of toast, coleslaw instead of cabbage
  - Eat more snacks during day to add more calories
Choosing more energy-dense foods can help those who are underweight gain weight.
Dying to be thin video (50 minutes)

For Extra credit – 10 points

Write a 1 page typed, single spaced, essay on what impact does this video has on your view of eating disorder and the health consequences. Discuss the most important lesson you learned from watching the video. Discuss what you would do if you suspect someone in your life has an eating disorder.