

Underweight

- Definition
 - ✓ BMI < 18.5 kg/m²
- Causes
 - ✓ Illness
 - ✓ Eating disorders
 - ✓ Metabolic factors
- Weight-gain strategies
 - ✓ Small, frequent meals
 - ✓ Fluids between meals
 - ✓ High-calorie foods and beverages

Overweight

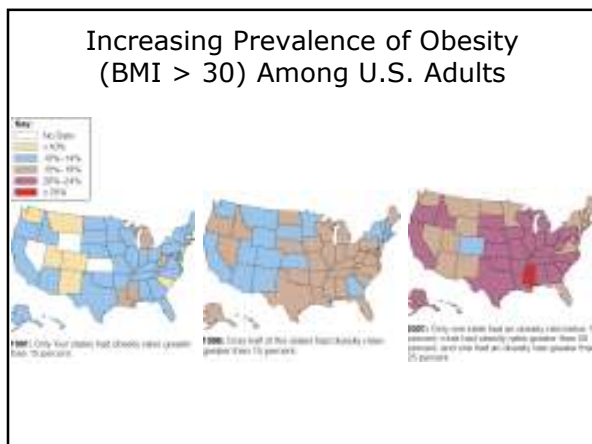
- Overweight (BMI 25-29.9) and obesity (≥ 30) are widespread health problems that are continuing to increase.
- Many refer to overweight and obesity as an epidemic.
- For good health, weight management is important.

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Overweight

- Fat Cell Development
 - ✓ Fat cell numbers
 - Fat cell numbers increase most rapidly in later childhood and early puberty.
 - Fat cell numbers increase in times of positive energy balance.
 - Hyperplastic obesity

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Fat Cell Development

- **Hyperplasia** (↑ cell number) → **Hypertrophy** (↑ cell size)
- Cell number normally increases during late childhood, early puberty
- Afterwards, may continue to increase with positive energy balance
- Obesity develops when adipocytes increase in number, size, or both

Overweight

- Fat Cell Development
 - ✓ Fat cell size
 - Fat cell sizes increase when energy intake exceeds expenditure.
 - Hypertrophic obesity
 - ✓ The adverse effects of fat in non-adipose tissue are called lipotoxicity.

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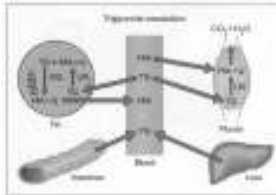
Overweight

- Fat Cell Metabolism
 - ✓ Lipoprotein lipase promotes fat storage.
 - ✓ Gender differences
 - Men are at increased risk for developing central obesity and women are at increased risk for lower body fat.
 - Enzymes that break down fats affect men and women differently.

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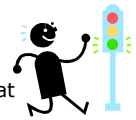
Fat Cell Metabolism

- **Lipoprotein lipase (LPL)**
- Promotes TG storage in adipocytes
- More fat cells = more LPL activity
- As fat cells shrink, LPL remains
- Loss of body fat signals gene for LPL to ↑

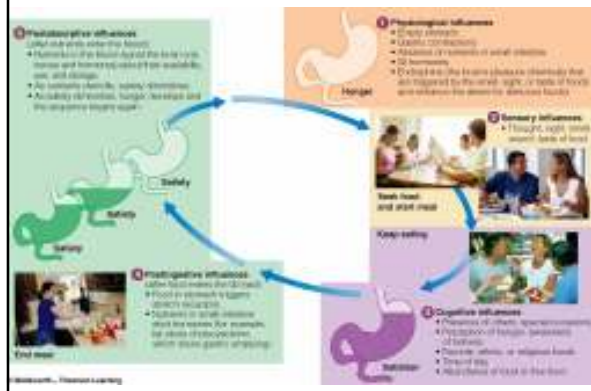


Eating Behavior Regulation

- "GO" signals:
 - ✓ **Hunger**: physiological drive to eat
 - ✓ **Appetite**: psychological drive to eat
- "STOP" signals:
 - ✓ **Satiation**: fullness immediately following meal
 - ✓ **Satiety**: fullness between meals



Food Intake



Satiety Values of Foods

- High satiety foods:
 - ✓ Protein
 - ✓ Fiber
- Low satiety foods:
 - ✓ Simple sugars
- Exception:
 - ✓ Potatoes



Table 13-2 Hormones, Neuroendocrine Substances, Medications, and Other Factors That Affect Feeding Behavior^{14, 18}

Increase Food Intake	Neurotransmitters	Decrease Food Intake
Norepinephrine Growth hormone releasing hormone	Serotonin Dopamine	
Neuropeptides and Hormones		
C-peptide Galxin Neuropeptide Y Agouti-related protein Orexin-A Melanin-concentrating hormone Ghrelin Gastric inhibitory peptide		Cholecystokinin Enterostatin Tumor necrosis factor- α Glucagon-like peptide-1 (GLP-1) Corticotropin releasing hormone Melanocortin Peptide 443-36 Aprelin Adipon
Medications		
Corticosteroids Some tranquilizers Progestins Some antidepressants		Sibutramine Lorcain* Amphetamines

Some of these medications are also food hormones. Many of the neuropeptides are also found in the gastrointestinal tract (see Chapter 2).
*In combination with the hormone insulin when both are present in the brain.


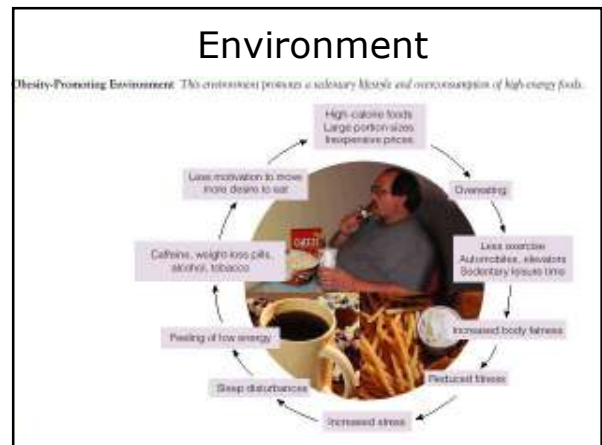
Causes of Obesity

- Most likely due to many interrelated causes:
 - ✓ Genetic
 - ✓ Environmental
 - ✓ Cultural
 - ✓ Behavioral
 - ✓ Socioeconomic
 - ✓ Psychological
 - ✓ Metabolic



Causes of Obesity

- **Regulation of eating behaviors**
 - ✓ Hunger and appetite
 - ✓ Satiation and satiety
 - ✓ Neurotransmitters
 - ✓ Neuropeptides, hormones
- **Genetics**
 - ✓ Twin studies
 - ✓ Set point theory
- **Environment**
 - ✓ Toxic food environment
 - ✓ Cues to overeat
 - ✓ Food availability
 - ✓ Physical inactivity

Leptin – A hormone

- Made by adipose tissue
- Influences regulation of fat mass
- Both mice have defective *ob* gene
- Neither produces leptin
- Mouse on right received daily leptin injections
- Suppressed food intake, increased EE, wt loss
- Obesity treatment?



Unregulated Eating Behavior



Regardless of hunger, people typically overeat when offered the abundance and variety of an "all you can eat" buffet.

Problems with Obesity

- Obesity problems depend on many factors such as
 - ✓the extent of overweight
 - ✓Age
 - ✓health status
 - ✓genetic makeup
- Risk factors may differ among individuals.

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Problems with Obesity

- Health risks are evaluated using BMI, waist circumference and disease profiles.
 - ✓ Overweight people who are in good health may not need to lose weight.
 - ✓ Obese or overweight people with risk factors could improve health by losing weight or using other diet and exercise strategies. Risk factors include:
 - Hypertension
 - Cigarette smoking
 - High LDL
 - Low HDL
 - Impaired glucose tolerance
 - Family history of heart disease
 - Men \geq 45 years, women \geq 55 years

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Problems with Obesity

- Health Risks
 - ✓ Obese or overweight people with the following life-threatening-conditions may improve health by losing weight:
 - Heart disease
 - Type 2 diabetes
 - Sleep apnea

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Problems with Obesity

- Perceptions and Prejudices
 - ✓ Social Consequences
 - Prejudices and discrimination
 - Judged on appearance rather than character
 - Stereotyped as lazy and lacking self-control
 - ✓ Psychological Problems
 - Feelings of rejection, shame and depression are common.
 - Ineffective treatments can lead to a sense of failure.

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Genetics

- Twin studies:
 - ✓ Identical twins raised apart have similar weight-gain patterns
 - ✓ Fraternal twins vary less in weight than two unrelated people
 - Parents and offspring:
 - ✓ A child with no obese parents has 10% chance of becoming obese
 - ✓ Child with one obese parent has 40% risk
 - ✓ Child with 2 obese parents has 80% risk




Genetics and Obesity

- Genetics account for ~40% of weight differences
- Genes affect metabolic rate, fuel use, brain chemistry
- Genetics influences fat distribution
- Thrifty metabolism gene allows for more fat storage to protect against famine
- Set point theory:
 - ✓ Genetically predetermined body weight or fat content



Set Point Theory



- Supporting evidence:
 - ✓ Hypothalamus tries to maintain constant body fat over time
 - ✓ Starved subjects regained original weight (or slightly more)
 - ✓ Low energy intake reduces BMR, increases LPL
 - ✓ Overeating increases BMR, reduces gain in short term
- Refuting evidence:
 - ✓ Weight increases with age, shifting set point
 - ✓ Weight can change markedly in different environment
 - ✓ Stable weight is based on nature/nurture interactions

Weight Management

- Perception of weight
- Setting realistic goals
- Weight management lifestyle
 - ✓ Diet and eating habits
 - Reduce total calories
 - Reduce fat calories
 - Increase complex carbohydrates
 - Improve eating habits
 - ✓ Increase physical activity
 - ✓ Stress management
 - ✓ Self-acceptance




Weight Management

- Weight management approaches
 - ✓ Self-help books and manuals
 - Watch for signs of a fad diet
 - ✓ Self-help groups
 - ✓ Commercial programs
 - ✓ Professional counselors
 - ✓ Prescription drugs
 - ✓ OTC drugs and dietary supplements

Obesity Treatments

- Who needs to lose weight?
- Consider health status and motivation
- Higher BMI, greater waist circumference, more risk factors warrant treatment
- Risk factors:
 - ✓ Hypertension
 - ✓ High LDL, low HDL
 - ✓ Impaired glucose tolerance
 - ✓ Family history of heart disease
 - ✓ Cigarette smoking
 - ✓ Age: men \geq 45 yr; women \geq 55 yr

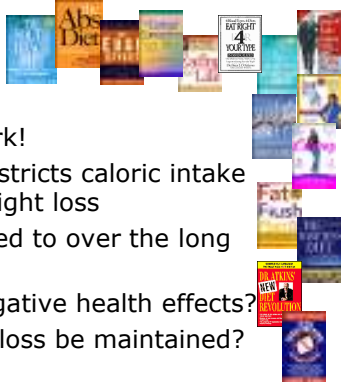


Obesity Treatments

- Benefits of weight loss:
 - ✓ Improve health
 - ✓ Control or prevent chronic disease
- Dangers of weight loss:
 - ✓ Fad diets
 - ✓ Weight cycling
 - ✓ Psychological problems




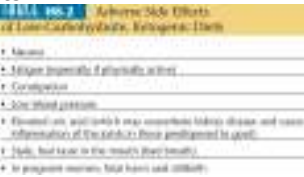
Fad Diets



- All fad diets work!
- Any diet that restricts caloric intake will result in weight loss
- Can it be adhered to over the long term?
- Is it without negative health effects?
- Can the weight loss be maintained?


Characteristics of Fad Diets

- Offer exaggerated claims
- False theories, false hope
- Most are nutritionally inadequate
- Range of side effects
 - ✓ Headaches
 - ✓ Nausea
 - ✓ Death



Characteristics of a Sound Weight Loss Program

- Meets nutritional needs, except for kcal
- Slow & steady weight loss
- Adapted to individual's habits and tastes
- Contains enough kcal to minimize hunger and fatigue ($\geq 1200-1600$ kcal/d)
- Contains common foods
- Fit into any social situation
- Change eating problems/habits
- Improves overall health
- See a physician before starting




Weight Cycling

- Repeatedly losing and regaining weight
- Common with repeated dieting
- Yo-yo dieting
- Negative consequences:
 - ✓ ↑Risk of premature death
 - ✓ ↑Risk of chronic disease
 - ✓ Upper body fat deposition
 - ✓ Possibly lower HDL
 - ✓ Eroded self esteem



Psychological Problems

- Repeated dieting can also do psychological damage
- Get stuck in a cycle of
 - ✓ Ineffective treatment
 - ✓ Repeated failure
 - ✓ Leads to poor self esteem
 - ✓ Disordered eating



Aggressive Treatments for Obesity: Pharmacotherapy

- Candidates for drug therapy:
 - ✓ BMI > 30
 - ✓ BMI > 27, weight-related condition(s)
- Three types of drugs available
 - ✓ **Amphetamine**-like: stimulates CNS
 - ✓ **Sibutramine**: works on NTs, reduces hunger
 - ✓ **Orlistat**: lipase inhibitor
- None are without side effects
- None work without behavior change, reduced energy intake, increased physical activity



Aggressive Treatments of Obesity

- Drugs
 - ✓Sibutramine suppresses the appetite and is most effective when used with a reduced calorie diet and increased physical activity. There are many side effects.
 - ✓Orlistat blocks fat digestion and absorption. There are many side effects.
 - ✓Other drugs are still under study.

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Dietary Supplements Marketed for Weight Loss

Product	Manufacturer/Claims	Research/Findings	Adverse Effects
Chlorophyll	Chlorophyll is a natural pigment found in plants, the substance that turns the food plants into glucose, starch, and other carbohydrates.	Effective	Reported symptoms of fat-oxidation-related
Chlorophyll extract	Chlorophyll extract	Effective	Headaches, sleep disturbances, and blood changes (decreased hemoglobin and hematocrit)
Chlorophyll extract (with other ingredients)	Chlorophyll extract with other ingredients	Effective	None known
Chlorophyll extract (with other ingredients)	Chlorophyll extract with other ingredients	Effective	Headaches, nausea, heart attacks, stroke, and death. Risk may be limited by the use of other products
Chlorophyll extract (with other ingredients)	Chlorophyll extract with other ingredients	Effective	Headaches, nausea, heart attacks, stroke, and death. Risk may be limited by the use of other products
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Aggressive Treatments of Obesity

- Surgery
 - ✓Surgery is an option for those who have tried weight loss programs and failed, have a BMI ≥ 35 , and are having health problems due to their weight.
 - ✓Gastric surgery has short-term and long-term problems and requires compliance with dietary instructions.
 - ✓Liposuction is a popular procedure that is primarily cosmetic but poses risk.

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Aggressive Treatments for Obesity: Surgical Intervention



- **Gastroplasty**
 - ✓ BMI > 40
 - ✓ BMI > 36 , with serious health concern
 - ✓ Obesity present for 5 years
 - ✓ No history of alcoholism
 - ✓ No major psychiatric disorders
- Stomach reduced from 1 liter to 30 mL
- Requires major, lifelong lifestyle changes

Aggressive Treatments for Obesity: Surgical Treatments

Roux-en-Y Vertical banded Lap-Band



Reasonable Treatments for Obesity

- Healthy eating plan
- Physical activity
- Behavior and attitude
- Weight maintenance



What It Takes To Lose a Pound

- Body fat contains 3500 kcal per pound
- To lose 1-2 lbs/wk
 - ✓↓ energy intake by 500-1000 kcal/d
 - ✓↑ energy expenditure with physical activity
- Higher rate of weight loss may be due to loss of lean tissue (as well as adipose)
- 1 lb muscle = 1 lb fat

Healthy Eating Plan

- When designing a plan:
 - ✓ Be realistic about energy intake
 - ✓ Emphasize nutritional adequacy
 - ✓ Eat small portions
 - ✓ Lower energy density
 - ✓ Focus on complex carbohydrates
 - ✓ Remember water
 - ✓ Choose fats sensibly
 - ✓ Watch for empty calories



Weight Management Strategies

In General


- Focus on healthy eating and activity habits, not on weight losses or gains.
- Adopt reasonable expectations about health and fitness goals and about how long it will take to achieve them.
- Make nutritional adequacy a high priority.
- Listen, practice, and follow a healthful eating plan for the rest of your life.
- Participate in some form of physical activity regularly.
- Adopt consumer lifestyle changes to achieve and maintain a healthy weight.

For Weight Loss

- Energy out should exceed energy in by about 300 kcal/day. Increase your physical activity enough to spend more energy than you consume from food.
- Emphasize foods with a low energy density and a high nutrient density.
- Eat small portions. Share a restaurant meal with a friend or take home half for lunch tomorrow.
- Eat slowly.
- Limit high-fat foods. Make legumes, whole grains, vegetables, and fruits central to your diet plan.
- Limit low-fat meats to the serving size on the label.
- Limit concentrated sweets and alcoholic beverages.
- Drink a glass of water before you begin to eat and another while you eat. Drink plenty of water throughout the day (8 glasses or more a day).
- Keep a record of diet and exercise habits. It reveals problem areas, the first step toward improving behaviors.
- Learn alternative ways to deal with emotions and stress.
- Attend support groups regularly or develop supportive relationships with others.

Physical Activity

- Make it a part of a daily routine
- Duration and regularity are important
- Regular physical activity and obesity:
 - ✓↑ energy expenditure
 - ✓↑ metabolism
 - ✓ Improves body composition
 - ✓ Improves appetite control
 - ✓ Psychological benefits
 - Combats depression
 - Improves self esteem



Weight Maintenance

- Preventing relapse
- "Successful" weight-loss is defined as:
 - ✓ Achieving a weight loss of ≥ 10% of initial body weight and maintaining the loss for at least one year
- National Weight Control Registry:
 - ✓ Low fat, high carb diet
 - ✓ Don't skip breakfast
 - ✓ Keep track of what they eat
 - ✓ Exercise for one hour daily



<http://www.uchsc.edu/nutrition/WyattJortberg/nwcr.htm>

Public Health Strategies for Controlling the "Toxic-Food" Environment

Challenges	Examples of Suggested Nutritional Strategies	Examples of Universal Nutritional Strategies
Reduce safety concerns to reduce the potential for harm	• Regulate the labeling for safety of food. • Regulate the use of pesticides on high-fat foods.	• Mandate safety plans in supermarkets. • Regulate the food source of food.
Reduce government subsidizing to limit the availability of harmful products	• Influence nutrition labeling and product packaging. • Reduce the promotion of high-fat foods (especially when directed at children).	• Reduce subsidy and other supports when directed at children. • Reduce subsidy to alcohol beverages.
Reduce the production and other practices that will be hard to control in the marketplace	• Regulate high-fat, low-nutrient density foods. • Regulate product energy density. • Reduce the number of calories allowed in soft-drink beverages.	• Mandate process and laws for the use of labels: Alcohol, food additives. • Mandate the number of calories allowed in soft-drink.
Control prices to make consumption	• Tax soft drinks and other foods high in calories, fat or sugar.	• Tax alcohol beverages.