

Chapter 18
Body Composition

Objectives

1. Describe the limitation of the height/weight table in determining overweight & obesity.
2. Provide a brief description of the following methods of measuring body composition: isotope dilution, photon absorptiometry, potassium-40, hydrostatic (underwater weighing), dual energy x-ray absorptiometry, near infrared interactance, radiography, ultrasound, nuclear magnetic resonance, total body electrical conductivity, bioelectrical impedance analysis, air displacement plethysmography, & skinfold thickness.

Objectives

3. Describe the two-component model of body composition & the assumptions made about the density values for the FFM & the FM; contrast this w/ the multicomponent model.
4. Explain the principle underlying the measurement of whole-body density w/ underwater weighing, & why one must correct for residual volume.
5. Explain why there is an error of $\pm 2.0\%$ in the calculation of %BF w/ the underwater weighing technique.

Objectives

- 6. Explain how a sum of skinfolds can be used to estimate a %BFness value.
- 7. List the recommended %BFness values for health & fitness for males and females, & explain the concern for both high & low values.
- 8. Discuss the reasons why the average weight at any height (fatness) has \uparrow d while deaths from cardiovascular diseases have \downarrow d.
- 9. Distinguish between obesity due to hyperplasia of fat cells & that due to hypertrophy of fat cells.
- 10. Describe the roles of genetics and env't in the development of obesity.

Objectives

- 11. Explain the set point theory of obesity, & give an example of a physiological & behavioral control system.
- 12. Describe the pattern of Δ in body weight & caloric intake over the adults years.
- 13. Discuss the Δ s in body composition when weight is lost by diet alone vs. diet plus exercise.
- 14. Describe the relationship of the FFM & caloric intake to the BMR.
- 15. Define thermogenesis and explain how it is affected by both short- & long-term overfeeding.

Objectives

- 16. Describe the effect of exercise on appetite & body composition.
- 17. Explain quantitatively why small differences in EE & dietary intake are important in weight gain over the years.

Methods of Assessing Overweight & Obesity

- Metropolitan Life Insurance Company's height/weight tables
 - Original 1959 tables & 1983 update
 - Relative weight (RW)

- Problems w/ height/weight tables

Methods of Assessing Overweight & Obesity

- Body mass index (BMI)
 - Weight (kg) / height (m²)
 - Classification for adults

Methods of Measuring Body Composition

- Isotope dilution

- Photon absorptiometry

- Potassium-40

- Hydrostatic (underwater) weighing

- Dual energy X-ray absorptiometry (DEXA)

Methods of Measuring Body Composition

- Near infrared interactance (NIR)
- Radiography
- Ultrasound
- Nuclear Magnetic Resonance (NMR)
- Total body electrical conductivity (TOBEC)

Methods of Measuring Body Composition

- Bioelectrical impedance analysis (BIA)
- Air displacement plethysmography
- Skinfold thickness

Body Composition Assessment

- 4-component model
- 3-component model
- 2-compartment model

2-Component System of Body Composition

- Body divided into fat-free & fat mass

- Measurement of whole-body density

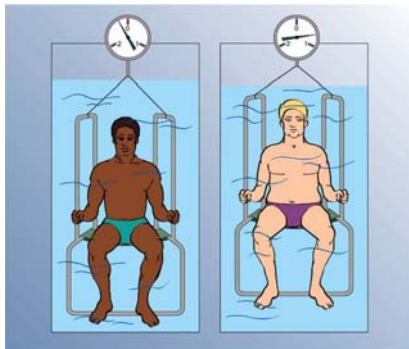
- Equation to convert body density to % fat

Underwater Weighing

- Density = mass / volume
- Measurement of body volume
 - Subject is submerged in tank of water
 - Weight of water displaced = loss of weight when submerged ($M_a - M_w$)
 - Weight of water displaced is divided by density of water (D_w) to calculate volume of water displaced
 - Volume is corrected for residual lung volume (V_R) and gas in intestinal tract (V_{GI})

$$D = \frac{M}{V} = \frac{M_A}{\frac{(M_A - M_w)}{D_w} - V_R - V_{GI}}$$

The Underwater Weighing Technique



Copyright © The McGraw-Hill Companies, Inc. Permission required for reproduction or display

Figure 18.2

Skinfolds

- Prediction of body density from estimation of subcutaneous fat
- Thickness of subcutaneous fat is measured

Body Fatness for Health & Fitness

- Recommended body fatness

- Health concerns above & below these values

Obesity

- Diseases linked to obesity:

Obesity

- Prevalence of overweight & obesity in U.S. adults

- Distribution of BF is important

Fat Cell Size vs. # & Obesity

Relationship b/n Fat Cell Size & Fat Cell # to Total BF

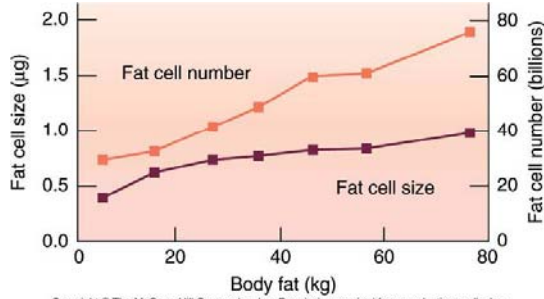


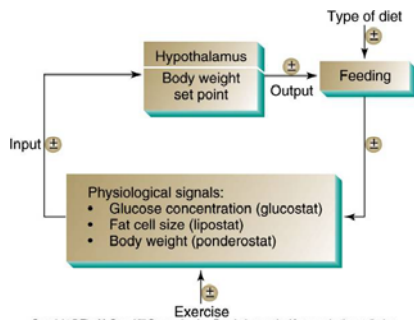
Figure 18.3

Causes of Obesity

Set Point & Obesity

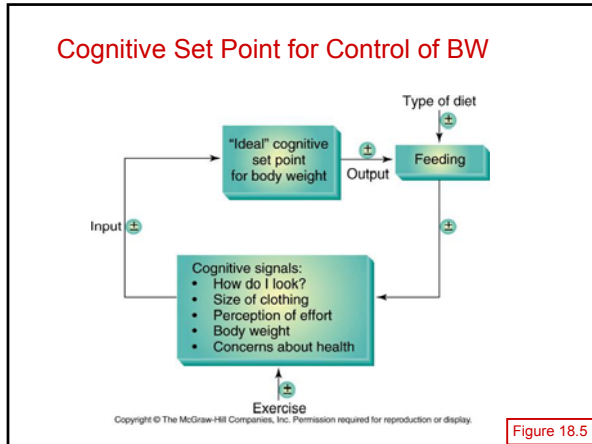
- Set point theory
- Physiological set point model
- Cognitive set point model

Physiological Set Point Model for Control of BW



Copyright © The McGraw-Hill Companies, Inc. Permission required for reproduction or display.

Figure 18.4



Energy Balance

- Static energy balance

- Dynamic energy balance

Diet & Weight Control

PA for Weight Control

EE & Weight Control

- Basal metabolic rate (BMR)

EE & Weight Control

- Thermogenesis

EE & Weight Control

- PA & exercise

Relationship b/n Body Fatness & Nonbasal EE

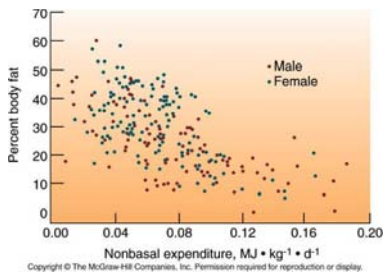


Figure 18.8

Effect of Exercise on Appetite

- Most humans
 - Energy intake is \uparrow d across a broad range of EE
 - Maintains body weight
- Formerly sedentary individuals
 - Net loss of appetite on an exercise program
 - Facilitates weight loss

Exercise & Body Composition

- Individuals who exercise generally have lower body weight & %BF
- Weight loss in conjunction w/ exercise
 - Less lean body mass is lost
 - More fat mass is lost

Exercise, Weight Loss, & Weight Maintenance

- Weight loss
- Weight maintenance
 - Light to moderate exercise
 - Moderate exercise
 - Vigorous exercise

Diet, Exercise, & Weight Control
