Energy Balance and Body Composition

Dr. Lamis Aziz

Energy balance is the relationship between energy intake and energy expenditure

Energy balance is achieved when the kilocalories consumed equal the kilocalories expended

Positive energy balance results in weight gain and negative energy balance results in weight loss

- Kilocalories come from foods and beverages
  - The energy in foods and beverages can be measured with **Bomb calorimeter** in the laboratories.
  - Food composition tables can be used to estimate energy in foods:
    - Carbohydrate and Protein: 4 kcal/gram
    - Fat: 9 kcal/gram

Calculate the caloric yield of a piece of food, if you know that the composition is:8gm protein, 1gm fat, 58 gm CHO?

Caloric yield= (8x4)+(1x9)+(58x4)=273kcal

Total daily energy expenditure (TDEE) is determined by:

1. basal metabolism (BMR) **50-70%**,
2. thermic effect of food (**10%**), *the energy required to process food (digest, absorb, metabolize, and store ingested nutrients).*

TEF = 200 Kcal/day when total daily consumed energy is 2000 Kcal

3. thermic effect of exercise (physical activities)
4. adaptive thermogenesis

} **20-35%**

Adaptive thermo genesis ------- Some additional energy is spent when a person must adapt to special circumstances (trauma or other illnesses).

How Do We Measure Energy Expenditure?

- **Direct calorimetry** measures energy expenditure by assessing body heat loss

- **Indirect calorimetry** estimates energy expenditure by measuring oxygen consumed and carbon dioxide produced
- **Simple calculations** can estimate energy expenditure based on age, gender, height, weight, and level of physical activity

What Is Body Composition?

- The ratio of fat tissue to lean body mass (muscle, bone, and organs)

-Usually expressed as *percent body fat*

-Important for measuring health risks associated with too much body fat.

Most Body Fat Is Stored in Adipose Tissue ►

- Subcutaneous fat – located under the skin
- Visceral fat – stored around the organs in the abdominal area

- In negative energy balance, fatty acids are released from adipose cells
  - Used as fuel and adipose cells shrink
- In positive energy balance, fat accumulates and adipose cells expand

Body Fat Distribution Affects Health

Storing excess fat around the waist versus the hips and thighs increases the risk of heart disease, diabetes, and hypertension.

- Central obesity (*android obesity*) –storing too much visceral fat in the abdomen

- Gynoid obesity –excess fat around the thighs and buttocks

**Visceral fat releases fatty acids which travel to the liver causing insulin resistance, increased LDL, decreased HDL, and increased cholesterol

Central obesity is associated with increased risk of heart disease, diabetes, and hypertension

How Do We Estimate a Healthy Body Weight?

- Height and weight tables and BMI are used to predict overweight and obesity

Height and weight tables can provide a healthy weight range

- Contain Desirable Weights for Men and Women
  - Not standardized, height and weight was self-reported

- Used a reference and will not necessarily indicate a healthy weight for everyone

- Body mass index is a useful indicator of healthy weight for most people

- **Body mass index (BMI)** calculates body weight in relation to height
- BMI = body weight (in kilograms) / height2 (in meters)
  - **Healthy weight** BMI 18.5–24.9
  - **Overweight** BMI 25–29.9
  - **Obese** BMI ≥ 30
  - Obese type 1 (Obese) BMI 30-40
  - Obese type 2 (Obese) BMI > 40-50
  - Obese type 3(Super obese) BMI > 50

    Obese individuals have a 50–100% higher risk of dying prematurely than those at a healthy weight

    BMI may not be accurate for everyone►
- Is not a direct measure of percent body fat and doesn't assess if weight is predominantly muscle or fat.
- Athletes and individuals with high muscle mass may have a BMI over 25, yet a low percentage of body fat
- Chronic weight loss in older adults signals loss of muscle mass and depletion of nutrients stores even though BMI may be within the healthy range
- Individuals less than 5 ft (152.4 cm) in height may have a high BMI, but not be unhealthy

Waist Circumference Will Indicate Abdominal Fat

- Waist circumference – a quick indicator of health risk
  - Greater than 35 inches in women and 40 inches in men is associated with increased health risk even if BMI is normal

Using BMI and Waist Circumference to Determine Health Risks

Extremely High Risk : BMI 40+ and high waist circumference
Very High Risk : BMI 30-39.9 and high waist circumference
High Risk : BMI 25-29.9 and high waist circumference

Or

BMI 30-34.9 and low waist circumference

Increased Risk BMI 25-29.9 and low waist circumference
Low Risk BMI under 25

Health Risks Associated with Body Weight and Body Composition

- Being underweight increases health risks
    - Symptomatic of malnutrition, substance abuse, or disease
    - Higher risk of anemia, osteoporosis and bone fractures, decreased muscle strength, heart irregularities, and amenorrhea
    - Correlated with depression and anxiety, a depressed immune system, trouble regulating body temperature, decreased muscle strength, and risk of premature death
    - May be unintentional and due to malabsorption associated with diseases such as cancer, inflammatory bowel disease, or celiac disease
- Being overweight increases health risks
    - Overweight and obesity associated with increased risk of heart disease, hypertension, stroke, hyperlipidemia, gallstones, sleep apnea, and reproductive problems
    - Increases risk of certain cancers including colon, breast, endometrial, and gallbladder cancer
    - More than 80% of people with type 2 diabetes are overweight
    - Metabolic syndrome is associated with central obesity