Energy Balance (4.2) and Body Composition (4.3)

Figure 2.20

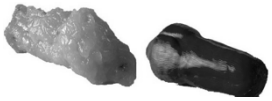
Energy Balance :

- Positive vs Negative Energy Balance
- Energy Intake vs Expenditure
- Components of Energy Expenditure

BMR
PA
TEF

Body Composition

- A Healthy Body Composition
  - Methods used
- Body Weight vs Body Fat
- Fat Distribution



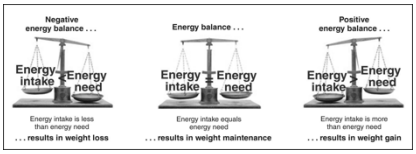
Principles of Energy Balance

- 1 pound fat = 3500 Calories stored.
- To lose body fat, a Calorie deficit needs to be created.
- To gain body weight, a Calorie excess needs to be created.

Body weight changes are based on the relationship of Caloric (Energy) intake & Energy Expenditure.

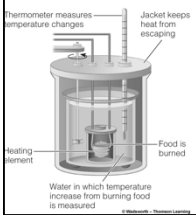
Energy Balance Equations

- If Calories Consumed = Calories Expended
  - *Energy balance occurs-WEIGHT MAINTENANCE*
- If Calories Consumed > Calories Expended
  - *Positive energy balance occurs-WEIGHT GAIN*
- If Calories Consumed < Calories Expended
  - *Negative energy balance occurs-WEIGHT LOSS*



Energy Intake-calories

- Consumption of Energy Producing Nutrients in Food and Drinks
- All of the Calories add up!



Bomb calorimeter

PHYSIOLOGICAL FUEL VALUE OF FOOD-

THE BODY IS LESS EFFICIENT THAN A BOMB CALORIMETER

Bomb calorimeter	Coefficient of digestibility	Adjustment for -NH2	Physiological Fuel Value
cal/gram	%		cal/gram
CHO =4.10	97		4.0
PROT =5.65	92	**-1.3 cal/gram**	4.0
FAT =9.45	92		9.0
ALCOHOL =7.0	100		7.0

Why the difference between the bomb calorimeter and the physiological (our body) fuel values?

Points to Consider

- The body doesn't completely digest and absorb all nutrients, so there is a slight loss of energy
- This loss is referred to as the
  - **Coefficient of Digestibility**
- The body cannot use ***NITROGEN*** as a source of energy, so protein values must be adjusted
  - **Adjustment for Nitrogen**

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- Basal Metabolic Rate (BMR)
  - » An amount of energy needed to sustain life
- Voluntary muscle movement
  - » Calories burned in physical activity (PA)
- The thermic effect of food
  - » Energy required for food digestion & processing (TEF)

Energy Expenditure

Energy Expenditure

basal metabolism **60-65%**

physical activity **25-35%**

dietary thermogenesis **"thermic effect of food"5-10%**

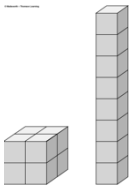
Energy Expenditure

Basal Metabolic Rate (BMR):

- The energy required by the body to minimally function
  - (heart to beat, lungs to breathe, …)-**INVOLUNTARY ACTIVITIES**
- It is determined in a fasting state (12 hours) and when the body is at complete rest.
- Majority of expenditure in a sedentary person.

Factors Affecting BMR

- **Age**
- **Gender**
- **Physiological State**
- **Body Size** (surface area)



Energy Expenditure

Physical Activity (PA):

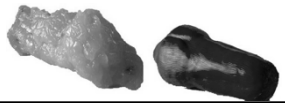
- The energy expended to perform physical activity.
- Voluntary muscle movement.
  - The total amount of energy expended increases with body weight and the intensity of the exercise.

Energy Expenditure

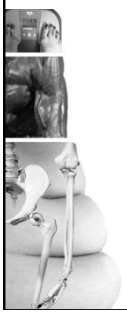
Thermic Effect of Food (TEF)

- The food processing charge.
- 5-10% of the total number of Calories consumed is required for the digestion, absorption & assimilation of nutrients into the body.
  - Metabolism is increased when fed.

- Let's look at Body Composition:



Healthy Body Composition



- **Lean body mass** ~55% of total body weight (muscle is ~70% H_20)
- **Essential fat mass**
  - 3% body fat in ♂ 12% body fat in ♀
- **Stored fat mass** is variable ~ 15-20% (Additional fat beyond essential fat is stored)
- **Minerals** ~4% of total body weight
- **Water ~** 60% of total body weight

Body Weight vs. Body Fat

The best way to determine obesity is to determine the **% of body fat.**

- ♂ **is too fat if ≥20% body fat.**
- ♀ **is too fat if ≥26% body fat.**

Determining Body Fat

- **Underwater weighing** (very accurate)
- **Bod Pod** (very accurate)
- **Skin fold calipers** (the more sights, the better)
- **Bioelectrical impedance** (the persons hydration level affects the reading accuracy)
- **Futrex 5000** (more accurate when average body fat)
- **Research Techniques** (DEXA, MRI, total body potassium, substance dilution)

Under Water Weighing

Electrical Impedance

Bod Pod

Skin Fold Calipers

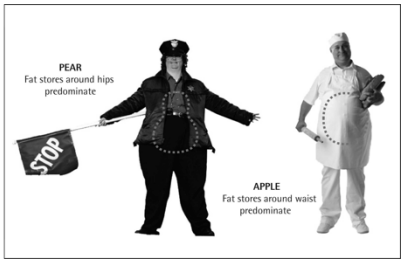
Central Adiposity

Pear (Android) Obesity & Apple Shape

Determined by waist measurement.

- waist measurement > 40 inches = central adiposity & apple shape.
- waist measurement > 35 inches = central adiposity & pear shape.

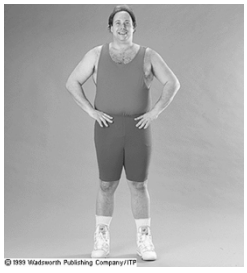
Apple vs Pear:

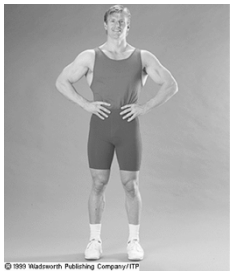


Body Mass Index (BMI)

- Measurement of body weight in relation to height.
- Is not an accurate measure of % body fat.
- A BMI ≥ 25 and a waist circumference of >40 inches for men or >35 inches for women places an individual at increased risk for:
  - Heart disease, Hypertension, Dyslipidemia, & Type 2 diabetes.

Same Weight-Same BMI….





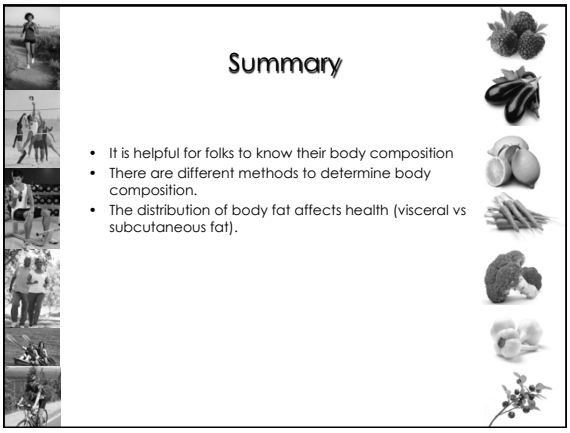
Summary

- Energy balance is the state of energy intake vs energy expenditure.
- Intake occurs with food consumption.
- Expenditure occurs by BMR, PA, & TEF

Weight gain & body fat accumulation occurs with **positive energy balance**.

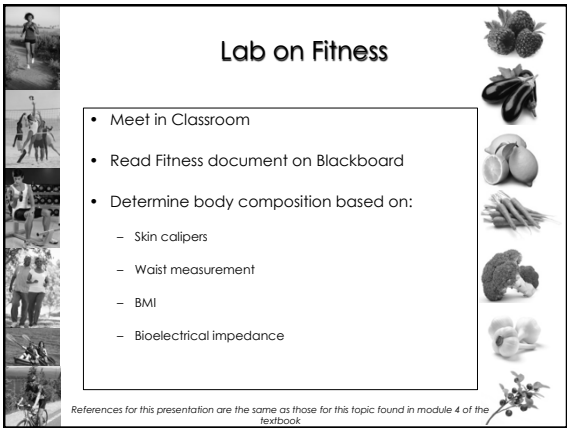
Weight loss & fat mass reduction occurs with **negative energy balance**.

References for this presentation are the same as those for this topic found in module 4 of the textbook



Summary

- It is helpful for folks to know their body composition
- There are different methods to determine body composition.
- The distribution of body fat affects health (visceral vs subcutaneous fat).



Lab on Fitness

- Meet in Classroom
- Read Fitness document on Blackboard
- Determine body composition based on:
  - Skin calipers
  - Waist measurement
  - BMI
  - Bioelectrical impedance

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