The Truth Revealed: The Physiology of Fitness and Obesity

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True or False??

- Working out allows me to eat whatever I want. T/F
- Muscle weighs more than fat. T/F
- No pain, no gain. T/F

True or False??

- I must stop eating to lose weight. T/F
- Spot Reducing Works (i.e. 6-pack from stomach crunches) T/F
- Diet Pills Work T/F

The *Real Meaning* of Exercise

- **Exercise**
  - Physical activity that is planned and structured.
  - Repetitive bodily movement to improve/maintain one or more components of physical fitness.

Components of Fitness

- **"Cardio" Respiratory Training**
  - Aerobic and Anaerobic Activity
- **Muscular Strength / Endurance**
  - Eccentric – Elongation
  - Concentric – Bicep Curls
  - Isometric – Wall Sits
- **Flexibility**

F.I.T Model and Physical Activity Guidelines

- **Frequency:** How Often?
  - **2 ½ hours** per week of moderate intensity (5 days per week/ 30 minutes of activity)
  - Not Sufficient for “High Performance”
  - **1 hour and 15 minutes** per week of vigorous physical activity

F.I.T Model and Physical Activity Guidelines

- **Intensity:** How Hard?
  - Metabolic Equivalent – MET
  - Body at Rest Vs. Body at Work

- **Time:** How Long?
  - Duration of activities like walking, jogging, dancing, basketball, football
  - Moderate Intensity – 30 min.
  - Vigorous Intensity- 20 min. +

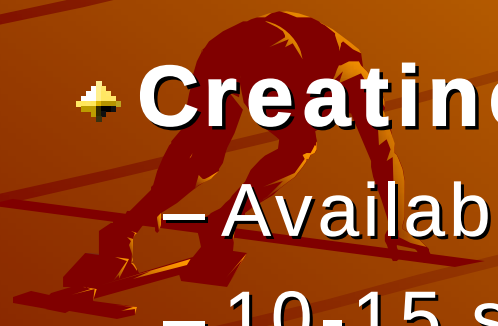
Exercise Physiology Facts

- **Heart Rate Maxiumum**
  - **Karvonen Formula**
    - 220 – Age = Maximum Heart Rate
    - Shavon's Heart Rate Maximum = 190 bpm

- **Basal Metabolic Rate (BMR)**
  - The minimum amount of energy expenditure required to carry on normal biological functions
  - BMR per day = 1 Calorie x weight (lbs)/ 2.2 x 24

What Your Muscles Need for Fitness

- **Adenosine TriPhosphate (ATP)**
  - Powers skeletal muscle
  - First 5 or 6 seconds of muscle power



- **Creatine Phosphate**
  - Available to cells, rapidly produces ATP
  - 10-15 seconds of muscle power provided through the body's use of phosphagen system

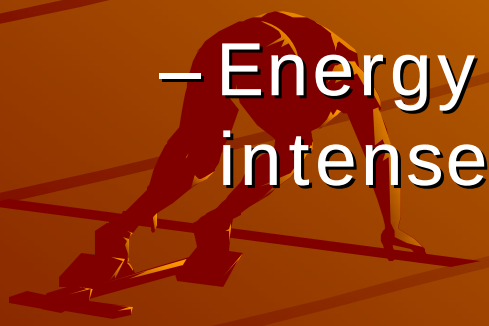
What Your Muscles Need for Fitness

- **Glycogen Lactic Acid System**
  - For another 30-40 sec of energy
  - Burning in your muscles
  - Track and Field (400 meter races)
- **Aerobic system**
  - Provides energy that is limited by the body's ability to supply oxygen/nutrients
  - Long runs, soccer games, basketball, football

“Native” Athletes Using Their Muscle Systems

Food for Fitness.. and ATP

- **Fat**
  - Adipose tissue throughout the body, energy reservoir
  - Energy release is too slow for very intense activity



Food for Fitness.. and ATP

- **Carbohydrates**
  - At rest, carbohydrate is taken up by the muscles and liver and converted into **glycogen**.
  - Heavy training session can deplete carbohydrate stores in muscles and liver

Food for Fitness.. and ATP

- **Protein**
  - Source of energy, particularly during prolonged activity
  - Broken down into amino acids before then being converted into glucose
  - Protein cannot supply energy at the same rate as carbohydrate.

Supplements: Good, Bad, Ugly

- **Creatine**
  - Short term, high intensity activity will last longer = greater load on your body
  - *Requires increase in water consumption, can cause unwanted weight gain and side affects.*
- **Sports Drink**
  - Replenish electrolytes during activity
  - High sugar content and caloric intake

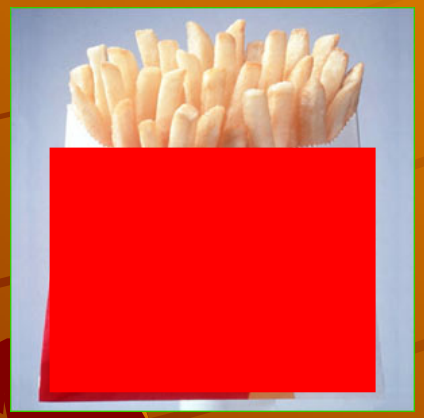
Supplements: Good, Bad, Ugly

- **Steroids**
  - Increase in testosterone hormone provides increase in ability to perform Work (high level fitness)

  - Side affects: females lose breast tissue and fat mass, males can become sterile
  - Death!!!!

Fitness and French Fries?

20 Years Ago



210 Calories
2.4 ounces

Today

610 Calories
6.9 ounces

Calorie Difference: 400 Calories

How to burn* 400 calories:

<u>Walk 2 hours 20 minutes</u>

*Based on 130-lb person.

Obesity…The “Buzz” Word

- **Obesity**
  - Excess storage of energy (**E**) in the form fat (Excess body fat versus body weight)
- **Body Composition**
  - Used to determine if an individual is overweight or obese
- **Body Mass Index**
  - Tool for indicating weight status and correlates with body fat.
  - BMI = weight (kg) / height 2 (cm)

Fat Cells

- **Hyperplastic Obesity**
  - Classification of obesity in which individuals have a **greater number of fat cells which are also larger than normal**

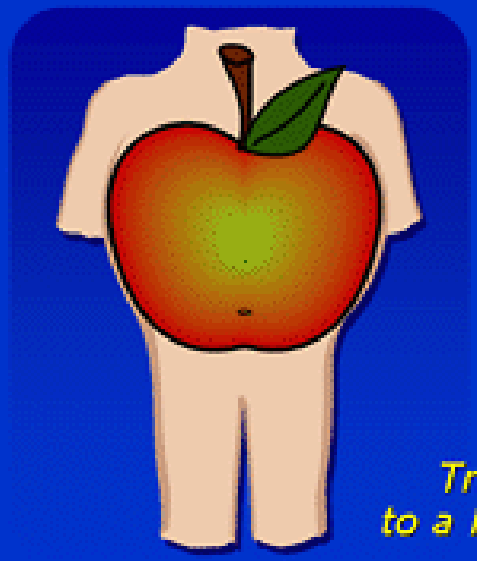
- **Hypertrophic Obesity**
  - Caused by a **normal number of cells have increased in size**.
  - Most common form of obesity

Physiology of Obesity

- **Gynoid**
  - Fat storage in the **hips**
  - Fat storage in the **thighs**

- **Android**
  - Fat storage in the **abdomen**

Android (Apple) vs. Gynoid (Pear) Obesity



A Tribute to a Pioneer:

Jean Vague (1947)

Vague J. *Presse Med* 1947;30:339-340.

Slide Source:
Lipids Online Slide Library
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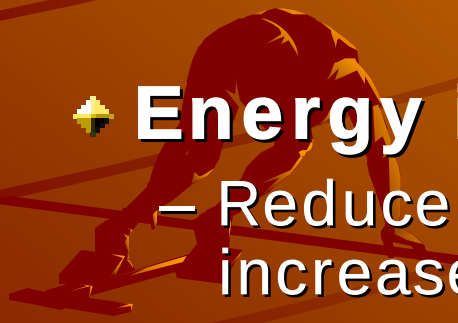
Gender and Obesity

- **Gynoid Obesity**
  - most common form of obesity in women
- **Female Disadvantage-Obesity Affecting Metabolic Rates (Gleim et al, 1993)**
  - Moderate exercise alone may not be enough to affect body composition
  - Disadvantage: elevating/maintaining RMR b/c of smaller body size, differences in body fat, and lower aerobic capacity.

Energy Equation: Law of Thermodynamics Applied to Obesity

- **E** in **(food)** = **E** out (work) + E out (heat) +/- **E** stored (fat)
  - Food Consumed E, heat released as chemical E, E stored for later use



- **Energy is neither created or destroyed**
  - Reduce (food intake) left side of equation and increase right side. (exercise)

Thermodynamics

- When diet plans make claim about rapid weight loss **WITHOUT** exercise or special food choices, remember Energy is neither created or destroyed”

Barriers to Wellness

Jack in the Box

Bacon Ultimate Cheeseburger

1020 calories

71 grams of fat

Average American teens

watches 3-4 hours

of TV/media per day

BARRIERS TO WELLNESS

20 Years Ago

140 calories
3-inch diameter

Today

350 calories
6-inch diameter

Calorie Difference: 210 calories

Strategies to Overcome Barriers to Wellness

- Understand BMI, lean body mass vs. scale
- Access Health Care: Regular Check ups, physical!
- Refrain from the use of drugs and alcohol
- Increase Physical Activity, make it a part of your life = **YOU WILL FELL BETTER!!**
  - Endorphins
  - Healthy Weight
  - High Self Esteem

Strategies to Overcome Barriers

- **Access Nutritious Foods and Maintain Healthy Eating Habits**
  - Fruits and Vegetables
  - Lean cut meats: grilled chicken, fish, turkey
  - Whole Grains: “BROWN on DOWN”
  - Healthy Snacks: granola, yogurt, air popcorn, unsalted pretzels

Healthy Teens!!

- Education
- Prevention
- **PERSONAL ACCOUNTABILITY**
  - “Its Up To You”

Resources

- **"Racial Differences in Cardiovascular Health". Pfizer Global Pharmaceuticals: 2003**
- **"Unequal Treatment: Confronting Racial and Ethnic Disparities in Healthcare." Institute of Medicine, 2002.**
- www.cdc.gov (division of nutrition and physical activity)
- www.nhlbi.nih.gov/about/oei/index.htm
- www.hp2010.nhlbinih.net
- www.Blackwomenshealth.org

Resources

- Guyton AC, Hall JE. *Textbook of Medical Physiology*. 9th ed. Philadelphia, Pa: WB Saunders Company; 1996.
- Hochachka PW. Oxygen, homeostasis, and metabolic regulation. *Adv Exp Med Biol*. 2000;475:311-35. [Medline].
- Scott CB. Energy expenditure of heavy to severe exercise and recovery. *J Theor Biol*. Nov 21 2000;207(2):293-7. [Medline].

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