Nutrition in Physical Activity

Fitness

What is fitness? Are you “physically fit”? The characteristics that enable the body to perform physical activity
The ability to meet routine physical demands with enough reserve energy to rise to a sudden challenge.
The body’s ability to withstand stress

Fitness

More than 50% of adults in the US are not regularly active
25% are completely inactive (sedentary)
Physical inactivity is linked to:
Heart disease
Cancer
Stroke
Diabetes
Hypertension

$77 billion dollars per year is spent on health care costs attributed in inactivity in the US

Benefits of Fitness

Restful sleep
Nutritional health
Optimal body composition
Optimal bone density
Resistance to colds
Strong circulation and lung function
Lower risk of some types of cancers (colon, breast)
Lower risk of cardiovascular disease
Lower risk of diabetes- Type II
Lower risk of anxiety and depression
Strong self image
Longer life; higher quality life in later years

Benefits of Fitness

To receive the health benefits of physical activity:
The Dietary Guidelines for Americans specify that people need to spend an accumulated minimum 30 minutes of total of physical activity (can be intermittent) on most days of the week.

Benefits of Fitness

- The DRI Committee and the Dietary Guidelines recommends at least 60 minutes of moderately intense activity (walking or jogging) each day (can be intermittent) to maintain a healthy body weight

ACSM Guidelines

Developing and Maintaining Physical Fitness

Frequency: 3 – 5 days per week
Intensity: 50 – 90% of maximum heart rate
Duration: 20 – 60 minutes of continuous activity
Mode: any activity that uses large muscle groups (legs, buttocks, and abdomen)
Resistance Activity: strength training of moderate intensity at least two times per week.

Guidelines for Physical Fitness

Developing Fitness

Components of Fitness

Flexibility: Allows joints to move with less chance of injury
Muscle strength and muscle endurance: Allows muscles to work harder and longer without fatigue
Cardiorespiratory endurance: Supports ongoing action of the heart and lungs

Fitness

Developing Fitness

The Overload Principle – to slightly increase comfortable capacity in each area; asking a little more from your body in each training workout
This is also called the progressive overload principle.
Increase frequency – how often an activity is performed
Increase intensity – the degree of exertion while exercising
Increase duration – the length of time

Fitness

Developing Fitness

The Body’s Response to Physical Activity

Hypertrophy is muscle gain in size and strength, the result of repeated work.
Atrophy is muscle loss in size and strength, the result of lack of activity.

Other Tips

Be active all week.
Use proper equipment and attire.
Use proper form when exercising.
Include warm-ups and cool-downs.
Challenge yourself, but not every time you exercise.
Pay attention to body signals.
Build intensity slowly.

Developing Fitness

Cautions on starting
Risk factors include:
Family history of heart disease
Cigarette smoking
Hypertension
Serum cholesterol > 200
Diabetes
Sedentary lifestyle
Obesity

Cardiorespiratory Endurance
Cardiorespiratory Endurance - the length of time a person can remain active with an elevated heart rate
Is Aerobic
Improves your ability to sustain vigorous activity
Improves capacity of heart and lungs to deliver oxygen
Oxygen is delivered more efficiently

Cardiorespiratory Endurance
Cardiorespiratory conditioning:
Cardiac output is increased and enhances oxygen delivery
Heart stronger-pumps more blood per beat.
Resting heart rate decreases.
Average RHR for adults=70 beats/min
Cardiac conditioning: 50 BPM
Breathing becomes more efficient
Improves circulation
Reduces blood pressure
Delivery Of Oxygen To Muscles
Cardiorespiratory Endurance
To improve cardiorespiratory endurance:
Work 20 min or longer
Use large muscle groups (legs, buttocks, abdomen)
Train at intensity to increase heart rate.

Fitness
Weight Training
Also called resistance training
Increases muscle strength and endurance
Prevent cardiovascular disease
Enhances psychological well-being
Maximizes and maintains bone mass
Enhances performance in other sports
Muscle strength- heavy weights with low repetitions.
Muscle endurance-lighter weights with more repetitions

Energy Systems of Physical Activity
ATP- Adenosine triphosphate
High energy compound
Present all body tissues all the time
Delivers energy instantly
ATP splits, energy is released
Energy Systems
CP- Creatine Phosphate
High energy compound in the muscles
Used anaerobically (without oxygen)
Splits to release phosphate to make more ATP
Reservoir of energy to maintain supply of ATP
Provides energy for short bursts of activity

**Energy Systems of Physical Activity**

**Energy yielding nutrients**
When body demands are higher— you breakdown **CHO, PRO, and FAT** to generate ATP (energy)
Muscles use a mixture of fuels
  - Full mix depends on:
    - Diet
    - Intensity and duration of activity training
    - Degree body is conditioned to perform the activity

**Energy Systems of Physical Activity**

High intensity, short duration:
  - Anaerobic: depend on glucose for fuel.
  - Low-moderate intensity, long duration:
    - Aerobic: depend on fat for fuel

**Fuels Used for Activities of Different Intensities & Durations**

**Energy Systems, Fuels, and Nutrients to Support Activity**

**Extremely intense activity**
8-10 seconds
ATP-CP (immediately available)
No oxygen needed (anaerobic)
Activity example – 100 yard dash, shot put

**Very highly intense activity**
20 seconds to 3 minutes
ATP from carbohydrate (lactic acid)
No oxygen needed (anaerobic)
Activity example – ¼ mile run at maximum speed

**Highly intense activity**
3-20 minutes
ATP from carbohydrate
Oxygen needed (aerobic)
Activity example – cycling, swimming, running

**Moderately intense activity**
More than 20 minutes
ATP from fat
Oxygen needed (aerobic)
Activity example – hiking

**Glucose use in Physical Activity**
During exercise:
- Liver glycogen is broken down and released as glucose into the bloodstream.
- Muscles use this glucose as well as their own glycogen to fuel their work.
- The more glycogen muscles store, the longer the activity can last.
- When glycogen is depleted, the muscles become fatigued.

Glucose Use in Physical Activity

**Glycogen storage:**
- Diet content reflects glycogen storage.
- High carbohydrate diet enhances endurance by enlarging glycogen stores.

Effect of Diets on Physical Endurance

**Intensity of Activity:**
- Greater intensity activity will use glycogen more quickly (running).
- Glycogen depletion usually occurs within 2 hours from onset of intense activity.
- Less intense aerobic activity—slower glycogen use (jogging).
- Use glucose and fatty acids.

Glucose Use in Physical Activity

**Lactic Acid:**
- Produced when rate of the activity exceeds the body's ability to supply adequate oxygen to the tissues.

Cori-cycle:
- Lactate → Liver → Glucose → Muscles.

Glucose Use in Physical Activity

**Recycling of Glucose**

**Duration of Activity:**
- 20 minutes of moderate activity:
  - Uses mostly glycogen.
  - Muscle glycogen, then liver glycogen.
- After 20 minutes of moderate activity:
  - Use more fat.
- Eventually will deplete muscle and glycogen stores.

Glucose Use in Physical Activity

**Glucose depletion:**
- Usually occurs within 2 hours from onset of intense activity.

Brings nervous system to a halt—"hitting the wall".

To prevent—maximize glucose supply.
- Eat high CHO diet (about 8 grams/kg body weight).
- Take glucose periodically (juice, sports drinks).
- Eat high CHO foods after the activity (60 grams).
- Train muscles to store glycogen.

Glucose Use in Physical Activity
**Glucose during Activity:**
Endurance activities > 1 hour
Eat 30-60 grams of Carbohydrate per hour
Sport drinks during the activity

**Glucose after activity:**
High carbohydrate meal the 1st 15 minutes after activity is most effective at increasing glycogen storage
High CHO food eaten within 2 hours following activity enlarges glycogen stores

**Glucose Use in Physical Activity**

**60 gram CHO Snacks**
16 oz sport drink and bagel
16 oz milk and 4 oatmeal cookies
8 oz pineapple juice and a granola bar

**Training affects glycogen use:**
Muscles that consistently deplete stores- Adapt to store more.
Conditioned muscles rely less on glycogen and more on fat.

**Fat Use in Physical Activity**

**Duration of activity**
After 20 minutes of sustained, moderate activity, fat is used as the major fuel.

**Intensity**
As intensity increases- use less fat as fuel

**Training**
Aerobic training allows body to adjust to using fat as fuel
Muscles make more and larger mitochondria

**Fat Use in Physical Activity**
(for weight control)

**Recommendations for Intensities and Duration:**
Low-moderate intensity
Long duration (fast paced walk)

**Choosing an activity:**
Health benefits-30min/day
Lose weight-45 min 3 days/wk
Strength and firmness-lift weights

**Protein Use in Physical Activity**

- **Protein use in muscle building:**
Synthesis occurs between activities,
Not during the activity
Active muscle building training-can add 1/4 -1 ounce muscle mass each day

- **Protein as Fuel:**
Contributes about 10% of total fuel

**Diet affects protein use:**
Adequate energy and carbohydrate
Diet rich in CHO-use less protein for fuel
Protein Use in Physical Activity

- **Intensity and Duration:**
  - Protein needs are higher for endurance and strength athletes

- **Training:**
  - Higher degree of training—less protein used

- **Protein recommendations:**
  Needs are higher for athletes in training

Recommended Protein Intakes for Athletes

**Vitamins and Minerals**

**Supplements:**
Do not enhance performance of nourished person.
Deficiencies will impede performance

**Iron Deficiency:**
At risk—physically active young women
Vegetarian athletes
Losses—sweat, menstruation, poor intake
Low hemoglobin—less oxygen to cells for energy

**Vitamins and Minerals**

**Anemia:**
Low hemoglobin—less oxygen to cells for energy.

- **Sports Anemia:**
  Temporary condition resulting from strenuous aerobic activity which destroys older RBCs
  Occurs initially in training—low hemoglobin
  Adaptive temporary response; does not require treatment

**Recommendations:**
Women, Active teens may need supplement.

**Fluids and Electrolytes**

The need for water surpasses the need for any other nutrient

**Losses in sweat and breathing**
Body cools itself via sweat
Dehydration is a concern
Water loss of 2% of body weight can reduce muscle capacity

**Fluids and Electrolytes**

**Hyperthermia:**
Risk in hot humid weather
Drink fluid before and during activity
Rest in shade and wear lightweight clothing
Heat stroke can be fatal

**Hypothermia:**
Cold weather
Shivering, weakness, disorientation
Drink warm fluids

**Fluids and Electrolytes**

**Fluid replacements:**
Endurance athletes lose 1.5 liters *per hour*
Hydrate before activity
Rehydrate during and after the activity
Best fluid:
- Non-competitive - water
- Endurance - water and carbohydrate

**Fluids and Electrolytes**

Electrolyte loss replacement:
Na, K, Cl, Mg
Eat regular diet
Event >1 hour may need sports drink
Poor beverage choices:
Caffeine containing beverages, alcohol

**Hydration Schedule for Physical Activity**

**Choosing a Diet to Support Fitness**

**Water:**
Drink before you feel thirsty

**Nutrient Density:**
High vitamins & minerals
High Carbohydrate-60-70%
Low fat- 20-30%
Adequate Protein: 15-20%

**Choosing A Diet**

**Meals for Competition**

**Pregame meal:**
High fluids, light, easy to digest
300-800 kcal
High CHO, Low Fiber, low fat
Meal should end 3-4 hours before competition.

**Postgame meal:**
High CHO
Low protein, fat, fiber

**Choosing A Diet**

**Supplements**
Ergogenic aids
Protein powders
Amino acid supplements
Ergogenic Aids
Ergogenic Aids
Protein Powders
Amino Acid Supplements
Carnitine
Vitamin E
Chromium Picolinate
Complete Nutrition Supplements
Creatine Monohydrate
Caffeine
Anabolic Steroids
DEHA
Human growth Hormone
Dietary Supplements
Carnitine
Non-essential nutrient
Facilitates transfer of fatty acids across mitochondria membranes
Supplementation does not increase muscle carnitine or enhance exercise performance.
Chromium Picolinate
Essential mineral in carbohydrate and lipid metabolism
Supplementation has no effect on strength, lean body mass, or body fat.
Dietary Supplements
Creatine
Some studies suggest improvement
muscle strength and size, cell hydration and glycogen loading capacity
Safety issues and side effects
Weight gain
Kidney disease
Dietary Supplements
Conjugated Linoleic Acid (CLA)
Derived from linoleic acid, an essential fatty acid
In animals, increases lean body mass and reduces fat mass
Few human studies have been performed.
Caffeine
Caffeine can enhance performance by stimulating fatty acid release.
Adverse effects include stomach upset, nervousness, irritability, headaches, and diarrhea.
Use in moderation.
Use as an addition to other fluids, not as replacement.
Oxygenated Water
Oxygen cannot enter the bloodstream by way of the GI tract.
The body gets oxygen from the lungs.
Hormonal Supplements
Anabolic Steroids
Illegal
Authorities ban use
Plant sterols from herbs are poorly absorbed.
Dangerous side effects on the body and the mind
Hormonal Supplements
DHEA (dehydroepiandrosterone) and Androstenedione
Hormones that are precursors to testosterone
No evidence to support claims
Short-term effects are identified
Human Growth Hormone (hGH)
Used to build lean tissue and increase height if still growing
Extremely high cost
Many adverse side effects

End of Chapter 14
Nutrition in Fitness