

## Unit 5 – SPORTS NUTRITION

### Nutrition Lecture Guide

- I. Introduction
  - A. Proper nutrition is a vital consideration for athletes who seek to maximize their performance.
  - B. Just as using the proper gasoline, oil, or radiator fluid, is important for your vehicle, eating the proper food will directly affect how the body “machine” operates!
  - C. A proper diet will provide the necessary raw material to allow a good training program to build and run the human machine
    1. It will provide the proper nutrients and energy for athletic performance, training and healing.
  - D. Many factors affect nutrient needs and nutrient availability including the athletes’:
    - 1.
    - 2.
    - 3.
    - 4.
  - E. These factors make it essential that the diet be individualized.
  
- II. Purpose of Nutrition
  - A.
  - B.
  - C.
  - D. The right foods help the athlete to:
    - 1.
    - 2.
    - 3.
  
- III. Sports Nutrition Goals are to Ensure:
  - A. \_\_\_\_\_ to meet the energy demands of training
  - B. Adequate replenishment of muscle and liver \_\_\_\_\_ with dietary carbohydrates
  - C. Adequate \_\_\_\_\_ intake for growth and repair of tissue, particularly muscle
  - D. Adequate overall diet to maintain a healthy \_\_\_\_\_
  - E. Adequate \_\_\_\_\_
  - F. Consumption of food and beverages to delay \_\_\_\_\_ during training and competition
  - G. Minimization of \_\_\_\_\_ during exercise
  
  - H. Utilization of dietary strategies known to be beneficial for performance including:

- 1.
- 2.

#### IV. The Food Pyramid



##### A. Components of the Pyramid

1. Find Your Balance Between Food and Physical Activity
  - a. Represented by \_\_\_\_\_ and the \_\_\_\_\_, as a reminder of the importance of daily physical activity
  - b. Be physically active for :
  - c. Activity for children and teen agers:
  
2. Moderation
  - a. Represented by :
  - b. Wider base stands for :
    - i. These should be selected more often
  - c. Narrow top stands for :
    - i. The more active you are, the more of these foods can fit into your diet
  
3. Personalization
  - a. Represented by :
  
  - b. Mypyramid.gov is interactive and designed to give each individual a more customized approach to nutrition
  - c. The link [MyPyramid.gov/professionals/food\\_tracking\\_wksht.html](http://MyPyramid.gov/professionals/food_tracking_wksht.html) gives 12 different worksheets that best match an individual's caloric needs
  
4. Proportionality
  - a. Represented by :
    - i. Suggest how much food a person should choose from each group.
  - b. Variety
    - i. Represented by:
      - ii. Illustrates that foods from all groups are needed each day for good health

5. Gradual Improvement

a. Represented by :

- i. Suggests that individuals can benefit from taking small steps to improve their diet and lifestyle each day

B. The Groups of the Pyramid

1. Grains (\_\_\_\_\_)

- a. Eat \_\_\_\_\_ every day
- b. Grains include bread, cereal, pasta, crackers, rice or pasta
  - i. Look for “\_\_\_\_\_” before the grain name on the list of ingredients.
  - ii. At least \_\_\_\_\_ should come from whole grains
  - iii. Examples of 1oz grains:
    - A.
    - B.
    - C.
    - D.

2. Vegetables (\_\_\_\_\_)

- a. Eat \_\_\_\_\_ cups per day
- b. Eat more \_\_\_\_\_ vegetables
- c. Eat more \_\_\_\_\_ vegetables
- d. Eat more dry beans and peas

3. Fruits (\_\_\_\_\_)

- a. Eat about \_\_\_\_\_ per day
- b. Eat a variety of fruits
- c. Choose fresh, frozen, canned, or dried fruit
- d. Go easy on fruit juices
  - i. Why? \_\_\_\_\_

4. Oils (\_\_\_\_\_)

- a. Make most of your fat sources from :
- b. Limit solid fats like, lard, stick margarine, shortening, and butter.

5. Milk (\_\_\_\_\_)

- a. Drink \_\_\_\_\_ per day
- b. Go low fat or fat free
- c. If milk cannot be consumed, choose lactose free products or other calcium sources

6. Meats and Beans (The Purple Color)

- a. Eat about \_\_\_\_\_ each day
- b. Choose low fat or lean meats and poultry
- c. Prepare it by:
- d. Vary your choices – with more fish, beans, peas, nuts, and seeds.

V. Basic Nutrients

A. Nutrients are chemical substances in food that provide energy, act as building blocks in forming new body components, or assist in the functioning of various body processes.

B. The six classes of nutrients are:

1.

- a. One of the 3 nutrients that provide energy
- b. Yields approximately \_\_\_\_\_
  - i. Carbohydrates are the basic source of energy for the body
- c. Common carbohydrates are :  
Found in :
- d. The body converts sugars and starches to \_\_\_\_\_ for energy or to \_\_\_\_\_ for energy storage in the liver and muscles.
  - i. When glycogen stores are full, excess carbohydrates are converted to \_\_\_\_\_
- e. Carbohydrates tend to be high in fiber
  - i. Fiber:
  - ii. While a high-carbohydrate diet is essential to good health in all individuals, it is especially important to the athlete
  - iii. \_\_\_\_\_% of the athlete's caloric intake should be from carbohydrates to keep the glycogen stores filled.
  - iv. Athlete recommendation is \_\_\_\_\_ grams of carbohydrate per kilogram of body weight per day
    - A. Varies depending on sport, gender, etc
  - v. Carbohydrate loading (discussed below) is used to generate extra glycogen and requires a carbohydrate intake of 70-80%.
  - vi. See handout for foods that are good sources of carbohydrates

2. Proteins

- a. Protein is critical to growth and development especially muscle and bones
  - i. This important fact puts proteins above all other nutrients in the minds of some individuals. However, no one nutrient is more important than another to assure proper health
- b. General functions of protein
  - i.
  - ii.
  - iii. Can be a source of energy
    - A. Yields approximately \_\_\_\_\_
    - B. This occurs:

1. Example:

C. Also occurs :

- c. Proteins are derived from \_\_\_\_\_
  - i. Such as:
  - ii. Other sources are :
  - iii. See handout for extended list
- d. During the digestive process, proteins are broken down into different amino acids.
  - i. \_\_\_\_\_ of these amino acids are essential to build and repair body tissues.

A. The term “essential” means :

B. The term “indispensable” is now being used to describe this type of amino acid

- e. As stated earlier proteins may be used by the body for cellular energy, but proteins are the body’s least efficient source of energy.
- f. The body cannot store protein; therefore, extra protein is converted to \_\_\_\_\_
- g. Protein intake should be approximately \_\_\_\_\_% of caloric intake.
- h. The Dietary Reference Intake (DRI) for adults is . \_\_\_\_\_ body weight
  - i. Athlete recommendation is \_\_\_\_\_ of protein per kg body weight per day
    - A. Endurance athletes:
    - B. Strength athletes:

3. Fats (Lipids)

- a. The third energy yielding nutrient
  - i. Yields \_\_\_\_\_
  - ii. That’s over twice carbohydrates and proteins!
- b. Main sources include meats, eggs, milk, cheese, fried foods, butter, margarine, salad dressings, oils, and mayonnaise.
- c. Fats also carry vitamins A and D to cells, and are necessary for normal growth and development.
- d. Function of Fats:
  - e. Add flavor to our foods.
  - f. Fats are necessary, in fact important, in the diet. Yet many people consider fats to be a harmful nutrient.
    - i. The problem is the fact that we often eat far more than the daily recommended amount of fats (30% of our caloric intake).
    - ii. Most Americans eat a whopping \_\_\_\_\_ or more of their daily calories from fats.

- g. Athlete recommendation is \_\_\_\_\_ of fat per kg of body weight per day
- h. High-fat diets are associated :
- i. Fats are not digested as quickly as other nutrients.
- j. Fats are a basic source of \_\_\_\_\_, since fats are used when the carbohydrate sources are depleted.

#### 4. Vitamins

- a. *Vitamins do not provide energy!*
- b. Vitamins are essential for maintaining good health.
- c. A lack of vitamins in the diet leads to deficiency conditions, which express themselves in a variety of ways.
- d. Most vitamins cannot be synthesized by the body and must be ingested via foods or pills.
- e. No single food or food group will supply all the vitamins needed by the body
  - i. A good reason to eat a variety of different foods.
- f. Vitamins are usually identified as either fat soluble or water soluble.
  - i. Fat soluble vitamins :
    - A. These vitamins are stored in body cells, especially liver cells.
  - ii. Water soluble vitamins :
    - A. The body doesn't store these vitamins well and excess quantities are excreted in urine.
  - iii. Requirements for exercise:
    - A. Supplementation:

#### 5. Minerals

- a. *Minerals do not provide energy!*
- b. Minerals :
- c. Some examples of essential minerals include:
  - i. Calcium –
  - ii. Potassium –
  - iii. Iron –
  - iv. Sodium –
  - v. Phosphorus –
  - vi. Requirements for Exercise:
  - vii. Heavy sweating may lead to excess losses of :
  - viii. Losses of these minerals may affect performance
  - ix. Increase in salt for athletes should come from:

6. Water

- a. Water is often considered the most important nutrient:
  - i. Failure to consume other nutrients will show harmful effects on the body after several weeks or months but humans can only survive without water for a few days!
- b.
- c.
- d.
- e.
- f.
- g. Note that a loss of fluid through exercise may have an effect on these functions; many of which will affect performance
- h. See the “Fluid Replacement” section for an in depth study of how water affects performance

VI. Fluid Replacement

A. Exercise increases water loss

- 1.
  - a. Increased breathing during exercise increase this loss
- 2. Heat production is a byproduct of muscle contraction.
  - a. Increased muscle contraction during exercise increases overall body heat forcing the body to compensate through

b. \_\_\_\_\_ per hour!

B. Water loss affects performance

- 1. Diminished water content in the blood causes:
  - a. Diminished capacity to transport \_\_\_\_\_ to body cells
  - b. Diminished capacity to get rid of excess \_\_\_\_\_ from working muscles causing increased body temperature since heat is transported in the blood
    - i. Body cells must have a consistence temperature to function properly (homeostasis)
- 2. Loss of fluid causes cells to \_\_\_\_\_ (crenation) which affects their normal function
- 3. These affects are summarized as follows:

- a.
- b.
- c.
- d.

C. Sports drinks

- 1. During heavy sweating water is not the only element lost
- 2. Electrolytes are also lost including:
  - a. Of these, \_\_\_\_\_ is lost in the greatest abundance

3. During exercise of 2 hours or less the body is able to reabsorb sodium loss
  - a. There does not seem to be a performance or health issue with sodium loss during shorter exercise bouts
  - b. During exercise lasting less than two hours, the athlete would need to pay more attention to :
  - c. \_\_\_\_\_ works well as a fluid replacement beverage under these conditions
4. During exercise lasting over 2 hours, and in hot environments, sodium loss in sweat occurs too rapidly for reabsorption to occur
5. Exercise lasting 2 hours or more may also significantly decrease \_\_\_\_\_
6. Sports drinks may be a good option for fluid replacement during exercise lasting over 2 hours and for exercising in the heat
  - a. Sports drinks may help to replenish :
  - b. Sodium replacement and maintaining hydration during exercise may help to reduce muscle cramping during exercise especially in salty and heavy sweaters.
    - i. Cause of muscle cramping:
    - ii. Another cause of muscle cramping:
      - A. Prevention:
  - c. There are many types of sports drinks to choose from and choosing one over another is up to each individual
    - i. However, there is a proper proportion of the chemicals in the drink in order to optimize performance and limit any detrimental affects
      - A. Carbohydrate (sugar):
      - B. Sodium:
  - d. Example of a sports drink recipe
    - i.
    - ii.
    - iii.
    - iv.
    - v. Keep refrigerated
7. Monitoring hydration status
  - a. Thirst mechanism:



- i. By the time you are thirsty, you are already dehydrated
      - ii. Therefore, thirst is not a good indicator of hydration
    - b. There are a number of very expensive and time consuming test to monitor hydration but this process can be accomplished with relative ease
    - c. Urine color is a good indicator of hydration
      - i. See *Urine Color Chart*
      - ii. Diet, supplementation, or medications, may affect urine color but this method is easy and practical
    - d. Weight loss that occurs during a single bout of exercise is likely due to :
      - i. Changes in body weight can be used as a marker for short term fluid loss
      - ii. One liter of water weighs approximately \_\_\_\_\_
      - iii. If an athlete completes a hard workout lasting approximately one hour and loses 2kg of body weight it can be assumed that approximately \_\_\_\_\_ have been lost
        - A. Or just simply :
      - iv. It must be cautioned that the need for frequent weighing may put undue stress on certain athletes who already have anxiety in regard to their weight
        - A. In these instances an alternate method may be more appropriate
8. Fluid Replacement strategies
- a. Pre-hydration should begin at least \_\_\_\_\_ before competition
    - i. Recommendation :
    - ii. Ex: a 50kg (110lb) female would drink :
    - iii. This recommendation assumes the athlete is in a hydrated state at the time
    - iv. It should be noted that water is sufficient, however, sodium stimulates \_\_\_\_\_ so a beverage that contains sodium may be beneficial
    - v. Pre-hydration should be determined on an individual basis and by trial and error to determine the appropriate amount for each individual
      - A. Too little may lead to :
      - B. Too much may :

- b. Hydration during activity
  - i. It is generally recommended that an athlete drink :
    - A. Small amounts taken frequently are tolerated best by most athletes and leads to more effective gastric emptying
  - ii. Hydration needs during activity is highly individual and routines should be established well before competition to avoid introducing a “new” routine during competition.
  - iii. Gastric emptying:
    - c. \_\_\_\_\_ to water before, during, and after activity should be encouraged.
- 9. The thirst mechanism can be unreliable for athletes.
  - a. Athletes should be encouraged to :
  - b. By the time the brain signals the thirst mechanism, the athlete :
  - c. This can significantly impair performance.
- D. Hyponatremia
  - 1. A potentially serious medical complication that may occur in endurance athletes during prolonged exercise such as ultra-marathons or triathlons
    - a. Events lasting :
  - 2. Occurs when :
  - 3. Sodium plays a vital role in the body in maintaining normal fluid balanced throughout the body
    - a. Low sodium level in the extracellular compartment causes:
      - b. This is particularly important :
  - 4. Cause:
    - a. When dehydration is prevented with copious consumption of water, sodium loss is not replaced leading to an imbalance of sodium in the extracellular fluid.
  - 5. Signs & Symptoms
    - a.
  - 6. Prevention:
    - a. The recommendation is \_\_\_\_\_ of sodium per liter of fluid
    - b. Athletes should be encouraged to consume enough fluid to match fluid loss and prevent dehydration while not exceeding the amount of fluid lost

VII. Energy Drinks

A. Energy drinks are a \$10 billion industry!

1. Marketing:

B. They contain ingredients that are not regulated by the FDA which allows the companies to make claims that are not based on scientific data

1. Guarana is a fruit from Brazil. It is a natural form of caffeine
2. Ginseng has been associated with :
3. Ginkgo is used to :
4. Taurine is a naturally occurring amino acid found in the body.
5. Many of these ingredients are “linked” to impressive claims but most are unsubstantiated and companies can include them in any quantity they choose and make claims that are attractive to the target audience
6. It should be noted that one of the main ingredients in energy drinks is caffeine.
  - a. Content in most brands is :
  - b. See “ergogenic aids” for details on detrimental effects of performance of caffeine
7. Most contain a very high sugar content which causes an “\_\_\_\_\_” which actually causes a low blood sugar content

VIII. Pre Game Meals

A. What is eaten before competition has four main functions:

1. To help prevent \_\_\_\_\_ (low blood sugar), with its symptoms:
2. To help settle the stomach, absorb some of the gastric juices, and decrease \_\_\_\_\_.
3. To \_\_\_\_\_ muscles, both with food eaten in advance that is stored as glycogen, and with food eaten within an hour.
4. To \_\_\_\_\_ the mind with the knowledge that the body is well fueled.

B. Sports nutrition for performance benefits must begin days in advance.

1. Type of meals daily:
  - a. Food eaten within an hour before exercise primarily decreases hunger and maintains blood sugar
    - i. It doesn't significantly replenish muscle glycogen stores.
2. When exercising for more than 60-90 minutes, carbohydrates which slowly enter the bloodstream as they are digested (\_\_\_\_\_) such as :

- a. When eaten an hour before exercise, these slow carbohydrates will be digested enough to be burned for fuel, and then will continue to provide sustained energy during the long workout.
    3. When exercising for less than an hour, snacking on any tried-and-true foods that digest easily and settle comfortably is satisfactory.
      - a. Popular choices:
    4. Limit high-fat proteins like cheese, steak, hamburgers, and peanut butter.
      - a. They may cause:
      - b. Be cautious with sugary foods such as:
      - c. Many athletes who eat these foods within 15-12 minutes before hard exercise can experience;
      - d. Experiment and learn how your body responds.
    5. Allow adequate time for food to digest.
      - a. Remember that high calorie meals take longer to leave the stomach than do lighter snacks.
      - b. The general rule of thumb is:
        - i. Large meal:
        - ii. Smaller meal:
        - iii. Snack
      - c. Some athletes can comfortably eat before they exercise, but others prefer to abstain. Both sorts perform well, and both have simply learned how to best fuel their bodies.
      - d. It should be noted that exercise increases blood flow to working muscles and away from digestive organs
        - i. Causing:
    6. Always eat familiar foods before a competition.
      - a. Don't try anything new!
      - b. New foods always carry the risk :
    7. Drink plenty of fluids.
- IX. Carbohydrate Loading
- A. The purpose of carbohydrate loading is to “super-compensate” for glycogen depletion in an effort to store the maximum amount of glycogen possible prior to an event
  - B. The athlete most likely to benefit from carbohydrate loading programs are:
    1. Examples:

- C. Carbohydrate loading may also benefit athletes involved in sports that require prolonged movement of varying intensities:
  - 1. Examples:
  
- D. The most accepted protocol is a 6 day cycle:
  - 1. Phase 1- The “Depletion Phase”
    - a.
    - b. Carbohydrate intake:
    - c. This is the minimum amount recommended to athletes in training
    - d. The first day should be:
    - e. Followed by 2 days of:
  - 2. Phase 2- The “Repletion Phase”
    - a.
    - b. Carbohydrate intake increases to :
    - c. This is followed by:
  
- E. Some side effects may occur
  - 1.
    - a. This may not be tolerated well by some athletes who may feel sluggish and heavy
  - 2. Eating too many carbohydrates can lead to :
  
- F. Choose wholesome, fiber-rich carbohydrates.
  - 1. These types of carbohydrates keep your system running smoothly.
  - 2. Examples:
  
- X. Post Game Meals
  - A. What you eat after a hard workout or competition does affect your recovery.
  - B. Foods eaten after exercise or competition require the same careful selections as the meal before exercise.
  - C. Competitive athletes who are engaged in 2 or more workout per day must be especially concerned about recovery diet such as:
    - 1.
    - 2.
    - 3.
    - 4.
    - 5.
  
  - D. Athletes commonly have reasons to eat inadequately after exercise, including that they don't feel hungry and don't have time.
  - E. Recovery Carbohydrates
    - 1. Recommendation is :
      - a. Ex: a 176lb athlete should consume approximately :
        - i. This could easily be achieved with :

- ii. Consumption of carbohydrate in smaller, more frequent meals appears to further aid the rate at which muscle glycogen is replaced in the hours after exercise
  - A. With larger meals, blood glucose and insulin rise rapidly and then return to baseline relatively quickly
  - B. Blood glucose levels can be sustained for a longer period of time with smaller meals
- b. It is also recommended that \_\_\_\_\_ body weight be consumed each of the next 3 hours
2. Ideally, carbohydrate-rich foods and beverages should be consumed within \_\_\_\_\_ after a workout
  - a. Why? \_\_\_\_\_
3. Liquids and solid foods will refuel muscles equally well.
  - i. Liquids should contain :
  - ii. Studies show fructose does not result in glycogen synthesis rates that are as high as those with glucose
  - iii. Solid foods should have a \_\_\_\_\_ index
    - A. These are most effective in enhancing the resynthesis of glycogen
    - B. Ex:
4. See handout for a more complete list of carbohydrates with a high glycemic index

#### F. Recovery Protein

1. Protein intake after exercise is important for muscle anabolism
2. Recommendation is \_\_\_\_\_ immediately after exercise
  - a. \_\_\_\_\_g/kg body weight
3. Good examples of proteins are:
  - a.
  - b.
  - c.
4. Some protein can actually enhance glycogen replacement in the initial hours after hard exercise.
5. Protein eaten along with \_\_\_\_\_ is recommended

#### G. Recovery Electrolytes

1. Sweating not only causes water loss but also some minerals (\_\_\_\_\_) such as \_\_\_\_\_ and \_\_\_\_\_ that help the body function normally.
2. Electrolyte losses are primarily responsible for :
3. Most athletes should be able to consume more than enough electrolytes from standard post-exercise foods.

a. Salt tablets :

XI. Body Composition

A. Body composition refers to :

B. Body composition is usually divided into 2 main categories:

- 1.
- 2.

a. Includes :

3. Most athletes are interested in the ratio of fat mass to total body mass which is commonly expressed as \_\_\_\_\_.

C. Essential fat is the minimum amount of fat necessary for proper physiological function

1. Essential fat for males =
2. Essential fat for females =
  - a. Of this approximately \_\_\_\_\_ is considered sex-specific fat
    - i. This is fat needed for proper hormonal and reproductive functions
3. Body composition that drops below these levels interferes with normal body function

D. Body Fat Norms

1. Females
  - a. Caution-
  - b. Excellent-
  - c. Good-
  - d. Average-
  - e. Overfat-
  - f. Obese-
2. Males
  - a. Caution-
  - b. Excellent-
  - c. Good-
  - d. Average-
  - e. Overfat-
  - f. Obese
3. See “%Fat Brake-Down for College Athletes” Hand out for more details information

XII. Measuring Body Fat

A. Errors

1. It should be noted that body fat cannot be directly measured except by chemical analysis of human cadavers
2. All other methods “estimate” or “predict” body composition using data from the direct chemical analysis of relatively limited number of human cadavers
3. All methods also have potential technical error in the assessment method itself

- B. There are five common methods to estimate percent body fat:
1. Body Max Index (\_\_\_\_\_)
    - a. BMI does not measure body composition but is a common method used to measure “fitness” associated with weight
    - b. BMI is used as a quick screening tool for physicians to screen for chronic disease risk associated with obesity
    - c. It assumes that adult height is stable and that any increase in scale weight is a result of an increase in body fat
    - d. This is not an accurate test to calculate body composition
      - i. Athletes typically have more than average muscle mass which leads to inaccurate findings
    - e. Ex: an athlete whose height is 6’ 3” and weighs 240 lbs has a BMI of \_\_\_\_\_ and is classified as \_\_\_\_\_!
    - f. BMI is defines :
      - i. This gives a unit of kg/m<sup>2</sup> but units are usually not included
    - g. BMI criteria are as follows:
      - i. Underweight =
      - ii. Healthy =
      - iii. Overweight =
      - iv. Obese =
    - h. See “Body Mass Index Table” for a quick way to calculate BMI
  2. Hydrostatic (Underwater) Weighing
    - a. Traditionally has been considered to be the most accurate method.
    - b. The subject exhales all of the air in their lungs and is then weighed while submerged in a tank of water.
      - i. This technique does not measure body fat, rather it measures \_\_\_\_\_
      - ii. This density measurement translates mathematically into percent body fat.
    - c. Errors with underwater weighing include:
      - i.
        - A. as little as \_\_\_\_\_ of air can affect body fat measurements by as much as 3-5%.
      - ii.
      - iii.
  3. Plethysmography (\_\_\_\_\_)
    - a. Measures :



- b. The subject sits in an air-tight enclosure while the amount of air displaced by the subject's body is sensed by a special diaphragm and pressure transducer
    - c. Once body volume is determined, body density can be calculated and body fat estimated
    - d. Errors include air pockets in clothing
      - i.
- 4. Skinfold calipers, which are more convenient and still relatively accurate.
  - a. Calipers are large "pinchers" that measure the thickness of the fat layer on specific body sites.
    - i. Common sites are :
  - b. Error:
- 5. Bioelectrical impedance analysis (BIA)
  - a.
    - i. Current typically flows up one leg and down the other
    - ii. The flow of the current is affected by the amount of fat that is encountered
  - b. Error:
- 6. Near Infrared Reactance (NIR)
  - a. Measures the thickness of the skin at only one site, which may poorly represent overall body fat.
  - b. This method measures fat thickness based on principles of light absorption and reflection.
  - c. An instrument that emits an infrared light beam is placed over the biceps. It measures :
  - d. Error:

7. Comparison of Methods used to estimate Body Composition

Method	*Accuracy	Practicality & Portability	Ease of Use	Time	Cost	Subject Comfort & Effort	Technician Training
Underwater (Hydrostatic Weighing)		Practical in exercise physiology laboratories or large fitness centers, not portable	Requires subject to submerge, exhale all air, and hold breath	Procedure should be repeated 3-5 times	Initial purchase of equipment is expensive	Subject may be uncomfortable wearing bathing suit, submerging in water, and exhaling air	Training is needed but is not difficult
Plethysmography (Bod Pod)		Requires 8'X8' space; can be moved but takes effort	Requires subject to sit quietly		Initial purchase of equipment is expensive	Subject may be uncomfortable wearing bathing suit and cap and sitting in an enclosed space	Minimal training needed
Skinfold Measurements (Calipers)		Practical in settings that have a private area; very portable	Requires subject to be still; Measurement sites must be determined and marked		Initial purchase of equipment is moderately expensive	Subject may be uncomfortable partially disrobing; some skinfolds are difficult to grasp	Training and consistency are critical; technique improves with experience
Bioelectrical Impedance Analysis (BIA)		Practical in most settings; very portable	Easy to use		Initial purchase of equipment is moderately expensive	Procedure is simple but pre-measurement guidelines require substantial subject compliance	Minimal training needed
Near-infrared Interactance (NIR)		Practical in most settings; very portable	Easy to use		Initial purchase of equipment is moderately expensive	Simple procedure; generally no problems	Minimal training needed

\*Error assumes that the procedure is done with quality equipment and a skilled technician

XIII. Weight Gain & Loss

A. In order to gain or lose weight, proper exercise and diet must be combined in the right ways.

B. Weight Gain

1. Theoretically, in order to gain 1 pound of body weight per week, the consumption of an additional \_\_\_\_ calories per day is needed.
2. The extra calories should primarily come from \_\_\_\_
  - a. They fuel muscle so the muscles can perform intense muscle-building exercise.

- b. However it is recommended that protein intake increase by \_\_\_\_\_ per day to provide necessary amino acids for muscle growth
- 3. Protein Powders/Shakes:
  - a. The only reason some athletes may see results from these is likely :
- 4. Weight is most likely gained if larger-than-normal meals are consumed.
- 5. Finding the time to eat can be the biggest challenge to boosting caloric intake.
  - a.
  - b.
  - c.
  - d.
  - e.
- 6. Taking the prescribed 500-1000 additional calories per day should cause some weight gain.
  - a. It is vital to include :
  
  - b. It is recommended to have body fat routinely measured, to be sure that weight gain is mostly muscle, not fat.

### C. Weight Loss

- 1. Understanding body composition is an important component of weight loss
  - a. \_\_\_\_\_ weighs more than \_\_\_\_\_
  - b. When an individual begins an exercise program in an effort to lose weight he or she may find that the scale is not showing significant weight loss
    - i. However, it is likely that body composition is changing
      - A. Fat may be decreasing while muscle is increasing
  - c. For this reason some form of body composition analysis should be utilized rather than body weight itself
- 2. Body fat is stored energy
  - a. In order to decrease body fat one :  
  
  - b. Quite simply, the equation to lose excess body fat is:  
  
  - c. It should be noted that every human body is different and fat is stored at different rates for each person
    - i. Storing fat can be effected by:

- ii. Therefore, while the equation seems simple, it can be quite difficult
- 3. To lose weight healthfully, and successfully keep it off:
  - a.
  - b.
  - c.
  - d.
- 4. Theoretically, 1lb. per week should be lost if \_\_\_\_\_ fewer calories per day is eaten than normally
- 5. Weekly weight loss recommendation:
- 6. Eat slowly! The brain needs about \_\_\_\_\_ to receive the signal that food has been eaten.
  - a. No matter how much food is consumed during this time the satiety signal doesn't move any faster.
- 7. Exercise regularly, but do not over-exercise.
  - a. Too much exercise may lead to injury, fatigue, and irritability.
  - b. Exercise will be more satisfying when it is for fun and fitness, not simply for burning off calories.
- 8. Crash Diets
  - a. Weight loss fads are common in today's world
  - b. These technique usually focus on :
    - c. Such diets are unsuccessful because losing body fat and keeping it off requires :
    - d. These diets can actually cause long term weigh gain because :
      - i. This means that the body will burn less calories day to day than normal
    - e. These fads are dangerous and can cause problems such as:

D. Rapid weight loss is sports

- 1. Sports that have weight categories because differences in body size make it impossible for all athletes to fairly compete among one another are at risk for unhealthy weight loss tactics
  - a. Examples :
- 2. Other sports in which weight must be moved or that physical appearance may be judged may also be at risk
  - a. Examples :
- 3. Rapid weight loss tactics include:

4. These tactics have serious risks and should never be condoned.
  - a. Most health risks are associated with prolonged energy deprivation (see eating disorder section below) or dehydration (see hydration section above)
  - b. There are several documented cases of deaths due to these tactics
  - c. Other side effects include :
  - d. Studies are also showing that the weight “cycling” of these athletes is leading to \_\_\_\_\_ as aging occurs and an increase likelihood of being overweight later on in life
  - e. Many states are implementing rules to limit such tactics in order to create a safer environment for the athletes
    - i. In 2006 the National Federation of State High School Associations instituted rule changes that include:
      - A.
      - B.
      - C.

XIV. Eating Disorders

- A. Eating disorders affect more that 8 million Americans at any given time
- B. All forms of eating disorders can be fatal
  1. \_\_\_\_\_ people will die as a direct result of their eating disorder
- C. Males can get eating disorders but the vast majority are females

D. Signs to look for include:

1. Social isolation.
2. Lack of confidence in performance.
3. Ritualistic eating behaviors, such as cutting food into small pieces and playing with it.
4. Obsession with calories.
5. Obsession with weight.
6. Distorted body image.
7. Wearing layers of baggy clothing to hide thinness.
8. Nervous at mealtime, avoidance of eating in public.
9. Patterns of leaving the table directly to go to the bathroom.
10. Running water in the bathroom after meals to hide the sound of vomiting.
11. Significant weight loss.
12. Obsession with grades.
13. Obsession with organization of personal space.
14. High emotions; tearful, uptight, overly sensitive, restless.
15. Signs of malnutrition.
16. Menstrual irregularities.
17. Loss of hair.
18. Light-headedness.
19. Blood-shot eyes.
20. Inability to concentrate.
21. Chronic fatigue.
22. Hyperactivity – compulsive exercise beyond normal training.
23. Decrease in performance.
24. Recurrent overuse injuries and stress fractures.
25. Depression.

E. Anorexia Nervosa

1. People with anorexia restrict their caloric intake for long periods of time and deliberately starve themselves, resulting in loss of body weight of at least \_\_\_\_\_.
2. They have an intense fear of becoming obese as well as a distorted body image.
3. Weight loss is achieved by :
4. The following signs and symptoms are used by the American Psychiatric Association to define Anorexia Nervosa:
  - a.
  - b.
  - c.
  - d.
  - e.
  - f.
5. Anorexia is a life-threatening condition if left untreated.

F. Bulimia Nervosa

1. Definition:

a. Purging takes on different forms:

2. The definition used by the American Psychiatric Association includes:

a. Recurrent episodes of binge eating, characterized by both of the following:

i. Eating an unusually large amount of food in a discrete period of time (the amount eaten is larger than most people would eat during a similar time period and under similar circumstances).

ii. Feeling out of control during the eating episode and unable to stop eating or control what and how much is eaten.

b. Compensating for the food binge to prevent weight gain, such as inducing vomiting; misusing laxatives, enemas, or other medications; fasting; or exercising excessively.

c. Binge eating and purging, on average, at least twice a week for three months.

d. Evaluating self-worth according to body shape and weight.

3. Many individuals (\_\_\_\_\_) who have been diagnosed with anorexia will also develop symptoms of bulimia.

G. Bulimic behavior can cause:

H. The Female Athlete Triad

1. A term used to describe three interrelated conditions that can occur in competitive women athletes:

a.

i. This may be the result of simply trying to prevent any added fat in order to keep body weight low

A. This athlete may or may not have the same psychological risk as a similar athlete with disordered eating

ii. Can occur in sports in which a low body weight is desirable

A. Examples:

iii. The low energy availability coupled with the energy demands of the sport brings the athlete into energy deficit

iv. This can be worsened in the adolescent athlete do to:

v. Energy deficits force the body to adapt and begin to suppress physiological functions that are associated with normal growth and development

b.

- i. Definition:
  - ii. Caused by high energy expenditure and can be coupled with low energy intake
    - A. This alters the secretion of luteinizing hormone (LH) and estrogen which control the menstrual cycle
  - c.
    - i. Definition:
    - ii. Low estrogen secretion interferes with the females ability to store calcium in the bones
      - A. one of estrogens' functions is to protect against calcium loss from bone
    - iii. this increases the athletes susceptibility to :
    - iv. Studies show that amenorrhea that lasts longer than six months will likely have a negative effect on the athletes' bone mineral density
    - v. This bone loss is typically occurring at a vital time when bone density should be increasing as the athlete matures
    - vi. This causes a significant increase in the susceptibility of problems due to osteoporosis in the athlete in later years of life
2. If not treated, the energy deficit can result in the following sever health problems (this list is not exhaustive):
- a.
  - b.
  - c.
  - d.
  - e.
3. Prevention begins with :
- a. A healthy goal should be established for a desired training weight of the athlete
    - i. This goal should be such that will be beneficial to the athletes \_\_\_\_\_ yet not compromise \_\_\_\_\_
    - ii. Use of :
    - iii. Professional help may include:
  - b. A training and diet plan can be established that Provides:
4. Treatment :
- a. Menstruation will return when energy balance is achieved with no long term conception issues



- b. Depending on the length and severity of the osteoporosis there may be :
      - I. Any victim of an eating disorder must be approached and handled extremely carefully. Referral for medical treatment is essential!
      - J. Prevention of Eating Disorders
        - 1. Many athletes think – or feel pressured to believe – that by restricting their food intake to lose weight they will exercise better, look better, and enhance their overall performances.
        - 2. Ironically, restricting food in an attempt to improve performance can actually result in :
        - 3. Some athletes may manage to do well for a while without an obvious decline in performance, but then injuries and lack of energy will catch up with them.
        - 4. Eating disorders would fade if people could learn to love their bodies. As a society we must:
          - a.
          - b.
          - c.
          - d.
- XV. Ergogenic Aids
  - A. Definition:
  - B. The IOC definition: “The administration or use of substances in any form alien to the body or of physiological substances in abnormal amounts and with abnormal methods by health persons with the exclusive aim of attaining an artificial and unfair increase in performance in sports.”
  - C. The use of these substances and practices is controversial. There is great concern about the number of athletes engaging in the use of ergogenic aids.
    - 1. Drug testing has been instituted in many sporting programs in order to help curtail the use of these substances.
  - D. Because of ethical violations associated with the inequities that result in competition and health problems that can result, use of these substances cannot be condoned!

E. Common Ergogenic Aids:

<b>Ergogenic Aid</b>	<b>Explanation</b>	<b>Physiologic Effect</b>	<b>Common Sports</b>	<b>Side Effects</b>
<b>Ephedra</b> (known as <b>Ma Huang</b> in traditional Chinese medicine)			<b>varied</b>	
<b>Caffeine</b>	<b>Most widely consumed, self-administered psychotropic drug in the world. Found in many beverages and a few foods. Primary active ingredient is methylxanthine</b>		<b>Any sport to increase alertness and for perceived decreased fatigue. Wrestlers may abuse drug for diuretic effect.</b>	
<b>Morphine &amp; Codeine</b>		<b>Changes the way the body senses pain</b>	<b>Any sport to decrease the symptoms of pain</b>	
<b>Beta Blockers</b>				
<b>Diuretics</b>				<b>Affects associated with dehydration</b>
<b>Anabolic Steroids</b> (including any drug which is a precursor to	<b>Most commonly abused ergogenic aid. They are obtained on the black market. These drugs are synthetic</b>			<b>Too many to list – see handout!</b>

<b>testosterone such as Androgen)</b>	<b>forms of the male sex hormone testosterone.</b>			
<b>Human Growth Hormone (Hgh)</b>				
<b>Erythropoietin (EPO)</b>				
<b>Blood Doping</b>				
<b>Local Anesthetics (Including Corticosteroids)</b>	<b>Injected locally to inhibit or deaden pain</b>			
<b>Creatine</b>	<b>A chemical that is part of a metabolic pathway that replenishes ATP very rapidly.</b>	<b>The body creates a limited amount so loading may increase ATP availability through this pathway and allow athlete to train harder</b>	<b>***</b>	<b>****</b>

\* There have been numerous accounts of death where ephedra is a contributing cause leading to bans in many professional sports including the NFL

\*\* Although caffeine has been thought to have a diuretic effect, recent studies indicate that caffeine is safe up to the level of 300mg which is far above what a person would typically take in through coffee, carbonated drinks, etc. Caffeine intake in an already dehydrated state may obviously increase risks associated with dehydration.

\*\*\*Studies have only showed positive performance results on weight lifters

\*\*\*\*These symptoms were postulated when creatine first came onto the market, however, current scientific studies have not shown these side effects when used in the recommended doses.

F. Prevention of Drug Use

1. The major goal of sporting organizations is to protect the health of athletes and to help ensure that competition is fair and equitable.
2. Sports programs should have full-service programs that provide substance abuse education, counseling, and drug-detection.
3. Drug testing should be performed periodically in a random manner.
4. Athletes, parents, coaches, athletic trainers, physicians, and administrators must be educated about the dangers of drug abuse and the fact that it has no place in sports participation and recreation.
5. Above all, a sports program must adopt the philosophy that “winning at all costs” is wrong.
6. It is essential for athletes to believe that if they do their very best and adhere to the rules of the sport, they will be doing exactly what is expected of them.