Unit 5 – SPORTS NUTRITION
Nutrition Lecture Notes

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. physical condition
      2. nutritional status
      3. age
      4. genetic background
   E. These factors make it essential that the diet be individualized.

II. Purpose of Nutrition
   A. Good nutrition promotes a healthier mind and body.
   B. Aids in resistance to illnesses.
   C. Provides energy
   D. The right foods help the athlete to:
      1. Feel better
      2. Sleep better
      3. Speed the healing process.

III. Sports Nutrition Goals are to Ensure:
   A. Adequate energy intake to meet the energy demands of training
   B. Adequate replenishment of muscle and liver glycogen with dietary carbohydrates
   C. Adequate protein intake for growth and repair of tissue, particularly muscle
   D. Adequate overall diet to maintain a healthy immune system
   E. Adequate hydration
   F. Consumption of food and beverages to delay fatigue during training and competition
   G. Minimization of dehydration during exercise
   H. Utilization of dietary strategies known to be beneficial for performance including:
      1. Pre-competition meals
      2. Carbohydrate loading
IV. The Food Pyramid

A. Components of the Pyramid

1. Find Your Balance Between Food and Physical Activity
   a. Represented by the steps and the person climbing them, as a reminder of the importance of daily physical activity
   b. Be physically active for 30 Minutes most days of the week
   c. Children and teen agers should be physically active for 60 minutes every day or most days of the week.

2. Moderation
   a. Represented by the narrowing of the each food group from bottom to top.
   b. Wider base stands for food with little or no solid fats or added sugars
      i. These should be selected more often
   c. Narrow top stands for foods containing more added sugars and solid fats
      i. The more active you are, the more of these foods can fit into your diet

3. Personalization
   a. Represented by the person on the step, the slogan, and the URL.
   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 gives 12 different worksheets that best match an individual’s caloric needs

4. Proportionality
   a. Represented by the different widths of the food group bands.
      i. Suggest how much food a person should choose from each group.
   b. Variety
      i. Represented by the 6 color bands for the 5 food groups and oils.
      ii. Illustrates that foods from all groups are needed each day for good health
5. Gradual Improvement
   a. Represented by the slogan.
      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 (The orange color)
      a. Eat 6 oz every day
      b. Grains include bread, cereal, pasta, crackers, rice or pasta
         i. Look for “whole” before the grain name on the list of ingredients.
         ii. At least 3 oz should come from whole grains
         iii. Examples of 1oz grains:
               A. 1 slice of bread
               B. 5 whole wheat crackers
               C. ½ cup cooked oatmeal
               D. 1 pancake
   2. Vegetables (The Green Color)
      a. Eat 2 ½ to 3 cups per day
      b. Eat more dark green vegetables
      c. Eat more orange vegetables
      d. Eat more dry beans and peas
   3. Fruits (The Red Color)
      a. Eat about 2 cups per day
      b. Eat a variety of fruits
      c. Choose fresh, frozen, canned, or dried fruit
      d. Go easy on fruit juices
         i. They don’t contain fiber
   4. Oils (The White Color)
      a. Make most of your fat sources from fish, nuts, and vegetable oils
      b. Limit solid fats like, lard, stick margarine, shortening, and butter.
   5. Milk (The Blue Color)
      a. Drink 3 cups 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 6oz each day
      b. Choose low fat or lean meats and poultry
      c. Bake it, broil it, or grill it
      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. Carbohydrates
         a. One of the 3 nutrients that provide energy
         b. Yields approximately 4kcal/gram
            i. Carbohydrates are the basic source of energy for the body
         c. Common carbohydrates are sugars, starches, and fiber found in fruits, vegetables, and grains.
         d. The body converts sugars and starches to glucose for energy or to glycogen for energy storage in the liver and muscles.
            i. When glycogen stores are full, excess carbohydrates are converted to fat.
         e. Carbohydrates tend to be high in fiber
            i. Fiber is a type of carbohydrate that the body cannot absorb but is essential for gastrointestinal functioning
            ii. While a high-carbohydrate diet is essential to good health in all individuals, it is especially important to the athlete
            iii. 50-60% of the athlete’s caloric intake should be from carbohydrates to keep the glycogen stores filled.
            iv. Athlete recommendation is 5 to 10 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. Function as enzymes to catalyze chemical reactions in the body
            ii. Many hormones are proteins
iii. Can be a source of energy
   A. Yields approximately 4kcals/gram
   B. Occurs abnormally when carbohydrates and fats are not available
      1. Such as in starvation
   C. Also occurs normally during prolonged endurance exercise

c. Proteins are derived from animal foods – meat, milk, eggs, fish, cheese, and poultry.
   i. Other sources are soybeans, dry beans, some nuts, and whole-grain products.
   ii. See handout for extended list
d. During the digestive process, proteins are broken down into different amino acids.
   i. Eight of these amino acids are essential to build and repair body tissues.
      A. The term "essential" means they must be provided in the diet; they cannot be manufactured in the body as the rest of them can.
      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 fat.
g. Protein intake should be approximately 10-12% of caloric intake.
h. The Dietary Reference Intake (DRI) for adults is .8g/kg body weight
   i. Athlete recommendation is 1.2 to 1.7g of protein per kg body weight per day
      A. Specifically, 1.2 – 1.4g/kg for endurance athletes and 1.6-1.7 for strength athletes

3. Fats (Lipids)
a. The third energy yielding nutrient
   i. Yields 9kcals/g
   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. Fats insulate the body from temperature extremes, protect the body from the impact of injuries, and shield the body’s organs
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 50% or more of their daily calories from fats.
g. Athlete recommendation is 1.0 to 2.0g of fat per kg of body weight per day
h. High-fat diets are associated with heart disease, hypertension, and cancers.
i. Fats are not digested as quickly as other nutrients.
j. Fats are a basic source of muscular energy, 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 (vitamins A, D, E, and K) are emulsified and absorbed in the small intestines.
         A. These vitamins are stored in body cells, especially liver cells.
      ii. Water soluble vitamins (B complex and vitamin C) are absorbed along with water through the digestive tract and dissolve in body fluids.
         A. The body doesn't store these vitamins well and excess quantities are excreted in urine.
      iii. Vitamin requirements do not increase during exercise.
         A. Available evidence does not justify supplementing the diet of the athlete with vitamins to improve physical performance unless a pre-existing vitamin deficiency exists.
   1. However, many athletes do not choose nutrient dense foods. In these cases, supplementation may be suggested
5. Minerals
   a. Minerals do not provide energy!
   b. Minerals are inorganic substances and are known to have functions essential to life.
   c. Some examples of essential minerals include:
      i. Calcium – necessary for bone strength and muscle contractions.
      ii. Potassium – regulates cardiac rhythm.
      iii. Iron – assists hemoglobin in the delivery of oxygen to body tissues.
      iv. Sodium – essential in maintaining fluid balance.
      v. Phosphorus – needed for strong bones and teeth.
   d. Exercise does not seem to affect dietary needs of most minerals with the exception of the effects of sweating
      i. Heavy sweating may lead to excess losses of sodium, chloride, and potassium
      ii. Losses of these minerals may affect performance
      iii. It is recommended that athletes involved in prolonged activity, especially those who are considered “salty sweaters” consume more salt in their meals before and after activity
         A. Generally, this added salt can easily be gained through the salt added to foods and not through “salt pills”

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. Provides an aqueous medium for chemical reactions
   c. Provides a medium for transportation of oxygen, hormones, nutrients, etc. throughout the body (i.e. the blood)
   d. Facilitates thermoregulation for the body (i.e. sweet)
   e. Lubricates joints and cushions organs and tissues
   f. In saliva and gastric secretions, water helps digest food
   g. Note that a loss of fluid through exercise may have and 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. During normal breathing, water is added to inspired air to protect delicate respiratory cells from drying out.
         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 sweating
   b. Athletes may loss up to 1 liter per hour!

B. Water loss affects performance
   1. Diminished water content in the blood causes:
      a. Diminished capacity to transport oxygen and nutrients to body cells
      b. Diminished capacity to get rid of excess heat 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 shrink (crenation) which affects their normal function
   3. These affects are summarized as follows:
      a. Decreased VO2max
      b. Decreased mental capacity
      c. Increased fatigue rate
      d. Increase susceptibility to heat illness

C. Sports drinks
   1. During heavy sweating water is not the only element lost
   2. Electrolytes including sodium, potassium, chloride, and traces of some others are also lost
      a. Of these, sodium 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 fluid replacement to address water loss through sweating than to sodium replacement
      c. Water 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 reabsorbsion to occur
   5. Exercise lasting 2 hours or more may also significantly decrease glycogen stores (stored glucose)
   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 lost sodium and glycogen stores
b. Sodium replacement and maintaining hydration during exercise may help to reduce muscle cramping during exercise especially in salty and heavy sweaters.
   i. One cause of muscle cramping is an electrolyte imbalance caused from fluid and sodium loss from sweating.
   ii. It should be noted that another cause of muscle cramping is muscle fatigue
       A. It is vital to assure proper intensities during training that match intensities during competition to prevent fatigue that may lead to cramping

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. 6-8% is recommended and is less likely to induce gastric distress due to slowed gastric emptying in most individuals
      B. Sodium content of 460-690mg/liter is recommended to replace sodium loss and encourage further drinking since sodium tends to induce thirst

d. Example of a sports drink recipe
   i. 1 quart or 1 liter water
   ii. 1/3 cup sugar
   iii. ¼ teaspoon table salt
   iv. Flavor to taste – use orange juice, lemon juice, etc
   v. Keep refrigerated

7. Monitoring hydration status
a. The body’s thirst mechanism lags behind dehydration
   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 tests 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