Chapter 5

Nutritional Considerations

Nutrition Basics

- Science of substances found in food that are essential to life
  - Carbohydrates (CHO)
  - Protein
  - Fat
  - Vitamins
  - Minerals
  - Water

Nutritional Considerations

- Nutrients
  - Carbohydrates
  - Protein
  - Fat
  - Vitamins
  - Minerals
  - Water
- Roles
  - Growth, repair & tissue maintenance
  - Regulation of body processes
  - Production of energy

Carbohydrates

- Body's most efficient energy source
- Accounts for 55-70% of total caloric intake

Carbohydrates

- Sugars (simple)
  - Monosaccharides
    - single sugars (fruits, syrup and honey)
    - Glucose
  - Disaccharides
    - 2 sugars combined (milk sugar, table sugar)
  - Should account for <15% of caloric intake

Carbohydrates

- Starches (complex)
  - Long chain glucose units
  - Rice, potatoes, breads
**Carbohydrates**

**Starches**
- Body cannot use starch directly
  - Broken down in simple sugars
  - Unused starches and sugars are stored as glycogen to be used by the body later
  - Inadequate CHO intake results in protein utilization for energy
  - Protein sparing action of glucose occurs if adequate CHO in the system

**Fiber**
- Structural part of plants and is not digestible in humans
- Soluble
  - Oatmeal, legumes, and some fruits
- Insoluble
  - Grain breads and bran cereal

**Carbohydrates**

**Fiber**
- Aids normal elimination of waste (bulk)
- Reduces risk of colon cancer and coronary artery disease
- Reduces incidents of obesity, constipation, colitis, appendicitis, and diabetes

**Carbohydrates**

**Fiber**
- Intake should be approximately 25 grams per day
- Most Americans only consume 10-15%
- Excessive consumption may lead to intestinal discomfort and increased loss of calcium and iron

**Fats**

**Most concentrated source of energy**

**Serves to make food flavorful and contain fat soluble vitamins**

**Essential for normal growth and development**

**Fats**

**Saturated vs. unsaturated**
- Saturated (fatty acids derived from animal products)
- Unsaturated (plant derivatives - liquid at room temperature)
### Fats
- Phospholipids
  - Lecithin
  - Sterols
    - Cholesterol (consume <300mg/day)
    - Omega-3 fatty acids (unsaturated fat) aids in reduction of heart disease, stroke, hypertension
      - Found in cold-water fish
- Fat Substitutes
  - Simplese and Olea
  - Contain 80% fewer calories than fat and no cholesterol
  - May cause abdominal cramping and diarrhea

### Proteins
- Required for growth, maintenance, and repair of the body
- Aid with hormone and enzyme production
- Should encompass 12-15% of daily caloric intake

### Proteins
- Amino Acids
  - Basic units that compose protein
  - 20 amino acids compose the majority of body protein
  - Most can be produced by the body while others (essential) must be consumed

### Proteins
- Animal products contain all essential amino acids
- Incomplete sources (i.e. plants sources) do not contain all essential amino acids

### Proteins
- Sources and needs
  - Most diets are rich in protein and often athletes consume twice the amount that is recommended
  - Excess protein is converted to fat and may result in dehydration and potential kidney damage
  - Increased physical activity may result in increased need for protein in the diet

### Regulator Nutrients
- Vitamins (13) serve as regulators in many body processes
- Antioxidants
Vitamins

Fat soluble
- Vitamins A, D, E, K
- Generally found in fatty portion of foods and oils

Water soluble
- Vitamin C, B-complex vitamins
- Help to regulate metabolism but cannot be stored
- Each serves a series of roles

Fat Soluble Vitamins

Vitamin A
- Roles
  - aids in night and color vision
  - necessary for growth
  - may serve as an antioxidant
- Recommendations
  - Men: 5000 IU
  - Women: 4000 IU

Sources
- spinach
- carrots
- sweet potatoes
- lettuce
- cantaloupe
- mango
- apricots
- broccoli

Deficiencies
- can lead to night blindness
- Can make a person more susceptible to infections and illness due to lack of immune function.

Water Soluble Vitamins

Vitamin C
- Sources
  - citrus fruits (oranges, grapefruit)
  - green peppers
  - broccoli
  - cauliflower
  - potatoes
  - lettuce
- Deficiencies
  - may lead to a disease known as Scurvy
  - Symptoms include bone pain, diarrhea, and small hemorrhages around the hair follicles of the skin.

Roles
- collagen synthesis
- bone maintenance
- help wounds heal
- may also serve as an antioxidant, which may aid in preventing certain types of cancer.
- Recommendation: 60 mg for adults.

Deficiencies
- may lead to a disease known as Scurvy
- Symptoms include bone pain, diarrhea, and small hemorrhages around the hair follicles of the skin.
Antioxidants
- May prevent premature aging, cancers, heart disease and other health problems
- Help protect cells from free radicals

Antioxidants
- Include vitamins A, C, E
  - Found in a number of dark green, deep yellow and orange fruits and vegetables
- Supplements
- Vitamin deficiencies
  - Illness that results from a deficit in a particular vitamin/mineral
  - Avoidable if an adequate diet is consumed

Minerals
- 20 minerals have essential roles in the body
- Many are stored in liver and bones

Minerals
- Iron
  -trace mineral in the body
  -function:
    - energy metabolism
    - oxygen transport
    - Plays an important role in the immune system of the body.
  - recommendation:
    - 15 mg for women
    - 10 mg for men
  - Iron is the only nutrient which more is required for women than men. This is due to the amount lost in blood via the menstrual cycle.
  - sources:
    - spinach, liver, red meat, legumes, and oysters
  - deficiency: usually referred to as iron deficiency anemia
    - Symptoms include pale skin, fatigue, loss of appetite, and apathy

Minerals
- Calcium (most abundant mineral in body; 99% found in bones)
  - Function:
    - bone formation, blood clotting, muscle contractions
    - nerve transmission, and cell metabolism
  - recommendation: 800 mg per day
  - sources: Milk and dairy products, spinach, broccoli, canned fish-such as tuna, salmon, and sardines.
  - deficiency:
    - can lead to osteoporosis
    - characterized by the loss of bone mass
    - can lead to loss of teeth and bone fractures

Minerals
- Magnesium
  - energy supplying reactions
- Sodium and Potassium (nerve conduction)
Water
- Most essential nutrient and most abundant in body (60% of body weight)
- Essential for all chemical processes
- Lack of water (dehydration) can lead to illness and death

Electrolytes
- Requirements
  - Involve minerals of the body - must maintain adequate levels for optimal functioning
  - Excess sweating can lead to depletion of these electrolytes

Nutrient Requirements and Recommendations
- Amount of nutrient required to prevent deficiency diseases
- Varies among individuals and across populations

Water
- Body has mechanisms to maintain homeostatic levels of hydration
  - When hydration levels drop below normal, the brain stimulates thirst
  - When hydration levels exceed normal, the kidneys are stimulated to excrete excess fluids

Electrolytes
- Requirements
  - Help to maintain levels of hydration
  - Can generally maintain through proper diet, however, additional salts may need to be added periodically

Nutrient Requirements and Recommendations
- Requirements vs. Recommendations
  - RDA (Recommended Daily Allowance) vs. DRI (Dietary Reference Intake)
- Food Labels
  - Aids consumers in determining levels of nutrients in foods
**Nutrition and Physical Activity**

- Activity increases need for **energy** not necessarily all vitamins, minerals and nutrients
- **Vitamin Supplementation**
  - Athletes believe large doses can lead to superior health and performance

**Vitamin Supplementation**

- **Vitamin E**
  - Protects cell membranes from damage
  - Little evidence to support enhancing performance or life expectancy

**Vitamin Supplementation**

- **B-complex vitamins**
  - Aid in release of energy from CHO, fat, and protein
  - If additional energy is required, increased caloric intake is necessary

**Vitamin Supplementation**

- **Vitamin C**
  - to prevent common cold and slow aging
  - may cause kidney stones and diarrhea

**Vitamin Supplementation**

- **Vitamin E**
  - Protects cell membranes from damage
  - Little evidence to support enhancing performance or life expectancy
Mineral Supplementation

**Calcium Deficiency**
- Most abundant mineral in body
- Over time additional levels of calcium are required for bone maintenance
  - Without, bones become weak and brittle resulting in osteoporosis

**Calcium Deficiency**
- Young adult requires 1000mg/day
- Females tend not to get enough calcium in diet
- While exercise helps bones to retain calcium, extreme levels of exercise, causing hormonal imbalances, can disrupt calcium retention
- Supplementing with calcium carbonate or citrate is advisable

**Iron Deficiency**
- Common in females
- Results iron-deficiency anemia, limiting oxygen carrying capacity of blood
- Athlete feels tired and weak due to muscles' inability to generate energy

Protein Supplementation

- Approximately 1-1.5g/kg body weight of protein should be consumed for increasing muscle mass
- Often times exceeded with normal diet and supplementation is not necessary
Creatine Supplementation

- Naturally occurring substance in body produced by kidneys, pancreas and liver
- Found in meat and fish
- Role in metabolism
- Two types (free creatine and phosphocreatine)

Creatine Supplementation

- Phosphocreatine is stored in skeletal muscle and works to re-synthesize ATP during activity
- Positive effects
  - increase intensity of workouts
  - lactic acid buffer
  - stimulates protein synthesis
  - decreases total cholesterol and total triglycerides and improves HDL-LDL ratio
  - increases fat free mass

Creatine Supplementation

- Negative effects
  - weight gain
  - muscle cramping
  - gastrointestinal disturbances and renal dysfunction
- Not a banned substance, however, distribution by NCAA institutions is banned

Sugar and Performance

- Positive effect on performance
- However, some athletes are sensitive to high CHO feedings and have problems with increased levels of insulin

Sugar and Performance

- Ingesting large quantities of sugar prior to activity causes an increase glucose in the blood
- Release of insulin stimulated allowing cells to utilize free circulating glucose, sparing blood glucose

Caffeine

- Central nervous system stimulant found in carbonated beverages, coffee, tea (chocolate contains relate compounds related to caffeine)
- Increase alertness and decrease fatigue
- Too much causes nervousness, irritability, increased heart rate and headaches
**Caffeine**
- Headaches may result when ceasing caffeine use (withdrawal)
- Not detrimental to performance
  - Enhances fat utilization and endurance performance
  - Makes calcium more available allowing muscles to work more effectively
  - May cause slight headaches

**Alcohol**
- Provides energy for the body
- Little nutritional value
- Central nervous system depressant
  - Decreases coordination, slows reaction time, decreases mental alertness
  - Increases urine production (diuretic effect)

**Organic, Natural, of Health Foods**
- Claim to be safer and nutritionally superior due to absence of pesticides and fertilizers
- All foods are organic due to presence of carbon
- More expensive no increased benefit physiologically
- Processing (preservatives) helps to maintain nutritional value

**Herbs**
- Trend - natural alternatives to drugs and medications
- Safe to ingest as natural medicines we few side effects (occasional allergic reaction)
- Offer nutrients that nourish brain, glands and hormones

**Organic, Natural, of Health Foods**
- Don’t need to consume with food - contain own digestive enzymes
- Work with the body’s functions (whole body balancers)
- Caution must be exercised as there is no governmental control or regulation

**Vegetarianism**
- Utilize plants to form foundation of diet - anima foods are either excluded or included in a variety of eating patterns
- Economic, philosophical, religious, cultural, or health reasons
- While practiced intelligently (not a fad) a vegetarian diet can result in deficiencies
- Diet must be carefully planned
**Pre-event Nutrition**

- Importance and content pre-event meal vs. traditional rewarding that may hamper performance
  - Traditional steak and eggs
- Long term food consumption is more important than immediate consumption

- Purpose should be to provide competitor with nutrients/energy and fluids for competitions (taking digestibility into consideration)
- Encourage athletes to be conscious of diet
- Diets are also individual to each athlete

- Individual is the best judge of what should or should not be consumed
- What is the individual comfortable with
- Liquid Supplementation
  - Extremely effective and successful
  - 225-400 calories per serving
  - Successful in reducing pregame symptoms of dry mouth, abdominal & leg cramps, nervous defecation and nausea

- Food generally takes 4 hours to clear stomach and upper GI tract
- Liquid supplements clear stomach and upper bowel before game time, settling the stomach and making available nutrients

**Fast Foods**

- Way of life in America --world of fast food junkies
- Often meal of choice during travel
- Big concern is the amount of fat (40-50% of calories from fat)
- Size vs. supersize
- Increased menu size is a plus (variety)
- Nutritional information posting

**Glycogen Supercompensation**

- Increase muscle and liver glycogen stores prior to major event by altering eating and training habits
- Decrease training at least 48 hours prior to event
- Increase CHO loading to increase glycogen stores and positively impact muscle glycogen and muscle endurance
**Glycogen Supercompensation**

- Six-day period
  - Phase I (Days 1-2): hard training with reduced CHO intake
  - Phase II (Days 3-5): decrease training and increase CHO (potentially increasing glycogen stores 50-100%)
  - Phase III (Days 6-7): resume normal diet

**Glycogen Supercompensation**

- Not clearly demonstrated as being beneficial in endurance activities
- Do not perform more than 2-3 times per year
- Ideally for prolonged duration events

**Weight Control and Body Composition**

- Gains and loss of weight in athletes can be problematic
- Intelligent and conscientious approach involves some knowledge of what is involved on the part of the athlete and athletic trainer
- Results in athlete displaying discipline relative to types and quantities of food

**Body Composition**

- Ideal body weight = age-related height/weight chart
  - Inaccurate due to broad ranges and failure to take individual body types into consideration
- Health and performance may be best indicators
- Fat vs. nonfat components of body = body composition

**Body Composition**

- Non-fat or lean tissue (lean body weight)
  - bone, muscle, tendon, connective tissue
- Body comp is the relationship between fat tissue and lean body tissue

**Body Composition**

- Averages
  - Female 20-25% body weight = fat
  - Male 12-15% body weight = fat
  - Should not fall below 3% and 12 % for males and female respectively
  - Results in loss of essential fat padding for organs
Overweight = excess body weight relative to size and stature
Overfat = excessively high percentage of total body weight is fat
Obesity = extreme amount of excessive fat
Female >30% and male >20% percent body fat

Factors that determine amount of fat
- Number of cells
  - Proliferation or hyperplagia of fat cells occurs from birth to puberty
- Size of cells
  - Increase/decrease over time until adulthood relative to caloric balance
- Change of weight = change in size not number

Adipose cell stores triglycerides (liquid fat)
Moves in and out of cells according to energy demands
Moderate, long term activity uses greatest amount of fat
One pound of fat = 3500 calories, stored as triglycerides

Several methods
- Hydrostatic, bioelectrical impedance, skinfold thickness measures
- Skinfolds based on the fact that 50% of body fat is subcutaneous
  - Utilize skin fold calipers
  - Relatively low accuracy but is easy to learn and utilize
  - Error is ± 3-5%

BMI (body mass index) is a ratio of height and weight
BMI >25 indicate excess body fat
BMI 25-30 indicates overweight
BMI >30 indicates state of obesity

Caloric balance = Calories consumed - calories expended
Positive caloric balance results in weight gain and vice versa for negative caloric balance
Assessing Caloric Balance
- Can be calculated through accurate record keeping of calories consumed and expended relative to metabolic and activity needs
- Calories are expended through:
  - basal metabolism (calories expended at rest)
  - work (activity that requires more energy than sleeping)
  - excretion

Methods of Weight Loss
- The key is moderation
  - A combination of dieting and exercise
  - A negative energy balance must be achieved
  - Loss of 1.5-2.0 pounds per week is adequate
  - Weight loss of more than 4-5 pounds per week can be attributed to dehydration
  - It takes time to put weight on and also takes time to take it off

Methods of Weight Loss
- Exercise or dieting alone is ineffective over the long run
- Dieting alone results in lean body tissue loss
  - Should not drop below 1000-1200 calories for women and 1200-1400 for men

Methods of Weight Loss
- Exercising, while resulting in loss of fat mass, will also enhance strength, cardiorespiratory endurance and flexibility

Methods of Weight Loss
- Body size also factors in
- Energy expenditures can be consulted to determine average energy expenditures per activity (kcal/min/lb)

Methods of Weight Loss
- Must calculate total time engaged in all 3 areas over a 24 hour period
- BMR is determined in laboratory setting through indirect calorimetry which measures oxygen uptake
- Work (type, intensity, duration) must be determined
**Methods of Weight Gain**
- Aim should be to increase lean body mass
- Increased physical activity (muscle work) and dietary modifications
- Approximately 2500 calories is required per pound of lean body mass, an increase 500-1000 calories per day
- A 1-2 pound per week gain is adequate

**Eating Disorders**
- Epidemic in our society, especially in sports
- 1 out of 200 girls age 12-18 will develop some pattern of eating disorder (1-2% of population)

**Eating Disorders**
- **Bulimia**
  - Generally females ranging in age from adolescence to middle age
  - Periods of starvation, bingeing (thousands of calories) and purging through vomiting, fasting and laxatives/diuretics

**Eating Disorders**
- **Bulimia**
  - Characteristics
    - Typically bulimic athletes are white, middle to upper-middle class
    - Perfectionist, obedient, overcompliant, highly motivated, successful academically, well-liked, and a good athlete
    - gymnastics, track, dance
    - occasionally seen in male gymnasts and wrestlers

**Eating Disorders**
- **Anorexia Nervosa**
  - 30-50% of anorexics also suffer from bulimia
  - Characterized by distorted body image and constant concern about weight gain
  - Impacts mostly females
  - Starts often with adolescents and can be life threatening
Eating Disorders

- Anorexia Nervosa
  - While the athlete tends to be too thin they continue to feel fat
  - Deny hunger and are hyperactive
  - Highly secretive

- Early intervention is critical with eating disorders
  - Empathy is a must
  - Psychological counseling is key
  - Must have athlete recognize the problem, accept the benefits of assistance and must voluntarily accept help for treatment to work

Female Athlete Triad

- Potentially fatal problem
- Combination of eating disorder, amenorrhea and osteoporosis
- Some suggest eating disorders may exist in 62% of females in certain sports and amenorrhea found in 60%
- Major risk is the fact that bone lost may not be regained

Questions?