

## Weight Training

### Introduction

- 1) You have 206 bones in the adult human body.
- 2) There are approximately 600 muscles in the body that make up 50% of your body weight
- 3) 40% are voluntary (skeletal), 10% Involuntary (cardiac, smooth(digestive))
- 4) Physical benefits of weight training include: Muscle strength, balance, posture, injury prevention, increase bone density, increase muscle endurance, increased metabolism. Emotional/mental benefits: release tension, release anger, alleviates depression, increases self-esteem, teaches discipline
- 5) Possible grips used: overhand (pronate); underhand (supinate); combo
- 6) Set realistic goals, know what you want to achieve through your lifting program
- 7) Machines vs. Free weights - \*Machines: safe without spotter, provide variable resistance throughout (the resistance varies so that the intensity remains the same), easy to adjust weight, encourages proper form  
\*Free weights: learn proper form, using stabilizing muscles, more free range of motion, some machines don't adjust to fit your body, more variety of exercises, more technically difficult

### Key Points

- 1) You should lift no less than 2 days a week, preferably at least 3, work all major muscle groups all days
- 2) OR 4-6 workout days a week, varying muscle groups to give 48 hours rest to each group between workouts
- 3) As a beginner lifter:
  - Week 1 and 2 – 1 set of 20 reps per muscle group
  - Week 3 and 4 – 2 sets of 20 reps per group
  - Week 5 and 6 – will start to vary based on long-term goals
- 4) Lift the **largest muscle** groups first; also the most technically difficult exercises first.
- 5) Lift opposing muscles for muscle balance and to help prevent injury
- 6) Use full range of motion during a lift, stretching (static), warm-up (cardio or light weight) – for full flexibility retention
- 7) Exhale on exertion (hardest phase of lift)
- 8) Proper form is: relaxed knees and shoulders, abdominals contracted isometrically, standing – feet hip width apart
- 9) Never hyperextend (lockout) or hyperflex any joint
  - Extension – opening of a joint (i.e. straighten knee, elbow, etc.)
  - Flexion – closing of a joint (i.e. bend knee, elbow, etc.)

- Increasing muscular strength and size – The ability of a muscle to exert a force against a greater resistance, increasing blood flow to the fibers and increasing the size (using high weight, low reps 2-6) Example: Pyramid Program
- Increasing muscular endurance – The ability of a muscle to exert a force against a resistance for a progressively longer period of time (using low weight, high reps – 15-30) Example: Circuit Training
- Sport training – Informal sports and recreation- develops muscle strength, endurance and cardiovascular endurance (using medium weight and moderate reps 8-12, and incorporating aerobic training)

### Important Definitions:

- Metabolism – your body's rate of burning calories (75 Calories a day sustain 1 lb. Of muscle, only 3 calories a day to sustain 1 lb. Of fat)
- Atrophy – Decrease in size and functional ability of a muscle due to lack of use
- Hypertrophy – Increase in size and functional ability of a muscle (voluntary, not cardiac) due to increased usage or resistance
- Aerobic vs. anaerobic – Cardiovascular endurance vs. short bursts of intense energy

Aerobic – oxygen mixes with the energy source  
Anaerobic – oxygen does not mix with the energy source

- Active rest – Exercising at low intensity and volume
  - May be used as part of a program cycle to encourage progression. Also used when a person is lifting and not ‘100%’ healthy.
- Progressive resistance – Progressive increase in load intensity (either weight or reps or both, but never both at the same time)

### **Types of Contractions:**

Isometric – muscle length remains the same during the contraction

Isotonic – resistance remains the same

Isokinetic – speed or velocity remains the same

Concentric (Positive): the muscle shortens, the most effective

Eccentric (Negative): the muscle lengthens, more delayed muscle, soreness is involved, an advanced type of contraction

**Types of Stretches:**       Static – no movement; safest; most effective  
                                      Ballistic – a moving, bouncing stretch; higher risk of injury

**Physical Fitness**, According to the American Medical Association is: “the general capacity to adapt and respond favorably to physical effort.” Individuals are physically fit when they meet the ordinary and unusual demands of daily life safely and effectively without being overly fatigued, and have energy left for leisure and recreational activities.

### **Five Components of Physical Fitness**

1. **Cardiovascular Endurance:** the ability of the lungs, heart and blood vessels to deliver adequate amounts of oxygen to the cells to meet the demand of prolonged physical activity. (Aerobic Fitness)
2. **Muscular Strength:** maximal amount of resistance (one repetition maximum) that an individual is able to lift in a single effort.
3. **Muscular Endurance:** the ability of a muscle to exert sub maximal force repeatedly over a period of time.
4. **Body Composition:** Lean body mass + fat mass = 100%; your body’s proportion of fat to lean
  - A. Lean body mass: Skeletal system, muscle, internal organs, fluids, connective tissue.
  - B. Fat mass: Total fat mass is made up of two types:
    1. **Essential Fat:** needed for physiological functions - without it, health deteriorates  
Men- 3% of Total Body Fat. Women-10-12% of Total Body Fat.
    2. **Storage Fat:** fat that is stored in adipose tissue, beneath the skin (subcutaneous fat) and around major organs in the body.
  - C. Three basic functions of fat.
    1. Insulator to retain body heat.
    2. Energy source for metabolism.

3. Padding against physical trauma to the body.
- D. Testing procedures for assessing body composition.
1. Hydrostatic or Underwater Weighing – most accurate
  2. Electrical Impedance – weak electrical currents (painless) run through body fat, lean mass, and body H<sub>2</sub>O
  3. Skinfold Thickness – calipers
  4. Girth Measurements: Women- upper arm, hip and wrist, Men- waist and wrist
  5. BMI (Body Mass Index)

**Body Fat Classification**  
**% of Body Fat**

<u>Level</u>	<u>Men</u>	<u>Women</u>
1. Possible at risk	< 6	< 14
2. Ideal	7-16	15-22
3. Slightly overfat	17-23	23-30
4. Obesity	24+	31+

**Body Composition (Jackson – Pollock Tables)**

- E. Physical classification of the body.
1. Ectomorph
    - a. small bones
    - b. long and lean body
  2. Endomorph
    - a. minimal definition of muscle tone
    - b. soft and round body
  3. Mesomorph
    - a. muscular
    - b. square shape body

5. **Flexibility:** the ability of a joint to move freely through its full range of motion. Changes in muscular temperature can increase or decrease flexibility by as much as 20%. Some things that determine flexibility are: age, genetics, activity level, and type of activity.

**Training Effect**

Training effect describes the physiological changes that occur from regular participation in a fitness program. To achieve the training effect and experience the benefits of exercises the following concepts must be applied.

1) Overload Principle- To achieve training effect, selected systems of the body must be subjected to loads greater than those to which they are accustomed. A body adapts to the higher performance levels and then gradually increases its capacity to do more work. This effects the development of strength, flexibility, and muscular, strength, and endurance.

The three variables of the overload principle that must be applied:

- a) Intensity- the degree of strength, energy, or difficulty; as related to a workout. To achieve cardiorespiratory training effect the intensity of the aerobic exercise should sustain the heart rate at 60-80% of the participant's maximum heart rate.
- b) Duration- The length of each exercise session. For cardiorespiratory training effect exercise should be performed at a low to moderate level and sustained for at least 15

minutes and up to 60 minutes.

c) Frequency- The number of exercise periods or sessions performed each week. Three to five days each week are necessary for a training effect to be achieved.

2) Specificity Principle- Specificity principle means that the human body adapts specifically to those demands placed upon it. For example, strength training induces specific strength gains but does not develop cardiorespiratory fitness. Specificity principle applies to each body part. If the legs are exercised, fitness is built in the legs, etc. Do not confuse this with **spot reducing**, a theory that **does not work**. Fat reduction occurs all over the body during exercise. Eventually the weight loss will occur in the desired area, providing the participant exercises regularly, maintains a healthy diet and applies the specificity principle.

3) Principle of Reversibility – is use it or lose it; within two weeks of the time you stop exerting, your body begins to adapt to the lack of activity.

4) Principle of Individuality – or that no two people react to exercise the same two ways.

## SAFETY AND INJURY PREVENTION

### **TYPES OF INJURIES**

The injuries and conditions commonly associated with aerobic exercise classes can be extremely disabling. If injury awareness and safety is not emphasized, a student can be damaged mentally and physically. To prevent aerobic exercise injuries, the following areas must be understood.

Overuse - Overuse means an excessive amount of activity of exercise; a practice that is potentially harmful to involved body parts. Overuse is the primary cause of aerobic exercise injuries. Placing too much stress on one area of the body over an extended period of time causes a break down. This is more commonly known as a “breaking point.” Excessive, repeated stress causes failure, which usually results in chronic injury.

Chronic Injury – Chronic problems have a gradual onset, without history of a specific incident of injury. They last for several weeks, often getting neither better nor worse. Generally symptoms of discomfort, swelling or limited motion persist. If a chronic injury continues to be stressed, it may become an acute injury. (Shin splints is a chronic injury.)

Acute Injury – An acute injury occurs when an area already stressed and weakened is pushed beyond its limits and further injury results. Acute injury has a more sudden onset, usually characterized by a specific incident. The symptoms are specific pain, swelling, limited motion and inability to use the injured area normally. Acute injuries may also occur without being related to chronic injuries, as in an ankle sprain. (Stress fracture is an acute injury resulting from a shin splint.)

Stress Fractures – Stress fractures occur in major weight-bearing locations of the body, especially the foot and lower leg. It is an impending fracture due to excessive stress (overuse) of a bone. Stress fractures occur gradually. There is usually a specific area of pain directly over the affected bone. The affected area always tender to the touch, and the pain is sharp and radiating. Pain may persist in varying degrees for 4-12 weeks.

Muscle Strain – A muscle strain is the overstretching of a muscle, which damages the muscle fibers or surrounding tissue. Once fiber of a muscle has been damaged, scar tissue forms; scar tissue is much weaker than muscle tissue. Injury can occur in the belly of the muscle, in the muscle fascia and in the tendons of the muscles that attach the muscles to the bones.

Sprain – More serious than a strain, a sprain is a sudden or violent twisting or wrenching of a joint, causing the ligaments to stretch or tear and often the blood vessels to rupture, with hemorrhage (bleeding) into the surrounding tissue. Symptoms are swelling, inflammation, area tenderness, and discoloration. Ankle sprains are the most common in aerobic exercise.

## SELF-CARE INJURIES

**Stitch Pain** - A pain in the side from running is called a stitch pain, which is the result of a spasm in the diaphragm. A stitch pain usually occurs due to a lack of oxygen and/or a buildup of carbon dioxide from poor rhythmical breathing, as well as improper preparation such as warm-up or the body trying to digest food.

- **Treatment** – Bend over in the direction of the stitch and slowly perform inhale/exhale breathing, or walk slowly compressing and massaging area while performing inhale/exhale breathing.

**Blisters** – A blister, caused by friction, is an escape of tissue fluid from beneath the skin's surface. A blister generally occurs on the toes or foot area of the exerciser, therefore proper fitting footwear and socks is recommended.

- **Treatment** – Never pop or drain a blister unless it interferes with your daily activity to a point where it has to be drained. If this occurs, clean the area with antiseptic, then lance the blister with a sterile needle at several points, then drain. As it dries, do not peel off top skin. Keep area clean and well covered when exercising.

**Cramp** – A cramp is a painful spasmodic muscle contraction. Muscle cramps commonly occur in the back of the lower leg (calf), the back of the upper leg (hamstring) and the front of the upper leg (quadriceps). Cramps are related to fatigue, muscle tightness, or water, salt, potassium, or calcium imbalance.

- **Treatment** – Gently stretch and/or massage the cramped muscle area. Discontinue exercise that may be contributing to the cramp. Increase your potassium intake (citrus juices, bananas) naturally. Drink water!

Lactic acid formation is associated with muscle fatigue. If removal of lactic acid by the circulatory system cannot keep pace with its accumulation in the muscle, temporary muscle fatigue occurs with painful symptoms (usually called “the BURN”). It occurs during anaerobic activity.

**Muscle Soreness and Stiffness:** *Acute Soreness* after exercise is believed to be related to a lack of blood (oxygen) flow and general fatigue of muscles that were exercised. *Delayed Soreness* after approximately 12 hours and lasting 2-4 days may be related to actual minute tears in muscle tissue (not considered an injury, is a positive response), muscle spasms that increase fluid retention that stimulate painful nerve endings, and overstretching or tearing of connective tissue in and around the muscles and joints.

*Prevention:* proper stretching before and after exercise, progressing gradually into the exercise program. Avoid doing too much too soon.

### **R-I-C-E: The Recipe for First Aid**

Every athlete faces the risk of injury, and the aerobic exerciser is no exception. Some injury may require medical attention with professional diagnosis and treatment. Other injuries, and even the serious ones, require the first aid treatment that quickens the healing process called R-I-C-E.

**Rest** – Stop using the injured area as soon as you experience pain.

**Ice** – Ice reduces swelling and alleviates pain. Apply ice immediately to the injured area for 15 to 20 minutes.

**Compression** – Firmly wrap the injured body part with an elastic or compression bandage between icings.

**Elevation** – raise the injured part above heart level to decrease the blood supply to the injured area.

You must let the injury heal completely before resuming activity and follow these 5 tips of injury recovery offered by Dr. Bob Goldman, President of the National Academy of Sports Medicine.

- 1) Limit your activities to things you can do comfortably. Avoid any activities that cause pain at the site of injury.
- 2) Gently try to reestablish range of motion. For example, if you have an ankle sprain, write the alphabet with your big toe.
- 3) Rebuild your strength by lifting weights. Go to a gym to get advice on how to start your program.
- 4) Maintain your fitness level with rapid walking or swimming, or using a stationary bicycle, stair climbing, cross-country skiing or rowing machine. You shouldn't feel pain during or after the activity.
- 5) For minor aches and pains use an over-the-counter medication such as ibuprofen to reduce pain.

Everyone has a requirement for food, from the person who sits behind his desk to the athlete who trains three or more hours a day. The body works and moves by using energy that comes from the food we eat. The food we eat consists of different nutrients we need to survive and be active. There are two separate classes of nutrients: energy nutrients (carbohydrates, fats and proteins), and others (vitamins, minerals, electrolytes and water) needed for the digestion of the energy nutrients.

1. Nutrients (Satisfy 3 fundamental body needs)
  - a. Provide energy
  - b. New tissue growth and repair
  - c. Regulate the metabolic functions

## 2. Six Classes Of Nutrients:

### a. **Water (Most essential)**

Necessary for temperature control, energy production, digestion, absorption, and elimination of waste products. Dehydration reduces endurance and increases the risk of muscle cramping, heat exhaustion, or stroke. Drink before, during, and after exercise. Cold water is best. It empties more rapidly from the stomach than warm drinks and lowers body temperature. (Minimum of 8 glasses daily)

### b. **Minerals**

#### 1. Calcium - Creates strong bones and regulates muscle contractions

Need 800 Mg. daily for adult men and women (50% of women intake insufficient amounts daily). When the supply of calcium is too low, the body withdraws calcium from the bones to circulate in the bloodstream. Sources include: dairy, dark green veggies, seafood (Insufficient intake could result in cramping)

#### 2. Iron - Forms hemoglobin, which carries oxygen through the blood to the tissues.

Need 10-18 Mg. daily for adult men and women (40% of adult women are iron deficient). Sources: Animal protein, beans, dark green veggies, strawberries, raisins.

### c. **Vitamins**

Provide no calories and cannot be used as fuel, but they function as metabolic regulators that can control the process of energy production.

A,D,E,K: Oil based/ B,C: Water soluble

### d. **Protein**

Needed for tissue growth and repair. Only used as fuel source when caloric intake or stored energy (fat, carbohydrates) is inadequate. There are 9 essential amino acids. All 9 are found in meat, fish, and poultry. Vegetables and grains supply only part of these, but with the right combination can provide complete proteins. Approximately 12%-15% of

your daily intake of calories should come from protein. There are 4 calories per gram of protein. A rule of thumb is that an active person needs about 1 gram of protein (about the weight of a paper clip) per kilogram (2.2 lbs) of body weight.

#### e. Fats

Used for skin growth and maintenance, insulation, a secondary energy source, and protection for body's organs. 9 calories per gram of fat. Approximately 30% of daily intake of calories should come from fats. Only 10% of that being saturated fat. LDL's and HDL's transport fats (triglycerides and cholesterol) through the blood. They are water soluble bubbles of protein that coat the fat. LDL's attach to tissue and blood vessel walls. HDL's transport them back to liver, where it is excreted. Increase HDL's by exercise.

Source of fatty acids – two categories:

Saturated: Comes mainly from animal and dairy sources; raise the level of cholesterol (increases LDL's significantly more than HDL's). Also comes from palm and coconut oil.

Unsaturated: Comes from mainly plant sources

Polyunsaturated: lowers blood cholesterol, by dropping LDL and HDL levels. Sources are safflower, soybean, sunflower, corn oils, canola, and fish

Mono-saturated: Lowers LDL levels and total cholesterol but maintains HDL levels. Source: Olive oil (mostly mono.)

Hydrogenated: process called hydrogenation makes liquid vegetable oils creamy by converting some of the unsaturated fats to saturated. (ritz crackers, pop tarts, vegetable shortenings)

#### f. Carbohydrates

Best source of food energy. Broken down to simple sugar (glucose) during digestion, stored in the liver and muscle tissue as glycogen, which is the preferred fuel during aerobic exercise. There are 4 calories per gram. Should be approximately 50-60% of daily intake. Only 10% from refined and processed (simple) sugars.

**Complex**: Provides nutrients and fiber with calories. Fruits, veggies, grains.

**Simple**: Empty calories. Refined sugar. Complex carbohydrates are preferred over simple as an energy source.

Any food ingested soon before an activity will remain in the stomach, and be of no use for energy production, until the activity is concluded because the blood is directed to the working muscles instead of toward the digestive tract. Water replacement is important, however. Water can be consumed at any time - pure water is better able to be transported to the tissues than a sugary solution.

The need for calories is highly variable – depending on basal metabolism, environment, and activity level. In general, 3500 calories translates into 1 pound of body fat, whether stored or utilized.

When you start to slide out of shape, you really look out of shape before your bathroom scales give you a clear warning. That's because each pound of fat you put on bulges out 18% bigger than lean. (1.1 liters compared to 0.9)

Despite the sports drink hoopla, water is still the best liquid replacement for ordinary mortals who work out for less than 90 minutes. To stay hydrated, drink six to eight ounces 15 minutes before exercise, sip throughout and drink another two cups afterward. Don't wait until you're thirsty; by the time you feel it, you're already partially dehydrated. You'll know you're drinking enough if your urine is clear and you make trips to the restroom every two to three hours during the day. If your workout goes longer than 90 minutes or you're a heavy sweater, a sports drink may be called for.

Replace fluids, energy and electrolytes (sodium, potassium and magnesium) with water, diluted fruit juice, nonfat yogurt, bananas, raisins, pretzels, and baked potatoes. All totaled, you'll need at least 200 calories worth of carbohydrate rich snacks per workout.

## THE PYRAMID APPROACH

The U.S. Department of Agriculture has recently introduced the Food Guide Pyramid to help in making daily food choices.

Fats,  
Oils,  
Sweets

USE SPARINGLY

Dairy  
(low-fat)

2-3 servings

Poultry,  
Eggs, Fish,  
Meat, Legumes

2-3 servings

Vegetables

3-5 servings

Fruits

2-4 servings

Grains (rice cereal, breads, pasta)  
6-11 servings

*Food Guide Pyramid, a guide to daily food choices*

## THE SIX ESSENTIAL NUTRIENTS

1. Carbohydrates
  - a. complex
  - b. simple
2. Proteins
3. Fats
  - a. saturated
  - b. unsaturated
4. Vitamins
5. Minerals
6. Water



## NOTES ON NUTRITION AND WEIGHT LOSS

Carbohydrate	=	4 calories/gram	50-60% daily intake
Protein	=	4 calories/gram	12-15% daily intake
Fat	=	9 calories/gram	>30% daily intake
Alcohol	=	7 calories/gram	
Water	=	0 calories/gram	
1 lb.	=	3,500 calories	

To lose one pound per week, eliminate 500 calories per day.

It is advisable to lose weight gradually. A loss of body fat of up to 1 pound per week is within acceptable medical limits. This is partially based on the fact that those who have been successful in losing and maintaining a desirable body weight, lost no more than 1 pound per week. **WEIGHT LOSS PER WEEK: 1/2 –1 POUND.**

Which is healthier, **COMPLEX CARBOHYDRATES** or **SIMPLE CARBOHYDRATES**?

Complex carbohydrates such as beans, peas, fruit, seeds, vegetables, whole grain breads and cereal products contain essential nutrients in addition to calories. Simple carbohydrates such as candy, doughnuts, other pastries, (sugar) provide calories, but lack nutrients. They are empty calories.

Will excess carbohydrates result in weight gain?

**YES.** Once the carbohydrate reserves of the liver and muscles are filled, any excess is converted to fat. Excessive calories, be they protein, fat or carbohydrate will be converted to fat. **WATCH YOUR SUGAR INTAKE. WHILE SUGAR CONTAINS NO FAT, ANY EXCESS IS CONVERTED TO FAT.**

### ENRGY BALANCE EQUATION

3000 KCAL intake	3000 KCAL output	= no change in body weight
4000 KCAL intake	2000 KCAL output	= increase in body weight
2000 KCAL intake	3000 KCAL output	= decrease in body weight

What's the best diet for weight loss?

Diets are out – correct eating habits are in. People who eat well balanced meals and participate in aerobic exercise, have an excellent chance of achieving personal goals.

Some rules to lose weight by:

1. Minimum DCI (DAILY CALORIC INTAKE): 1200-1500 CALORIES
2. Do not drop intake by more than 500 calories less than your usual daily caloric intake.
3. Cut out the fat in your DCI (keep it above 10%)
4. Do not weigh yourself – go by the fit of your clothes.
5. Do not skip meals. It's better to eat less, more often. (4-6 times a day).
6. Spot reduction - you can tone, but you **can't** spot reduce