Section 1: Why participate in a fitness program

Aerobic exercise, also considered cardiorespiratory (or simply “cardio”) exercise, is physical exercise that primarily depends on the aerobic energy system which uses oxygen to metabolize glucose and produce energy to move muscles. It can also be fueled by fat and/or glycogen reserves stored in the body.

The benefits of proper exercise -

• Body is strengthened by use
• Lungs become more efficient in handling oxygen, and blood increases its ability to carry oxygen
• Heart pumps more blood with fewer beats and so your resting heart rate is lower
• Heart responds more quickly to various work loads and recovers faster
• Capillaries increase in number, leading to more surface area for the exchange of oxygen.
• Elimination of waste products improves
• Boost immune system and reduce the chances of developing to many common diseases
• The ability to do more work for longer periods of time without fatigue
• Reduce pain such as aching back and legs, stiffness of muscles and joints
• Improved efficiency of body systems, such as digestion of food and elimination of waste
• Increased energy
• Increased ability to handle stress
• Muscles better defined, body becomes firm and contoured
• Correct body alignment and body carriage when muscles become strengthened
• Decrease in signs of degeneration and aging
• Reduction of fatty tissue and firming of muscles
• Healthy decrease in nervous and emotional stress
• Decreases symptoms of depression
• Positive self-image
• Fewer expenses: lower medical costs, less time off of work due to illness
• Improved memory and mental function
Section 2: Components to consider in a fitness program

There are four physiological components to a fitness program, all essential to health and well-being.

**Cardiovascular Endurance** - The ability of the heart and lungs to supply the muscles with needed blood and oxygen. Developed by regularly engaging in vigorous activity that utilizes large muscles of the body in rhythmic contraction.

**Muscular Strength and Endurance** – The capacity to exert a muscle contraction or force against a resistance. Developed with progressive-overload workouts. Start at a level appropriate for you, and gradually increase the workload.

Strength training is important because it translates to higher rate of calorie burn when at rest. Also as we age, we lose fast-twitch type muscle fibers (the type involved in strength and power) faster than slow-twitch type fibers (used for endurance). Strength training offsets this effect of aging.

**Flexibility** - Refers to the full range of motion at the joints. Range of motion is determined by elasticity of the surrounding tissues. Develop flexibility by stretching exercises in a slow, continuous and controlled manner. (No bouncing)

Flexibility can also be gained through careful full range of motion movement during strength training.

**Lean/Fat Body Ratio aka Body Composition** - The ratio of lean tissue (muscle, bones, organs and skin) to fat tissue. The following chart shows the categories of body composition based on accurate measures of body fat, such as hydrostatic weighing, Bod Pod, or Dexascan.

<table>
<thead>
<tr>
<th>Body Composition</th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risky (high body fat)</td>
<td>&gt;30%</td>
<td>&gt;40%</td>
</tr>
<tr>
<td>Excess Fat</td>
<td>21-30%</td>
<td>31-40%</td>
</tr>
<tr>
<td>Moderately Lean</td>
<td>13-20%</td>
<td>23-30%</td>
</tr>
<tr>
<td>Lean</td>
<td>9-12%</td>
<td>19-22%</td>
</tr>
<tr>
<td>Ultra Lean</td>
<td>5-8%</td>
<td>15-18%</td>
</tr>
<tr>
<td>Risky (low body fat)</td>
<td>&lt;5%</td>
<td>&lt;15%</td>
</tr>
</tbody>
</table>

Body Mass Index (BMI) is an indirect measure of body fat based on height and weight. This measure does not differentiate between fat and muscle, so that a big muscular football player would have the same BMI as an obese man of the same height and weight. Nonetheless, this measure is a satisfactory estimate of body fat for the general public. Determine you BMI with the following formula:

$$BMI = \frac{Weight\ (in\ lbs)}{Height\ (in\ inches)^2} \times 703$$

<table>
<thead>
<tr>
<th>Underweight = &lt;18.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal weight = 18.5–24.9</td>
</tr>
<tr>
<td>Overweight = 25–29.9</td>
</tr>
<tr>
<td>Obesity = BMI of 30 or greater</td>
</tr>
</tbody>
</table>
Section 3- Anatomy of an aerobic workout

**Warm-up** - Prepare your body for vigorous exercise, improve your performance, prevent injury, increase circulation and raise your heart rate gradually. Move the major muscle groups through a full range of motion.

**Aerobic Activity** - 20-30 min of moving your body at moderate to vigorous intensity. It may include some strength type activities, such as air squats.

**Cool-down** - Continuation of the activity at a slower pace to slowly decrease your heart rate. If you stop immediately you may become nauseated, dizzy, faint, or suffer other forms of illness. Continue to move until your heart rate returns to near normal. Include static or dynamic stretches to help prevent stiffness and help improve flexibility.

Section 4: Achieving a training effect and enhancing skills

**Training effect**: The physiological response of the body to regular repetitive exercise. Beneficial effects include a slower heart rate, lower blood pressure, decreased blood cholesterol levels, increased muscle strength, better oxygen and glucose extraction from the blood, and improvement in mood.

The training effect results when you properly modify one or a combination of the following:

- **Intensity** – How hard you exercise
- **Duration** – How long you exercise
- **Frequency** – How often you exercise

The American College of Sports Medicine (ACMS) recommends that healthy adults engage in:

- moderate-intensity cardiorespiratory exercise for at least 30 minutes per day, 5 or more days a week (150 mins/week)
- or vigorous intensity cardiorespiratory exercise for at least 20 mins/day 3 or more days a week (75mins/week)
- and resistance (e.g. weight lifting) exercises 2-3 days/week for each major muscle group at an intensity appropriate to the individual’s habitual physical activity, physical function, health status, and stated goals

It’s also important to note that the National Institutes of Health (NIH) states that your aerobic activity does not have to be done all at once. You can accumulate it in bouts of at least 10 minutes throughout the day.

Apply the overload principle by stimulating the body beyond its normal workload by progressively increasing intensity, duration and/or frequency.

**Aerobic dance enhances motor skills, specifically the following:**

- **Agility** – change positions of the body quickly
- **Balance** - control and manage body parts while moving
- **Coordination** - harmonious working relationship of one part of the body with another
How hard should you work during an aerobic workout?
Follow the steps below to determine what your heart rate should be for moderate exercise using the Karvonen Method:

1. Estimate your maximal heart rate (MHR):

   \[ \text{MHR} = 220 - \text{age} \]

   \[ \text{MHR} = 220 - \underline{\phantom{000}} = \underline{\phantom{000}} \]

2. Measure your Resting Heart Rate (RHR):

   Note: Measure your RHR before you get out of bed in the morning. Find your pulse and count the number of beats in 60 seconds. As you get more fit, this number should lower. The lower it is, the less your heart has to work.

   \[ \text{Resting heart rate (RHR)} = \underline{00} \]

3. Calculate your Heart Rate Reserve (HRR):

   \[ \text{Heart Rate Reserve (HRR)} = \text{MHR} - \text{RHR} \]

   \[ \text{HRR} = \underline{00} - \underline{00} = \underline{00} \]

4. Calculate your training intensity per minute using the following guide

   Moderate Intensity: 40-59%
   Vigorous Intensity: 60-89%

   For moderate intensity (40-59%)
   Low end 40% = (HRR x .40) + RHR
   High end 59% = (HRR x .59) + RHR
   40% = (\underline{00} x .40) + \underline{00} = \underline{00}
   59% = (\underline{00} x .59) + \underline{00} = \underline{00}

   For vigorous intensity (40-59%)
   60% = (\underline{00} x .60) + \underline{00} = \underline{00}
   89% = (\underline{00} x .89) + \underline{00} = \underline{00}
The following is an example of calculating heart training zone for a 20-year-old female with a resting heart rate of 55 beats per minute

Step 1: Determine your maximum heart rate:

Maximum Heart Rate: 220 – 20 = 200

Step 2: Measure your resting heart rate in the morning before you get out of bed

Resting Heart Rate: 55 beats/min

Step 3: Calculate your Heart Rate Reserve

Heart Rate Reserve: 200 – 55 = 145

Step 4: Calculate your heart rate for a moderate training intensity between 40 and 59%

Low end: (145 x .4) + 55 = 113 beats per minute

High end: (145 x .59) + 55 = 141 beats per minute

NOTE: For people who are overweight or out-of-shape, it is safest to start at a light intensity and slowly progress to higher intensities as they reduce weight and increase fitness.
Section 5: Bioenergetics and characteristics of each metabolic system

Metabolism is the process by which your body breaks down food to release energy. Your body uses three metabolic pathways to provide energy. The study of these systems is called bioenergetics.

<table>
<thead>
<tr>
<th>System Name</th>
<th>Source of Energy</th>
<th>Duration that it works</th>
<th>When it is used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phosphogen, ATP-CP or Immediate System</td>
<td>Creatine phosphate</td>
<td>3-8 seconds</td>
<td>Sprinting, jumping, throwing, kicking, lifting heavy objects</td>
</tr>
<tr>
<td></td>
<td>Stored ATP</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lactic acid, Glycolysis or Anaerobic System</td>
<td>stored carbohydrates</td>
<td>30 s -2 minutes</td>
<td>Used for intensities between 85-95% of max; e.g. prolonged sprints, high intensity rallies in a game</td>
</tr>
<tr>
<td>(operates without oxygen)</td>
<td>blood glucose</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aerobic System</td>
<td>• Primarily carbohydrates-</td>
<td>Indefinitely</td>
<td>At rest; during endurance activities such as long steady-state runs e.g. marathon</td>
</tr>
<tr>
<td>(uses oxygen)</td>
<td>for intensities between 70-85% of aerobic power</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aerobic Dance primarily uses oxygen to burn fat</td>
<td>• Primarily fats-for intensities below 65% of aerobic power, but fewer calories are burned at this intensity</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Crossover Point: when energy for exercise is derived from fat and carbohydrate utilization equally. As exercise intensity increases, the body tends towards carbohydrate utilization.

Note: Aerobic power is the amount of oxygen the body consumes for a given workload, aka VO2.

Section 6: Essential nutrients to build and maintain tissues

Macronutrients

Carbohydrates- 4 kcal/g: 45-65% of your daily caloric intake should come from carbohydrates. Carbohydrates come from simple sugars and from starches and fibers. They are found in fruits, vegetables, grains, and dairy foods. Simple sugars should be limited to 10% of your calories. At least half your carbohydrates from grains should be whole grains.

Fiber is a complex carbohydrate that is not broken down for energy, i.e. it does not contain calories. Soluble fiber helps remove cholesterol articles from your digestive system, helps control blood sugar because it isn’t well absorbed, adds bulk to your stool, and helps you feel full without adding calories to your diet. Insoluble fiber also helps in weight control by helping you feel full, and helps regulate your bowels by adding bulk.

Protein- 4 kcal/g: 10-35% of your calories should come from protein. Protein is used to build and repair tissue such as muscles, internal organs, skin, hair, nails and bones. A limited amount is used as an energy source unless there is not enough carbohydrate and fat available to meet energy needs. If there is too much protein, it is converted to fat.

Proteins are made up of amino acids. The body can synthesize all but nine of the more than 20 amino acids that our bodies use. Those nine are considered essential amino acids and must be supplied in the diet. Primary sources of amino acids include beans, dairy foods and meats.

Fat- 9 kcal/g: No more than 20-35% of your total calories should come from fat, but it is essential because it...

- Protects the internal organs from shocks and blows to the body
- Insulates the body from the elements
- Energy and fat-soluble vitamins are stored in fat

Fatty acids are found in fats and play roles in cell signaling and in forming cell membranes. They are classified as saturated or unsaturated depending on the degree that their molecular structure is saturated with hydrogen. Unsaturated can be divided into mono- and poly-unsaturated fats. They are liquid at room temp and come from plant sources. Saturated fats are solid and come primarily from animal sources. Monounsaturated fats tend to lower cholesterol levels, whereas saturated fats tend to raise blood cholesterol. Diets rich in polyunsaturated and low in saturated fats are most healthful. Saturated fat should be no more than 10% of your total calories. Trans fats are synthesized fatty acids found in foods such as margarine and shortening and are unhealthy.

Micronutrients

Vitamins and Minerals: Vitamins are required to help you use the energy from food, resist infection, keep nerves healthy, and help blood to clot properly. Minerals are essential for energy production, and building and maintaining body tissues such as bone and muscle.
Avoid processed foods and added sugars

*From Dr. Benjamin Bikman, expert in bioenergetics and head of the Obesity and Metabolism Lab at BYU:*

When viewed in light of obesity incidence, dietary trends reveal an interesting finding. Despite increasing rates of global obesity and associated diseases, we eat less fat now than we ever have. In fact, careful scrutiny of macronutrient consumption reveals that only carbohydrate consumption has increased, while fat consumption has decreased, and protein remained largely the same. Within the last 40 years, the average American is eating 20 lbs. more sugar per year, and we’re eating *20 times* more sugar now than we did in 1820.

The history behind this remarkable shift in dietary trends can be readily traced back to the origins of the food guide pyramid, when the USDA declared dietary fat as something to be largely avoided. Sugar took the place of fat in most processed foods. Indeed, research now indicates that sugar, which is found in roughly 70% of all processed foods, increases the risk or is a key causal variable in virtually all chronic diseases, including obesity, type 2 diabetes, Alzheimer disease, heart disease, and even certain cancers.

This is why the American Heart Association recommends limiting the amount of added sugars to no more than half of your daily *discretionary calorie allowance* (those calories that you may intake beyond those needed for homeostasis). For most women that is no more than 100 calories per day, and for most men that’s 150 calories per day.

In March 2015 the World Health Organization (WHO) issued a statement recommending that adults and children reduce their free sugar intake to less than 10% of their total energy intake. That excludes sugars found in fruits, vegetables and milk.

**Putting it all together: Diet, Nutrition and Weight Control**

The best diet includes a wide variety of foods focusing on a variety of fruits and vegetables, good sources of protein, calcium, micronutrients, and fiber, and limiting high fat, high sugar foods. Choose foods that are “nutrient dense”, which means for the given amount of calories they contain a high amount of vitamins and minerals. For example consider the nutrient density of a Krispy Cream donut vs. three peaches, which have the same calorie content.

To maintain weight, balance your energy input (food intake) with your energy output (daily activities, including resting metabolism and exercise). To lose weight, take 500 calories per day off of your maintenance intake.
Section 7: Safety, Injury Prevention and Treatment

General principles of safety and injury prevention

- When beginning an exercise program, work into it slowly
- Keep yourself properly hydrated and be mindful of your nutrition
- Perform a proper warm-up and cool-down each session
- Wear appropriate footwear and clothing for the activity in which you are participating
- Exercise with friends – it’s more fun that way anyway!

RICE, a common treatment

Rest - give the body time to heal and prevent further injury

Ice - reduce swelling by applying intermittently during the first 24 hours

Compression – wrap an injury with an ACE bandage to reduce swelling and internal bleeding

Elevation - elevate injured area above the heart as long as possible to reduce internal bleeding and excessive fluid
Section 8 – Anatomy of major muscle groups

<table>
<thead>
<tr>
<th>Major Upper Body Muscle Groups</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Biceps</td>
<td>front of upper arms</td>
</tr>
<tr>
<td>Triceps</td>
<td>back of upper arms</td>
</tr>
<tr>
<td>Deltoids</td>
<td>shoulder cap</td>
</tr>
<tr>
<td>Pectoralis major (and minor)</td>
<td>chest</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Major Trunk Muscles</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Rectus abdominus, internal oblique, external oblique</td>
<td>abdominal muscles</td>
</tr>
<tr>
<td>Trapezius and rhomboid</td>
<td>upper back</td>
</tr>
<tr>
<td>Erector spinae</td>
<td>Deep back muscles that primarily run parallel to the spine</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Major Lower Body Muscle Groups</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Gluteus maximus, gluteus minunus</td>
<td>buttocks</td>
</tr>
<tr>
<td>Semintendinosus, biceps femorus, semimembranosus</td>
<td>hamstrings on the back of the upper leg</td>
</tr>
<tr>
<td>Rectus femoris, vastus lateralis, vastus medialis, vastus intermedius</td>
<td>quadriceps on front upper leg</td>
</tr>
<tr>
<td>Gastrochnemuous, soleous</td>
<td>Calve muscles</td>
</tr>
<tr>
<td>Tibialis Anterior</td>
<td>Front shin</td>
</tr>
</tbody>
</table>