AEROBIC EXERCISES: THEIR CARDIOVASCULAR AND OTHER BENEFITS

Fatima R*

SUMMARY:
Aerobic exercise can help prevent Ischemic Heart Disease and other diseases. Physical inactivity is a major factor for developing Coronary Artery Disease (CAD) which is characterized by deposit of cholesterol, calcium, and other substances in the inner lining of the arteries, that supply to cardiac muscle. It also contributes to other risk factors including obesity, hypertension, increased triglycerides, low level of HDL cholesterol and diabetes.

The essential components of a systematic individualized exercise prescription include the appropriate mode, intensity, duration, frequency and progression of physical activity. There are four components of exercise program; a warm up, an endurance phase, optional recreational activity and a cool down. For sedentary individuals, exercise should start at 60% of maximum heart rate. Benefits of physical activity depend on the total amount of exercise. Vigorous leisure time activity should be promoted in order to give way to healthy living.

KEYWORDS: Aerobic exercises, physical activity, cardio-respiratory fitness.

American College of Sports Medicine (ACSM) defined, aerobic exercise as “any activity that uses large muscle groups, can be maintained continuously, and is rhythmic in nature.” It is a type of exercise that over loads the heart, lungs and causes them to work harder than at rest.

The basic idea of aerobic exercises is to get up and get moving, find some things you enjoy doing that keeps your heart rate elevated for continuous time period and get moving to healthier life. The word “aerobic” is short for aerobic metabolism which is the process that occurs in muscles and involves microscopic exchange of oxygen in order to produce energy for muscle contraction.

Lisa Balbach, defines aerobics as, “Using the same large muscle group, rhythmically for a period of fifteen to twenty minutes or longer while maintaining 60-80% of maximum heart-rate.”

Aerobic activity includes: Walking, biking, jogging, swimming, cross country skiing, treadmill walking, jumping rope, stair climbing, inline skating and aerobic dance.

Aerobic exercises burn fat faster than any other type of exercise.
BENEFITS OF AEROBICS

Cardiovascular
Aerobic exercise conditions the heart and lungs by increasing the oxygen available to the body and by enabling the heart to use oxygen more efficiently. Exercise alone cannot prevent or cure heart disease. It is only one factor in a total program of risk reduction; other factors such as high blood pressure, cigarette smoking and high cholesterol level will need to be taken into consideration to prevent heart disease.

Additional Benefits
Additional benefits of aerobics besides cardiovascular include:
- Control of body fat (Aerobic exercise in conjunction with strength training and a proper diet will reduce body fat).
- Increase in resistance to fatigue and extra energy
- Toning of muscles and increase in lean body mass.
- Decrease in tension and aid in sleeping.
- Increase in general stamina.
- Possibly even the treatment and Prevention of Cancer.
- The benefit of aerobic exercise for relieving radicular pain is controversial.
- A regular aerobic program gives a sense of responsibility and assurance of being in control of one’s body, which are two positive mental attitudes that are necessary to reduce stress. For stress and anxiety reduction, a program of aerobic exercises of twenty to thirty minutes duration over a period of 10-16 weeks is recommended.
- Aerobic helps relax tense muscles and a regular aerobic activity increases the body’s production of endorphins (A natural sedative) and catecholamines (chemical substances) that help stabilize mood.
- Both the seventh report of Joint National Committee on detection, evaluation and treatment of high blood pressure (JNC VII) and the American College of Sports Medicine (ACSM) recommend aerobic exercises to lower blood pressure. The ACSM recommend aerobic exercises for mild hypertension, frequency (3-5 days/week), duration (20-60 minutes) and intensity (50-85%) of maximal oxygen uptake. For individuals with markedly elevated blood pressure, exercise training at lower intensities (40-70%) is recommended after initiated pharmacologic therapy.
- Aerobic exercises are very effective in lowering triglycerides and increasing HDL level.

Older adults are at greater risk for cardiovascular disease and musculo skeletal injury and can benefit greatly from an exercise program regardless of previous physical conditioning. Aerobic exercise helps maintain functional capacity (Physical Independence) in old age.

Thresholds for Improved health and fitness from aerobic exercises
Aerobic exercises can help improve health with benefits to blood pressure, cholesterol, weight and mental state, as shown in Fig. 1. When a person increases the level of activity and exercise there are corresponding levels of improved health benefits. At an intensity, which is about 50% of a person’s aerobic capacity VO2_max, fitness improvement can clearly be measured. The recommended threshold for health and fitness benefits is at present being reviewed. A verbal report from Dr. Michael Pollock, on behalf of the American College of Sports Medicine (ACSM) has suggested

Figure-1: Theoretical relationship between health and fitness benefits and the amount or intensity of exercise.
accepting a threshold as low as 40% of VO2\textsubscript{max} for conferring some benefit in sedentary individuals. The amount of activity recommended is an accumulation of up to thirty minutes of physical activity per day with minimum bout of ten minutes or more vigorous activity three times per week for twenty minutes.\textsuperscript{3}

Equipments used in aerobics include Treadmill, Arm ergo meter and Stationary cycle ergo meter.

**DETERMINATION OF EXERCISE PROGRAM**

**Frequency**

Frequency refers to the number of training sessions per week. The number of exercise sessions per week varies depending on the caloric goal, participant preferences and limitations imposed by participant lifestyle. Frequency varies depending on the health and age of the individual. Optimal frequency of training is generally three to four times a week. If training is at low intensity, greater frequency may be beneficial. A frequency of two times a week does not generally evoke cardiovascular changes, although, older individual and convalescing patient may benefit from a program of that frequency.\textsuperscript{7} As frequency increases beyond the optimal range, the risk of musculo skeletal complication increases. For individuals who are in good general health, exercising 30 to 45 minutes at least three times a week (2000 Kcal/week) appear to protect against coronary heart disease.

**Intensity**

Intensity of activity is different for everyone. No pain No gain statement is not only false but can be dangerous for the beginners. The daily activity massage focuses on the idea that if one is active at lower intensities the activity must be performed longer to obtain similar health benefits than if one were to go harder for short periods.

The cardiac patient working to 60% of their capacity is enough to confer health benefit and improve their VO2\textsubscript{max} - assuming that a regular (frequency) program is followed for duration in excess of 15 minutes. The marathon runner will have to train at 75-90% of their capacity to at least maintain their existing performance ability.\textsuperscript{3}

Duration and frequency must also be individualized in order to establish a progression but also the framework for these is generally established by the fact that if an individual is following the minimum of 20 minutes three times per week, it must be at an intensity of at least 55-60% of their aerobic capacity.

Activity model for improving health (i.e. blood pressure & cholesterol) accumulating 30 minutes per day can be done at intensities ranging as low as by 40% and up to the typical exercise levels of 55-75% of aerobic capacity. Duration is the function of intensity.\textsuperscript{3}

ACSM recommends an intensity of exercise corresponding to between 55 and 65% (55/65%) to 90% of maximum heart rate (HRmax), or between 40 and 50% (40/50%) to 85% of oxygen uptake reserve (VO2R) or HR reserve HRR.\textsuperscript{8}

**INTENSITY PRESCRIPTION IN METs**

Traditionally, the range of exercise training intensities (In METs or ml/kg/min) has been based on a straight percentage of VO2\textsubscript{max}. For example, if an individual has measured VO2\textsubscript{max} of 10 METs the prescribed intensity could be set at 6 to 8 METs, corresponding to 60% and 80% of VO2\textsubscript{max} respectively. To calculate the target VO2 based on Reserved VO2 (VO2R), the following equation is used:-

\[
\text{Target VO2} = \{(\text{Exercise Intensity}) \times (\text{VO2\textsubscript{max} - VO2\textsubscript{rest}})\} + \text{VO2\textsubscript{rest}}
\]

In target VO2 equation VO2\textsubscript{rest} is 3.5 ml/kg/min (one MET) and the exercise intensity is 50 to 85% or as low as 40% for very reconditioned individuals.\textsuperscript{8} Most common methods of setting the intensity of exercise are Rating of Perceive Exertion (RPE) and Heart Rate (HR) because HRmax decline with age.
RATING OF PERCEIVE EXERTION (RPE)  
(BORG’S SCALE)

Intensity of exercise may be determined by RPE. Currently two RPE scales are widely used, as illustrated in Table-I, the original and category scale, which rates exercise intensity on a scale of six to twenty and the revised or category - ratio scales of 0-10. Category ratio scale provides more valid information to direct the test. It has been seen that threshold for blood lactate accumulation are achieved at rating of “Some what-hard” to hard which approximates a rating of 12 to 16 on category scale or 4 to 5 on the category ratio scale.8

Heart rate method

Heart rate method is used as a guide to set exercise intensity because of the relatively linear relationship between HR and %VO2 max. It is best to measure HRmax (maximal heart rate) during a progressive exercise test. Maximal heart rate (HRmax) = (220-age). To gain the benefits of aerobic exercise, heartbeat must be at least 60-75% of its maximum capacity. Below that level, exercise does little to promote fitness, and above that level, exercise is not safe. For a beginner, exercise should start at 60% of HRmax.3,8

Low target heart rate range  
= {(HRmax - HRrest) X 0.6} + HRrest

High target heart rate range  
= {(HRmax - HRrest) X 0.83} + HRrest

Heart rate reserve method

Heart rate reserve method is also called as the Karvonen method. In this method resting

<table>
<thead>
<tr>
<th>Category Scale</th>
<th>Category Ratio Scale</th>
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<tbody>
<tr>
<td>6</td>
<td>0 Nothing at all (No. 1)</td>
</tr>
<tr>
<td>7 Very, very light</td>
<td>0.3 Extremely weak (Just noticeable)</td>
</tr>
<tr>
<td>8</td>
<td>0.5</td>
</tr>
<tr>
<td>9 Very light</td>
<td>0.7</td>
</tr>
<tr>
<td>10</td>
<td>1 Very weak</td>
</tr>
<tr>
<td>11 Fairly light</td>
<td>1.5</td>
</tr>
<tr>
<td>12</td>
<td>2 Weak (Light)</td>
</tr>
<tr>
<td>13 Somewhat hard</td>
<td>2.5 Strong (Heavy)</td>
</tr>
<tr>
<td>14</td>
<td>3 Moderate</td>
</tr>
<tr>
<td>15 Hard</td>
<td>4</td>
</tr>
<tr>
<td>16</td>
<td>5 Strong (Strongest I)</td>
</tr>
<tr>
<td>17 Very hard</td>
<td>6</td>
</tr>
<tr>
<td>18</td>
<td>7 Very strong</td>
</tr>
<tr>
<td>19 Very, very hard</td>
<td>8</td>
</tr>
<tr>
<td>20</td>
<td>9</td>
</tr>
<tr>
<td>10 Exremely strong (strongest I)</td>
<td></td>
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N.B.

For correct usage of the Borg scales, it is necessary to follow the administration and instructions given in Borg’s Perceived Exertion and Pains Scales.
heart rate is subtracted from maximal heart rate to obtain heart rate reserve. Target heart rate range is only a guideline in setting the exercise intensity.

**Duration**

In the initial stages to overcome the expected muscle stiffness exercise should be done two times per week with enough days in between to allow the stiffness or minor aches to resolve then progressing to three times per week unless a person is highly trained or an athlete, there should be at least 2-3 rest day per week to allow the body to recover and restore its energy stores.\(^5\)

**Energy expenditure goals**

ACSM recommended a target range of 150-400 kcal of energy expenditure per day in physical activity and/or exercise. Approximately energy expenditure of 1000 kcal per week in physical activity and/or exercises should be initial goal for previously sedentary individuals. One useful method to approximate the caloric cost of exercise is by using the following equation based on the MET level of the activity. \((\text{METs} \times 3.5 \times \text{bodyweight in kg}) / 200-\text{kcal/min}.\)

Figure-2 shows that benefits of physical activity depend on the total amount of exercise accomplished or calories burnt than on the specific exercise frequency, intensity or duration. Although vigorous leisure time activity (e.g. noon hour jog) has been widely promoted in order to give way to healthy living, several shorter bouts of lesser intensity physical activity into their daily routine (dashed line) may be taken as an alternative strategy.

Theoretically, if area under the dashed line (life style exercise) is equal to that under the dotted line (leisure time exercise), it suggests that the associated energy expenditure is comparable, and similar health benefits should occur.\(^6\)

**Components of the aerobic exercise**

The format for the exercise session should include a warm-up period (approximately 10 minutes), a stimulus or endurance phase (20 to 60 minutes), an optional recreational game and a cool down period (5 to 10 minutes). Figure-3.

**Warm-up**

Warm-up facilitates the transition from rest to exercises stretch postural muscles augments blood flow and increase the metabolic rate from resting level (IMET) to the aerobic requirement for endurance training. A warm-up may reduce the susceptibility to musculoskeletal injury by increasing connective tissue extensibility improving joint range of motion and function and enhancing muscular performance. It also has a preventive value, it decrease the occurrence of Ischemic ST-segment Depression

![Figure-2: Theoretical patterns of physical activity for sedentary persons (solid line), individuals who engage in regular; leisure time exercise in noon job; dotted line), but are otherwise sedentary, and individuals who integrate several shorter bouts of activities may include brisk walking, stairs climbing gardening, household chores, painting and table tennis. These may be as effective as structured leisure time exercise in promoting health benefits provided that the total energy expenditure is comparable.](image1)

![Figure-3: Format of a typical aerobic exercise session illustrating the warm-up, endurance, and cool down phases along with a representative heart rate response.](image2)
threatening ventricular arrhythmias and transient global left ventricular dysfunction following sudden strenuous exertion in healthy and post Myocardial Infarction (MI) patients who were taking beta blocker have failed to confirm these cardiovascular abnormalities during sudden strenuous exercise.

Endurance phase
The stimulus or endurance phase develops cardio respiratory fitness. It includes 20-60 minutes of continuous or intermittent (minimum or 10 minute bouts accumulated throughout the day) aerobic activity. The most effective exercises for endurance phase employ large muscle groups in activities that are rhythmic or dynamic in nature, sports such as tennis, racquetball, handball and basketball also have aerobic conditioning potentially if they are pursued for a sufficient period of time. Duration is inversely related to the intensity of the activity (e.g. lower intensity activity should be done for longer time (30 minutes or more)

Recreational Activity
Activities like golf and bowling are not ‘aerobic’ in nature but are enjoyable have definite recreational value and may yield health related benefits. These recreational activities during or immediately after the endurance phase often enhance adherence. However, game rules may be modified to decrease skill requirement competition, and the energy lost and heart rate responses to play; winning or losing should be of lesser importance.

Cool Down
The cool down phase provides a gradual recovery from the endurance phase and includes exercises of diminishing intensities for example slower walking or jogging, calisthenics and stretching exercises and breathing exercise. The Cool-Down permits appropriate circulatory adjustments and return of the heart rate and blood pressure to near resting values, enhances venous return, thereby reducing the potential for post exercise hypotension, dizziness, facilitates the dissipation of body heat. In cardiac patients, cool-down may reduce the likelihood of threatening ventricular arrhythmias - potential harbingers of sudden cardiac death. Of 61 cardiovascular complications reported during the exercise training of cardiac patients, at least 44 (72%) occurred during either the warm-up or cool down phase.

RATE OF PROGRESSION
The recommended rate of progression in an exercise-conditioning program depends on functional capacity medical and health status, age, individual activity preferences and goals, and an individual’s tolerance to the current level of training. For apparently healthy adults, the endurance aspect of the exercise prescription has three stages of progression initial, improvement and maintenance. Physical activity recommendation from the ACSM / Centers for disease Control and Prevention (CDC) include 40 minutes of moderate physical activity on most, if not all days of the week apparently healthy but sedentary individuals may not be able to attain this initial level of activity, they should be encouraged to progress to this goal during the first few weeks of the training program.

CONCLUSION
Aerobic exercises are beneficial for both sedentary individuals and cardiac patients. Research shows that simple regular activity (not necessarily sport) equivalent to a daily 20 minutes brisk walk can be beneficial to health. If the duration is greater than 30 minutes per day and the intensity of the exercise increases to a range of 40-70% of an individual aerobic capacity, the protection against CHD is further increased. After heart attack it has been shown that for the next 2-3 years there is a reduced risk of further MI and 20-25% reduction in all causes of death if patient had participated in an exercise rehabilitation program.

One should not consider aerobic exercise as form of a mere medicament but we should treat it as a part of our everyday lives in other
words a person may need to start with simple exercises that can be intensified gradually to lessen the disastrous affects of a sedentary lifestyle.

REFERENCES