



# Monitoring the Heart During Exercise

# USING A HEART RATE MONITOR DURING CARDIOVASCULAR EXERCISE IS CENTRAL TO DEVELOPING AN APPROPRIATE FITNESS PROGRAM.

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No lifestyle plan is complete without a fitness plan, and no fitness plan is complete or successful without monitoring heart rate and caloric expenditure. A

heart rate monitor is a valuable lifestyle barometer, and knowing your clients' resting metabolic rates will optimize your ability to balance the calorie equation. Measuring the heart's performance in real time allows for the establishment of a realistic exercise prescription, and helps to monitor progress and optimize outcomes. The same can be said for documenting resting metabolic rate.

Strapping on a heart rate monitor has become as commonplace as putting on a wristwatch for the majority of competitive athletes and weekend warriors. Now, thanks to the boom in heart monitoring technology and a drastic drop in price for these units, average folks are finding that using a heart rate monitor can help them lose weight and reduce the risk of exercise-related injuries. The technology is getting so inexpensive that there really isn't any excuse for the general consumer not to buy a monitor if their goals are weight loss, performance enhancement or a healthier lifestyle.

Heart rate monitors can help to motivate, educate and monitor clients.

## Types of heart rate monitoring

Think of a heart rate monitor as one of the only non-invasive windows into what's going on within the body physiologically,

The following "normal" heart rates are listed in beats per minute.

	Resting (awake)	Resting (sleeping)	Exercise or fever
Newborn	100 to 180	80 to 160	Up to 220
One week to three months	100 to 220	80 to 220	Up to 220
Three months to two years	80 to 150	70 to 120	Up to 200
Two years to 10 years	70 to 110	60 to 90	Up to 200
10 years to adult	55 to 90	50 to 90	Up to 200

**Table 1.** Normal Heart Rates

metabolically and emotionally. Regardless of fitness goals, a heart rate monitor can help your members and clients during exercise.

One of the most frequently asked questions is, "Why can't I just take my pulse on my neck or wrist?" According to James Rippe, M.D., and as published in *The New England Journal of Medicine*, taking a pulse during exercise is not only intermittent, but also inaccurate and potentially dangerous. The heart rate variability when taken by this method may be inaccurate to the tune of +/-15 beats per minute. This discrepancy is significant with a healthy population, so consider the potential conse-

## Frequent Vigorous Exercise vs. Intermittent Exercise

According to Paul D. Thompson, M.D., in his book, *Exercise and Sports Cardiology*, exercise can provide adults with multiple cardiovascular benefits, but it also carries risks. Sudden cardiac death (which kills an estimated 225,000 Americans each year) and acute myocardial infarction are the most important cardiovascular complications of exercise based on both frequency and seriousness. Researchers at Brigham and Women's Hospital, Boston, Mass., have found that frequent vigorous exercise is better than intermittent vigorous exercise in the reduction of cardiovascular disease and sudden cardiac death. Besides protecting the heart, regular vigorous exercise strengthens bone and muscles, increases flexibility, and reduces blood pressure, cholesterol, body fat, stress and risk of stroke.

quences with a deconditioned or diseased population. Also, consider that other muscle movements and heavy breathing can make the pulse difficult to find, let alone count. And if exercisers stop or slow their activity level to count, it's not really an accurate measure of their exercising heart rate.

Intermittent vs. continuous heart rate monitoring is another issue worth exploring. Intermittent usually means taking the pulse manually at the wrist or neck. Another example of this is the contact method employed by cardiovascular equipment and pulse meters. This requires the participant to grasp the appropriate handles or buttons on the device to get a pulse reading. These can be inaccurate and awkward to use, and are affected by sweat, hand lotion and contact pressure, among other things. Some devices also employ the contact/intermittent method. They either pick up the radial pulse at the wrist, or require the participant to apply digital pressure on the monitor to take a pulse.

A heart rate monitor with a chest strap (transmitter) provides a continuous heart rate reading by picking up the electrical activity of the heart, magnifying it and sending it to the receiver (wristwatch). These are

Following are the recommended blood fat levels for heart and vascular health (source: American Heart Association).

- Cholesterol less than 200mg/dl
- LDL cholesterol less than 100mg/dl
- HDL cholesterol greater than 35ml/dl
- Triglyceride less than 200mg/dl

**Table 2. Recommended Blood Fat Levels**

true heart rate monitors that incorporate the same technology as hospital ECG machines. The receiver picks up the heart's activity and displays it on the watch in a real-time, beat-to-beat fashion.

## Measuring success

Heart rate monitors can help to motivate, educate and monitor clients. The monitor potentially increases the safety and effectiveness of exercise, optimizes calories burned and modulates metabolism.

The heart responds to exercise like any other muscle. Just as lifting weights can make biceps stronger, exercising the heart will make it stronger (more blood pumped per beat by the left ventricle). As fitness level increases, the heart can pump more oxygenated blood with each beat. When this happens, the heart does not have to beat as often to get needed oxygen and nutrients to the muscles. Therefore, heart rate is lower per given volume of work. Although heart rate measurement is most useful during exercise, it is also relevant for other situations, such as gauging the cardiac demands of occupational and leisure-time activities, relaxation and stress management.

## Advantages to monitoring

Everyone has their own heart rate, and people respond to exercise in different ways. This is one of the fundamental reasons why fitness professionals should determine heart rate with a monitor, and not use tables and charts. Under a constant workload, the heart rate of a very fit person increases more slowly than that of an unfit person. Differences in skill and technique during exercise also affect heart rate. A person's heart rate can also vary from day to day.

Heart rates are based on maximal heart rate. Factors affecting max heart rate include age, gender, stress, disease and fitness level, along with other genetic factors. A simple and effective method is to take 208 minus 70 percent of the person's age (Tanaka, et al., University of Colorado, Boulder, 2000).

## Benefits of Exercise

Heart rate-appropriate exercise has been shown to have the following effects on coronary artery disease:

- Lowers blood pressure, especially in people who have high blood pressure (keep in mind the new standard of 120/85 as "high normal").
- May reduce triglyceride and total cholesterol levels, increase HDL cholesterol levels, and lower LDL cholesterol levels.
- Helps control body weight and reduce body fat.
- Relieves stress (a major risk factor in heart disease).
- Helps regulate blood sugar levels in people with diabetes.

## Other types of heart tests

In addition to heart rate monitoring, those who have risk factors or a history appropriate of further testing, and who are considering engaging in an exercise regimen or increasing the intensity of their program, should have a graded exercise test (GXT) under the supervision of a cardiologist. Not only will this determine maximal heart rate, but it will also provide valuable information regarding cardiovascular response to increased workloads. The test will determine three important variables: the electrical response of the heart under stress; blood pressure response to increased demands; and heart rate response to increased demand. These factors are critical in determining the appropriateness of exercise and the appropriate intensities. This is also a way to rule out potential risk factors and identify "silent killers."

During the exercise assessment, the intensity level is increased each minute, while the technology analyzes the composition of every breath (oxygen and carbon dioxide) while monitoring

## Cardiac Arrest in Young People

Doctors from the Centers for Disease Control and Prevention conducted the first-ever survey of cardiac arrest in people ages 14 to 34. Across the United States, the number of fatal cardiac arrests in this age group rose from 2,710 in 1989 to 3,000 in 1996. In all, 23,320 young adults died, almost three-quarters of them men. According to federal figures, 17 percent of U.S. high school students say they smoke cigarettes regularly, compared with 12 percent a decade ago. Twelve percent of people in their 20s are now considered obese, compared with 7 percent 10 years ago. Among people in their 30s, obesity has risen from 11 percent to 19 percent. Too much weight causes an array of ill effects that might increase the risk of cardiac arrest, including heightened cholesterol levels, high blood pressure and diabetes.

heart rate. Based on the assessment, the individual's unique response to exercise is mapped to create a metabolic profile. The results include an objective measure of fitness, a comparison to others of similar age and, most importantly, all the information needed to create an effective personal exercise program to help meet weight-management or fitness goals.

The results of the assessment establish a unique metabolic profile, and can be generally categorized into three areas: peak oxygen uptake, level of fitness and a metabolic profile.

**1. The body's maximum potential (peak oxygen uptake or  $VO_2max$ ).** Peak oxygen uptake stands for the volume of consumed oxygen per minute, representing the ability of the heart, lungs and circulation to deliver oxygen to the exercising muscles. It is a gauge of the maximum amount of energy output, or work, the body can produce at peak performance.  $VO_2max$  is reached for a brief moment as the participant nears exhaustion. It is determined by factors that include current level of fitness, age, sex, body size and heredity.

**2. The body's level of fitness.** Anaerobic threshold (AT) represents how efficiently the muscles use oxygen to produce energy. As such, AT represents the level of work the body can sustain over an extended period of time, and is sometimes referred to as opera-

tional threshold. When the body is called upon to perform above AT, lactic acid builds in the muscles creating fatigue, and the ability to continue performing at this intensity is limited (seconds to minutes, depending on how fit the individual is). AT can be improved by training at the proper intensities, thus the need for a heart rate monitor to guarantee the appropriate intensity level is achieved. The closer AT is to the  $\dot{V}O_2$ max, the better the level of fitness.

## Everyone has their own heart rate, and people respond to exercise in different ways.

**3. Metabolic profile.** A metabolic profile yields two important variables: the caloric burn rate and the type of fuel the body uses. The caloric burn rate is the number of calories a body burns during each minute of activity. To put the caloric burn rate into perspective, 3,500 calories equates to 1 pound of fat. So if your client wants to lose 10 pounds, they'll need to increase the amount of exercise and/or reduce food intake by a total of 35,000 calories to achieve their goal.

The second part of a metabolic profile is the fuel type the body uses at various exercise intensities. At lower intensities (aerobic), the body primarily uses fat for fuel. At higher intensities (anaerobic), the body uses carbohydrates (sugars) as its primary source of fuel.

### Creating a fitness program

Once the necessary data has been collected and analyzed, an appropriate fitness program can be developed. In addition to heart rate and metabolic profile, the following factors should be considered when developing and implementing an effective exercise program.

**Intensity.** During aerobic exercise, intensity level is determined by the speed and type of movement, as well as the muscle mass involved. A fast tempo makes the exercise more strenuous. Adding active muscle mass (for example, adding arm movements to leg movements, or adding hand-held weights) during exercise increases the intensity.

**Mode.** The type of exercises will be determined by the current condition of the individual, goals of the program and equipment available.

**Duration/frequency.** Studies show that more frequent, shorter duration bouts of cardiovascular activity are just as effective as one long session. Minimal levels might include 30 to 40 minutes of aerobic activity five to six times a week.

**Body position.** The heart rate is lowest

when lying down, and highest when standing, because of the work required to return the blood through the veins to the heart.

**Environmental factors.** High temperatures and/or humidity increase heart rate; low temperatures may alter the heart rate as well. Also, a 1 percent decrease in hydration level may vary the heart rate by as many as five beats per minute.

**Psychological and physiological stress levels.** The heart rate, both at rest and

during exercise, is generally elevated in the overworked body. Excessive exercise may cause excess fatigue and stress. Lack of sleep and the demands of family, study and job may also influence heart rate.

**Drugs.** A number of drugs used to treat heart disease, hypertension, asthma, coughs, stress and anxiety can accelerate or decelerate the heart rate, depending on the pharmacological action of the drug. Refer to the American College of Sports Medicine's drug guide for specifics.

**Limb movement.** Most forms of aerobic training use the legs, not the arms. (Exceptions include full-body elliptical trainers, rowing, swimming and skiing machines.) However, in many activities of daily living, the need for upper-body strength and endurance is tremendous. Because of the SAID principle (specific adaptation for imposed demands), the upper body will not be conditioned in the same manner as the lower extremities. Typically, the heart rates for upper-body activity are 10 to 15 beats lower than for the lower extremity.

### Put it to use

Some current trends in fitness include group programming, weight management programs and programs for deconditioned/at-risk populations. To make these programs safer and more effective, more attention should be paid to evaluating and monitoring clients and members. Providing technology to your staff and members will encourage safe, effective and efficient programming for all. **FOS**

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