

Advanced CARDIO Training



WITH
KNOWLEDGE OF
HOW THE BODY REACTS
TO CARDIO TRAINING, AND
WITH WAYS TO MONITOR
PROGRESS, YOU CAN CREATE
SUCCESSFUL CARDIO
PROGRAMS FOR
YOUR MEMBERS.

By Stephen A. Black,
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Why do cardio? Using an analogy from the automobile industry, it is simple: A person can have the best fuel (carbohydrates, supplements, etc.), most horsepower (bulging biceps/massive quads) and best body, but if the fuel pump or carburetor is missing, the person just sits there looking pretty. The heart is necessary to sustain life, but it can be a neglected component in fitness.

All too often, group exercise instructors focus on the choreography, music and fun aspects of their classes, with little consideration to intensity, duration and frequency of intensity. Following is how your instructors can help your group exercise participants get the maximum benefits for their hearts.

HELP MEMBERS BECOME HEART-STRONG

The inclusion of an appropriate cardio program for members is imperative to their overall success and longevity as members and humans. To achieve optimal results, fitness enthusiasts must train at intensities appropriate to their goals and current level of fitness, and within the constraints of their health. Intensity is important because too low an intensity will not produce optimal results, while too high an intensity can lead to overtraining, injury and even death.

Assessment and prescription for appropriate cardio training programs are important for all members. According to Ed Coyle at the University of Texas, Austin, "if you are not conducting exercise testing with credible equipment and methods, you will not get the desired results and lose the client, if not kill them in the process." (Coyle should know, since he has been testing and presenting results to Lance Armstrong since the cyclist was 20 years old.)

PHYSICAL CHANGES DURING CARDIO EXERCISE

The body uses oxygen and fuel to generate energy. The cardiovascular system delivers oxygen to the skeletal muscles, which uses this oxygen to "burn" various fuels (carbohydrate and fat) to yield mechanical energy. A unique feature of the body is its ability to change in response to the demands placed on it. By working out hard, the aerobic system is overloaded. During rest, the body adapts, resulting in increased strength. This is accomplished by improvements in cardiovascular and muscular function, along with an improved transport system (like adding additional lanes to accommodate increases in traffic). The heart becomes stronger and more efficient, and the skeletal muscles become better at extracting oxygen from and excreting waste back into the bloodstream. Within muscle cells, the mitochondria boost their enzyme systems to oxidize fuels.

All of these changes occur slowly over time. For continued improvement, the system must be continually overloaded, and

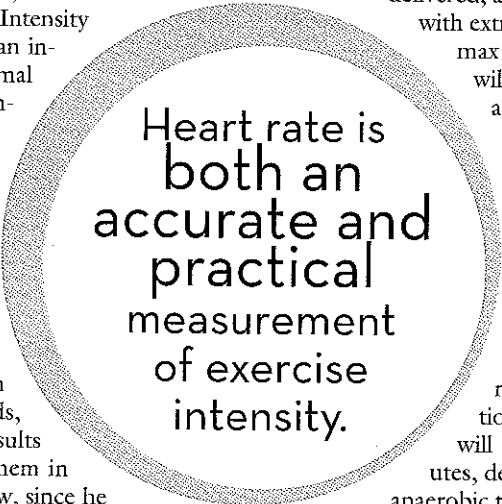
workouts become more difficult. How is the right training level determined? Physiologists have discovered that the rate of oxygen "burned" in the muscles is the best measure of aerobic work. Determining this used to require expensive equipment and specialized testing facilities. But now, basically, an individual runs on a treadmill, elliptical machine or cardio piece of choice while the volume of inhaled and exhaled air is measured. Samples of exhaled air are periodically taken, and the oxygen concentration determined. The difference between the amounts of oxygen breathed in and out during the test is what the muscles have consumed to burn fuel. Also, the ratio of these substrates will tell what the muscles have used for fuel (carbohydrates and/or fat).

VO₂. Both the oxygen (O₂) in and the carbon dioxide (CO₂) out are critical to the process. Equipment that does not measure both O₂ in and CO₂ out is inaccurate, and the resulting exercise prescription invalid. The rate of oxygen consumption, in milliliters/kg body weight per minute, is called VO₂. The test is performed at progressively harder levels until the individual "maxes out." The maximum rate of oxygen consumption is called the VO₂ max or VO₂ peak.

VO₂ peak tests may not be practical in the fitness center environment. With advances in software, a sub-max test can be delivered, and the software will extrapolate the VO₂ peak with extraordinary accuracy. Also, on the way to a sub-max or VO₂ peak threshold, the client/member will pass through anaerobic threshold, which is another marker of cardiovascular fitness, and one that can be used to establish appropriate training zones for safe programming.

Anaerobic threshold. The anaerobic threshold (AT) represents how efficiently the muscles use oxygen to produce energy or work. As such, AT represents the level of work the body can sustain over an extended period. When the body is called upon to perform above AT, lactic acid builds in the muscles creating fatigue (the burning sensation felt), and the ability to continue at this level will be very limited (a few seconds to a few minutes, depending on the fitness level). Improving the anaerobic threshold is paramount to developing aerobic fitness. Generally speaking, AT may be between 52 and 95 percent of maximum heart rate. The more aerobically fit, the higher the AT.

Other physical changes. Physiologically, in addition to burning fat in the aerobic zone, the body makes other, even more important, adaptations. Blood supply is increased through the new growth of blood vessels. This provides more nutrients to the working muscles, and helps take metabolic wastes from the muscles. The mitochondria of the cells, where the energy production takes place, multiply up to 200 percent, providing a higher capacity for workload. The body also increases the level of hemoglobin and total blood volume. Oxygen in the blood is predominantly carried by hemoglobin, so with more hemoglobin, the working muscles will get the oxygen they need more efficiently. With the increase in blood volume, the cardiac muscle becomes stronger (primarily the left ventricle), increasing the amount of blood pumped per heartbeat. This means a lower heart rate at rest and more efficient recovery. The additional benefit of exercising at the appropriate intensity is increased lean mass. Muscle tissue burns, on average, 50 calories per hour per pound.



Heart rate is
both an
accurate and
practical
measurement
of exercise
intensity.

TIME (MIN.)	APPROX. PACE (MPH)	HEART RATE
0 to 3	4.0	Aerobic base
3 to 6	4.5	Threshold
6 to 9	4.8	Threshold
9 to 12	3.5	Tempo
12 to 15	4.0	Tempo
15 to 18	4.5	Threshold
18 to 21	4.8	Threshold
21 to 24	3.5	Tempo
24 to 29	4.0	Tempo
29 to 34	4.5	Threshold
34 to 39	4.8	Threshold
39 to 42	3.5	Tempo
42 to 45	4.0	Tempo
45 to 48	4.5	Threshold
48 to 51	4.0	Aerobic base

TABLE 1.
Fast Walk Workout

TIME (MIN.)	APPROX. PACE (MPH)	HEART RATE
0 to 3	4.0 walk	Aerobic base
3 to 6	4.5 walk	Aerobic base
6 to 9	5.5 run	Tempo
9 to 12	4.0 walk	Aerobic base
12 to 16	6.5 run	Tempo
16 to 19	4.0 walk	Aerobic base
19 to 22	6.5 run	Tempo
22 to 25	4.0 walk	Aerobic base
25 to 29	5.5 run	Tempo
29 to 33	6.5 run	Tempo
33 to 37	4.5 walk	Aerobic base
37 to 41	6.5 run	Tempo
41 to 44	5.5 run	Tempo
44 to 51	4.0 walk	Aerobic base

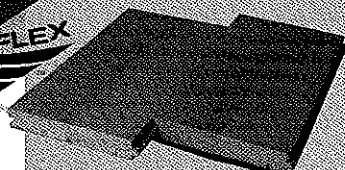
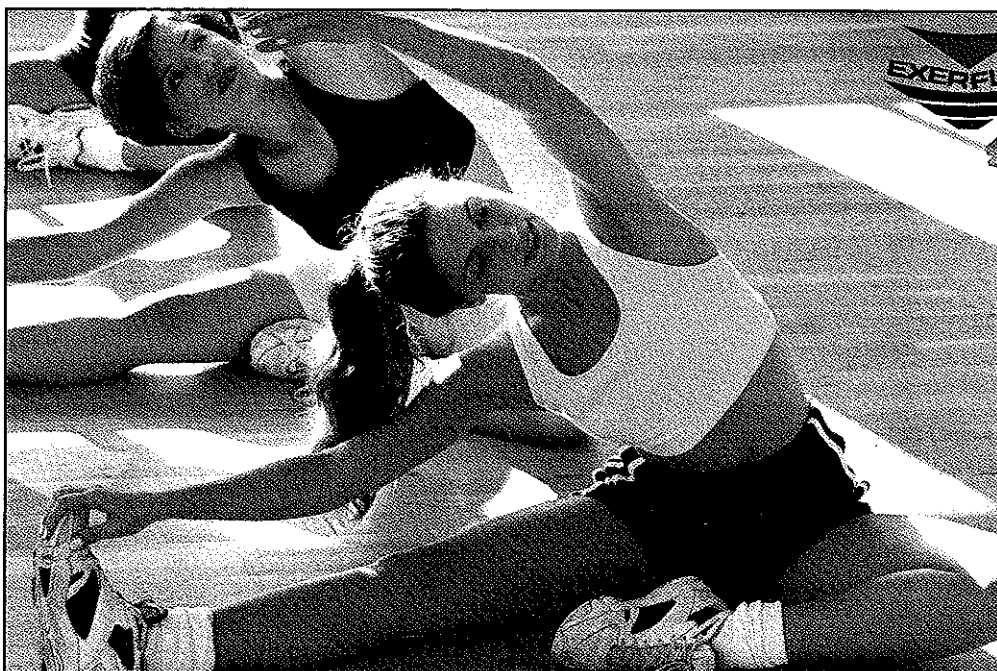
TABLE 2.
Walk/Run Workout

MODERATION IS KEY

Moderate-intensity exercise is associated with many improvements in health-related variables. The improvement of endurance performance requires increases in qualities such as aerobic power and anaerobic threshold. To elicit positive changes in these qualities, a minimum intensity must

TIME (MIN.)	INCLINE (PERCENT GRADE)	HEART RATE
0 to 12	2	Aerobic base
12 to 22	4	Tempo
22 to 30	6	Threshold
30 to 36	8	Threshold
36 to 40	10	Anaerobic endurance
40 to 42	12	Anaerobic endurance
42 to 50	2	Aerobic base

TABLE 3.
Hill Pyramid Workout



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be reached in training. Therefore, too low an intensity may lead to positive health benefits, but is unlikely to result in a change in endurance performance. On the other hand, a chronically high intensity with lack of sufficient recovery can lead to decreases in performance; this is known as overtraining. Too high a heart rate too frequently has also been shown to cause irreversible cardiac muscle damage. A practical and accurate method for monitoring training intensity is required.

MONITORING METHODS

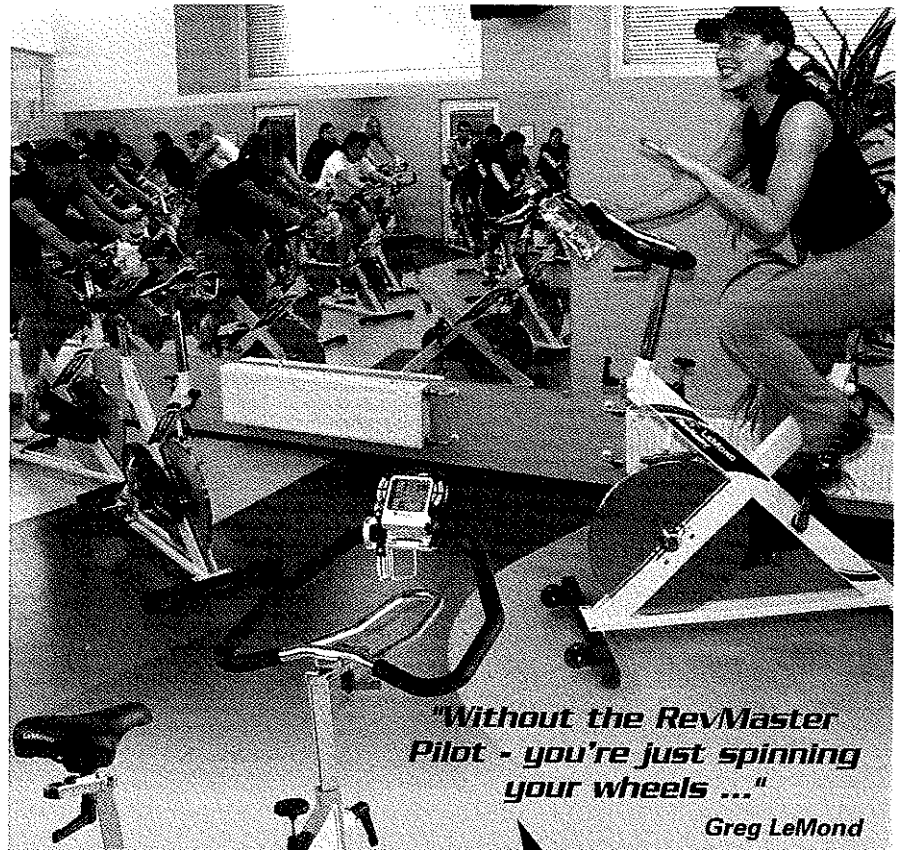
Research on VO_2 has shown that there is a threshold below which no additional gains are achieved from aerobic exercise. For most people, this is a pace that allows for casual conversation during the workout, and is approximately 55 percent of VO_2 peak. Above this level, an exerciser is sufficiently overloading the cardiovascular system and muscular systems to bring about improvement. A good example of this is group cycling. Many participants exercise at too high an intensity for too long without sufficient recoveries. Then they complain they are exhausted and don't lose any weight. They need to determine their "real" heart rate zones and adhere to them, regardless of the instructor's prodding.

Methods for monitoring intensity include use of subjective ratings of perceived exertion; monitoring blood lactate levels; monitoring heart rate; and monitoring O_2 uptake during training. Interpretation of lactate data is difficult for the average recreational athlete. Subjective ratings of exertion have been used to monitor intensity, but several studies have shown that recreational athletes and those new to exercise judge intensity poorly with this method. Heart rate (HR), however, is both an accurate and practical measurement of exercise intensity. Heart rate is often used as a tool to estimate O_2 consumed at a certain workload.

Heart rate. Heart rate can be used to estimate energy expenditure during exercise lasting more than three or four minutes. This is due to the generally linear relationship between heart rate, power output and oxygen consumption. This relationship predicts that an increase in power output should be reflected in a proportional increase in HR.

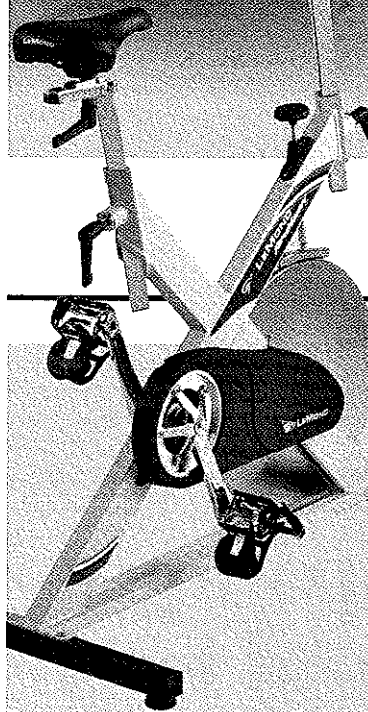
There are many methods used to measure HR. Commonly used methods include:

- Measurement of the pulse at the fingers or wrist
- Measurement of pulse pressure at the



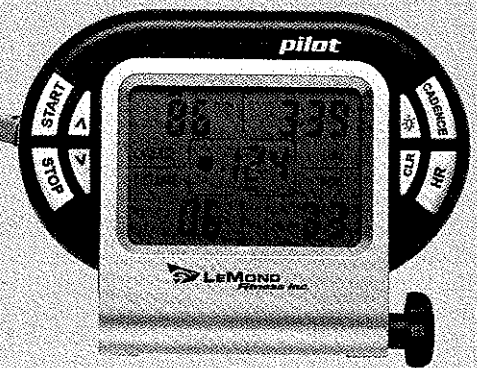
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Greg LeMond



pilot

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neck (carotid artery) or wrist (radial artery)

- Measurement of ear lobe opacity (how much light passes through)
- Measurement of electrical activity of the heart at the chest.

Studies conclude that the most valid and reliable system measures the electrical impulses of the heart at the chest (other methods might underestimate HR by up to 20 to 54 beats per minute). These systems commonly consist of a strap, which is positioned just below the breast. Two electrodes lie on the inside of the strap, one on either side of the chest; they directly measure the interval between the "R" sections of the heart contraction.

HR itself is not a direct indicator of exercise intensity. It is used to indicate intensity because it varies with exercise intensity. However, it can also be affected by a number of other factors. These include body position, hydration status and drugs (e.g., caffeine, beta blockers).

PRESCRIBING EXERCISE

Exercise shouldn't be based on the distance traveled, the amount of time involved or the physical workload; it should be controlled by the degree of physical effort as measured by physiological signs, especially heart rate. Using the various formulas available for estimating max heart rate is fraught with error. Each member has his/her own unique maximum heart rate. Testing each individual is the key to successful cardio programming.

A successful end-result for an exercise program is dependent on the development of an aerobic base. The key components of the aerobic base are

- Increasing the efficiency of the heart (stroke volume)
- Increasing hemoglobin concentration (more oxygen transportation)
- Increased muscle capillary density (better feeding system for the working muscles).

The key components of a successful weight-loss program include cardio work at the appropriate intensity, resistance training, appropriate caloric modulation and psychological readiness.

SAMPLE WORKOUTS

Following are several examples of cardio workouts with different goals. The speeds and times can be modified to fit the individual's ability to hold the heart rate, and for time available. As always, be conservative in the beginning stages, and include adequate warm-up, stretching and cool-downs. You may adjust these workouts for group cycling (change pace for resistance, hills, flats, sprints, etc.), group treadmill and combo group tread/bike class.

Fast walk. A fast walk uses approximately 325 calories. For this program, exercisers mix up faster sprints with slower recovery periods. Speedier walking calls more muscles into action — specifically the butt, hips, abs and arms. With each step, have members roll from heel through the foot, then push down with the ball and toe into the next step. They should lean slightly forward from the hips. (See Table 1.)

Walk/run. With a walk/run workout, members use approxi-

mately 400 calories. Tossing short stints of running into the walk cranks up the intensity without too much stress. But if the extra impact makes members' joints ache, it is OK to power-walk the running intervals instead. Clients should run tall, but keep the upper body relaxed. Be sure they extend the back leg to lengthen their stride. They should avoid shuffling the feet, pick up their knees with each footstep and keep arms close to the body. (See Table 2.)

Hill pyramid. A hill workout uses about 325 calories. Walking or running up hills uses calories faster than walking on a flat surface because more effort is extracted in order to climb. With this gradual incline, there is plenty of time to adjust to the higher verticals. Keep a 4 mph (walking) or 5.5 to 6.5 mph (running) pace as the grade slowly increases. Be sure members keep their backs straight, then lean slightly into the incline. Encourage them to take quick short strides rather than long steps. They should lift their knees no higher than 6 inches for steep climbs. Decrease the incline if members' heels feel overstretched. (See Table 3.)

Group cycling. For a group cycling workout, have members perform a 10-minute warm-up at 55 to 60 percent maximum heart rate, or 30 beats below anaerobic threshold. Then, have them perform the following:

- Six times for 30 seconds each at 10 beats below anaerobic threshold; 30 seconds between each interval
- Three minutes at 20 beats below anaerobic threshold
- Six times for 15 seconds each at anaerobic threshold; recover 10 beats before next interval
- Three minutes at 20 beats below anaerobic threshold
- Two minutes at anaerobic threshold
- Six times for 10 seconds each at 90 percent max heart rate or 10 beats above anaerobic threshold
- Five minutes at anaerobic threshold
- Six times for 10 seconds each at 90 percent max heart rate, or 10 beats above anaerobic threshold
- Three minutes at anaerobic threshold
- Five minutes at 10 beats below anaerobic threshold
- Two minutes at 20 beats below anaerobic threshold
- Three minutes at 30 beats below anaerobic threshold

WHY CARDIO

The inclusion of innovative cardio programming can catalyze new growth opportunities within your facility. Your staff will have a better handle on member exercise intensity and new programming ideas to energize current cardio training for individuals and groups.

To make every type of group exercise safer and more effective, avoid a group exercise culture that drives participants to intensities beyond their capabilities — incorporate heart rate monitoring into the program. Providing monitors for participants to use during the class will encourage safe, heart-rate-appropriate conditioning for maximum fun and fitness. Appropriate instruction can encourage all participants to purchase a monitor for use in class. **FM**

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