

BY PAUL ROBBINS

Use heart rate to design progressive, effective cardiovascular training programs based on your clients' training zones.

Training **M** by Heart

Monitoring heart rate to determine and manipulate training zones is enjoying a resurgence in popularity in both group fitness and personal training. Why? Because regular exercisers are beginning to realize that performing the same routine on the bike, treadmill or elliptical trainer week after week does not lead to significant improvements in cardiovascular fitness. With cardiovascular training as with strength training, positive gains are achieved only when exercisers challenge their bodies with progressive workloads.

TRAINING ZONES

ZONE	% OF HR MAX	RESPIRATORY EXCHANGE RATIO	APPROXIMATE % OF CALORIES FROM FAT
Zone 1	60%-65%	0.80-0.90	50%
Zone 2	80%-85%	0.95-1.0	16% or less
Zone 3	90%-92%	up to 1.1	0%

When designing resistance training programs, you start slowly and then have clients increase their workloads by adding weight and/or reps as they progress; with cardio training on machines, you start slowly and have clients

increase their workloads by adjusting the speed, incline and/or resistance as they progress. If the workload is of the right magnitude—slightly more than the body is currently used to—adaptation occurs.

But how do you challenge your clients or class participants without running the risk of overtraining? You can accomplish this by designing interval programs based on training zones. This type of program has three key benefits:

1. Varying the workload leads to improvements in cardiovascular fitness.
2. The constantly changing program helps prevent boredom and keeps participants motivated.
3. Research suggests that interval training raises postworkout metabolism and keeps it up longer than steady-state exercise (Phelain et al. 1997).

USING HEART RATE TO DESIGN A PROGRAM

The first step in designing a program based on heart rate is to determine a client's training zones. One way to do this is to use a common formula for estimating maximum heart rate (e.g., the age-predicted formula, the Karvonen formula), then use a percentage of the maximum to define the "fat-burning" zone, in which most of the fuel the body uses is fat. (Of course, although the body is burning a higher *percentage* of calories from fat at this level, it is not burning as many total calories as it would at higher intensities.) The fat-burning zone is commonly defined as 60 to 70 percent of heart rate maximum (HRmax). Using the age-predicted $(220 - \text{age})$ formula, then, you would determine that a 40-year-old client would have an HRmax of approximately 180 beats per minute (bpm) and a fat-burning zone of about 117 bpm (65% of 180). Most formulas assume that exercisers will reach the anaerobic threshold at approximately 80 percent of the age-predicted HRmax (ACSM 2000). This would not necessarily be accurate for all exercisers, however. For example, a client with a strong aerobic base might reach the anaerobic threshold anywhere from 5 to 40 percent above the fat-burning zone. For this reason, using a formula has its limits. According to Daniel Kosich, PhD, "When an individual determines a heart rate training zone based on age-predicted maximum heart rate, he or she has to understand there is a potential for significant error—plus or minus 15 beats" (IDEA 1998).

Another alternative for determining a client's training zones is to measure his respiratory exchange ratio (RER). RER is the vol-

ume of carbon dioxide the body produces (VCO_2) divided by the volume of oxygen the body consumes (VO_2). The RER value varies with the type of fuel being burned (fat, carbohydrate or protein), so once you have measured the client's RER, you can use it to determine when he is in the fat-burning zone; when he moves to the next zone, in which carbohydrates are the primary fuel; and so on.

Finally, a metabolic test, which measures various parameters of a client's cardiovascular fitness, including RER, can determine more precise, individualized heart rate zones for endurance, interval and recovery training. (See VO_2 /Metabolic Testing sidebar.)

THREE STAGES OF TRAINING

Once you have determined a client's training zones by whatever means, you can design an effective cardio program and adjust it as the client progresses. I use a system I call "stage training," which incorporates three heart rate zones. (To keep the client working—and recovering—at the right intensity, I specify an upper limit for each zone; that's why there seems to be a "dead period" in which the client is not in any specific zone but is in the process of moving from one zone to another.)

STAGE I. Stage I training is for beginners who have not been working out and need to create an aerobic base. Have clients begin slowly and work 5 to 30 minutes in zone 1. Do whatever it takes (e.g., adjust the speed or incline on the treadmill, change the resistance or incline on the elliptical trainer) to keep clients from going higher than 65 percent of HRmax. At this heart rate, they will probably be doing moderate exercise, such as a fast walk or light jog.

Zone 1 is typically called the fat-burning zone. In fact, the body actually uses the highest percent of its fuel from fat at an RER of 0.71—when it is at complete rest (Wilmore & Costill 1994). The reason fat calories make up a high percentage of the total calories burned at rest is that the body is not burning many calories! As activity level increases, the RER increases. A client exercising in zone 1 would have an RER of between 0.80 and 0.90, would be using some fat as fuel and, more important, would also be burning a fair number of calories.

This is a great zone to start in, and I consistently use it to help beginners build a strong aerobic base. When clients exercise regularly, their blood volume increases, improving blood circulation and allowing more blood to get to the exercising cells. This leads to improved cardiorespiratory capacity.

When your clients have been able to maintain their zone 1 heart rates for at least 30 minutes for 2 to 3 weeks, you can gradually take the clients up to stage II. This could take from 4 weeks to 3 months, depending on the individual starting points.

STAGE II. Stage II provides an introduction to interval training. Have clients start with a warm-up in zone 1 for 10 minutes and then do a 1-minute interval that slowly moves them into zone 2. Once their heart rates hit 80 to 85 percent of HRmax, clients should maintain that intensity for the rest of the minute. It may take 45 seconds to reach that level, which means clients will be at the top end for only 15 seconds before reducing the workload and returning to zone 1.

When clients are new to stage II training, have them start the zone 2 interval at 80 percent of HRmax, and then adjust the workload to raise or lower their heart rates two to three beats based on how well they perform and how they feel at the end of the intervals. They should be somewhat winded but still able to talk. The type of cardiovascular exercise performed is not important, as long as the workload gets the heart rate into zone 2.

After completing the 1-minute interval ending in zone 2, return clients to zone 1, or 65 percent of HRmax, prior to repeating the interval. The most important part of the workout is the recovery back to zone 1 between the intervals. Start with 5 minutes between intervals and slowly reduce the time as clients recover more quickly.

Stagger the training sessions, alternating a low-intensity day with a high-intensity day. For example, if a client works out 3 days a week, do a stage I workout on Monday, a stage II workout on Wednesday and another stage I workout on Friday. The next week, start with a stage II workout, continuing to rotate the stages so the workouts remain balanced.

During stage II training, clients are using nearly all carbohydrates for fuel but are burning more calories. Because calorie burning is generally the most important issue, individuals training at this level are on the right track. The bottom line in winning the weight loss game is burning more calories than you consume.

But clients shouldn't stay in zone 2 all the time. For improvements in cardiovascular fitness, they have to challenge their bodies with progressive workloads. To do this, they want eventually to move to a true high-intensity workout—one that takes

them to 90 percent of HRmax (or an RER of about 1.0 to 1.1).

STAGE III. In stage III, clients move into “overload” mode by performing 30- to 60-second intervals in zone 3. Start them with 5 minutes in zone 1, then increase the workload every 30 seconds until they reach zone 3. They should slowly climb through zone 2 for at least 2 minutes, then push for another 30 to 60 seconds in zone 3 before decreasing the workload for 1 minute. (The goal is eventually to do 60-second intervals in zone 3.)

Standard heart rate formulas would allow clients to go to 90 to 92 percent of HRmax for this third zone, but that may be too high for some individuals and not high enough for others. Instead, keep clients' zone 3 training to 5 percent above their zone 2 training. Depending on how your clients feel, you can adjust the workload to change their heart rates by two or three beats, but never let rates rise more than 5 percent above where they were in zone 2. The sprint in zone 3 should be hard, but not so hard that clients cannot recover and do additional intervals.

The 1-minute break after the interval in zone 3 is important for gauging improvement. During this minute, drop the workload down to the level clients were at when they started the interval. After several weeks of training, heart rate will begin to drop more quickly. After a client's heart rate has consistently dropped to the same level in the same amount of time for a few weeks, you can use this recovery rate to avoid overtraining. For example, if a client's heart rate drops 20 bpm during the 1-minute recovery period on

STAGE TRAINING

Stage I	5 to 30 minutes in zone 1
Stage II	10-minute warm-up in zone 1 1-minute interval ending in zone 2 Recover to zone 1 (5 minutes or less). Repeat. Continue alternating 1-minute intervals that end in zone 2 with recovery periods in zone 1.
Stage III	5 minutes in zone 1 Increase the workload every 30 seconds until zone 3 is reached. Push for another 30 to 60 seconds in zone 3. Decrease the workload for 1 minute. Record the recovery heart rate. Increase the workload to get the heart rate back into zone 3 for 30 to 60 seconds. (This will take about 5 minutes.) Return to zone 1 for 5 minutes before repeating. Continue alternating 30- to 60-second intervals in zone 3 with 5-minute recovery periods in zone 1.

a normal day, then drops only 10 bpm during that 1-minute break on another day, you can conclude that the client is tired and in danger of overtraining. Perhaps she had a particularly hard workout the day before, did not get enough sleep or has not been eating well over the past few days. The solution is to stay in zone 1 for the rest of the workout.

After a 1-minute recovery with the heart rate dropping to normal, gradually increase the workload again to take the heart rate back into zone 3 for 1 minute. The entire interval should be about 5 minutes long. Now return to zone 1, for 5 minutes this time, before repeating.

As with stage II training, alternate low-, medium- and high-intensity days to avoid overtraining.

A SAMPLE GROUP FITNESS CLASS

GOAL: Leg Strengthening/Toning

A number of exercisers, particularly women, want to achieve a “toned” look in their legs, so they spend a lot of time doing light leg exercises with weights. But in fact two of the best leg-toning exercises are riding a stationary bike and using a stair machine. The type of program described here has three major benefits:

1. It helps clients lose weight and tone their legs.
2. It can increase leg strength, a boon to clients who find that their legs “give out” when they are performing cardiovascular workouts.
3. It encourages cross training. Many people use a treadmill for all their cardio training because they say they can't get past level 2 on the bike or stair machine. Strengthening their legs will help with this problem.

For a group fitness program, participants must be familiar with their own training zones and check their heart rates at appropriate intervals throughout the workout.

This workout can be done on various types of cardiovascular equipment, such as bikes, treadmills or elliptical trainers.

- Have participants warm up for 5 minutes in zone 1.
- Increase the workload by one level (or about 25 watts) every 30 seconds until participants get to their individual zone 3 levels—or until their legs can no longer keep up 70 to 80 revolutions per minute. During this interval, each exerciser's heart rate should climb through zone 2. The stronger participants are, the longer this interval will last.
- At the end of this climb, participants who are able to can overload by adding more resistance and pushing in zone 3 for an additional 30 seconds, but if their legs burn out or they hit their peak heart rate at the top of zone 3, they should immediately return to zone 1.
- Return participants to zone 1 for a 5-minute recovery before repeating the climb.

Note: In a class setting, set the climb for 5 minutes. Stronger participants will climb for the full 5 minutes. Beginners might hit their peak within 3 or 4 minutes. Once they do, they should return to zone 1. This means that beginners will spend more time in zone 1—the rest of the 5-minute climb that they couldn't complete plus the 5 minutes of recovery time. This format enables you to train a group while individualizing participants' intervals based on fitness level.

A SAMPLE ADVANCED PERSONAL TRAINING SESSION

GOAL: Cardiorespiratory Improvement

Many trainers focus primarily on resistance training, sending their clients to a group exercise class or having them use a treadmill for 30 minutes for the cardiovascular portion of their workouts. But most personal training clients would willingly pay extra to learn how to get the most out of their cardio workouts.

Once a client has used the basic exercise program described above to progress to stage III training (in which he is performing 30- to 60-second intervals in zone 3), you can introduce the following advanced program:

- Have the client warm up for 5 minutes in zone 1.
- Have him perform a 2-minute interval that eventually takes him to

zone 3, then drop back to the starting level for 2 minutes.

- Check the client's heart rate, and record this as his “active-recovery rate.” (The goal is to get the heart rate back into zone 1 in the 2 minutes.)
- Have the client repeat the 2 minutes up and 2 minutes down until his heart rate no longer returns to the active-recovery rate in the lower-intensity interval.
- In addition to taking heart rate, instruct your client to listen to his body to know how many intervals to perform. A client who feels extremely tired should stop doing zone 3 training, even if he is quickly returning to his active-recovery rate.

Since this type of cardiorespiratory exercise program works the heart without burning out the legs, it is a great once-a-week workout to help clients training for a 10K race increase their running time. If they train at the same intensity all the time, they'll never increase their anaerobic threshold or running pace.

THE IMPORTANCE OF RECOVERY

Most people who participate in group exercise programs or use cardiovascular equipment on their own generally stay right around their anaerobic threshold for every workout, which is a good program for *maintaining* one's cardiovascular endurance level, but not for *improving* it. This is the most frustrating part of working out for many people. They come to the gym five times a week and seemingly work hard during each workout, but they don't see any improvement. One reason they don't improve is that they fail to let their bodies truly recover. They begin each workout tired and finish it tired, and they never have the energy or strength to do overload training in order to progress. Endurance workouts are good but they can't be done each day. To improve, clients must give their bodies proper rest.

Recovery is used in two ways: (1) to recover between each interval in a workout and (2) to recover between high-intensity workout days. At least once a week, clients should have an "active rest" day, on which they perform exercise that keeps them mostly in zone 1. In addition, once a week they should take a true recovery day, when they do no exercise at all.

GOAL-ORIENTED PROGRAMS

As your clients improve their cardiovascular fitness, you can begin designing workouts based on specific goals. Most people overlook this aspect of cardiovascular training because they are too focused on burning calories or finishing up the 30 minutes they have programmed into the equipment. But you can design a group exercise workout or personal training session that has a specific goal, such as leg strengthening/toning or cardiorespiratory improvement. A goal-oriented workout of this kind would use the same three-zone system outlined in this article.

The programs described here should help you design some new and varied workouts for your clients. You could schedule a cardiorespiratory program one day, do a leg-strengthening/toning program another day, and fill in the rest of the week with endurance training in zone 2 and, of course, recovery days. The variety will help clients avoid boredom with "the same old routine"—and enable them to make noticeable progress toward their goals.

VO₂/METABOLIC TESTING

A VO₂/metabolic test can help determine precise training zones by providing a clear picture of an individual client's cardiovascular fitness, rather than by relying on a generic formula. A submax VO₂ test that takes the client to about 90 percent of max is followed by a 2-minute recovery interval. The test identifies the client's anaerobic threshold, peak interval zone and active-recovery period. This information helps you determine how hard you can safely push your client during interval training.

Once you have used the submax VO₂ test to pinpoint the client's training zones, you can take her heart rate at the different levels. During workouts, the client simply checks her heart rate to determine the right zone for each stage of interval training.

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RESOURCES

METABOLIC TESTING DEVICES

Cardio₂Tech, (480) 662-1724, www.cardio2tech.com

Chest M.I. Inc., www.chest-mi.co.jp/english/medicalE.htm

KORR Medical Technologies, (801) 483-2080, www.KORR.com

New Leaf, (888) 826-2751, www.newleaf-online.com

SensorMedics, (714) 283-2228, www.sensormedics.com/products/diagnostics/vmaxmetabolicanalysis.asp

HEART RATE MONITORS

Bodytronics, (770) 460-1205, www.bodytronics.com

FitSense, (508) 303-8811, www.FitSense.com

HeartZone, www.heartzones.com

Instapulse, (718) 339-6212, www.healthchecksyste.ms.com

Nike, (800) 344-6453, www.nike.com

Oregon Scientific, (800) 853-8883, www.oregonscientific.com

Physi-Cal Enterprises, (877) 566-INFO, ext. 4636, www.gophysical.com

Polar Electro Inc., (800) 227-1314, www.PolarUSA.com

Reebok, www.reebok.com