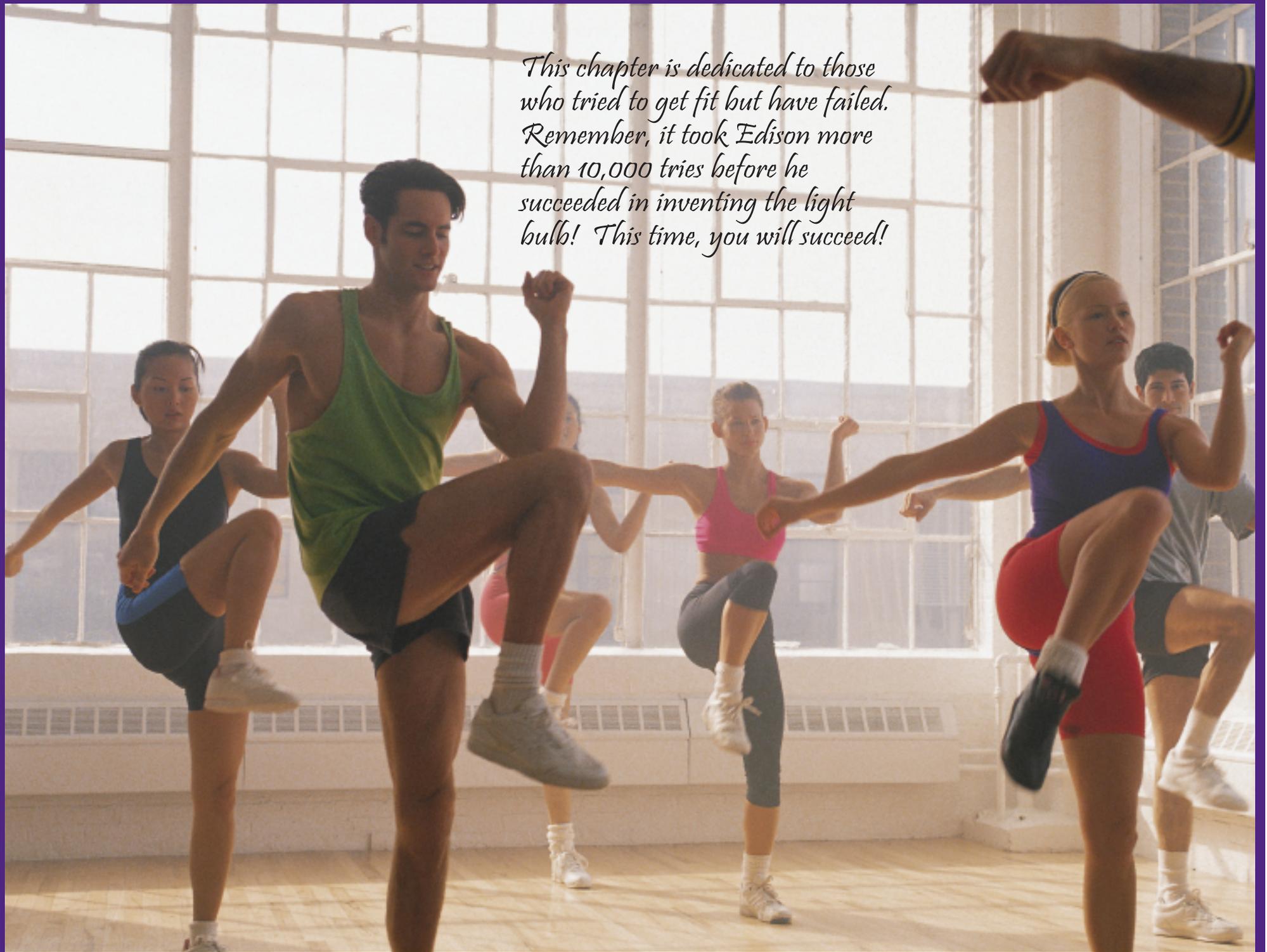


This chapter is dedicated to those who tried to get fit but have failed. Remember, it took Edison more than 10,000 tries before he succeeded in inventing the light bulb! This time, you will succeed!



The benefits of aerobic training sound like a litany of unbelievable claims from preventing disease to retarding the aging process. But the fact is that people haven't biologically evolved into the couch potatoes of modern society. Our bodies still think that they're in the hunting and gathering stage of the caveman era and not the immobility stage of the technology era. Many of the diseases of modern times are diseases of immobility. Diabetes, cancer, heart disease and digestive problems, to name a few, are often due to the lack of mobility to which people have subjected their bodies.

According to the Surgeon General's report (Physical Activity and Health: A Report of the Surgeon General), 60% of Americans aren't physically active on a regular basis. The report recommends that all Americans engage in moderate physical activity for at least 30 minutes per day. During adolescence, physical activity declines dramatically. To make matters worse, only 25% of the students in high school were enrolled in physical-education classes in 1996. Because many schools have dropped physical education from their curriculums since then, this statistic has worsened.

It's important to note that physical activity and exercise are different. Physical activity is generally any movement that increases energy expenditure above resting levels or uses calories above resting levels. Exercise is

the planned, structured and repetitive bodily movement that's done to improve or maintain aerobic capacity, muscular strength, muscular endurance, flexibility, body composition or health. Exercise is making an appointment with "Dr. Fitness" 3-5 times per week. Physical activity will confer some health benefits while exercise can prevent some diseases and improve your overall health and well-being.

BENEFITS OF AEROBIC TRAINING

The benefits of exercise have long been known but it wasn't until the second half of the 21st century that the scientific evidence was presented. The close connection between exercise and medicine dates back to three Greek physicians: Herodicus (ca. 480 B.C.), Hippocrates (ca. 377 B.C.) and Galen (ca. 195 A.D.). The first printed book devoted to exercise was *Book of Bodily Exercise* by Christobal Mendez, a physician. Thus, the positive effects of exercise that are felt by many of the body systems – namely, the musculoskeletal, cardiovascular, respiratory, endocrine and immune systems – are well known and have been documented for longer than anyone is alive! Exercise isn't a fad, trend or new way to improve your health. It's well established in the literature and has been around for a very long time. The only thing that you must do to reap these benefits and get fit is to exercise – which means take action and move!

Chapter 3

Aerobic Training

Mary Jane Myslinski, P.T., Ed.D.
Associate Professor
The University of Medicine and
Dentistry of New Jersey
Newark, New Jersey





Physical activity is generally any movement that increases energy expenditure above resting levels or uses calories above resting levels. Exercise is the planned, structured and repetitive bodily movement that's done to improve or maintain aerobic capacity, muscular strength, muscular endurance, flexibility, body composition or health.

The benefits of aerobic training are extensive. But simply stated, aerobic training . . .

- **improves the efficiency of the cardiac system**
 - ❖ decreases resting heart rate
 - ❖ decreases blood pressure
 - ❖ increases the amount of blood being pumped per heart beat
 - ❖ decreases the amount of oxygen needed by the heart during an activity
- **improves the efficiency of the pulmonary system**
 - ❖ increases the amount of air that's inhaled during exercise
 - ❖ increases the exchange of oxygen and carbon dioxide during exercise
- **bolsters the function of the immune system, thereby decreasing some infections**
- **increases the ability of a muscle to use oxygen**
- **decreases fatigue**
- **assists with weight loss by decreasing body fat and shrinking fat cells**
- **slows the aging process**
- **maintains daily function**
- **prevents Type 2 diabetes**
- **improves the glucose control in Type 1**

and Type 2 diabetes

- **decreases mortality rates**
- **decreases the risk for certain diseases such as heart disease, colon cancer, osteoporosis, hypertension, obesity and stroke and may decrease the risk of breast, prostate and lung cancer**
- **reduces the risk of falling**
- **decreases anxiety and depression**
- **enhances feelings of well-being**
- **enhances performance of work, recreational and sport activities**

More and more research is still being done regarding the benefits of aerobic training. As the research is more refined, many more conclusive benefits will be known. Now is the time to start an exercise program, no matter how old or busy you are. The benefits far outweigh the excuses that one can find not to exercise. As "The Physician and Sportsmedicine Journal" states, "Exercise is Medicine." Thus, you should schedule your appointment with "Dr. Fitness" as soon as possible!

MEDICAL SCREENING

There are risks associated with exercise. The most common risk is that of incurring a musculoskeletal (muscle and joint) injury. However, you can reduce this risk by seeing a physical therapist for a musculoskeletal screening and progressing slowly in your

exercise program. The more serious ones – heart attack or sudden death – are more rare and occur primarily among sedentary individuals with heart disease. Evidence suggests that regular exercise provides protection against the triggering of cardiac arrest and heart attacks during vigorous exercise and at other times. Prior to starting an exercise program, there are specific screening guidelines that should be followed. Hopefully, this will lessen the risks that are associated with exercise. These guidelines are well established by the American College of Sports Medicine (a reputable, scientific council for exercise).

Generally, sedentary individuals who have a small risk can start a low-level walking program prior to clearance. A more vigorous program that's typical of aerobic training shouldn't be used until physician clearance is obtained. This is a great reason to get that physical that you've been delaying! Even if you're healthy (and, therefore, don't require a physician clearance) and join a fitness facility, it's very typical to receive an assessment by a member of its fitness staff.

GENERAL PRINCIPLES OF EXERCISE PRESCRIPTION

The exercise prescription is considered to be an art and a science. It's designed to enhance physical fitness, promote health and,

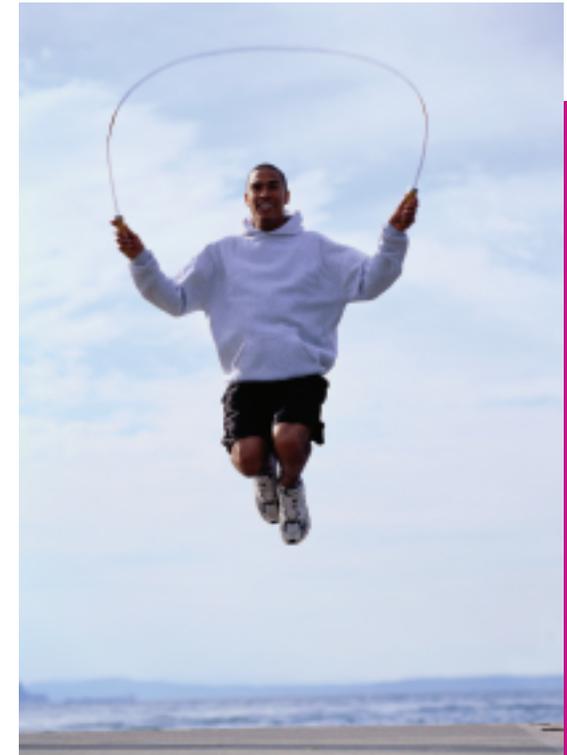
most importantly, ensure safety during exercise participation. The prescription described here is based on the best possible scientific evidence that's available. Be advised that this information only pertains to healthy individuals or those who are cleared by their physicians without further testing being required. Also understand that the prescription is only for the aerobic component of your program. It's imperative that the other components of physical fitness – such as flexibility training and strength training – be addressed in your overall exercise program.

PRINCIPLES OF TRAINING

While formulating the prescription, the basic principles of exercise training must be followed for effectiveness and safety. The principles of overload, specificity, individuality and reversibility must be applied to achieve the desired training outcomes. Let's take a closer look at these principles.

The Principle of Overload

The application of a load that enhances physiologic function to bring about a training response is called "overload." Appropriate overload is achieved by manipulating the frequency, intensity and duration of training. Overload focuses on the specifics of the prescription.



Aerobic training improves the efficiency of the cardiac system.



In general, 20-60 minutes of continuous activity is required to produce fitness benefits.

The Principle of Specificity

The adaptation in metabolic and physiologic functions that occurs as a result of the overload that's imposed is known as "specificity." The fact of the matter is that exercise outcomes are specific to the muscles and energy systems that are trained as well as the type of training. For example, if you only work your legs during aerobic training, you won't develop your arms; if you only do aerobic training, you won't develop your muscular strength. But the heart and lungs don't follow this principle. These two organs are generalists: They'll reap the benefits of training no matter what extremity you train or what equipment you use. Specificity focuses on the "how to" of goal achievement.

The Principle of Individuality

The individual variation in the training response is known as "individuality." This principle takes into account an individual's level of fitness and other specific factors in order to gear the prescription to that person's needs and capacities. Individuality reinforces the fact that everyone adapts to training in different ways and, therefore, achieves different outcomes.

The Principle of Reversibility

The detraining response that occurs rapidly when the overload is removed is called "reversibility." In a sense, it refers to "use it

or lose it." This principle focuses on the need for exercise compliance.

COMPONENTS OF A TRAINING SESSION

A training session has three phases: a warm-up phase, an endurance phase and a cool-down phase. For aerobic training to be safe and effective, these components must be followed.

The Warm-Up Phase

A warm up consists of 5-10 minutes of low-level activity. This can be walking, biking or simply using a lower level of the exercise intensity than that of your actual training. A warm up facilitates the transition from rest to exercise; it readies the body for the stress of exercise. This component will slowly increase various physiologic functions – including your heart rate, breathing rate and blood flow – to prepare your body for the increase in metabolism that occurs with exercise. A warm up can help to decrease the susceptibility of joint or muscle injury and prevent some of the serious complications that can occur with exercise. Stretching can occur during this component but only after your muscles are warm. Never stretch a cold muscle. Doing so increases the risk of injury from the micro-tearing of muscle fibers. Some research shows that stretching should

occur in the cool-down phase when the muscles, joints and tendons are warm and can be stretched easily. You shouldn't drive your car before you warm the engine. Likewise, you shouldn't exercise your body before you warm the muscles!

The Endurance Phase

The aerobic exercise session is the endurance phase. The duration of this phase should be about 20-60 minutes. It employs the continuous, rhythmic and dynamic activities that involve large muscle groups. (More will be discussed later regarding this component.)

The Cool-Down Phase

The final part of a training session is the cool-down phase. This provides a gradual recovery from a high metabolic state to one of resting. The cool down prevents some of the complications that can occur when a person abruptly stops exercising including dizziness, a quick decrease in blood pressure and skipped heart beats. The cool down also helps to restore the body to its pre-exercise state and allows for a quicker recovery. It consists of low-level activity such as walking for about 5-10 minutes. If desired, stretching can be done at that point since the muscles, joints and tendons are warm.

COMPONENTS OF THE EXERCISE PRESCRIPTION

The components of the exercise prescription correspond to the four principles of training that were discussed earlier. Here's a detailed look at overload, specificity and individuality:

Overload

The load at which you must exercise to achieve the benefits of aerobic training is overload. This can be broken down into three variables that are manipulated to bring about the correct overload: frequency, duration and intensity.

Frequency

Aerobic training should be done 3-5 days per week. Any less than three days will not produce significant fitness benefits; any more than five days can cause injury and will not increase the fitness benefits any faster. If you also wish to lose to weight, then you must exercise at least five days per week. Otherwise, doing aerobic training every other day is better to allow your body adequate time to rest/recover.

Duration

In general, 20-60 minutes of continuous activity is required to produce fitness benefits. Initially, you may need to progress to this duration by adding one- to two-minute rest periods





throughout the session so that you can achieve at least 20 minutes of activity. You may also start with three 10-minute bouts throughout the day. This will allow you to obtain the benefits with a duration that may be more suited to your ability. The important point to remember is that doing anything is better than doing nothing. Many exercise modalities put you in a seated position. Thus, you have no excuse not to exercise. If you can sit, you can exercise.

Intensity

Your exercising heart rate is a function of your intensity or effort. This is also known as the target heart rate (THR). It's the most important factor both for achieving fitness benefits and providing safety. Individuals need to determine their own THR for the endurance phase. At first glance, the formula looks complicated but it's actually very simple. It takes into account the Principle of Individuality because it uses your own resting heart rate. To determine the THR in beats per minute (bpm) for a 40-year-old individual who's sedentary, follow these steps:

STEP 1

To calculate the maximum heart rate (HRmax), use the formula $220 - \text{age}$. In this example, the individual's HRmax is 180 bpm [$220 - 40 = 180$].

STEP 2

To find the resting heart rate (RHR), a person should sit quietly for about 10 minutes and then count the number of beats for one minute. Ideally, this should be determined prior to getting out of bed in the morning; realistically, we all forget to do this. Let's suppose that the individual in this example has a RHR of 80 bpm.

STEP 3

Select a training intensity of about 60 - 90% of the HRmax. A person who's sedentary or hasn't exercised in some time should start with about 60% or less; a person who's been training for a while can use a level that's closer to 90%. Since the individual in this example is sedentary, let's choose an intensity of 60%.

STEP 4

Use this formula to calculate the THR: $(\text{HRmax} - \text{RHR}) \times \text{intensity} (\%) + \text{RHR}$. Staying with the ongoing example, the HRmax is 180 bpm, the RHR is 80 bpm and the intensity is 60%. Therefore, this individual has a THR of 140 bpm [$(180 - 80) \times 0.60 + 80 = 140$]. A range can also be used for the THR. Here, using an

intensity of 60 - 65% yields a THR of 140-145 bpm.

There are other methods that can be used but this is the most objective and based on the Principle of Individuality. Important point: For reasons of safety, don't exercise beyond your THR.

Specificity

This component takes into account the type of modality (or equipment) that you use or the part of the body that you train. Remember, your heart and lungs will respond to any type of aerobic training but there's no transfer of training between the arms and legs. If you do your aerobic training on machines, those that incorporate the arms and legs are best. This will not only burn more calories – since you're using more muscle mass – but will increase your ability to use oxygen more efficiently. If you're going to invest in a machine for your aerobic training, then find one that uses both the arms and legs and decreases the stress on your joints. One type of equipment that incorporates these factors is an elliptical machine. However, you must enjoy exercising on it. So, don't buy equipment because someone told you that it's great. Investigate for yourself and test out the equipment before you buy. Treadmills and bicycles can become expensive clothes hangers. And if you're just starting, many of the machines require high-level effort and

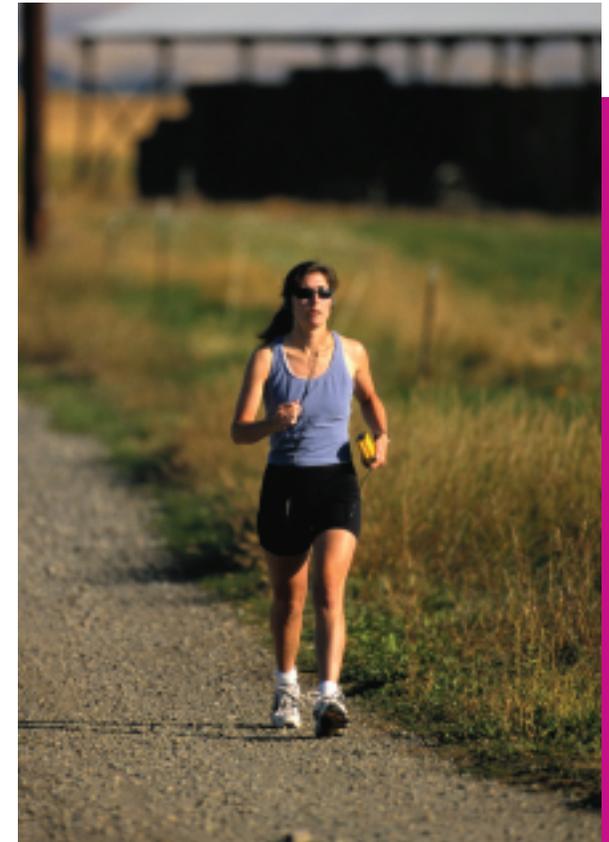
you may get discouraged because 20 minutes feels like an eternity. Recall, though, that rest periods are allowed and you now have a built-in goal to achieve.

Individuality

Everyone is different and, as a result, responds to exercise in a different way. Not everyone is able to start at the same level or achieve the same goals in the same time period. Most people will take about three months or more to achieve many of their goals. In fact, it can take 2-3 weeks before you notice any differences. It's important to understand that it took many years to get where you are now and change doesn't occur overnight. Besides, nothing that's achieved quickly is really worthwhile because the results are usually short-lived. Exercise is a life-long commitment – those appointments with “Dr. Fitness” should continue throughout your lifetime.

Other Considerations in the Prescription

An important consideration in the exercise prescription is progression. In terms of aerobic training, progress is based on your THR and your own ability to handle more demanding exercise. A goal might be to increase your THR by 5% every month until you reach a level of 90%. Or it might be to increase the duration of your workout by two minutes every week until you reach 30 minutes.





Some research has suggested that up to 90 minutes of exercise is needed to lose weight and/or maintain the weight loss. But you must also listen to your body. As you get older, you'll feel more wear and tear on your joints. Also, it's a good idea to change the type of modality that you use in order to train other muscle groups and rest those that you've been working.

Proper footwear and clothing are important considerations, too. Your footwear needs to be specific to your foot and the type of activity that you're planning to do. Sneakers without proper support will cause more injuries and keep you from exercising. In short, you need to invest in a good pair of shoes. In addition, your clothing should be comfortable and allow your skin to "breathe." Rubber garments shouldn't be worn. They promote fluid loss, not weight loss. After you re-hydrate, you'll put on all the "weight" that you lost. And these garments can be very dangerous, especially in hot, humid weather.

SAFETY CONSIDERATIONS

These are of the utmost importance. Here's a list – not at all inclusive – to make your aerobic training safer:

- **Get a clearance by a physician, if necessary.**
- **Obtain a screening by a physical therapist**

for musculoskeletal issues.

- **Develop an exercise prescription based on your levels.**
- **Avoid exceeding your THR and skill level.**
- **Practice proper nutrition and hydration before, during and after your workout.**
- **Avoid drinking alcohol before and/or after your workout.**
- **Refrain from exercising during the hottest part of the day.**
- **Let someone know your route if you exercise outside.**
- **Exercise in well-lit and safe areas.**
- **Be attuned to your surroundings and traffic.**
- **Keep identification with you at all times.**
- **Wear proper footwear and clothing.**
- **Don a hat and mittens in the winter to prevent frostbite.**
- **Refrain from exercising if you're ill or have a fever.**
- **Stop if you feel any abnormal symptoms.**
- **Purchase equipment that you like and will benefit you.**

CASE PRESENTATION

So, what does an exercise prescription look like? Suppose that a participant is a 40-year-old female who denies any health issues or orthopedic problems. Her goals are to get fit and lose weight. Presently, she's 30 pounds

overweight with a RHR of 90 bpm. She has never exercised and wants to purchase equipment for her house. She's very motivated and wants to get started now! An example of a proposed exercise prescription for her is shown in Figure 3.1.

THE BOTTOM LINE

As stated previously, people haven't evolved into couch potatoes. Exercise needs to be a part of your daily life. Fortunately, there are many ways to do this. Aerobic training confers many health and fitness benefits that other types of training don't. To achieve optimal results, it's imperative to balance your workout with aerobic training and strength training.

Remember, Rome wasn't built in a day. For most people, it'll take at least 2-3 weeks to achieve noticeable benefits. As you continue to do your exercise regimen, you'll achieve more benefits. But once you stop exercising, you'll gradually lose those benefits. Therefore, keep your appointments with "Dr. Fitness" and make fitness a priority

COMPONENT	NOTES
Frequency	5 days per week
Intensity	144-149 bpm (based on a maxHR of 180 bpm, a RHR of 90 bpm and an intensity of 60-65%)
Duration	20 minutes (not including brief rest/recovery periods, if needed)
Modality	dual-action bicycle (arms and legs) and/or elliptical machine (She tried both and likes them.)
Warm Up	5-10 minutes of low-level biking
Cool Down	5-10 minutes of low-level biking; stretching (Pilates style)
Progression	increase THR by 5% per month; increase the duration by 10-15 minutes per month; adjust the resistance on the machines to achieve the desired THR
Safety Issues	review the list on page 28 and add any others
Other	see a registered dietitian (R.D.) for weight loss and nutrition expertise (page 120)

Figure 3.1:
Example of an Exercise Prescription



in your life so that you have a long and healthy one. Good luck and get fit!



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