months and then to a maintenance phase from six months on. If you already have a higher level of fitness, you may shorten or skip the initial stage altogether. Keep in mind that you will make fitness gains more rapidly if you work out at the higher end of your intensity range (closer to 85 percent of heart rate reserve than to 50). After you reach the maintenance stage, your progress will slow unless you continue to overload yourself by increasing your exercise intensity, duration, frequency, or a combination of these. According to the overload principle of training, you must continue to challenge your muscles and cardiovascular system appropriately to have any further fitness improvements.

Resources for Active People with Diabetes

DESA

The original organization for active people with diabetes, the Diabetes Exercise and Sports Association (DESA, formerly IDAA), has as its stated mission to enhance the quality of life for people with diabetes through exercise and physical fitness. Their goals range from educating people about the benefits of physical activity, to creating opportunities for active people with diabetes to participate in recreational, sport, and athletic activities (through their local chapters), to promoting networking and forums for exchange of information, to acting as experts in diabetes and exercise.

Founded by Paula Harper in 1985, DESA has both local chapters throughout the United States and international affiliates abroad. To promote its goals, this organization holds annual educational conferences open to everyone in both North America and abroad. Their quarterly newsletter profiles diabetic athletes around the world and features stories about a variety of athletic endeavors. For more information, visit DESA's Web site at diabetes-exercise.org or call them at 800-898-4322.

COMPONENTS OF AN AEROBIC WORKOUT

Having reviewed what components you need to consider in your exercise program, you next need to consider what to include in each workout. An exercise session should consist of a warm-up, an aerobic exercise, and a cool-down (see figure 1.1). The warm-up and cool-down periods should consist of an aerobic activity similar to the one that you will perform as the main element of the workout but at a lower intensity, such as a slow jog before and after a faster run. A good warm-up comprises at least five minutes of an activity before the intensity is increased to meet the guidelines to improve aerobic fitness. An appropriate cool-down is five minutes of the same activity after the more intense activity.

Your workout session should also include a period of 5 to 10 minutes of static or dynamic stretching of the major muscle groups, the purpose of which is to facilitate movement throughout the full range of motion of each of your joints (which can be limited by aging-related changes in joint structures but worsened by elevations

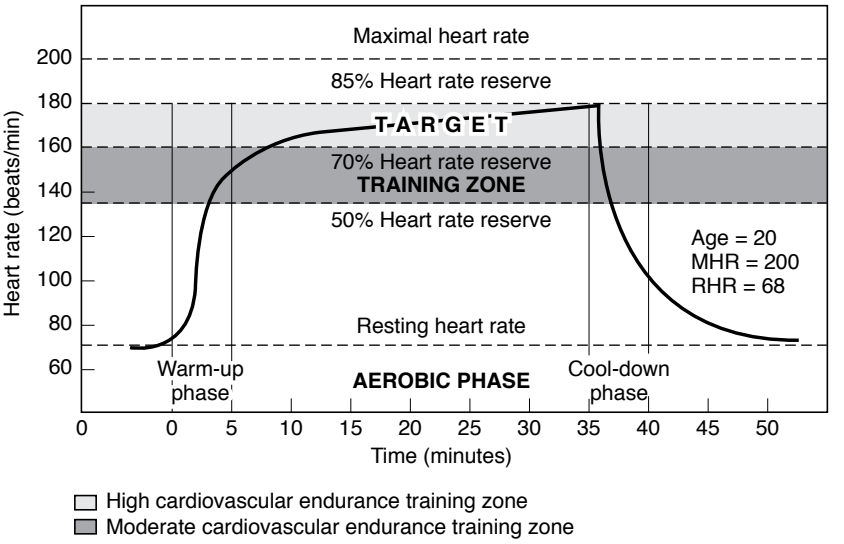

Figure 1.1 Example of an appropriate aerobic workout for a 20-year-old person with a resting heart rate of 68 beats per minute.

in blood sugar levels). You can stretch before and after exercise. The key in static stretching is to stretch to the point of discomfort, back off just a little bit, and then hold the stretch at that point for 10 to 30 seconds without bouncing. Bouncing elicits the muscles' stretch reflexes, and you may end up contracting the muscle or muscles that you are trying to relax. Stretching is usually easier after you have warmed up the muscles and joints and have increased blood flow to those areas, which is more the idea behind dynamic stretching. This type of stretching includes active movements like lunges, knee bends, and arm circles that work the full range of motion around your joints actively. Some studies have shown dynamic stretching to be more effective at preventing injuries than the more traditional static type.

People with diabetes form more glycated end products than people without diabetes do; that is, glucose molecules adhere to various structures in the body including cartilage and collagen, causing them to stiffen and lose their usual range of motion around joints. Although all people lose joint and muscular mobility with age, diabetes accelerates the usual loss of flexibility, especially when blood sugar levels are higher and greater glycation of bodily structures occurs. The result is that people with diabetes are usually more prone to overuse injuries such as tendinitis (inflammation of the tendons connecting muscle to bone) and diabetic frozen shoulder, a condition characterized by limited and painful movement of the shoulder (see chapter 7), and it may also take longer for joint injuries to heal properly if injured.

When you have diabetes, you must take the time to warm up, cool down, and stretch properly.

Thus, when you have diabetes, you really need to take the time to warm up for at least five minutes before your aerobic exercise session, cool down for five minutes, and stretch the major muscle groups involved in your activity either statically or dynamically. Diabetic people are at higher risk for heart disease and silent heart attacks, and proper warm-ups and cool-downs can help prevent cardiac arrhythmias (abnormal heartbeats) or sudden cardiac events during and following exercise. A proper cool-down is important as well to prevent blood from pooling in the extremities. You're more prone to dehydration when your blood sugars run above normal, especially while exercising in the heat. The reduced blood volume resulting from a combination of sweating and preexisting dehydration can cause fainting if you stop exercising abruptly without cooling down and allowing your body to redirect blood flow away from your muscles and back to your central circulation.

GETTING THE MOST OUT OF RESISTANCE TRAINING

Muscle-strengthening activities include a progressive weight-training program, weight-bearing calisthenics, stair climbing, and similar resistance exercises that use the major muscle groups. Ideally, you should do 8 to 10 exercises using your major muscle groups (in the upper body, thighs, and torso) on two or more nonconsecutive days a week. Some examples of traditional strength-training exercises are overhead (military) press, bench press, biceps and triceps curls, leg presses, leg extensions and curls, calf raises, and abdominal crunches.

You will definitely benefit from working on maintaining or increasing your muscular strength and endurance at least two days each week.

Your strength gains will be maximized by doing 8 to 12 repetitions of each exercise (usually 8 to 10 of them) until you're fatigued. If you are a novice at resistance work, you can start out with lighter weights or more flexible resistance bands that enable you to complete one or two sets of 12 to 15 repetitions on each exercise, but you should use enough weight or resistance to feel fatigued by the end of the last set. Although focusing on more reps using lower weights increases muscular endurance more effectively, lifting a greater resistance for fewer reps generally produces more of an overload on the muscle fibers and greater gains in muscular strength; consequently, all your muscle fibers will be engaged and increase in size faster, and you'll add more muscle mass. As a result, your muscles will then use more calories even at rest, your resting metabolism will increase, and your insulin sensitivity will improve.

The current recommendations don't state how many sets of repetitions you should do on each exercise. Previous studies showed that you can gain strength by doing only one set but that you'll likely gain more strength by performing two or three sets of each. Alternatively, when doing more than one set per exercise, you can increase the weight or resistance on each successive set, slightly decreasing the number of reps each time the load increases (for example, from 15 reps on the