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Developing Physical Fitness

After completing this chapter you should be able to:

- identify the fitness training principles and describe their characteristics;
- describe the components of physical fitness and motor ability;
- discuss the benefits of different types of fitness training activities;
- design a training program to meet specific fitness goals.



The health, joie de vivre, and creativity of a well-developed personality depend to a great degree upon general fitness levels. Fitness is your functional readiness and level of effectiveness that are required for everything you do. It involves the ability to adapt to the demands and stresses of daily life and is directly related to the amount and intensity of your physical activity. The term *fitness* is used in many ways and has many dimensions, including physical, emotional, social, and intellectual. The focus of this chapter is physical fitness.

Physical fitness is more than just a concept – it is a way of life that incorporates many components important for health, such as muscular strength, muscular endurance, cardiorespiratory endurance, flexibility, and body composition. Each of these components offers unique benefits and advantages that affect your health in a positive way. Engaging in physical exercise provides numerous benefits that help you control your weight, manage stress, and boost your immune system, as well as protect you against disease. Not only does exercise help you look and feel good, but it allows you to have fun while achieving a state of health and vitality. Fitness need not be boring and monotonous, or restricted to running and cycling; there are many options available, and all you need to do is discover what activities interest you most. Exercise is one of the most important, and indeed, most controllable, factors affecting your general health.

General physical fitness is of utmost importance to athletes who strive to achieve high

levels of performance. High levels of general fitness are important prerequisites for the effective and optimal development of sport-specific fitness. Both develop on the basis of the training principles governing exercise.

In order to get the most out of exercise and physical activity, you need an understanding of how to exercise properly and most effectively. This chapter will provide you with concepts related to components of fitness and equip you with basic knowledge governing training principles and their interrelationships.

Fitness Training Principles

Before we discuss the various components of physical fitness and the types of training activities, it is important to know something about the principles that govern training. A program that adheres to these well-established principles is more likely to generate the greatest improvements in your fitness level.

FITT Principle

The **FITT principle** is a simple method that can be used to help you recall the four important design elements of any training program: Frequency, Intensity, training Time, and Type of activity. Each of these components is described in more detail here.



The FITT Principle

The mnemonic FITT can be used as a simple method of recalling the four important design elements of any training program:

Frequency – How often should I train this component?

Intensity – How hard do I need to work to achieve a benefit?

Time – How long should I train for?

Type – What activities should I do?



Training Frequency

The number of times a person exercises each week is known as **training frequency**, which can depend on an individual's goals, abilities, fitness level, and sport. If the goal is to maintain an achieved level of fitness, two or three sessions per week are sufficient; however, if the goal is to improve physical fitness, four to six sessions are recommended.

Training Intensity

In order to achieve a fitness benefit or see an improvement, a person needs to work at a certain **training intensity**. This intensity level is measured differently for each physical fitness component. For instance, intensity in cardiorespiratory endurance training is monitored by measuring the pulse, or heart rate, with the goal of keeping the heart rate between 50 and 85 percent of the predicted maximum. Other measures of intensity include resistance to be overcome, number of repetitions, speed of movement, and percentage of maximum performance effort.

Another intensity consideration is the **work-to-rest ratio** (e.g., 1:2 – the rest phase is two times the length of the work phase). The rest phase allows for recovery from muscle fatigue. Generally, the lower the intensity of exercise, the shorter the rest periods required.

Training Time

The total time devoted to developing fitness is called **training time**, which is based on the duration of each training session. **Training volume**, another element of exercise time, is measured in various units depending on the type of activity. For instance, in cyclic movements (e.g., walking, running, swimming, kayaking, rowing), the total distance in one workout or several workouts over the course of one week represents the volume of training. For strength training, the volume may refer to (a) the total number of all repetitions of each exercise, (b) the total of all repetitions during a workout, (c) the total resistance moved, or (d) the number of times a circuit was completed.

Type of Activity

Choosing a type of exercise is also important. Physical activity can include **formal fitness activities**, where the development of fitness is the main goal (e.g., circuit training, group fitness classes, jogging, weight training), or **informal fitness activities**, which emphasize the social aspect of exercising – such as camaraderie, cooperation, and fun – as the main goal, with fitness being a by-product (e.g., pickup street hockey, social dancing, three-on-three basketball, mall walking).

Often the participant will determine whether an activity falls into the formal or informal category. One person may engage in pickup street hockey or mall walking to improve fitness, while another may participate in these activities to meet people and make new friends. It's important to set specific goals in order to maximize your training experience.

Overload Principle

For improvement to occur, training demands must be higher than normal performance requirements in order to stress the capacity of the targeted muscle or body system. This **overload principle** can be applied by increasing the frequency, intensity, or time of the exercise program.

How to Overload

One way to determine whether to increase the load is by judging the number of times a given weight can be lifted before causing fatigue. For example, if you start lifting 55 pounds (25 kg) 10 times and, after training for a length of time (two to five sessions), you can now lift the same weight 15 times, then to increase muscle strength, the load should be increased to what can be lifted maximally (until exhaustion) 10 times. This new weight will most likely be 65 pounds (30 kg). This ensures that the muscles are working in the overload zone and the “signals” that stimulate adaptation are being sent to the muscles.



Progression Principle

After a period of training, the load that previously created a level of stress will no longer provide an adequate overload stimulus. This stimulus is now a “normal” load, and to ensure that the muscles or systems continue to improve, the stimulus must be periodically increased. This is called the **progression principle**.

There are various ways to increase load, depending on one’s fitness level and the method of training used. Gradually increasing the training load, in small steps from one training cycle to another, is recommended for beginners and recreational trainees. An example is shown in the box *How to Overload*.

Reversibility Principle

Illness, injury, or even a short vacation can cause an unavoidable break in your training routine and schedule. While rest periods are necessary for recovery in between workouts, extended rest intervals like these can have a negative effect on fitness levels (see box *Use It or Lose It*). According to the **reversibility principle**, extended training interruptions can result in stagnation or a temporary decline in performance. Conversely, detraining effects can be reversed when training resumes. The length of the detraining period and the training status of the individual will dictate how much performance is lost during time off from training.

Use It or Lose It

Research has clearly shown that endurance athletes can lose up to 10 percent of their performance $\dot{V}O_2\text{max}$ following a one-week layoff from cardiorespiratory training. This illustrates the reversibility principle and emphasizes the need to use it or lose it!

Generally, cardiorespiratory and muscular endurance performance declines faster than maximal strength and power performance. Motor ability performance factors such as coordination and muscle integration also decline with training interruptions because these factors are all interrelated.



Specificity Principle

Specific activities and exercises cause specific physiological responses or changes. The **specificity principle** dictates that if you wish to improve a particular fitness or skill component, you must select a training modality that is as close in action as it can be to the end result.

Think of specificity in terms of the types of changes the body makes in response to training. Over time, your body becomes better able to meet the demands of a specific skill as it adapts to training. Stated another way, “What you do is what you get.”

When You Exercise for Performance, Be Specific!

- If you train arm strength by pushing with bent arms against immovable walls, you will become strong at pushing walls but not at doing push-ups, which require dynamic contractions.
- It makes little sense for basketball players to practise shooting at an 8-foot basket if they shoot at a 10-foot one in a game or for hockey players to practise shooting drills without a goalie in the net.
- If a person has to lift 50-pound boxes at work, it makes little sense to use a 10-pound resistance while training to improve work efficiency.
- Performing bench presses will not help you improve the endurance of your leg muscles.
- Sprinters will do themselves little good if they train by running long distances.



Components of Physical Fitness

Physical fitness incorporates various components important for general health that are essential for people of all ages and abilities (Figure 11.1). These components – muscular strength, muscular endurance, cardiorespiratory endurance, flexibility, and body composition – will be discussed in this section as they relate to achieving **health-related fitness**.

Muscular Strength



The ability of a muscle or muscle group to exert force against a resistance is known as **muscular strength**. The greater the muscle diameter, the greater the force it should be able to generate. Girls

and boys have similar levels of strength before puberty. Because of the influence of testosterone during and after puberty, however, males have the capacity to develop larger muscles and thus can generally develop greater strength.

In sports, the force generated by a muscular contraction may be applied against a movable object, as in weightlifting, or against a fixed object, such as the starting blocks in sprinting. If you think of sports that require great strength, the athletes that participate in these sports have large muscles. However in daily life, the average person needs only enough strength to manipulate his own body weight; lift and carry items such as a backpack, groceries, or children; or carry work-related items such as tools.

As discussed in Chapter 6, we can differentiate between absolute and relative strength. **Absolute strength** is the total force a person can apply in a single effort against a resistance: how much weight or mass she can move regardless of her weight or



Figure 11.1 The six major components of physical fitness.



Resistance Training Terminology

What is a set? What is a rep? What is resistance?

Resistance is the amount of mass you move. It can be your own body weight or the specific weight of a dumbbell, barbell, or weight machine (often based on a percentage of one repetition maximum, or 1RM).

Number of reps (repetitions) is the number of times you do a movement without stopping.

A **set** is one group of reps.

Example:

A student bench presses 100 pounds 12 times, rests 3 minutes, and repeats. This is recorded as 2 x 12 x 100.

mass. **Relative strength** takes the mass of the body into account and is calculated by taking the person's maximum (absolute) strength and dividing it by the mass of her body. For example, a fourteen-year-old girl who can do a chin-up can lift her own body weight. A year later, after gaining 10 pounds (5 kg), her upper body may be just as strong, but she may no longer be able to do a chin-up. She has maintained her absolute strength, but her relative strength has decreased.

Training Muscular Strength

It is important to give muscles time to adapt to training – normally at least 48 hours is required

between strength training sessions. It is during this time between sessions that optimal muscle adaptation occurs (i.e., increased size, or capacity to produce force) in response to the training challenge. If you prefer to work out every day, focus on training different body areas in each session. For example, you could train upper-body muscles on one day and leg muscles on the next day before returning to the muscles of the upper body. In general, for building maximum strength, the resistance should be high and the repetitions low.

Resistance or strength training can incorporate free weights, strength-training machines, body weight, medicine balls, and so on. It is important to overload the muscles by working at an intensity

Agonist–Antagonist Training

When planning training, care must be taken to include exercises that stimulate both the agonists (working muscles) and the antagonists (counteracting muscles; see discussion on muscle teamwork in Chapter 5). A program that focuses only on increasing agonist strength tends to shorten the agonist muscles and weaken the antagonist muscles. This results in a change in the proportion of strength between agonists and antagonists, which under normal circumstances is well balanced. This shift in strength equilibrium can result in impaired joint positions and make

articular cartilage and muscles (especially the tendons) prone to disease and injury.

Thus, a program that includes exercises to develop the biceps should also include exercises to enhance the triceps; trunk extensor training should be complemented with trunk flexor training. This approach to strength training is referred to as **agonist–antagonist training** (Figure 11.2).

To achieve a balanced development of strength, your strength program must ensure a balance between the training of agonists and antagonists.



Figure 11.2 Agonist–antagonist training can be done using free weights (A), partner-assisted exercises (B), or one's own body weight (C).

that makes it difficult to perform more than 8 to 12 repetitions per set. Generally, strength exercises must be repeated to muscular failure. For example, you can use a leg press machine, selecting a resistance that is about 75 to 80 percent of your 1RM and performing sets of 8 to 12 repetitions. However, if you can perform more than 12 repetitions, you are starting to work on muscular endurance rather than strength, and it is time to increase the weight resistance.

The variety of exercises and the respective order of exercises within a training session must also be considered. The variety depends on the overall

goal. Recreational athletes seeking to develop all-around strength of as many muscle groups as possible may train using more than 40 different strength exercises. Competitive athletes striving to develop strength capacities that are sport- or event-specific may find it necessary to perform only 3 to 5 exercises. Weightlifters customarily include 8 to 12 different exercises in their regular training programs. In comparison, bodybuilders use the greatest number of exercises by far in their training regimens, as they wish to target almost all the muscles of the body.

FITT Principle for Strength

Frequency – To allow muscle adaptation to occur, working out every other day is usually best unless the daily routines focus on different muscle areas.

Intensity – Generally, strength training requires relatively high resistance (i.e., 75 to 80 percent of 1RM) and low repetitions (8 to 12).

Time – The length of the training session is dependent on the number of sets and repetitions that are planned as well as the number of different exercises involved in the workout session.

Type – Examples include using free weights, body weight, strength training machines, and medicine balls.