



# Definition

## ➤ **Physical fitness:**

- It is considered a measure of the body's ability to function efficiently and effectively in work and leisure activities, to be healthy, to resist hypokinetic diseases, and to meet emergency situations.

## ➤ **General fitness:**

- It is a state of health and well-being.

## ➤ **Specific fitness:**

- It is a task-oriented definition based on the ability to perform specific aspects of sports or occupations.

# PHYSICAL FITNESS

is divided into five HEALTH-RELATED and six SKILL-RELATED components.



CARDIORESPIRATORY FITNESS

MUSCULAR STRENGTH

MUSCULAR ENDURANCE

FLEXIBILITY

BODY COMPOSITION

AGILITY

BALANCE

POWER

SPEED

COORDINATION

REACTION TIME

# MUSCULAR STRENGTH AND ENDURANCE

# Introduction

- Many people are under the impression that muscular strength and endurance are necessary only for athletes and those whose jobs require heavy muscular work.
- Actually, strength and endurance are important components of total physical fitness and have been shown to be essential to everyone.

- Adequate levels of strength enhance a person's health and well-being throughout life.
- Strength is crucial for top performance in daily activities such as sitting, walking, running, lifting and carrying objects, doing housework, and even enjoying recreational activities.
- Strength is also valuable in improving personal appearance and self-image, developing sports skills, and meeting certain emergencies in life in which strength is necessary to cope effectively.

- A strength-training program can have a impact on quality of life.
- As strength improves, so does the ability to move about, the capacity for independent living, and life enjoyment during the “golden years.”
- More specifically, good strength enhances quality of life in the following ways:

- It increases lean (muscle) tissue.
- It helps increase and maintain **resting metabolism**.
- It improves balance and restores mobility.
- It makes lifting and reaching easier.
- It decreases the risk for injuries and falls.
- It stresses the bones, thus preserving bone density, and decreasing the risk for osteoporosis.



# Muscular Strength and Endurance

- Muscular strength and muscular endurance are interrelated but the two have a basic difference.
- Muscular strength is the ability to exert maximum force against resistance.
- Muscular endurance (also called localized muscular endurance) is the ability of the muscle to exert submaximal force repeatedly over a period of time.

- Muscular endurance depends to a large extent on muscular strength and to a lesser extent on cardiorespiratory endurance.
- Weak muscles cannot repeat an action several times or sustain it for long.
- Keeping these concepts in mind, strength tests and training programs have been designed to measure and develop absolute muscular strength, muscular endurance, or a combination of the two.

# Determining Strength

- Muscular strength usually is determined using the **One Repetition Maximum (1 RM)** technique.
- Muscular endurance commonly is established by the number of repetitions an individual can perform against a submaximal resistance or by the length of time a person can sustain a given contraction.

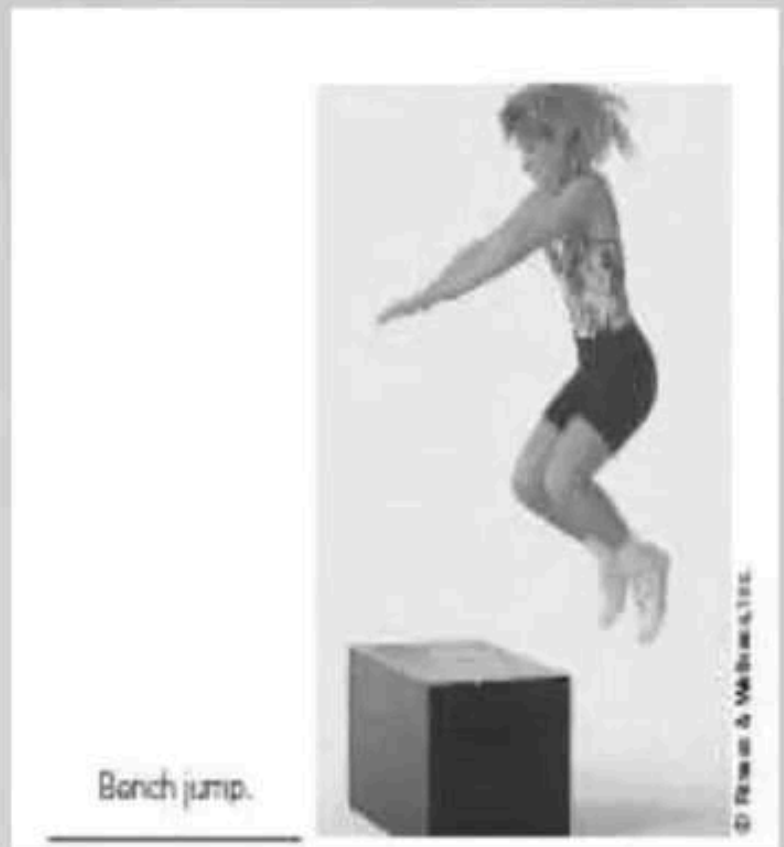
# Muscular Endurance Test

- Muscular strength and endurance are both required, and muscular endurance depends to a large extent on muscular strength.
- Accordingly, a muscular endurance test that uses three exercises to assess the upper body, lower body, and mid-body muscle groups have been selected to determine your level of strength.

- To perform the test, you will need a stopwatch, a bench or gymnasium bleacher, and a partner.
- The exercises conducted for this test are the Bench Jump, Modified Dip (men) or Modified Push-Up (women), and Bent-Leg Curl-Up.
- Individuals who are susceptible to low-back injury may do the Abdominal Crunch instead of the Bent-Leg Curl-Up test.
- All tests should be conducted with the aid of a partner.

# Bench Jump

- For the Bench Jump, use a bench or gymnasium bleacher, and attempt to jump up onto and down off of the bench as many times as you can in 1 minute.
- If you cannot jump the full minute, step up and down.
- A repetition is counted each time both feet return to the floor.



# Modified Dip

- The Modified Dip is an upper-body exercise that is done by men only.
- Using a bench or gymnasium bleacher, place your hands on the bench with the fingers pointing forward.
- Have a partner hold your feet in front of you.
- Bend your hips at approximately 90 degrees

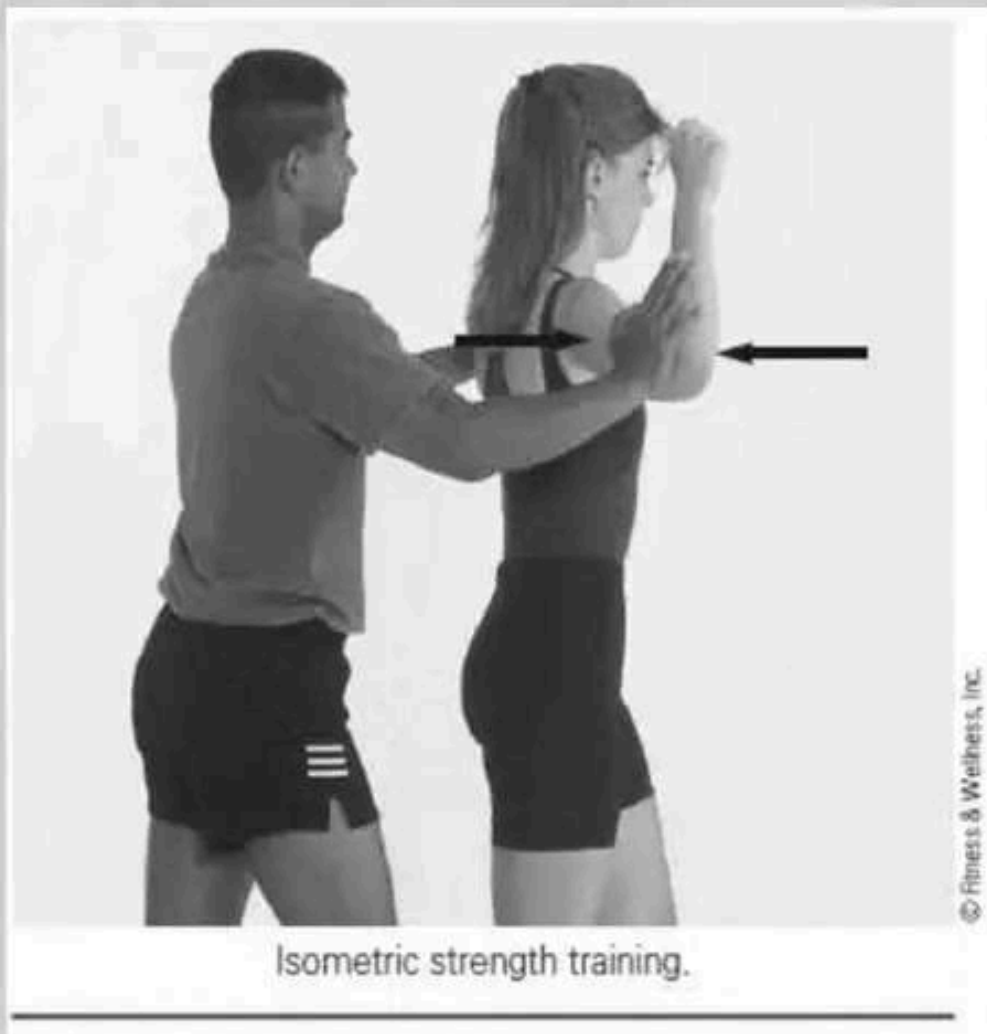
# Mode of Training

- Two basic training methods are used to improve strength: isometric and dynamic.
- **Isometric exercise** involves pushing or pulling against immovable objects.
- **Dynamic exercise** requires movement with the muscle contraction, such as extending the knees with resistance (weight) on the ankles.



## ➤ **Isometric training :**

- Strength gains with isometric training are specific to the angle of muscle contraction, this type of training remains beneficial in sports such as gymnastics that require regular static contractions during routines.



➤ **Dynamic exercise (previously referred to as isotonic exercise) :**

- **It can be conducted without weights or with free weights (barbells and dumbbells), fixed-resistance machines, variable-resistance machines, and isokinetic equipment.**
- When performing dynamic exercises without weights (for example, pull-ups, push-ups), with free weights, or with fixed-resistance machines, a constant resistance (weight) is moved through a joint's full range of motion.



Eric Roberg

Dynamic strength training.

## ➤ **Isokinetic and variable-resistance training :**

- These training programs require special machines equipped with mechanical devices that provide differing amounts of resistance, with the intent of overloading the muscle group maximally through the entire range of motion.
- A distinction of **isokinetic exercise** is that the speed of the muscle contraction is kept constant because the machine provides resistance to match the user's force through the range of motion.



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Isokinetic strength training.

- Because of the expense of the equipment needed for isokinetic training, this type of program usually is reserved for clinical settings (physical therapy), research laboratories, and certain professional sports.

- Dynamic training has two action phases:

- 1) **Concentric or positive resistance and**
- 2) **Eccentric or negative resistance.**

### 1) **Concentric or positive resistance :**

- In the concentric phase, the muscle shortens as it contracts to overcome the resistance.
- For example, during the bench press exercise, when the resistance is lifted from the chest to full arm extension, the triceps muscle on the back of the upper arm contracts and shortens to extend the elbow.



## **2) Eccentric or negative resistance :**

- During the **eccentric phase**, the muscle lengthens as it contracts.
- In the case of the bench press exercise, the same triceps muscle contracts to lower the resistance during elbow flexion, but it lengthens to avoid dropping the resistance.
- Eccentric muscle contractions allow us to lower weights in a smooth, gradual, and controlled manner.

- Without eccentric contractions, weights would be dropped on the way down.
- Because the same muscles work when you lift and lower a resistance, you should be sure to always execute both actions in a controlled manner.
- Failure to do so diminishes the benefits of the training program and increases the risk for injuries.

- The mode of training depends mainly on the type of equipment available and the specific objective of the training program.
- Dynamic training is the most popular mode for strength training.
- Its primary advantage is that strength is gained through the full range of motion.
- Most daily activities are dynamic in nature.
- We constantly lift, push, and pull objects, which requires strength through a given range of motion.

- Another advantage of dynamic exercise is that improvements are measured easily by the amount lifted.
- Benefits of isokinetic and variable-resistance training are similar to those of the other dynamic training methods.
- Theoretically, strength gains should be better because maximum resistance is applied through the entire range of motion.
- A disadvantage is that the equipment is not readily available to everyone.

- Plate-loaded barbells (free weights) were the most popular weight training equipment.
- Free weights require that the individual balance the resistance through the entire lifting motion.
- Thus, a logical assumption could be made that free weights are a better training modality because of the involvement of additional stabilizing muscles needed to balance the resistance as it is moved through its range of motion.

- The muscles do not know whether the source of a resistance is a barbell, a dumbbell, a Universal Gym machine.
- What determines the level of a person's strength development is the quality of the program and the individual's effort during the training program itself—not the type of equipment used.

# Resistance

- Resistance in strength training is the equivalent of intensity in cardiorespiratory exercise prescription.
- To stimulate strength development, the general recommendation has been to use a resistance of approximately 80 percent of the maximum capacity (1 RM).
- For example, a person with a 1 RM of 150 pounds should work with about 120 pounds ( $150 * .80$ ).

- The number of repetitions that one can perform at 80 percent of the 1 RM varies among exercises.
- The total number of repetitions performed at a certain percentage of the 1 RM depends on the amount of muscle mass used (bench press versus triceps extension) and whether it is a single or multi-joint exercise (leg press versus leg curl).
- In both trained and untrained subjects, the number of repetitions is greater with larger muscle mass involvement and multi-joint exercises.



- If a person is training with a resistance of 120 pounds and cannot lift it more than 12 times—that is, the person reaches volitional fatigue at or before 12 repetitions—the training stimulus (weight used) is adequate for strength development.
- Once the person can lift the resistance more than 12 times, the resistance is increased by 5 to 10 pounds and the person again should build up to 12 repetitions.
- This is referred to as **progressive resistance training**.

- From a general fitness point of view, working near a 10-repetition threshold seems to improve overall performance most effectively.
- We live in a dynamic world in which muscular strength and endurance are both required to lead an enjoyable life.
- Working around 10 RM produces good results in terms of strength, endurance, and hypertrophy.
- For older and more frail individuals (50–60 years of age and above), 10 to 15 repetitions to near fatigue may be more appropriate.

# Sets

- Strength training is done in **sets**.
- **For example, a person** lifting 120 pounds eight times performs one set of eight **repetitions (1/8/120)**.
- For general fitness, the recommendation is one to three sets per exercise.
- A recommended program for beginners in their first year of training is one or two light warm-up sets per exercise using about 50 percent of the 1 RM (no warm-up sets are necessary for subsequent exercises that use the same muscle group) followed by one to three sets per exercise.

- To make the exercise program more time-effective, two or three exercises that require different muscle groups may be alternated.
- In this way, a person will not have to wait 2 to 3 minutes before proceeding to a new set of a different exercise.
- For example, the bench press, leg extension, and abdominal curl-up exercises may be combined so the person can go almost directly from one set to the next.

- To avoid muscle soreness and stiffness, new participants ought to build up gradually to the three sets of maximal repetitions.
- This can be done by performing only one set of each exercise with a lighter resistance on the first day.
- During the second session, two sets of each exercise can be done: the first light and the second with the regular resistance.
- During the third session, three sets could be performed—one light and two heavy sets.
- After that, a person should be able to do all three heavy sets.

# Frequency of Training

- Strength training should be done either with a total body workout two or three times per week, or more frequently if using a split-body routine (upper body one day and lower body the next).
- After a maximum strength workout, the muscles should be rested for about 48 hours to allow adequate recovery.
- If not recovered completely in 2 or 3 days, the person most likely is overtraining and therefore not getting the full benefits of the program.
- In that case, a decrease in the total number of sets or exercises, or both, performed during the previous workout is recommended.

- Significant strength gains require a minimum of 8 weeks of consecutive training.
- After achieving the recommended strength level, one training session per week will be sufficient to maintain the new strength level.
- The frequency depends on the amount of resistance, number of sets performed per session, and the person's ability to recover from the previous exercise bout.

**FIGURE 3.3** Strength training guidelines.

Mode:	8 to 10 dynamic strength-training exercises involving the body's major muscle groups
Resistance:	Sufficient resistance to perform 3 to 20 repetitions to complete or near-complete fatigue (the number of repetitions is optional; you may use 3 to 6, 8 to 12, 12 to 15, or 16 to 20 repetitions)
Sets:	A minimum of 1 set
Frequency:	2 to 3 days per week on nonconsecutive days

Adapted from: American College of Sports Medicine, *Guidelines for Exercise Testing and Prescription*, (Baltimore: Williams & Wilkins, 2006).



STRENGTH- TRAINING PROGRAM	RESISTANCE	SETS	REST BETWEEN SETS*	FREQUENCY (WORKOUTS PER WEEK)**
General fitness	3–20 reps max	1–3	2 min	2–3
Strength athletes	1–6 reps max	3–6	3 min	2–3
Body building	8–20 reps near max	3–8	up to 1 min	4–12

\* Recovery between sets can be decreased by alternating exercises that use different muscle groups.

\*\* Weekly training sessions can be increased by using a split-body routine.

# **Strength-Training Exercise Guidelines**

- Select exercises that will involve all major muscle groups: chest, shoulders, back, legs, arms, hips, and trunk.
- Never lift weights alone. Always have someone work out with you in case you need a spotter or help with an injury. When using free weights, one to two spotters are recommended for certain exercises (bench press, squats, overhead press).

- Warm up properly prior to lifting weights by performing a light- to moderate-intensity aerobic activity (5 to 7 minutes) and some gentle stretches for a few minutes.
- Exercise larger muscle groups first, such as those in the chest, back, and legs. Then proceed to the smaller muscle groups (arms, abdominals, ankles, neck).
- Exercise opposing muscle groups for a balanced workout. If you work the biceps (arm curl), work the triceps (triceps extension).

- Perform all exercises in a controlled manner. Avoid fast and jerky movements, and do not throw the entire body into the lifting motion, which would increase the risk of injury and decrease the effectiveness of the exercise. Do not arch the back when lifting a weight.
- Perform each exercise through the entire possible range of motion.
- Breathe naturally, and do not hold your breath as you lift the resistance (weight). Inhale during the eccentric phase (bringing the weight down) and exhale during the concentric phase (lifting or pushing the weight up). Practice proper breathing with lighter weights when you are learning a new exercise.

- Avoid holding your breath while straining to lift a weight. Holding your breath greatly increases the pressure inside the chest and abdominal cavity, making it nearly impossible for the blood in the veins to return to the heart. Although rare, a sudden high intrathoracic pressure may lead to dizziness, a stroke, a heart attack, or a hernia.
- Based on the program selected, allow adequate recovery time between sets of exercises
- Discontinue training if you experience unusual discomfort or pain. Be sure to properly evaluate your condition before you continue training.

- Stretch out for a few minutes at the end of each strength-training workout to help the muscles return to their normal resting length and to minimize muscle soreness and risk of injury.

# Core Strength Training

- The trunk (spine) and pelvis are referred to as the “core” of the body.
- Core muscles include the abdominal muscles (rectus, transversus, and internal and external obliques), hip muscles (front and back), and spinal muscles (lower and upper back muscles).
- These muscle groups are responsible for maintaining the stability of the spine and pelvis.

- Many of the major muscle groups of the legs, shoulders, and arms attach to the core.
- A strong core allows a person to perform activities of daily living with greater ease, improve sports performance through a more effective energy transfer from large to small body parts, and decrease the incidence of low-back pain.
- A major objective of core training is to exercise the abdominal and lower back muscles.



- Besides enhancing stability, core training improves dynamic balance, which is often required during participation in physical activity and sports.
- Key core-training exercises include the abdominal crunch and bent-leg curl-up, reverse crunch, pelvic tilt, lateral bridge, prone bridge, supine bridge, seated back, and back extension.

- When core training is used in athletic conditioning programs, athletes attempt to mimic the dynamic skills used in their sport.
- To do so, they use special equipment such as balance boards, stability balls, and foam pads.
- The use of this equipment allows the athletes to train the core while seeking balance and stability in a sport specific manner.

# **Designing Your Own Strength-Training Program**

- If you have any concerns about whether your present health status will allow you to safely participate in strength training, consult a physician before you start.
- Strength training is not advised for people with advanced heart disease.

- The resistance, the number of repetitions, and sets you use with your program should be based on your current strength-fitness level and the amount of time that you have for your strength workout.

# Pilates Exercise System

- The exercises are designed to help strengthen the body's core by developing pelvic stability and abdominal control—coupled with focused breathing patterns.
- Pilates exercises are performed either on a mat (floor) or with specialized equipment to help increase strength and flexibility of deep postural muscles.
- The intent is to improve muscle tone and length (providing a limber body), instead of increasing muscle size (hypertrophy).
- The exercises are performed in a slow, controlled, precise manner.

- Properly performed, Pilates exercises require intense concentration.
- Initial Pilates training should be conducted under the supervision of certified instructors with extensive Pilates teaching experience.
- Fitness goals of Pilates programs include improved flexibility, muscle tone, posture, spinal support, body balance, low-back health, sports performance, and mind–body awareness.
- The Pilates program also is used to help lose weight, increase lean tissue, and manage stress.

# Contraindicated Exercises

- Most strength and flexibility exercises are relatively safe to perform, but even safe exercises can be hazardous if they are done incorrectly.
- Some exercises may be safe for you to perform occasionally but, when executed repeatedly, could cause trauma and injury.
- Preexisting muscle or joint conditions (old sprains or injuries) can further increase the risk of harm when performing certain exercises.

- **Contraindicated exercises may** cause harm because of the excessive strain placed on muscles and joints—in particular, the spine, lower back, knees, neck, or shoulders.



# **Tips to Enhance Compliance with Your Fitness Program**

- Set aside a regular time for exercise. If you don't plan ahead, it is a lot easier to skip. If you are too busy or your schedule too unpredictable, attempt to accumulate 30 minutes of activity daily by doing three separate 10-minute sessions.
- Exercise early in the day, when you will be less tired and the chances of something interfering with your workout are minimal.

- Select aerobic activities you enjoy. Exercise should be as much fun as your favorite hobby. If you pick an activity you don't enjoy, you will be unmotivated and less likely to keep exercising.
- Combine different activities. You can train by doing two or three different activities the same week.

- Wear the proper clothing and use equipment designed for exercise. A poor pair of shoes, for example, can make you more prone to injury, discouraging you from the beginning.
- Find a friend or group of friends to exercise with. Social interaction will make exercise more fulfilling.

- Don't become a chronic exerciser. Learn to listen to your body. Overexercising can lead to chronic fatigue and injuries.
- Exercise to music. People who listen to fast-tempo music tend to exercise more vigorously and longer. Using headphones when exercising outdoors, however, can be dangerous. Even indoors, headphones are not advisable. You need to be aware of your surroundings.

- Conduct periodic assessments. Improving to a higher fitness category is a reward in itself.
- Listen to your body. Stop exercising if you experience pain or unusual discomfort. Pain and aches are an indication of potential injury. If you do incur an injury, do not return to your regular workouts until you are fully recovered. You may cross-train using activities that do not aggravate your injury (for example, swimming instead of jogging).

- If a health problem arises, see a physician. When in doubt, it's better to be safe than sorry.
- Keep a regular record of your activities.

# Setting Fitness Goals

- As you prepare to write realistic fitness goals, base these goals on the results of your initial fitness test (pretest).
- For instance, if your cardiorespiratory fitness category was “poor” on the pre-test, you should not expect to improve to the “excellent” category in a little more than 3 months.
- Whenever possible, your fitness goals should be measurable and time-specific.

- A goal that simply states “to improve my cardiorespiratory endurance” is not as good as a goal that states “to improve to the ‘good’ fitness category in cardiorespiratory endurance by April 15” or “to run the 1.5-mile course in less than 11 minutes the week of final exams.”
- After determining each goal, monitor your progress toward your goal regularly. You also will need to write measurable objectives to accomplish that goal.
- A sample of objectives to accomplish the previously stated goal for development of cardiorespiratory endurance could be:



1. Use jogging as the mode of exercise.
2. Jog at 10:00 AM five times per week.
3. Jog around the track in the field house.
4. Jog for 30 minutes each exercise session.
5. Monitor heart rate regularly during exercise.
6. Take the 1.5-Mile Run test once a month.

- You will not always meet your specific objectives. If so, your goal may be out of reach. Reevaluate your objectives and make adjustments accordingly.
- Reconsidering your plan of action does not mean that you have failed. Failure comes only to those who stop trying, and success comes to those who are committed and persistent.