

The muscular system is made up of around 650 muscles and account for around half of the weight of our body. The muscular system of the body is what allows humans to move. It works together with the skeletal system and under the direction of the nervous system. It is the muscular system of the human body that enables us to move breath and digest food.

MUSCLE TYPES

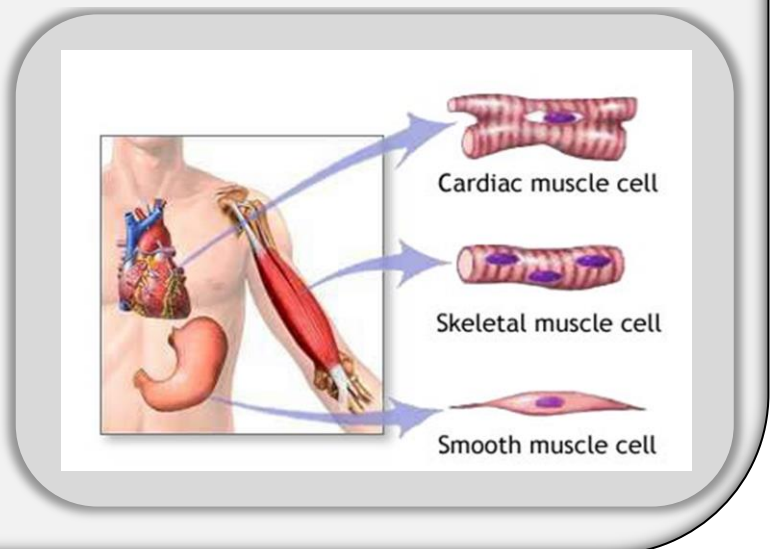
There are three types of muscles: smooth, cardiac, and skeletal. All have different structures and functions.

-Smooth muscle: It is often called *involuntary* muscles. These are muscles that you cannot control and that contract and relax automatically. They are found in the digestive and circulatory system (in arteries, veins, within the bladder, stomach and intestines).

-Cardiac muscle: It is also *involuntary*, and it is found only in the wall of the heart. It is constantly contracting and relaxing as the heart beats.

-Skeletal muscle: all of these muscles are attached to the skeleton. They are also called *voluntary or striated* muscles. Voluntary because we have control over them so that we can tell them when to contract or relax; striated because under a microscope they have a striped appearance.

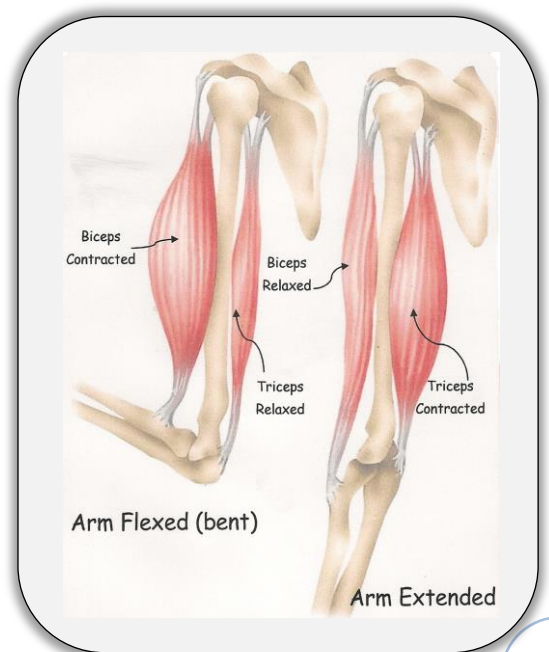
Skeletal muscle tissues have a profound influence on our physical capacity, physical appearance, metabolic function and injury risk.



HOW MUSCLES WORK

Skeletal muscles are attached to the bones of the skeleton by a piece of connective tissue called a **tendon**. When muscles contract, they pull on bones at a joint and sometimes cause movement. These muscles never work alone; they always work in pairs or groups. **When a muscle contracts** (get shorter), **another relaxes** (get longer).

We often describe these particular skeletal muscles by the work that they are doing. For example, a muscle that contracts and causes movement is called an **agonist**, the muscle that relaxes is called an **antagonist**. Muscles that help the action of the agonist are called **synergists**.



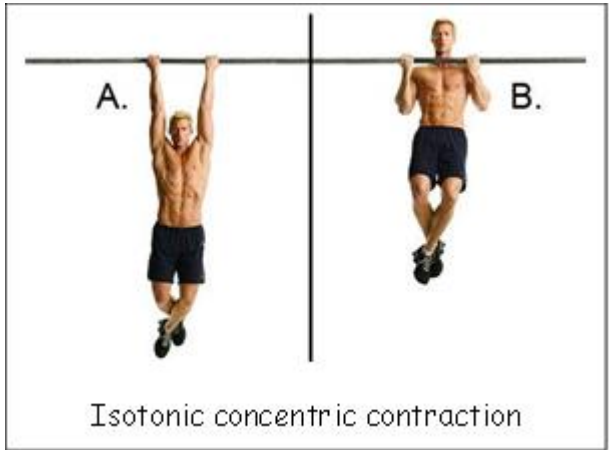
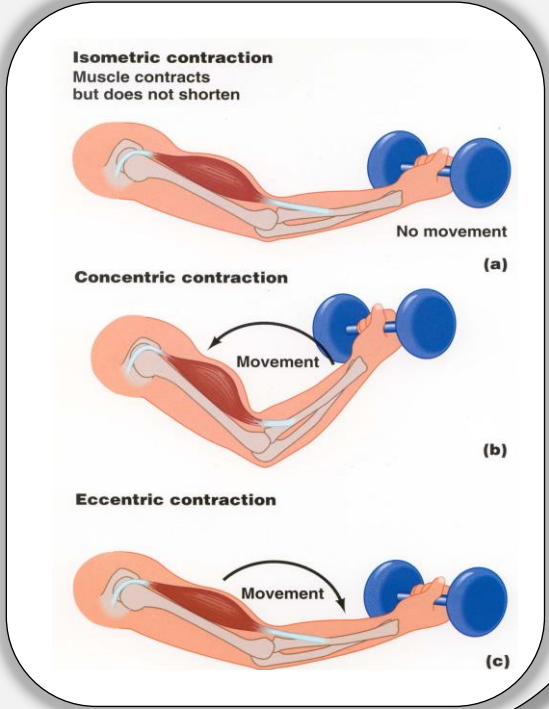
MUSCLE CONTRACTIONS

ISOMETRIC CONTRACTION: when the muscle fibers contract and stay the same length and the bones do not move. This type of contraction takes place, for example, in a rugby scrum or when the hands are pushed together.

ISOTONIC CONTRACTION: when the muscle fibers contract and the length of a muscle changes, so movement occurs. There are two types of isotonic contractions.

- **Concentric contractions** occur when the muscle shortens in length in order to make the bone move. These contractions occur when the body is working against gravity. For example - a bicep curl exercise. Concentric contractions are the most common type of muscle contraction and occur frequently in daily and sporting activities.

- **Eccentric contractions** are the opposite of concentric contractions. The muscle contracts but increases in length. This type of contraction occurs usually in the direction of gravity, to control a movement. For example, using the same biceps curl exercise - as the arm is slowly straightened from the bent position.



STRENGTH

The development of muscular strength is an essential component of fitness for anyone involved in a physical activity program. By definition, **muscular strength is the ability or capacity of a muscle or muscle group to exert a force against a resistance.**

Maintaining at least a normal level of strength in a muscle or muscle group is important for normal **healthy living.** You need strength:

- To increase work capacity.
- To decrease chance of injury.
- To prevent poor posture.



STRENGTH BENEFITS

PHYSICAL CAPACITY

Physical capacity may be defined as one's ability to perform work or exercise. Muscles utilize energy to produce movement and generate strength, functioning as the engines of our bodies. Specifically strength training increases the size and strength of our muscle fibers, resulting in a greater physical capacity to perform work strength exercise.

PHYSICAL APPEARANCE

Our physical appearance and capacity can be positively influenced by muscle gain or negatively influenced by muscle loss. Without an appropriate training stimulus, our muscles gradually decrease in size and strength (atrophy). Strength training is essential for preventing the muscle loss that normally accompanies the aging process.

METABOLIC FUNCTION

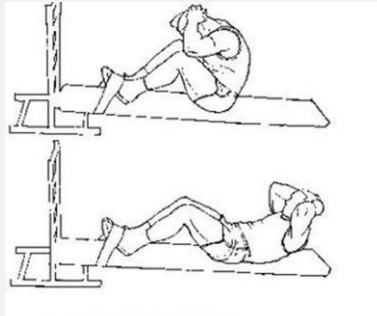
Muscle is a very active tissue with high energy requirements. Even while we sleep our muscles are responsible for 25% of our calorie use. An increase in muscle tissue causes a corresponding increase in our metabolic rate; likewise, a decrease in muscle tissue causes a corresponding decrease in our metabolic rate. Although our metabolism eventually slows down with age, this and other degenerative processes can be markedly delayed through regular strength training.

INJURY RISK

Muscles also serve as shock absorbers and balancing agents. Balanced muscle development reduces the risk of overuse injuries that result when one muscle group is much stronger than its opposing muscle group. *Jogging, for example, places more stress on the posterior leg muscles than the anterior leg muscles, creating a muscle imbalance that may cause knee injuries.* A strength-training program involving all of the major muscle groups may be the most effective way for reducing the risk of injury and many degenerative diseases.

TYPES OF STRENGTH

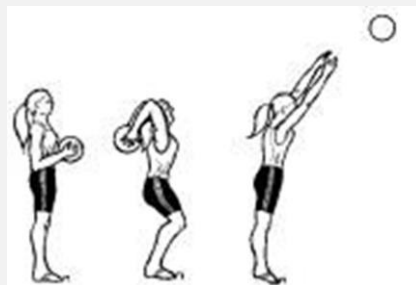
Dynamic strength or endurance strength: is the strength a person needs to sustain their body over a prolonged period of time, or to able to apply some strength against an object. Swimming, rowing and cross country skiing are muscular endurance exercises.



Maximal or static strength: is the ability to apply the maximum force in a muscular contraction. It's often measured in 1RM (one repetition maximum). Because it is a type of strength that requires moving the maximum weight, it is not recommended to young people. This is used when you try to move an immovable object or carry a heavy object.

There is no movement of the object. The muscles do not change length.

Explosive strength or speed strength: refers to the maximum amount of strength that can be applied in the shortest time. For example, jumping and throwing in athletics, hits in martial arts or batting in cricket or baseball are good examples of this type of strength.



PRINCIPLES OF TRAINING

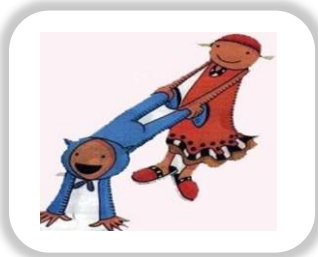
There are five main factors you must take into account when taking part in any form of training session. Each one of them has a specific effect on the body.

1. **Specificity:** The particular kind of activity or exercise you use to build up or improve certain body parts or skills. Training should be specific to a sport, to a physical component, to a person or to a part of the body.
2. **Overload:** Making your body work harder than normal in order to make it adapt to improve. The frequency, the intensity, the time of each session and the type of training or exercise are important to this type of training.
3. **Progression:** Increasing the overload gradually and safely. It is important to consider the starting level, age and the objective.
4. **Reversibility:** The loss of positive effects if you stop training.
5. **Peaking:** Making sure that you train to be ready for a particular event or activity.

HOW TO DEVELOP OUR STRENGTH

Strength training is a vital part of a balanced exercise routine that should include aerobic activity and flexibility exercises especially in teens. Because your bones, joints, and tendons are still growing and developing, it's easy to overdo it and strain or even permanently damage them if you only focus on strength training.

Self-charges: To work with your own body weight. There is a wide variety of different exercises you can do. When you do sit-ups, push-ups, pull ups, squats or any other exercise without any external weight you are working with self-charges.



Overloads: To improve muscle strength, we need to increase the weight with the exercise. If we don't, the muscle will adapt to the weight and it won't improve.

Work in pairs: To do exercises with another person's weight, you can do **transports** or exercises with the other's resistance.

This means that you try to do a movement and your partner stops it or tries to make it more difficult.

Light equipment: **Medicine balls** or **rubber bands**.

Weight training: The most used method and probably the most effective to improve all types of strength. The entire workout should be planned and supervised by a trainer. Because of its importance we will study it more.



Weight training: Most people who work out with weights typically use two different kinds: *free weights* (including barbells, dumbbells, and hand weights) and *weight machines*.

A set of exercises has to be completed in a prescribed order using weights. Each exercise will concentrate on a different part or muscle of the body. As training progresses, the weights can be made heavier and rest periods can be reduced.

The number of times you move the weights is called a repetition or rep. Each time you complete your repetitions is a set. The way in which you vary, or adjust, the number of sets and repetitions is the basis of any weight training session.

The general rule is that for the exercise to improve muscle tone you should use *light weights* but have a *high number of repetitions* for about *three sets*. For more *specific strength improvement*, which would include building up muscle bulk, you would choose *heavier weights* with a *small number of repetitions* and an *increased number of sets*.

Weight training methods make use of the specific ways in which muscles contract: Isotonic (to develop stamina as well as strength) and isometric (to develop mainly strength).

Advantages of weight training are that it is often a quick way to build up strength, can be adapted to suit most sports and can easily be carried out.

Types of strength	Weight	Sets	Rep	Rest time
Maximum strength	90-100%	4-6	1-5	3 min.
Explosive strength	60-90%	4-6	6-8	3-5 min.
Endurance strength	30-60%	3-6	12-30	30"-90"

Strength Training: Lower Body Exercises



Squat



Strength training lunge



Calf raise



Leg curl



Leg extension



Crunch

Strength Training: Upper Body Exercises



Bench press



Lat pull-down



Pull-up



Triceps extension



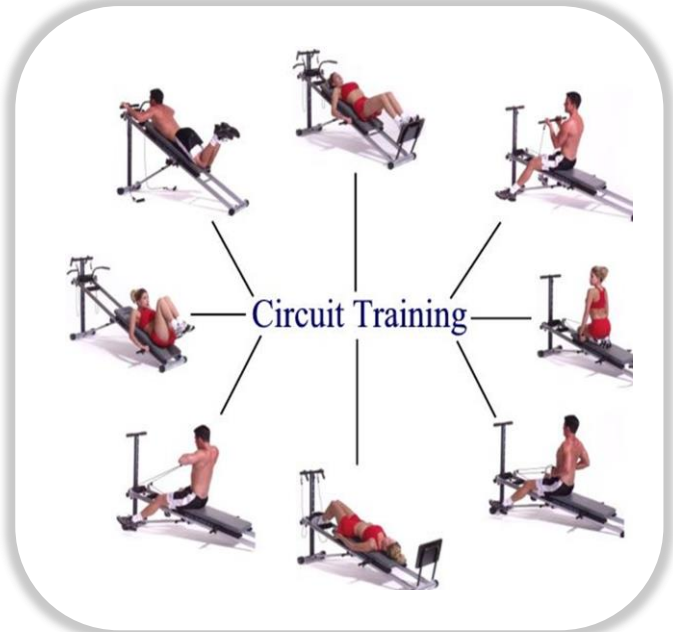
Dip



Curl

Circuit training. This method is one of the most common forms of training because various components of fitness can be worked on or improved such as endurance and explosive strength, stamina and speed. It is flexible and versatile. It consists of:

- A group of around **8-12 exercises**, completed one exercise after another. Both **aerobic and anaerobic activities** can be included.
- Each one of the exercises is performed for a specified number of **repetitions** (10 or 30) or for a prescribed **time** (10" or 30"), before moving on to the next exercise.
- The exercises within each circuit are separated by brief **rest intervals** (10" to 40").
- Each round of the circuit is separated by a longer rest period.
- The total **number of rounds** performed may vary between 2-6 depending on your training level (beginner, intermediate, or advanced) and your training objective.



Plyometric exercises are specialized and very intense training techniques, which are used to develop **muscular power or explosive strength**, referring to the relationship between strength and speed. Plyometric exercises include any exercise where the muscle is contracted eccentrically (stretched) then immediately moved concentrically (contracted). In order to produce results, the time between the eccentric contraction and the concentric contraction must be very short.

Lower body plyometric exercises include deep jumps, multiple jumps, marches and lateral jumps, often involving boxes or platforms, and weight vests.

Mid-section plyometric exercises include the broomstick twist, and twists, side-throws and sit-ups using a medicine ball.

Upper body plyometric exercises involve medicine ball exercises and different types of push-ups like push-ups with a clap in between each push-up.

