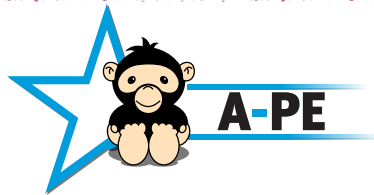


# A Healthy, Active Lifestyle and Your Muscular System



**Tendon of Insertion**

**Isotonic**

**Antagonist**

**Synergists**

**Fast-Twitch**

**Tendon of Origin**

**Antagonistic Pairs**

## Keywords

Muscles and Tendons

**Cardiac Muscle**

**Muscle Tone**

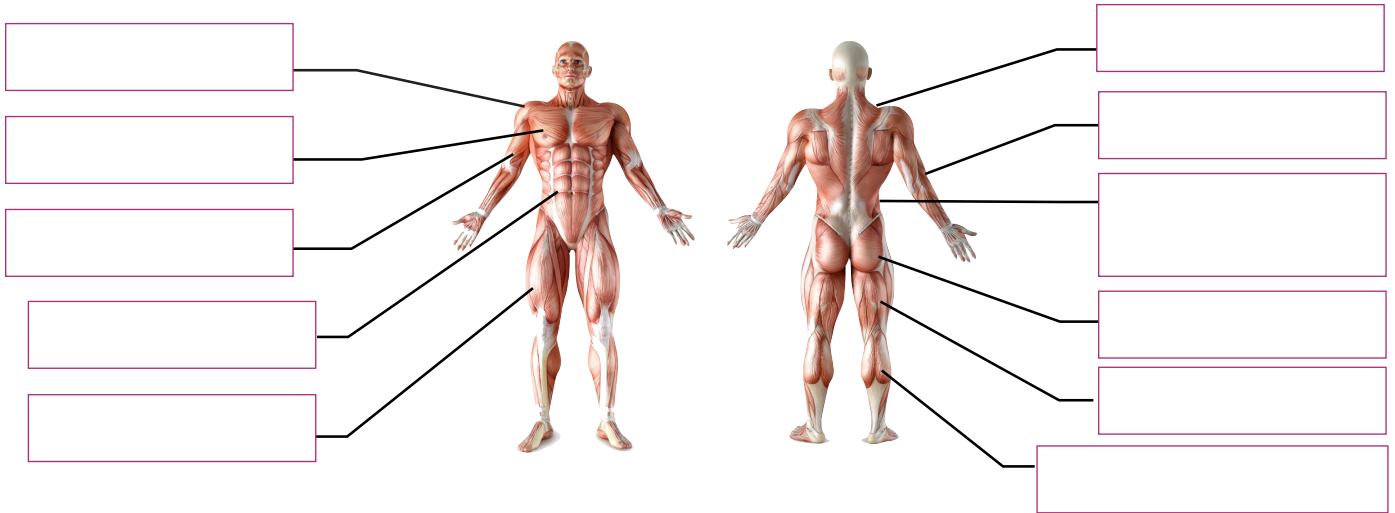
**Isometric**

**Voluntary Muscle**

**Slow-Twitch**



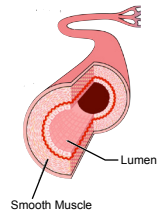
## 1. Muscular System



## 2. Types of Muscle

**Involuntary muscle** - Smooth Muscle that works without consciousness.

- a. **Arteries** - The walls of the arteries contract and push the blood along.
- b. **Stomach** - When the walls contract food is squeezed through the gut.



**Cardiac Muscle** - Smooth muscle that works **without consciousness** that **works non-stop** without tiring.

- a. Found in the **walls of the heart**.
- b. When it contracts it beats the walls **squeeze the blood along** the circulatory system.

**Voluntary Muscle** - Works under conscience control.

- a. **Skeletal muscle** attaches to bones by tendons called the origin and insertion.
- b. They create **movement** but they can only pull bones so they need to work in pairs.
- c. Voluntary muscles **tire** so they can only work for a limited amount of time.





## 3. Muscle Movement

Voluntary	Main Action
<b>Deltoid</b>	Flexion, extension, adduction and abduction at the shoulder
<b>Trapezius</b>	Rotation at the shoulder
<b>Pectorals</b>	Rotation and adduction at the shoulder
<b>Biceps</b>	Flexion at the elbow
<b>Triceps</b>	Extension at the elbow
<b>Latissimus Dorsi</b>	Adduction, extension and rotation at the shoulder
<b>Abdominals</b>	Flexion at the trunk
<b>Gluteals</b>	Rotation and extension at the hip
<b>Quadriceps</b>	Extension at the knee
<b>Hamstrings</b>	Flexion at the knee
<b>Gastrocnemius</b>	Extension (plantar flexion) at the ankle joint



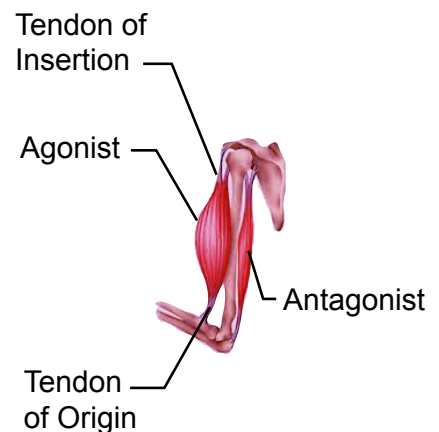
## 4. Antagonistic Pairs

Two good examples of antagonistic pairs are:

- a. Hamstrings and Quadriceps
- b. Biceps and Triceps

**Muscles can only pull so they have to work in pairs to create movement.**

- a. When the muscle contracts it **pulls on the moveable bone** attached by the **tendon of insertion**.
- b. It pulls **towards the tendon of origin** on the **fixed bone**.
- c. The **contracting muscle** is called the **prime mover** or **agonist**.
- d. The other muscle in the pair **relaxes** and this is called the **antagonist**.





- e. During movement other muscles called **synergists** contract to **support the contraction**.
- f. So during **muscle action** the **prime mover contracts** while the **antagonist** relaxes.

## 5. Types of Muscle Contractions

**Isotonic Contraction** - Muscle contraction that results in **limb movement**.

- a. This is the most frequent muscle contraction during **sports play**.
- b. When the **muscle contracts** it causes a **concentric movement**.
- c. When the **muscle relaxes** it causes an **eccentric movement**.
- d. **Training** your muscles **isotonically** improves dynamic (moving) strength, power and endurance.



**Isometric Contraction** - Muscle contraction with **no limb movement**.

- a. Despite contracting the muscle length stays the same.
- b. One muscle may contract isometrically to **stabilise a movement** so others can contract isotonically.
- c. Less sports require this muscle contraction but examples are **gymnastic handstand** or **rugby scrum**.
- d. Training isometrically provides **little improvements**.





## 6. Muscle Fibre Types

There are two different types of muscle fibre;



Slow Twitch	Fast Twitch
Contracts <b>slowly</b>	Contracts <b>quick</b>
Improved through <b>continuous training</b>	Improved through <b>interval training</b>
Uses <b>aerobic</b> energy	Uses <b>anaerobic</b> energy
Fatigues <b>slowly</b>	Fatigues <b>quickly</b>
Produces little <b>Lactic Acid</b>	Produces lots of <b>Lactic acid</b>
Suited to endurance sports	Suited to strength/ power sports



## 7. Immediate Affects of Physical Activity

### a. Increased energy demands.

- During increased muscle contraction more energy is required.

### b. More blood shunted to the working muscles.

- Blood is redirected from the digestive system to the muscles.

### c. Heart beat increases.

- Increased energy demand also results in an increased oxygen demand.

### d. Muscles fatigue.

- Insufficient oxygen and glucose delivery.

### e. Build up of lactic acid.

- Due to working anaerobically.

### f. Muscle soreness.

- Small muscle tears develop during contractions.

### g. Muscles produce heat.





## 8. Trained Muscles and Performance

### a. Increased Physical Performance

- Increase in **muscle size** and **bulk**.
- Increase in **strength**.
- Increase in **muscular endurance**.

### b. Decreased Risk of Injury

- Muscles act as **shock absorbers** so well conditioned muscles reduce the landing forces.
- More muscle around the joint helps **reduce joint injuries**.

### c. Increased number of capillaries surrounding the muscle.

- **More capillaries** surround the muscle.
- The muscle tissue can therefore receive more **O<sub>2</sub> and glucose**.

### d. Increase in metabolic efficiency.

- By increasing muscle size you **increase the body's engine** so you burn more calories.
- Your fuel burning engine is called your **Basal Metabolic Rate**.



## 9. Rest

**Rest** allows the body to recover in a number of ways and can take up to 48 hours.

- Allows the body to **recover** from **minor injuries**.
- Muscles** can **recover** from **stiffness** and soreness.
- Allows the muscles to **adapt** and improve.
- Allows for any lost **fluids** to be **replaced**.
- Gives time to **consume lost energy** and refill glycogen stores in the muscle and liver.





## 10. Muscle Tone

- Voluntary muscles **readiness to contract** or respond.
- Muscles have **slight tension** ready to be used.
- When muscles are **trained their tone increases**.
- The abdominal muscles tone helps with our **posture**.
- Posture** is important in **judged sports** such as trampoline and gymnastics as well as **preventing back problems** later in life.

## 11. Muscle Injuries

**Strain** - caused by a **tear or rupture in the muscle tissue** resulting in pain, swelling and bruising.

Strain should be treated with **R.I.C.E**

**Rest** - sit down or lie down and do not move.

**Ice** - cool the injured area by applying ice.

**Compression** - use a bandage to stop the swelling.

**Elevation** - Raise the joint higher than the heart to reduce the swelling.



**Sprains** - caused by **stretched or torn ligaments** from a sudden twisting movement.

**Rest** - sit down or lie down and do not move.

**Ice** - cool the injured area by applying ice.

**Compression** - use a bandage to stop the swelling.

**Elevation** - Raise the joint higher than the heart to reduce the swelling.



### Muscle Atrophy

- When we stop training our muscles can **shrink in size**.
- This especially happens when the limb is **restricted from moving** for a long period of time.
- This might happen when you break your leg and it is put in a **cast**.



## 12. Diet

**Protein** is the most important nutrient for muscle tissue.

**Why is it important**

- a. They **build muscle tissues** to make the body stronger.
- b. They **repair muscle tissue**.

**Sources of food**

- c. **Meat, eggs** and **nuts**.

**How much**

- d. **2 grams per kilo weight** to build muscle mass.
- e. **1 gram per kilo weight** for someone not aiming to gain weight.



## 13. Performance Enhancing Drugs

Athletes sometimes use banned substances to improve their muscle performance.

Type of Drug	Effect on Performance	Risks	Sports Used
<b>Narcotic-analgesics</b>	Painkillers mask the pain of injury.	Injuries become more severe, nausea, drowsiness, dry mouth and constipation	Used in all sports where injuries are sustained.
<b>Peptide hormones &amp; analogues</b>	They mimic the effect of naturally occurring hormones. Increase muscle strength and growth.	Allergic reactions, high blood pressure, abnormal growth in hands, feet and face.	Weight lifter to increase muscle mass.
<b>Anabolic Steroids</b>	Quick increase in strength. Able to train for longer.	Heart disease, high blood pressure, kidney and liver disease, infertility and aggression.	Strength and power related sports such as weightlifting and sprinting





## 14. Blood Doping

- a. The **higher** the **concentration** of **red blood cells** the **more oxygen** can be delivered to the working muscles.
- b. Long distance athletes such as **cyclists** and **marathon** runners may use this method.
- c. **Blood** is **drawn** from the athlete a few weeks before competition.
- d. The **red blood cells** are **separated** and **frozen**.
- e. **Just before** the **event** the red blood cells are **thawed** and **injected back into the athlete**.

