The Science of Health, Nutrition and Fitness

Skeletal Muscle Functions

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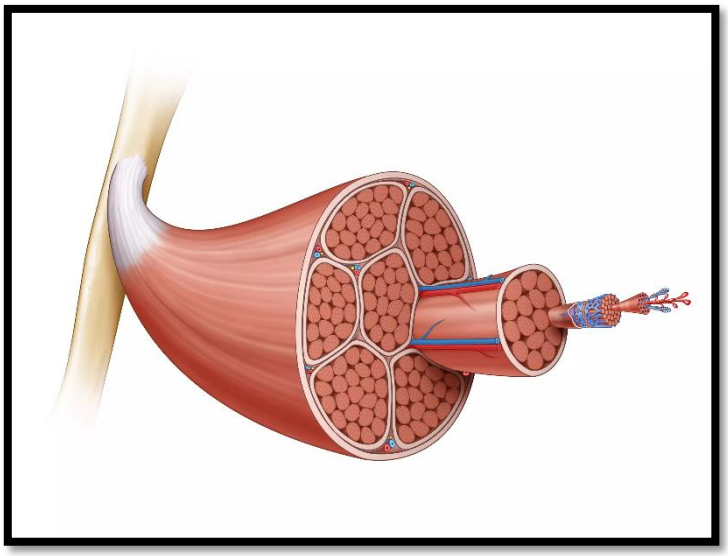
The human body has three identifiable types of muscle, all with specific functions. Cardiac muscle, found only in the heart walls, has the ability to contract independently of the nervous system and can continue to contract for the lifetime of the organism in which it resides. Smooth muscle, found in areas like the intestine walls and some blood vessels can change shape to allow 'movement' to occur. For example, smooth muscles drives the process of peristalsis. A movement of food throughout the intestinal tract.



The final muscle type is 'skeletal' muscle. This muscle type forms around 40% of the average human weight. Skeletal muscle is the muscle we associate with contraction and movement. It is the skeletal muscle we try and stimulate during resistance training.

This article will focus on skeletal muscle. Why it is instrumental in movement it also has other equally significant functionality. The functions we will address in this article are, force generation for movement, force generation for breathing, force generation for postural support, thermogenesis (heat production) and storage (glycogen).

Force Generation for Movement

Probably the most obvious of the many functions of the skeletal muscular system is 'production of movement'. Skeletal muscles attach to bones via connective insertions called tendons. The tendon fuses to the outer membrane of the bones and allow the muscles to pull on the bones as they contract. Where the muscle pulls over a joint, which is a form of lever, the bone on which it pull moves. For example, the Biceps Brachii, the agonist or prime mover, has its origins at its proximal end on the supraglenoid tubercle of the scapula (long head) and the coracoid process of the scapula (short head). It then inserts at its distal end on the radial tuberosity and the bicipital aponeurosis to the fascia on the medial side of the forearm. When the bicep contracts it pulls on its insertion point causing the bones located there to move. Therefore flexion of the elbow occurs.

Force Generation for Breathing

Breathing is a complex interaction of systems that has both active and passive components. The respiratory system involves actions of the ducts of inspiration and expiration, the trachea, bronchi and bronchioles. It involves the physiological action of diffusion at the alveoli. But also involved, are the

skeletal and muscular systems. The bones involved predominantly in breathing being the ribs. Bones that allow the thoracic cavity to increase and decrease in volume. That function is facilitated by a plethora of skeletal muscles including the sternocleidomastoid, external intercostal muscles, the diaphragm, the scalene, and the Pectoralis minor. These muscles interact to increase the volume of the thoracic cage. When this occurs the lungs inflate and inhalation begins. During hard exercise skeletal muscles also become involved in forced expiration including internal intercostal muscles, rectus abdominis and the transverse abdominis.

Force Generation for Posture

Every day we stand and sit without consciously contracting muscles. This maintenance of position is called posture and is in a sense 'involuntary' in nature. Posture is reliant on the non-conscious coordination of several groups of skeletal muscles. They all interact to aide in the postural process. The muscles that are involved in the postural process are the erector spinae muscles (Iliocostal, Longissimus Dorsi and the Spinalis muscles), Rhomboideus Major and Rhomboideus Minor and even the Gluteus Medius muscles. These muscles work with little conscious effort in a coordinated manner to facilitate standing and sitting.

Thermogenesis

The production of heat within the human body is an essential factor in the maintenance of homeostasis. Body temperature which is maintained at around $36.9^{O}C$ by the interaction of cardiovascular, integumentary and muscular systems is essential to the correct functionality of enzymes and other chemical within the body's environment. Heat is produced in the muscle by two main methods. Those being metabolic processes and muscular 'friction'.

Many chemical reactions take place within the cells of the skeletal muscles. The primary reactions that take place are concerned with energy provision. The raw energy chemicals found within the muscles, glycogen and ultimately ATP require several processes in order to break down the ATP and release its energy. These processes take place anaerobically and aerobically. Whenever any chemical reaction takes place one of the primary by-products created is heat. This heat production is instrumental in providing 'body heat'.

Friction is created when two surfaces 'rub' together. Within the human body muscle cells, muscles and other tissues rub together. This creates friction which then creates heat.

It is estimated that around 70% of body heat is created through skeletal muscular contribution.

Glycogen Storage

Carbohydrates are a primary source of anaerobic energy and valued source in the aerobic processes of energy production. Carbohydrates are stored in the body in two specific ways. Glucose, is found on the blood. Glucose is a simple sugar which is an important energy source. Carbohydrates can also be stored as glycogen, in the liver and in the skeletal muscles. Glycogen is a polysaccharide which forms glucose on hydrolysis. Glycogen is the primary fuel source in anaerobic glycolytic metabolism.

It can now be realised that skeletal muscle has a remit way beyond simply contraction and movement. It is a complex protein structure with many specific roles that all facilitate maintenance of the homeostatic environment of the body.