Study on introduction to strength training

WHAT IS STRENGTH TRAINING?

Strength training (also known as resistance training) is a type of exercise that causes your muscles to contract against an outside resistance.

The outside resistance can be from your body weight, weight machines, medicine balls, resistance bands or dumbbells.

WHAT ARE BENEFITS OF STRENGTH TRAINING?

1. **Increased Muscle Strength and Endurance:**

Strength training directly increases muscle strength, allowing you to lift heavier objects and perform daily tasks with greater ease.

2. **Improved Everyday Functionality:**

Exercises like squats, deadlifts, and bench presses target major muscle groups, enhancing your ability to perform everyday activities like walking, climbing stairs, and carrying groceries.

3. **Enhanced Metabolic Rate:**

Increased muscle mass from strength training boosts your metabolism, helping you burn more calories even at rest, which can aid in weight management and fat loss.

4. **Stronger Bones and Reduced Osteoporosis Risk:**

Strength training stresses bones, promoting bone density and reducing the risk of osteoporosis.

5. **Improved Heart Health:**

Strength training can improve heart function by making the heart pump more efficiently and reduce the burden on the heart.

6. **Reduced Risk of Chronic Conditions:**

Strength training can help manage symptoms of chronic conditions like arthritis, back pain, obesity, and diabetes.

7. **Enhanced Mental Well-being:**

Strength training has been linked to improved mental health, potentially reducing stress and anxiety.

8. **Improved Thinking Skills:**

Some research suggests that strength training may improve thinking and learning skills, especially for older adults.

9. **Improved Balance and Reduced Fall Risk:**

Strength training can contribute to better balance and reduce the risk of falls, which is important for maintaining independence as you age.

10. **Reduced Risk of Certain Cancers:**

Some studies suggest a link between strength training and a reduced risk of certain cancers.

11. **Improved Joint Health:**

Strength training can improve joint range of motion and reduce joint pain

BASIC MUSCLE PHYSIOLOGY:

v **Muscle Contraction:**

Muscle contraction is the shortening of muscle fibers, initiated by action potentials in motor neurons, leading to the release of neurotransmitters.

v **Muscle Fibers:**

Skeletal muscle is composed of muscle fibers, which are classified into two main types: slow-twitch (Type I) and fast-twitch (Type II).

v **Myofibrils:**

These are the contractile units within a muscle fiber, composed of repeating sarcomeres.

v **Sarcomeres:**

The basic unit of muscle contraction, containing thick myosin filaments and thin actin filaments that slide past each other to shorten the muscle

- **Actin:**

Actin is a globular protein that polymerizes into long, helical filaments called actin filaments. These filaments are known as the thin filaments in muscle cells.

- **Myosin:**

Myosin is a large motor protein that forms thick filaments. It has a head region that interacts with actin and a tail region that allows for filament formation.

v **ATP:**

Muscle contraction requires energy in the form of ATP (adenosine triphosphate), which is generated through various metabolic pathways.

v **Calcium:**

Calcium plays a crucial role in muscle contraction by binding to proteins that regulate the interaction between actin and myosin.

SLIDING FILAMENT THEORY:

In muscle contraction, myosin heads attach to actin filaments, forming cross-bridges. The myosin heads then move, pulling the actin filaments along the myosin filaments, causing muscle contraction. This process is driven by the hydrolysis of atp, which provides the energy for the myosin heads to move.

MUSCLE PHYSIOLOGY DURING STRENGTH TRAINING:

1. Muscle Fiber Activation and Contraction:

ü Strength training involves stimulating and recruiting muscle fibers, which are the basic units of muscle tissue.

ü These fibers contract by forming actin-myosin crossbridges, which shorten the muscle fibers and generate force.

ü The process is repeated for several repetitions until the muscles reach the point of failure.

2. Microscopic Damage and Repair:

ü When muscles are worked against resistance, microscopic damage, or microtears, occurs in the myofibrils within the muscle fibers.

ü These microtears initiate the body's repair response, which involves delivering nutrients to the muscle cells and stimulating the growth of more myofibrils.

ü The increased number of myofibrils causes the muscle fibers to enlarge, increasing their volume and size (hypertrophy).

3. Neuromuscular Adaptations:

Strength training leads to increased recruitment of motor units, improved coordination between muscles, and enhanced nerve impulse transmission.

4. Muscle Hypertrophy:

Resistance training causes muscle cells to increase in size (hypertrophy) by adding more structural proteins and myofibrils within the muscle fibers.

5. Increased Muscle CSA:

Strength training leads to an increase in the cross-sectional area of muscle fibers, resulting in larger and stronger muscles.

6. Hormonal Changes:

Weightlifting can trigger the release of hormones like testosterone and human growth hormone (HGH), which play a role in muscle repair and growth.

7. Connective Tissue Changes:

Strength training can also lead to changes in the connective tissue surrounding muscle fibers, making them more resilient and capable of supporting increased muscle mass.

8. Progressive Overload:

To continue making gains in strength and muscle mass, the intensity of strength training must be progressively increased over time.