

DETERMINATION OF MUSCLE FATIGUE LIMIT DURING ISOTONIC AND ISOMETRIC MUSCLE CONTRACTION

Aim:- The aim of this experiment is to make an estimate of the muscle fatigue limit by two separate methods.

Apparatus Required:-

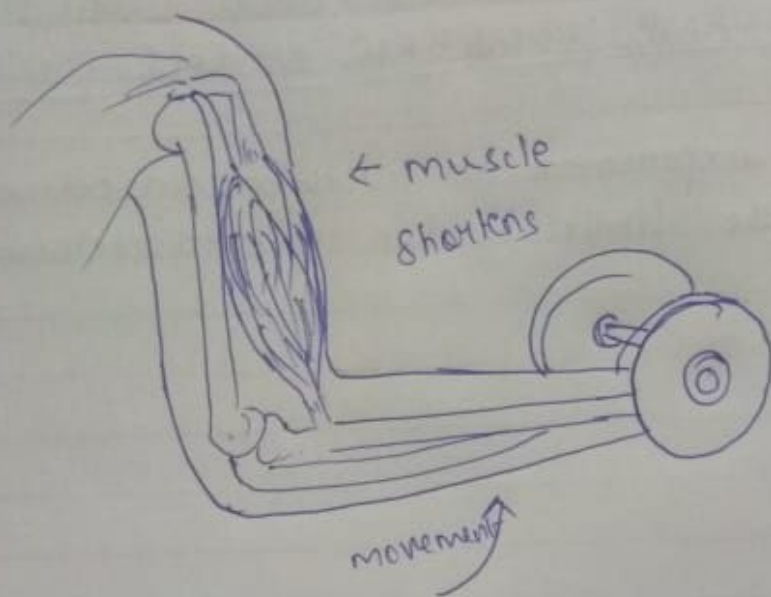
1. Weights
2. Stopwatch

THEORY:-

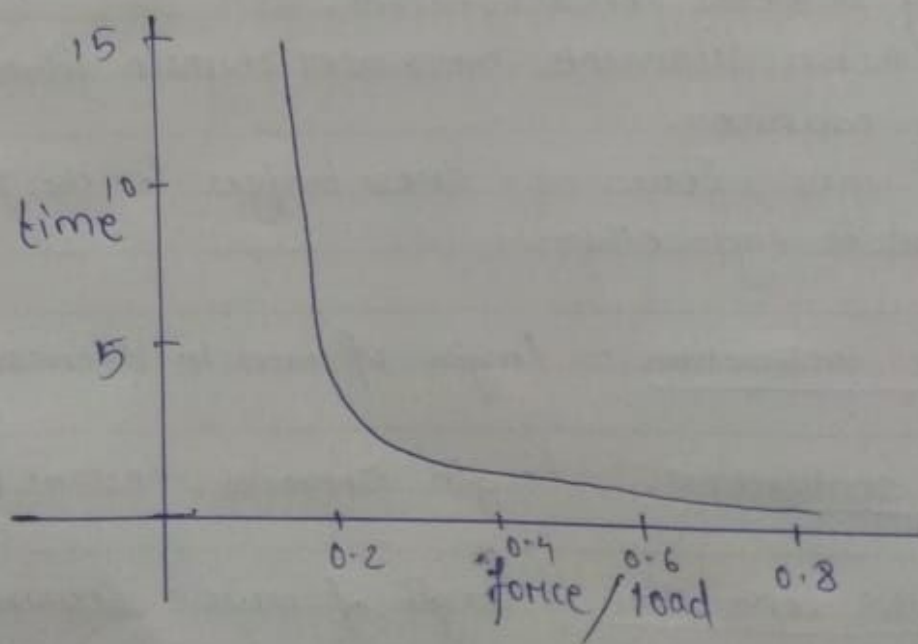
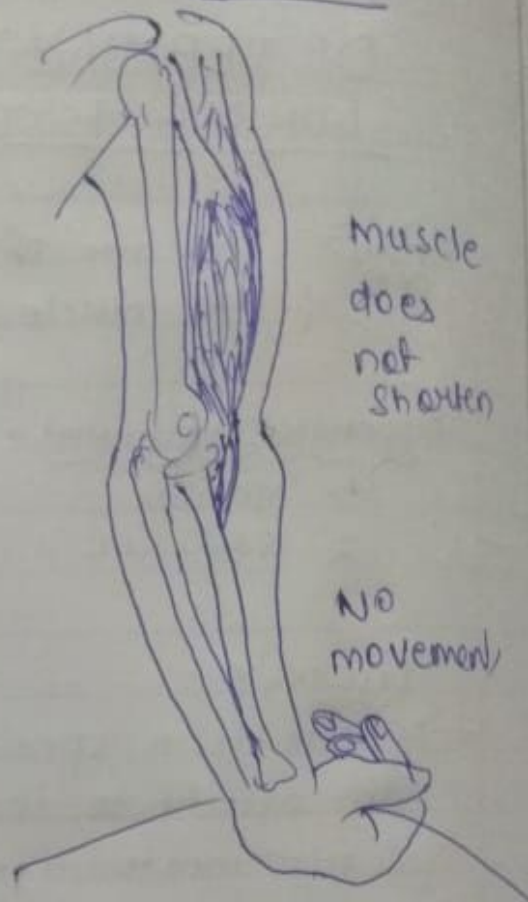
- Muscle is a special contractile tissue found in animals. The ability to change the length of muscle support a lot of movements like octopus movements and Aplysia peristaltic.
- Muscle contraction happen by changing the lengths of muscle according to needs for movement.
- Here actin filaments move over myosin filaments in a sliding manner.
- Ca^{2+} ions form as cross bridges for the filaments to bind to each other.

- Concentric contraction - length of muscle decreases. (flexion)
- Static contraction - length remains constant (flexed ^{force} ~~down~~)
- Eccentric contraction - length of muscle increases (extension)

Isotonic



Isometric



Time - Load graph.

- * A muscle can show movement only when shortened. The muscle increases length when it has to control the movement of a part attached to it. It has no motion when the muscle tension overcomes any external force.
- * During the joint's motion in the body, the muscle has to shorten. This is achieved through concentric contraction and muscle is called agonist.
- * Similarly, if it causes eccentric contraction, then it is known as antagonist muscle.

CONTRACTIONS

- Isotonic Contractions - These type of contraction happens only when the tension of the muscle is maintained irrespective of the change in length of muscle. This happens when maximal force of contraction exceeds the total load. It can be concentric/eccentric contraction.
- Isometric Contractions -
Unlike isotonic contraction, here the length remains same but the force is applied. These are found in hands and forearms. This happens when you hold an object in your hand or grip it. The joints and muscles are immovable but generates anti-gravity force.

OBSERVATION AND CALCULATION

(I) For isotonic contraction

Sl. No.	Load Applied (kg)	Number of flexion-extension cycles
1	6	10
2	4	19
3	2	62
4	1	140

(II) For Isometric Contraction

Sl. No.	Load Applied (kg)	Time taken to reach muscle fatigue (s)
1	1	35
2	2	26
3	4	9
4	6	2

PROCEDURE

Isotonic

- Ask a subject to hold a weight with fully extended arm.
- Then ask him to flex his arm and complete flexion.
- Repeat this flexion - extension until the hand is unable to lift load or reach muscle fatigue.
- Vary the load and repeat it.

Isometric

- Ask the subject to keep arm at 90° to horizontal and hold a weight.
- Load the arm with the weight & simultaneously start the stop watch.
- Measure the time interval till which he is able to hold the weight.
- Give him suitable break and then repeat it.
- Plot the $\frac{\text{No of cycles}}{(\text{Time})}$ - Loading data graph.

RESULT

The muscle fatigue limit was evaluated and suited by isotonic and isometric muscle contraction techniques.