MEASUREMENT OF CARDIOVASCULAR FITNESS

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FITNESS

A fit body has a defined shape, good posture and metabolism, high agility, quick reaction time, and strong stamina.

Fitness:

1. is the ability of the body to function properly during activity and leisure times.
2. is the ability to protect the body from diseases caused due to leading a sedentary life.
3. is the ability to meet the physical and functional requirements during emergency situations.

Concepts

• **General Fitness** – a state of physical and mental health and well-being.

• **Specific Fitness** – a specific task or sport-oriented fitness.

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COMPONENTS OF FITNESS

There are 5 components of fitness, these are:-

1. Cardiovascular Fitness.
2. Muscle strength.
3. Muscle Endurance.
4. Flexibility.
5. Body composition

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CARDIOVASCULAR FITNESS

- The ability of the heart, lungs, and blood vessels to deliver oxygen to working muscles efficiently.
- It measures a rhythmic, dynamic activity at a moderate to high intensity for extended periods of time.
- The cardio exercises are great for burning calories, losing weight, and to improve the cardiovascular fitness.

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IMPORTANCE

1. Improves Heart Health
2. Increases Lung Capacity.
3. Enhances Stamina.
4. Aids in Weight Management.
5. Improves Blood Circulation.
6. Reduces Stress and Anxiety.

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PHYSIOLOGY

Heart Adaptations: The heart becomes stronger and pumps more blood per beat (increased stroke volume).

Blood Vessels: More capillaries form around muscles, improving oxygen supply.

Lungs: Oxygen exchange efficiency improves due to increased alveolar surface area.

Muscles: Mitochondria (energy-producing units) increase, enhancing aerobic metabolism.

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FITNESS TEST

Test Name	Description	Suitable For
Step Test	Step up and down for 3 minutes, measure heart rate recovery	General Population

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MEASUREMENT OF CARDIOVASCULAR FITNESS

VO_2 Max (Maximum Oxygen Uptake)

- VO_2 Max represents the maximum amount of oxygen (ml) the body can use per kg of body weight per minute
- It is the best indicator of cardiovascular fitness.
- Measured in ml/kg/min.

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STEP TEST

1. It is a widely used method to evaluate cardiovascular fitness by measuring how quickly the heart rate recovers after exercise.
2. It is widely used in fitness assessments, health screenings, and rehabilitation programs.
3. Regular aerobic exercise can help improve Step Test performance and overall heart health.
4. It is done in two ways:
   a) 12 inch (Queens College Step Test).
   b) 16 Inch (Harvard Step Test)

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OBJECTIVE

To assess how ef ciently the heart recovers after stepping up and down on a platform at a set pace for a fixed duration.

A lower post-exercise heart rate indicates **better cardiovascular fitness**.

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EQUIPMENT REQUIRED

1. A sturdy step or bench (Height: 12 inches or 16 inches, depending on the protocol used)
2. A stopwatch or timer.
3. A metronome or pre-recorded audio (for maintaining stepping rhythm)
4. A heart rate monitor (optional) or manual pulse measurement

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STEP TEST PROCEDURE

1. **Warm-up:** Perform light stretching and a few low-intensity movements.
2. **Step Rhythm:** Step up and down at a specific cadence for a set time. The most common step rate is:
    1. **Men:** 24 steps per minute (96 beats per minute)
    2. **Women:** 22 steps per minute (88 beats per minute)
3. **Duration:** Continue stepping continuously for 3 minutes.
4. **Post-Test Measurement:**
    1. Immediately after the test, sit down and rest for 1 minute.
    2. Measure heart rate for 15 seconds.
5. **Result Interpretation:** A lower recovery heart rate indicates better cardiovascular endurance.

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Queens College Step Test Protocol

Used for: General fitness assessments, school settings, and populations with lower fitness levels.

Step Height: 12 inches (30.5 cm)

Step Rate:

a) Men: 24 steps per minute (96 beats per minute)

b) Women: 22 steps per minute (88 beats per minute)

Duration: 3 minutes

Heart Rate Measurement:

- After stepping, sit down immediately.
- Measure pulse for 15 seconds

Estimation of VO_2 Max (ml/kg/min):

a) VO2 Max (Men)=111.33−(0.42×HR post-test).

b) VO2 Max (Women)=65.81−(0.1847×HR post-test).

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Example

MEN: A man completes the test and records a heart rate of 150 BPM after the test.

Formula: VO2 Max=111.33− (0.42×150)

VO2 Max=111.33−63=48.33 ml/kg/min

Interpretation: Good cardiovascular fitness

WOMEN: A woman records a heart rate of 140 BPM after the test.

Formula: VO2 Max=65.81−(0.1847×140)

VO2 Max = 65.81 - 25.86 = 39.95 ml/kg/min

Interpretation: Above average fitness

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16-Inch Step Test Protocol (Harvard Step Test)

Used for: Military, firefighters, athletes, and medical screening.

Step Height: 16 inches (40.6 cm)

Step Rate: 30 steps per minute (120 beats per minute)

Duration: Up to 5 minutes or until exhaustion

Heart Rate Measurement: Pulse taken at 1, 2, and 3 minutes after finishing.

Scoring Formula (Harvard Fitness Index):

Fitness Index = 100 X test duration(sec) / 2*×(HR at 1 min+HR at 2 min+HR at 3 min).

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SCORING & INTERPRETATION

Age-Based Norms for 3-Minute Step Test					
Age (Years)	**Excellent**	**Good**	**Average**	**Below Average**	**Poor**
18-25	<84 BPM	84-94	95-104	105-119	>120
26-35	<86 BPM	86-96	97-106	107-121	>122
36-45	<89 BPM	89-99	100-109	110-124	>125
46-55	<90 BPM	90-100	101-110	111-126	>127
56+	<91 BPM	91-102	103-111	112-128	>129

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VO_2 Max Classification for Adults			
VO_2 Max (ml/kg/min)	**Men (20-29 yrs)**	**Women (20-29 yrs)**	**Fitness Level**
>55	Excellent	Excellent	Elite Athletes
46-55	Very Good	Very Good	Highly Fit
36-45	Good	Good	Average Fitness
30-35	Fair	Fair	Below Average
<30	Poor	Poor	Low Fitness

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ADVANTAGES OF THE STEP TEST

1. Simple and inexpensive (requires only a step and stopwatch).
2. Can be performed anywhere (home, gym, clinic).
3. No need for complex equipment like treadmills or cycling ergometers.
4. Easy to administer for all age groups.

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LIMITATIONS

1. Not suitable for individuals with knee or joint issues.
2. Step height and cadence may not be ideal for all fitness levels.
3. May be affected by fatigue, coordination, and body weight

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Practical on 12 Inch Step Test



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