



# Assessing Cardiorespiratory Fitness In Terms Of Maximum Oxygen Uptake In Physiotherapy Student: An Observational Study

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## ABSTRACT

### Background:

Determination of cardiorespiratory fitness in terms of maximum oxygen uptake ( $VO_2\max$ ) is restricted to within the laboratory because of its exhausting and difficult experimental protocol. It is therefore desirable to find a simple procedure for evaluation of  $VO_2\max$  in population studies, especially in the field and in the absence of a well-equipped laboratory. Among various indirect protocols the Queen's College step test or QCT is the simplest one, but its applicability has not yet been explored in an Indian population. The aim of this study was therefore to assess the cardiorespiratory fitness level in physiotherapy student.

### Purpose:

To assess the cardiorespiratory fitness in physiotherapy students.

### Methodology:

A total of 117 student young adult male ( $n=63$ ) and female ( $n=64$ ) around age group of 18-25 was taken as convenient sample.  $VO_2\max$  was estimated using the protocol of queen's college step test. It is the simplest one and require minimal equipment to determine cardiorespiratory fitness in terms of maximum oxygen uptake.

### Results:

In present study it was found that mean value of  $VO_2\max$  for male was 46.755 ml kg/min and that of female was 37.707895 ml kg/min. Five participants two male and three females terminated the test.

### Conclusion:

From the study it was concluded that the male subjects fitted in the category of average cardiovascular fitness and female in below average cardiovascular fitness. Cardio-respiratory fitness was better in male subjects compared to female subjects.

### KEY WORDS

Queen's college step test, cardiorespiratory fitness,  $VO_2\max$

## **INTRODUCTION**

Cardiorespiratory fitness may be defined as the ability of the circulatory and respiratory systems to supply oxygen to the muscles to perform dynamic physical activity. Maximum oxygen consumption is a body's capacity to use oxygen. It is maximum amount of oxygen consumed per minute when the individual has reached maximum effort. It is expressed as millilitres of oxygen consumed per kilogram of body weight per minute. High cardiorespiratory fitness is associated with increase health benefits and it has been well established that individual who do moderate or vigorous intensity exercise have significantly lower risk of cardiovascular disease than inactive people.<sup>[1]</sup>

VO<sub>2</sub>max is often measured using predicted equation rather than direct measurement as it is cost effective and relatively easier.<sup>[3]</sup> It is best indicator of aerobic fitness. VO<sub>2</sub>max estimation by step test is one such test and is considered to be a practical field test for assessing individual aerobic fitness.<sup>[1]</sup> Step test are widely utilized form of cardiorespiratory fitness assessment because of the practicality of this technique. They are short in duration, require little equipment yet are easily portable and allow for assessment of large groups.<sup>[3]</sup> Among various indirect protocols, the "Queen's College step test" is the simplest and reliable. It predicts VO<sub>2</sub>max from recovery heart rate. The lower the exercise heart rate and the greater the rate of recovery, higher is the estimated VO<sub>2</sub>max.<sup>[1]</sup> There is need for the physiotherapy students to measure and analyse their cardiorespiratory fitness for their own benefit and improvement. For better productivity the students should be healthy and have good cardiorespiratory fitness. Good physiotherapist must be physically fit and mentally alert.

### **AIM:**

VO<sub>2</sub> max is the single best measure of cardio respiratory capacity and is considered as bench mark to quantify cardiovascular function capacity and aerobic fitness.

Aim of these study was to assess cardiorespiratory fitness in physiotherapy student.

## **METHODOLOGY**

**STUDY DESIGN:** This is an observational study.

**SAMPLING METHOD:** Random sampling method.

**SAMPLE SIZE:** 63 male and 64 female Physiotherapy students

**STUDY SETTING:** Government physiotherapy college, Ahmedabad

### **ELIGIBILITY CRITERIA:**

- **Inclusion criteria:**
- Healthy male and female between age group of 18- 25 years.
- Non smokers.
- **Exclusion criteria:**
- Student with acute or chronic illness
- Student on any medication
- Student with any recent injury.

**STUDY DURATION:** 4 weeks

**OUTCOME MEASURES:** CARDIO-RESPIRATORY FITNESS.

### **TOOLS AND MATERIALS:**

- Stopwatch
- Consent form
- Metronome
- 16.25 inch step stool
- Ball pen
- PAR-Q

**PROCEDURE:**

- Detail history of the subjects were taken.
- Subjects were selected on the basis of inclusion and exclusion criteria.
- PAR-Q was taken before the test.
- Height, weight, age and resting heart rate was taken prior to the test.
- Aim and purpose of the study was explained to the subjects.
- Procedure and termination criteria were explained before the test.
- Subjects were restrained for heavy lunch before 2 hours of test.
- Before the test subjects were instructed not to indulge in any activities.
- VO<sub>2</sub>max was indirectly calculated by the protocol of Queen's College Step test.
- Duration of the test- 3 minutes
- Step stool of 16.25 inches was taken.
- Metronome was set:
  - Males: 24 steps/min
  - Females: 22 steps/min
- Stepping was done for duration 3 minutes at the rate of 24 step/min in males and 22 steps/min in females.<sup>[2]</sup>
- After completion of test pulse rate was measured from fifth to twentieth second.
- 15 second pulse rate was converted into beats per minute and following equation was used to predict VO<sub>2</sub>max:
  - For males
    - $VO_2\max = 111.33 - [0.42 * \text{pulse rate}/\text{min}]$
  - For females:
    - $VO_2\max = 65.81 - [0.1847 * \text{pulse rate}/\text{min}]^{[2]}$

**Normal value of VO<sub>2</sub>max**

Gender	Age	Poor	Fair	Average	Good	excellent
Male	≤29	≤24.9	25-33.9	34-43.9	44-52.9	≥53
Female	≤29	≤23.9	24-30.9	31-38.9	39-48.9	≥49

**RESULTS**

Means and standard deviation of physical parameters and VO<sub>2</sub>max values of male physiotherapist is shown in **table 1** and female physiotherapy students is shown in **table 2**.

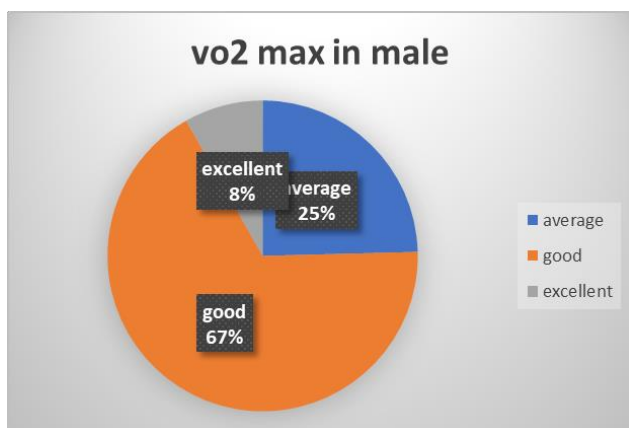
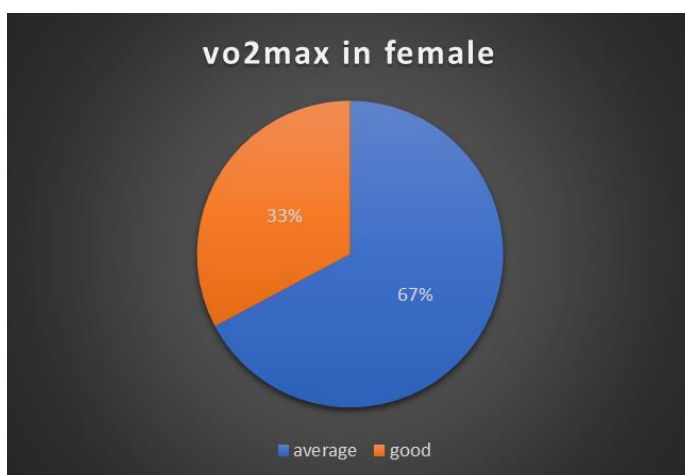
Table 1. Physical parameters and measured VO<sub>2</sub>max of male physiotherapy students

PARAMETERS	MEAN	STANDARD DEVIATION
AGE	20.80327869	0.206214478
HEIGHT	167.393	8.3218
WEIGHT	61.57377049	1.448092587
VO <sub>2</sub> max	46.755	5.076425574

Table 1. Physical parameters and measured VO<sub>2</sub>max of female physiotherapy students

PARAMETERS	MEAN	STANDARD DEVIATION
AGE	21.18333333	1.489985402
HEIGHT	157.3166667	6.140975649
WEIGHT	52	8.266739566
VO <sub>2</sub> max	37.707895	3.380107506

Measured VO<sub>2</sub>max values of male physiotherapy student is shown in figure 1. And female physiotherapy students is shown in figure 2.

Figure1. Measured VO<sub>2</sub>max range in male physiotherapy studentsFigure1. Measured VO<sub>2</sub>max range in male physiotherapy students

## DISCUSSION

An internationally accepted parameter, the maximum oxygen uptake [VO<sub>2</sub>max] to evaluate the cardio respiratory fitness reflects the amount of oxygen utilized by working muscles during maximal exercise.

- It is the best index of aerobic capacity and gold standard for cardio respiratory fitness. Thus measure of maximum oxygen consumption offer insight into ability of cardiovascular, respiratory and muscular system to deliver and utilize oxygen.

During exercise, up to a point the increase in oxygen consumption is proportionate to energy expended and all the energy needs are met by aerobic process. So in a person, the more is the maximum oxygen consumption capacity [VO<sub>2</sub>max], the more will be his/ her aerobic capacity.

Decrease in VO<sub>2</sub>max is therefore an indicator of reduced exercise capacity or tolerance. It is the product of maximum cardiac output and maximal arterio-venous oxygen difference. The reason for reduced VO<sub>2</sub>max in our subjects could be because of the decreased physical activity. Moreover due to stress academic stress and unhealthy lifestyle in physiotherapy students there might be decreased aerobic capacity observed.

## **CONCLUSION**

The result of the present study showed that mean value of VO<sub>2</sub>max for males falls in good range of cardiovascular fitness. The mean value of VO<sub>2</sub>max for female falls in average range of cardiovascular fitness. So there is need to add any activity in curriculum of physiotherapy which will improve their fitness level.

## **CONFLICT OF INTEREST**

There is no conflict of interest.

## **ABBREVIATIONS**

VO<sub>2</sub>max - Maximum oxygen uptake

QCT: Queens college step test

PAR-Q: Physical Activity readiness questionnaire

## **ETHICAL APPROVAL**

Ethical approval was taken.

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