Assessment of Cardiovascular Fitness Among Young Sedentary Adults Using 1600 M Walking Test

Aftab Begum¹, Lakshmi T², Syed Sadat Ali³*

¹Associate Professor, Department of Physiology, Basaveshwara Medical College, Chitradurga, Karnataka, India
²Assistant Professor, Department of Physiology, Mandya Institute of Medical Sciences, Mandya, Karnataka, India.
³Associate Professor, Department of Physiology, Sri Siddhartha Institute of Medical Sciences, T-Begur, Nelamangala, Bengaluru Rural, Karnataka, India

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*) Corresponding author:
drsadatali@gmail.com

ABSTRACT

Background: Cardiorespiratory endurance refers to the ability of the heart and lungs to deliver oxygen to working muscles during continuous physical activity, which is an important indicator of physical health. Physical activity is a complex multidimensional behaviour that is difficult to assess in free-living populations and for which a gold standard measurement does not exist. Thereby, we assessed cardiovascular fitness among young sedentary adults using 1600 M walking test.

Methods: The study participants were assessed for Pulse rate, Respiratory rate, Blood pressure and oxygen saturation at rest followed by 1st, 2nd, 3rd and after 5 minutes after 1600 M walking test.

Results: There were no significant changes in pulse rate, respiratory rate, blood pressure; both systolic and diastolic blood pressure, and oxygen saturation across both the genders after performing 1600 M walk at 1st 2nd and 5th minutes except significant changes for respiratory rate (P=0.03) & systolic blood pressure (P =0.02).

Conclusion: There is no single gold standard for estimating the cardiac endurance and fitness. It has to be assessed for Vo2 along with basic parameters and need to be repeated to validate the outcome and reduce the bias in case of aerobic exercises.
Introduction

Human evolution has been dependent on a physically active lifestyle supplemented with nutritional fortification. A physically active lifestyle is one of the 7 goals listed for ideal cardiovascular health in the 2020 American Heart Association impact goals. Physical activity is a complex multidimensional behaviour that is difficult to assess in free-living populations and for which a gold standard measurement does not exist. The 4 dimensions of physical activity include (1) mode or type of activity, (2) frequency of performing activity, (3) duration of performing activity, and (4) intensity of performing activity.

Cardiorespiratory endurance is an important aspect of health that affects a person's physical and mental activity. This is indicated by the absolute intensity determined by external work, while the relative intensity is determined relative to the individual's cardiorespiratory fitness level (VO2max). Walking, for instance, is often described as a moderate-intensity physical activity; however, the actual intensity for an individual may vary. Measures of physical activity derived from heart rate monitoring are typically time spent in physical activities at different intensity levels (eg, moderate and vigorous intensity).

Living environments in developed countries are characterized by low daily energy expenditure and an abundant and inexpensive calorie-dense food supply, making positive energy balance common. Numerous investigators have confirmed the strong link between physical activity and health in a variety of populations. There are major challenges to disentangling the complex multifactorial etiology of physical activity, adiposity and health outcomes. Lack of physical activity can have adverse effects and is often associated with chronic diseases, including heart disease, type 2 diabetes mellitus, hypertension, obesity, osteoporosis, depression, and breast and colorectal cancer.

As such, a variety of methods have been used to assess physical activity and these measurements have a broad range of accuracy, reproducibility, and feasibility. So, in this study we have used 1600 M walking test along with VO2 Max, Heart Rate and Respiratory rate to assess the cardiovascular endurance among the sedentary adults and compared it across the gender. We hypothesise that these above parameters collectively can be used to determine the cardiovascular endurance and validate the fitness of the individual.

Materials & Methods:

A Cross sectional study was conducted under the auspices of department of physiology among 188 male and 212 female study participants. Institutional ethical committee clearance & a written informed consent from the study participants were obtained.

The heart rate and blood pressure among the study participants were measured in seated position at rest before sending them for 1600 M walking test. This was followed by continuous heart rate monitoring and recording of blood pressure for every three minutes during the test. By using oximeter, “Pulse rate, Respiratory rate, systolic & diastolic blood pressure along with oxygen saturations were measured and recorded in the 1st, 3rd & 5th minutes after the test and before the test in both the genders”.

Statistical Analysis

The data was evaluated with the IBM SPSS Statistics 16.0 to compare the outcomes across the two groups. Two sample t test and confidence interval of 95% is used. P<0.05 is considered as statistically significant and P<0.01 is considered as highly statistically significant.

Results:

A total of 400 study participants among which 188 were male and 212 were female participants. All the participants have been measured for their anthropometric indices. They were checked for the basic parameters like Pulse rate, Respiratory rate, Blood pressure and oxygen saturation at rest. These study participants were informed to complete the 1600 M walking test. Following the walking test reading with regard to pulse rate, respiratory rate, systolic and diastolic blood pressure and oxygen saturation were recorded immediately after the walk followed after 1st, 2nd, 3rd and after 5 minutes.
Table 1: Cardiovascular endurance across pulse rate at rest, immediately after exercise, 1, 2, 3 and 5 minutes

| Variable     | Mean     | Std. Dev. | 95% Conf. Interval | t     | P     |
|--------------|----------|-----------|--------------------|-------|-------|
| Pulse rate _At | 84.3883  | 10.0306  | 82.94513           | 85.83146 | -1.4377 | 0.1513 |
| Pulse rate _Ime | 109.4628 | 12.5856 | 107.652           | 111.2735 | -1.0946 | 0.2743 |
| Pulse rate _1 | 104.4043 | 11.8143 | 102.7045           | 106.1041 | 0.5234 | 0.6010 |
| Pulse rate _2 | 98.87234 | 9.948245 | 97.44102          | 100.3037 | 0.1695 | 0.8655 |
| Pulse rate _3 | 91.78723 | 9.972017 | 90.3525           | 93.22197 | -0.3797 | 0.7044 |
| Pulse rate _5 | 90.61702 | 8.70565 | 89.36449          | 91.86956 | 0.8696 | 0.1643 |

Table 2: Cardiovascular endurance across Respiratory rate at rest, immediately after exercise, 1, 2, 3 and 5 minutes

| Variable     | Mean     | Std. Dev. | 95% Conf. Interval | t     | P     |
|--------------|----------|-----------|--------------------|-------|-------|
| Respiratory rate _At | 15.21277 | 3.274835 | 14.7416            | 15.68394 | -1.2112 | 0.2265 |
| Respiratory rate _Ime | 25.46277 | 5.364141 | 24.69099          | 26.23454 | 0.2352 | 0.8142 |
| Respiratory rate _1 | 22.90426 | 3.572231 | 22.3903           | 23.41821 | -1.1786 | 0.2393 |
| Respiratory rate _2 | 25.43906 | 4.291604 | 24.76803          | 25.93009 |
| Respiratory rate _3 | 22.90426 | 3.572231 | 22.3903           | 23.41821 | -1.1786 | 0.2393 |
| Respiratory rate _5 | 19.54787 | 2.135227 | 19.24066          | 19.85508 | -1.8918 | 0.0592 |

Table 3: Cardiovascular endurance across Blood Pressure at 1, 2, 3 and 5 minutes using 1600-meter walking test

| Variable     | Mean     | Std. Dev. | 95% Conf. Interval | t     | P     |
|--------------|----------|-----------|--------------------|-------|-------|
| SBP _ Atr    | 112.9787 | 10.82083 | 111.4219           | 114.5356 | 0.6163 | 0.5381 |
| Variable         | Mean     | Std. Dev. | 95% Conf. Interval | t   | P    |
|------------------|----------|-----------|--------------------|-----|------|
| **O₂ Sat._At**   | 96.68085 | .988444   | 96.53858           | 96.82312 | -0.0299 | 0.9762 |
|                  | 96.68396 | 1.083757  | 96.53724           | 96.83069 |          |       |
| **O₂ Sat._Ime**  | 95.42021 | 2.405212  | 95.07416           | 95.76627 | -0.8332 | 0.4053 |
|                  | 95.62736 | 2.547707  | 95.28243           | 95.97229 |          |       |
| **O₂ Sat._1**    | 94.48404 | 3.890859  | 93.92424           | 95.04384 | -1.5315 | 0.1264 |
|                  | 95      | 2.813306  | 94.61911           | 95.38089 |          |       |
| **O₂ Sat._2**    | 95.85106 | 1.634896  | 95.61584           | 96.08629 | -0.9908 | 0.3224 |
|                  | 95.97642 | .7995321  | 95.86817           | 96.08466 |          |       |
| **O₂ Sat._3**    | 95.54255 | 1.510497  | 95.32523           | 95.75988 | -0.2952 | 0.7680 |
|                  | 95.58491 | 1.358616  | 95.40097           | 95.76885 |          |       |
| **O₂ Sat._5**    | 96.27128 | 1.314593  | 96.08214           | 96.46042 | 1.0330  | 0.3023 |
|                  | 96.13679 | 1.286151  | 95.96266           | 96.31092 |          |       |

Table 4: Cardiovascular endurance across Oxygen saturation at rest, immediately after exercise, 1, 2, 3 and 5 minutes
Among these study participants, there were no significant changes in pulse rate, respiratory rate, blood pressure; both systolic and diastolic blood pressure, and oxygen saturation across both the genders after performing 1600 M walk at 1st, 2nd and 5th minutes except significant changes for respiratory rate (P=0.03) & systolic blood pressure (P =0.02), both, after 3 minutes were found. (Table 2 & 3)

Discussion:

Physical activity (PA) is one of the most important contributors to maintaining optimal health, and considerable evidence suggests that sufficient PA has the potential to prevent numerous diseases and provide health benefits to people of all ages.8

This study provides evidence that there is no single gold standard test for assessing the cardiovascular endurance and fitness of any individual. High level of cardiorespiratory fitness in childhood could be a protective factor of cardiovascular disease in adulthood.9 Fitness education and student fitness assessments offer students an opportunity to assess, track, and improve their fitness level. The effects of cardiovascular risk factors on health may partly be mediated through physical fitness level but the level of cardiorespiratory fitness is highly associated with the performance of other health-related fitness parameters in young people and in adults.10,11 In this study we could find that there were no significant changes in any of the parameters tested: Pulse rate, Respiratory rate, Blood pressure and Oxygen saturation except at one point for Respiratory rate & Blood pressure indicating that the assessment should include more than one tests which will increase the validity and these tests should be assessed repeatedly to overcome the confounding variables and bias. The findings of this study did not correlate with other study showing significant changes which would be due to the increase in the number of assessments.11

It is well known that individuals with regular physical activity have a lower risk of developing cardiovascular diseases, hypertension, type 2 diabetes, obesity and other chronic diseases. Therefore, performing regular cardiorespiratory exercise improves exercise capability which in turn increase cardiorespiratory fitness and results in short and long-term benefits on overall health.12 Thereby, consideration of study participants pertaining to the duration of exercise will help in eliciting their cardiovascular endurance using 1600 M walking test.

In this study we could not find any significant change in oxygen saturation across the gender. This finding was correlated with other studies done irrespective of their gender and ethnicities.5

Limitations of the study

1. The study has not included other variables affecting the cardiovascular endurance; Lifestyle and nutrition which may act as confounding variables in bringing up the expected change among the study participants.
2. The expected change in cardiovascular endurance has been studied with only one test;1600 M walk. This either, if, done repeatedly and done along with other tests may show better results and outcome among the study participants.

Conclusion:

The treatment of noncommunicable diseases (NCD), like coronary heart disease or type 2 diabetes mellitus, causes rising costs for the health system. Physical activity is supposed to reduce the risk for these diseases.13 There is no single gold standard for estimating the cardiac endurance and fitness. It has to be assessed for Vo2 along with basic parameters and need to be repeated to validate the outcome and reduce the bias in case of aerobic exercises.

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Conflicts of Interest

There are no conflicts of interest declared by the author.
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