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

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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.

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Introduction

Human evolution has been dependent on a physically active lifestyle supplemented with nutritional fortification.[1] A physically active lifestyle is 1 of the 7 goals listed for ideal cardiovascular health in the 2020 American Heart Association impact goals. [2] 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. [3,4] 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.[2]

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 (V̇o2max). [5] 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). [2]

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. [1] Numerous investigators have confirmed the strong link between physical activity and health in a variety of populations. [4] There are major challenges to disentangling the complex multifactorial etiology of physical activity, adiposity and health outcomes. [1] 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.[6,7]

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. [4] 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	84.3883	10.03061	82.94513	85.83146	-1.4377	0.1513
rate_At	85.78302	9.365162	84.51509	87.05094		
Pulse	109.4628	12.58569	107.652	111.2735	-1.0946	0.2743
rate_	110.9198	13.87856	109.0408	112.7988		
Ime						
Pulse	104.4043	11.81436	102.7045	106.1041	0.5234	0.6010
rate_ 1	103.7406	13.35883	101.9319	105.5492		
Pulse	98.87234	9.948245	97.44102	100.3037	0.1695	0.8655
rate_ 2	98.69811	10.53153	97.27228	100.124		
Pulse	91.78723	9.972017	90.3525	93.22197	-0.3797	0.7044
rate_ 3	92.17453	10.3632	90.77148	93.57758		
Pulse	90.61702	8.705652	89.36449	91.86956	0.8696	0.1643
rate_ 5	90.46698	9.467522	89.1852	91.74876		

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	15.21277	3.274835	14.7416	15.68394	-1.2112	0.2265
rate _At	15.84906	6.508897	14.96783	16.73028		
Respiratory	25.46277	5.364141	24.69099	26.23454	0.2352	0.8142
rate _ Ime	25.34906	4.291604	24.76803	25.93009		
Respiratory	22.90426	3.572231	22.3903	23.41821	-1.1786	0.2393
rate _ 1	23.65566	8.067213	22.56346	24.74786		
Respiratory	19.54787	2.135227	19.24066	19.85508	-1.8918	0.0592
rate _ 2	19.98585	2.456211	19.65331	20.31839		
Respiratory	17.68617	1.921569	17.4097	17.96264	-2.1344	0.0334*
rate _ 3	19.11321	8.985845	17.89664	20.32978		
Respiratory	16.6117	1.675004	16.37071	16.8527	-1.1734	0.2414
rate _ 5	17.23585	7.119897	16.2719	18.19979		

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

	112.3443	9.76692	111.022	113.6667		
DBP _ Atr	79.11702	2.674324	78.73225	79.50179	-0.3465	0.7292
	79.31132	7.263964	78.32787	80.29477		
SBP _ Ime	127.617	13.63709	125.655	129.5791	0.2948	0.7683
	127.2217	13.15467	125.4407	129.0027		
DBP _ Ime	73.51064	13.17853	71.61456	75.40672	-0.3056	0.7600
	73.90566	12.65138	72.19282	75.6185		
SBP _ 1min	123.9149	10.11343	122.4598	125.37	1.9099	0.0569
	121.8868	11.01298	120.3958	123.3778		
DBP _ 1min	74.86702	9.238861	73.53777	76.19627	0.0286	0.9772
	74.83962	9.828999	73.5089	76.17035		
SBP _ 2min	120.0532	11.52942	118.3944	121.712	1.7543	0.0802
	117.9953	11.86715	116.3886	119.6019		
DBP _ 2min	72.2766	7.8378	71.14892	73.40427	0.0559	0.9554
	72.23113	8.35744	71.09964	73.36262		
SBP _ 3min	116.2394	8.294779	115.0459	117.4328	2.3278	0.0204*
	114.0896	9.965651	112.7404	115.4388		
DBP _ 3min	73.79787	5.062349	73.06952	74.52622	0.4123	0.6803
	73.56132	6.256827	72.71423	74.40842		
SBP _ 5min	109.5798	10.61575	108.0524	111.1071	1.1748	0.2408
	108.4009	9.454034	107.121	109.6809		
DBP _ 5min	68.29787	8.289327	67.10524	69.49051	-0.8726	0.3834
	69.0566	9.011662	67.83654	70.27667		

Table 4: Cardiovascular endurance across Oxygen saturation at rest, immediately after exercise, 1,2, 3 and 5 minutes

Variable	Mean	Std. Dev.	95% Conf. Interval		t	P
O_2 Sat._At	96.68085	.9888444	96.53858	96.82312	-0.0299	0.9762
	96.68396	1.083757	96.53724	96.83069		
O_2 Sat._ Ime	95.42021	2.405212	95.07416	95.76627	-0.8332	0.4053
	95.62736	2.547707	95.28243	95.97229		
O_2 Sat._ 1	94.48404	3.890859	93.92424	95.04384	-1.5315	0.1264
	95	2.813306	94.61911	95.38089		
O_2 Sat._ 2	95.85106	1.634896	95.61584	96.08629	-0.9908	0.3224
	95.97642	.7995321	95.86817	96.08466		
O_2 Sat._ 3	95.54255	1.510497	95.32523	95.75988	-0.2952	0.7680
	95.58491	1.358616	95.40097	95.76885		
O_2 Sat._ 5	96.27128	1.314593	96.08214	96.46042	1.0330	0.3023
	96.13679	1.286151	95.96266	96.31092		

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.

References:

1. Michael J. LaMonte and Steven N. Blair. Physical activity, cardiorespiratory fitness, and adiposity: contributions to disease risk, Current Opinion in Clinical Nutrition and Metabolic Care 2006, 9:540–546.
2. Strath SJ, Kaminsky LA, Ainsworth BE, Ekelund ULF, Freedson PS, Gary RA, RN, et. al, Guide to the Assessment of Physical Activity: Clinical and Research Applications, Circulation, 2013;128:2259-2279.
3. Flegal KM, Carroll MD, Ogden CL, Johnson CL. Prevalence and trends in obesity among US adults, 1999–2000. JAMA 2002; 288:1723–1727
4. US Department of Health and Human Services. Physical activity and health: a report of the Surgeon General. Atlanta, GA: US Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion; 1996.
5. Kamyan D, Labania L, Kamyan A, Rahman M, Bagchi S. Assessment of Cardiorespiratory Endurance in Terms of Physical Fitness Index and VO2max among Young adult population of United Arab Emirates, International Medical Journal, 2020; 25(4):1927-11940.
6. Lee IM, Shiroma EJ, Lobelo F, Puska P, Blair SN, Katzmarzyk PT; Lancet Physical Activity Series Working Group. Effect of physical inactivity on major non-communicable diseases worldwide: an analysis of burden of disease and life expectancy. Lancet. 2012; 380:219–229.
7. US Department of Health and Human Services. Physical Activity Guidelines Advisory Committee Report, 2008. Washington, DC: US Department of Health and Human Services; 2008. http://www.health.gov/paguidelines/report/.
8. Yamakita M, Sato M, Suzuki K, Ando D, and Yamagata Z. Sex Differences in Birth Weight and Physical Activity in Japanese Schoolchildren, Journal of Epidemology, 2018:1-5. Available at https://doi.org/10.2188/jea.JE20170078.
9. Ruiz JR, Castro-Pinero J, Artero EG, Ortega FB, Sjostrom M, Suni J, et al. Predictive validity of health-related fitness in youth: a systematic review. Br J Sports Med. 2009; 43:909–23.
10. Ramírez-Vélez R, Correa-Bautista JE, Ramos-Sepúlveda JA, Piñeros-Álvarez CA, Giraldo LI, Izquierdo M et al. Aerobic capacity and future cardiovascular risk in Indian community from a low-income area in Cauca, Colombia, Italian Journal of Pediatrics ,2017;43(28):2-8.
11. Tiku R, Sharma P, Kaul B. Assessment of the cardio-respiratory fitness in young college going adults by 1 mile walk test - an observational study. Int J Health Sci Res. 2015; 5(9):338-345.
12. Nystoriak MA, Bhatnagar A. Cardiovascular Effects and Benefits of Exercise. Front Cardiovasc Med. 2018, 5:135.
13. Reiner M, Niermann C, Jekauc D and Woll A. Long-term health benefits of physical activity – a systematic review of longitudinal studies. BMC Public Health 2013, 13:813.