ORIGINAL ARTICLE

IJPHY

# RESPONSE TO 6 MINUTE WALK TEST IN HEALTHY ADULTS

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## ABSTRACT

***Background:*** 6Minute walk test (MWT) has been used as a performance based measure of functional exercise capacity in all populations including healthy adults. 6MWT is recommended out of other all timed walked tests due to its reproducibility and ease of administration compared to other longer or shorter time duration tests. It detects changes following interventions to improve exercise tolerance in healthy individuals, to assess the fitness level, used as intervention to improve walking endurance and as predictor of objectively measured aerobic fitness in healthy adults. It is essential to know a level of fitness healthy adults possess in our community, thus aim of this study was to evaluate response to 6MWT in young healthy adults.

***Method:*** 50 healthy individuals (25 males and 25 females) of 18 - 30 years of age were recruited. The 6MWT was performed as per standard guidelines. All subjects were assessed for the outcome measures by principal investigator at baseline i.e. before and post- 6MWT for following parameters. BP, PR, RR, SPO2, RPE.

***Results:*** The mean 6 minute walked distance (6MWD) was 635.6 + 59.07, for men it was 675.0 + 46.88 and for women it was 596.5 + 41.41. Out of study population 18% of people covered 70%-80%, 54% people covered 80%-90% and 28% people covered 90%-100% of their predicted distance. Oxygen saturation remained unaltered throughout the walk. Mean resting and walking spo2 values were 96.80 + 13.55% and 96.71 + 13.55% (p-value: 0.2288). Pulse rate (PR) and respiratory rate (RR) were affected by the walk. Mean resting and walking PR was 79.82 + 9.18 and 142.6 + 19.62 (p-value: 0.0001) and RR was 18.48 + 2.78 and 30.20 + 4.35 (p-value: 0.0001) respectively. Mean resting and walking systolic and diastolic blood pressure was significantly higher in males as compared to females.

***Conclusion:*** The 6 minute walk test is a useful measure of functional capacity in healthy adults. There was a difference between predicted distance covered and actual distance covered at the end of 6 minute walk test in study population. There was a significant difference between responses of males and females elicited during 6 MWT.

***Keywords:*** 6MWT, young healthy adults, normal response, functional capacity, timed walk test, predicted distance.

Received 2nd November 2015, revised 11th November 2015, accepted 26th November 2015

DOI: 10.15621/ijphy/2015/v2i6/80755

www.ijphy.org

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## INTRODUCTION

6 Minute walk test (MWT) was developed by Balke in 1963 to assess the functional capacity of an individual. Originally 6MWT was developed to measure exercise tolerance in chronic respiratory disease and heart failure. The test has since been used as a performance based measure of functional exercise capacity in other populations including healthy adults.[1]

6 minute timed walk is recommended out of other all timed walked tests due to its reproducibility and ease of administration compared to other longer or shorter time duration tests. As they are not as sensitive to evaluate the differences in walked distance.[2]

6MWT measures the distance an individual is able to cover over a time period of 6 minute for as far as possible and allows the individual to self pace and rest as required[2].

Reduction in walking distance is frequently due to multiple causes and may be from a varied set of disorders that affect a series of physiological variables engaged during exercise.[3]

Apart from this 6MWT has been used to detect changes following interventions to improve exercise tolerance in healthy individuals, to assess the fitness level, used as intervention to improve walking endurance and as predictor of objectively measured aerobic fitness in healthy adults[1].

Heart rate(HR) and Systolic blood pressure(SBP) both have linear relationship with amount of applied external work. 6MWT causes increase in systemic oxygen consumption which can be expressed as increase in MET levels, Kcal, L/O2, or ml O2/kg of body weight. HR and SBP should also increase[8].

Hellerstein et al reported that for each 10% increase of maximal HR , SBP increases by 12-15mm Hg. Naughton and Haider interpreted an increase in SBP in excess of 12mm Hg/MET as hypertensive response and below 5mm Hg as hypotensive response. Diastolic blood pressure(DBP) has limited changes. It may increase or decrease by 10mm Hg or show no change. oxygen consumption and depth of respiration should also increase. It is essential to know the level of fitness healthy adults possess in our community, to identify individuals at risk. Thus the objective of the study was to

1. To describe the cardio-pulmonary responses elicited during 6 minute walk test in healthy adults of age 18 to 30 years.
2. To measure difference between predicted distance covered and actual distance covered at the end of 6 minute walk test.

## MATERIALS AND METHOD:

The study was conducted at research laboratory at K.J. Somaiya College of Physiotherapy, Mumbai. The study design was experimental in nature which included 50 young healthy adults, 25 males and 25 females. Subjects found eligible for the study on the basis of inclusion and exclusion criteria i.e.

**Inclusion criteria**:
Healthy adults.
Age group- 18 to 30 years.

**Exclusion criteria**:
History of any musculoskeletal, neurological, cardiovascular or respiratory disease.
Individuals involved in competitive sports.
Use of walking aid.
Resting BP > 150/100mm hg.
Resting HR > 100, and < 50 bpm.
those willing were explained and recruited in study and a written informed consent was taken. Initial assessment for the study was done as per the case record form formulated for the study.

All subjects were assessed for the outcome measures by the principal investigator at baseline i.e. before 6MWT, which included BP by auscultatory method using sphygmomanometer, pulse rate by palpatory method, RR(respitatory rate) by observation, $spo_2$ by using pulse-oxymeter and RPE using modified borg's scale. Predicted distance was calculated using following formula.[5]

For men: (7.57x Height cm ) - (5.02x age) - (1.76x weight kg ) - 309 m
For women :( 2.11x Height cm) - (2.29 x weight kg) - (5.78 x age) + 667 m
Post-test measurements were taken immediately post-test, after 3 min and after 5 min of test.

The 6MWT was performed indoors as per standard guidelines by ATS, which included a long, flat, straight, enclosed corridor, 30 m in length. The length of the corridor was marked every 3 m. The turnaround points were marked with a cone. A starting line, which marks the beginning and end of each 60-m lap, was marked on the floor using brightly colored tape.[4]

**Figure 1:** Subject Performing 6 MWT

**Subject preparation**: Subjects were asked to wear comfortable clothes with comfortable walking shoes. The subjects were made to sit at rest in a chair, located near the starting position, for at least 10 minutes before the test started. During this time, pre-test measurements were taken (Blood pressure, Pulse Rate, Respiratory Rate, RPE, SpO2).

Subjects were demonstrated by walking one lap by the investigator.

The subjects were given standard instructions prior to the test as well as during the test as per ATS guidelines[4].

After completion of test subjects were made to sit on a chair and post-test measurements were taken. Post-test: BP, RR, PR, SpO2 and Rate of perceived exertion by using BORG's scale were recorded. Number of laps were recorded and total distance walked was calculated.

## DATA ANALYSIS AND RESULTS

The data thus collected was statistically analysed using software Graph pad prism version 5. intra group (males v/s females) analysis was done using unpaired t test at 5% level of significance. Anthropometric characteristics of study population, males and females are summarized in table-1, physiological characteristics of study population are summarized in table-2 and physiological characteristics of study population male v/s females are summarize d in table-3

**Table-1:** anthropometric characteristics of study population, males and females.

| Characteristic | General population (n = 50) Mean ± SD | Men ( n = 25) Mean ±SD | Women ( n = 25) Mean ± SD |
|---|---|---|---|
| Age (years) | 22.44 ± 3.363 | 22.40 ± 3.31 | 22.48 ± 3.47 |
| Height (cm) | 165.8 ± 9.285 | 173.4 ± 6.50 | 158.1 ± 3.39 |
| Weight (kg) | 69 ± 9.313 | 74.12 ± 7.36 | 63.88 ± 8.25 |
| BMI (kg/m2) | 25.17 ± 3.42 | 24.72 ± 2.93 | 25.63 ± 3.86 |

**Table-2:** physiological characteristics of general population.

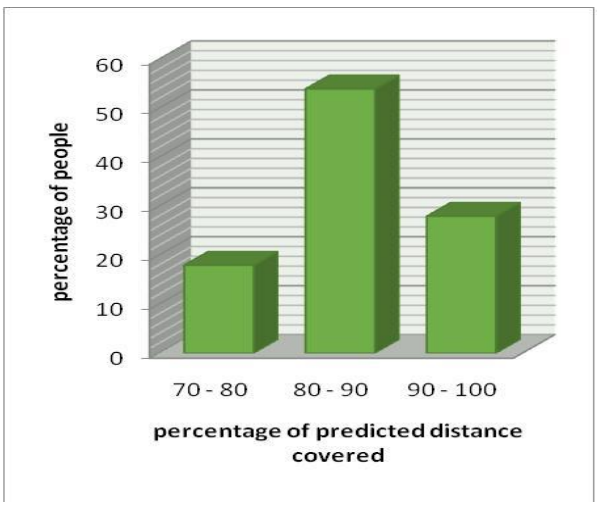
| Physiological parameters | General population n = 50 Mean ±SD | p- value |
|---|---|---|
| Systolic BP(mmhg) | | |
| Pre-test | 114.1 ± 9.5 | 0.0001* |
| Post-test | 136.4 ± 9.17 | |
| Diastolic BP(mmhg) | | |
| Pre-test | 74.36 ± 6.0 | 0.0271* |
| Post-test | 75.56 ± 5.5 | |
| HR (bpm) | | |
| Pre-test | 79.82 ± 9.18 | 0.0001* |
| Post-test | 142.6 ± 19.62 | |
| RR (breaths/min) | | |
| Pre-test | 18.84 ± 2.78 | 0.0001* |
| Post-test | 30.20 ± 4.35 | |
| Spo2 (%) | | |
| Pre-test | 96.80 ± 13.55 | 0.2288 |
| Post-test | 96.71 ± 13.55 | |
| Borg dysponea scale score | | |
| Pre-test | 0.0 ± 0.0 | 0.0001* |
| Post-test | 3.710 ± 1.03 | |

* - Significant.

**Table-3:** physiological characteristics of study population male v/s females.

| Physiological parameters | Men ( n = 25) Mean ±SD | Women ( n = 25) Mean ± SD | p- value |
|---|---|---|---|
| Systolic BP(mmhg) | | | |
| Pre-test | 119.0 ± 7.705 | 109.1 ± 8.719 | 0.0005* |
| Post-test | 140.6 ± 7.539 | 132.2 ± 8.875 | 0.0017* |
| Diastolic BP(mmhg) | | | |
| Pre-test | 77.52 ± 4.665 | 71.20 ± 5.568 | 0.0003* |
| Post-test | 77.92 ± 4.847 | 73.20 ± 5.196 | 0.0036* |
| HR (bpm) | | | |
| Pre-test | 78.88 ± 10.63 | 80.76 ± 7.584 | 0.5222 |
| Post-test | 143.7 ± 22.28 | 141.5 ± 16.95 | 0.5345 |
| RR( breaths/min) | | | |
| Pre-test | 18.88 ± 3.166 | 18.08 ± 2.344 | 0.2842 |
| Post-test | 29.76 ± 3.072 | 30.64 ± 5.376 | 0.8924 |
| Spo2 (%) | | | |
| Pre-test | 98.52 ± 0.653 | 98.88 ± 0.331 | 0.0094* |
| Post-test | 98.36 ± 0.907 | 98.84 ± 0.374 | 0.0244* |
| Borg dysponea scale score | | | |
| Pre-test | 0.0 ± 0.0 | 0.0 ± 0.0 | |
| Post-test | 3.660 ± 0.997 | 3.760 ± 1.081 | 0.5658 |

**GRAPH 1:** Percentage of predicted distance covered



## DISCUSSION

The present study provides reference values for the primary variables measured in 6 minute walk test in healthy subjects between 18 - 30 years of age. In this study 25 males with mean age of 22.40±3.317years and 25 females with mean age of 22.48±3.478years completed 6 minute walk test under standard conditions. Males had mean BMI 24.72±2.934 kg/$m^2$ and females had mean BMI 25.63±3.866 kg/$m^2$.

The mean 6 minute walked distance (6MWD) covered by the study population was 635.6±59.07mts, male population covered 675.0±46.88 mts and female population covered 596.5 ±41.41mts. There was a significant difference in mean of actual distance covered 635.6 ±59.07mts and distance predicted 742.5±46.71mts.. Mean PR and RR of study population pre-test was 79.82±9.18 bpm and 18.48±2.78 breaths/min, post-test was 142.6±19.62bpm and 30.20±4.35 breaths/min respectively, of male population pre-test was 78.88±10.63bpm and 18.88±3.166 breaths/min post-test was 143.7±22.28bpm and 29.76±3.072 breaths/min, of female population pre-test was 80.76±7.584bpm and 18.08±2.344 breaths/min post-test was 141.5±16.95bpm and 30.64±5.376 breaths/min respectively. Oxygen saturation remained unaltered throughout the walk. Mean resting and walking spo2 values were 96.80±13.55% and 96.71±13.55%. Mean resting and walking systolic blood pressure was significantly higher in males as compared to females. Mean resting and walking systolic blood pressure in males was 119.0±7.705mm hg and 140.6±7.539mm hg and in females was 109.1±8.719mm hg and 132.2±8.875mm hg respectively. There was significant rise in diastolic blood pressure pre and post walk. Mean resting and walking diastolic blood pressure in males was 77.52±4.665mm hg and 77.92±4.847mm hg and in females 71.20±5.568mm hg and 73.20±5.196mm hg respectively.

Literature suggests that various anthropometric factors of age, height and weight are independently associated with the distance walked. Apart from these factors like technical aspect and quality assurance of 6 minute walk test, especially length of the corridor 30m, to avoid too many turns during test and encouragement which was given to ensure maximal motivation and performance affects 6 minute walk distance.[5] One potential source of variance may be the different attitudes, beliefs, as well as the mood of the participants. Indeed, it has been demonstrated that psychological status is related to exercise capacity in healthy subjects.[7]

Six minute walk test in healthy adults has been found to be a valid and reliable test for describing the functional capacity in activity of daily living. Heart rate and systolic blood pressure have linear relationship with amount of applied external workload. Increase in heart rate is due to increase in venous return, myocardial contractility and stimulation of sympathetic system. blood pressure rises in order to supply more blood to exercising muscle which is due to increase cardiac output and vasodilatation. As the systemic oxygen requirement increases rate of respiration normally increases from rest. diastolic blood pressure exhibits limited changes with exercise. It may not change or increase by 10mm hg. In healthy adults oxygen saturation may not change.[8]

In summary this study gives us reference values for normal cardio-pulmonary responses elicited during 6 minute walk test and value of distance covered in healthy adult males and females of the study population.

## CONCLUSION

The 6 minute walk test is a useful measure of functional capacity in healthy adults. There is a difference between predicted distance covered and actual distance covered at the end of 6 minute walk test in study population as various factors are responsible for calculating the distance covered which should be born in mind.

Reference values are given by this study of normal cardio-pulmonary responses elicited during 6 minute walk test in healthy adults, age group of 18 - 30 years, which can be compared to other population to find out people at risk of cardiovascular and pulmonary diseases of same anthropometric characteristics.

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***Citation***
Vibhuti kiran shah, Mugdha Oberoi, & Veena krishnanand. (2015). RESPONSE TO 6 MINUTE WALK TEST IN HEALTHY ADULTS. *International Journal of Physiotherapy*, 2(6), 967-971.