



## ASSESSMENT OF FUNCTIONAL CAPACITY IN HYPERTENSIVE INDIVIDUALS USING 6 MINUTE WALK TEST.

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### ABSTRACT

**Background:** The aim of present study was to assess the functional capacity by 6 minute walk test in Hypertensive patients. The study was conducted in 120 male and female subjects between 40-80 years of age 30 subjects were taken as control and 90 subjects were further subdivided into four groups according to JNC-VII classification i.e. normotensive, pre-hypertensive and hypertensive, having 30 subjects each. Aim of the study is firstly, to identify effect of 6MWT, exercise toleration, aerobic capacity and compare functional capacity of normotensive in hypertensive patients. Secondary, to improve health status and wellbeing by encouragement of exercise and other methods.

**Material&Methods:** A structured proforma was given to subject to elicit lifestyle and systemic diseases. Then assessment of anthropometric parameters, cardiovascular parameters and exercise capacity by 6 minute walk test was done as per ATS guidelines 2002. VO<sub>2</sub> max was calculated and was compared with normal values

**Results:** Study confirms the reliability of 6 minute walk test in clinical follow up in hypertensive patients and with reduced physical activity. The use of the 6MWT is recommended as a complement to the evaluation of patients with pulmonary and cardiovascular diseases. It is a useful test that is accessible, and it represents an accurate and efficient method of quantifying exercise tolerance (James Eduardo et al, 2011).

**Conclusion:** This study concluded that functional capacity of prehypertensive and hypertensive individuals is less than the normotensive individuals suggesting remedial intervention to increase fitness levels and avoid future cardiovascular risks. 6- Minute walk test is a simple, effective tool to detect the fitness levels in these high risk populations

**KEYWORDS :** Six minute walk test (6MWT), Hypertension, Vo<sub>2</sub> max, work done

### INTRODUCTION

Hypertension, conjointly called high or raised vital sign may be a condition within which the blood vessels have persistently raised pressure. It's conjointly known as as "Silent Killer" because it seldom causes symptom within the early stages and plenty of individuals go un-diagnosed (WHO, 2013). It is one of the greatest public health problems of our time, affecting approximately 1 billion across the world and resulting, directly and indirectly in more than 7million death per years(Guilbert JJ, 2003). Globally, cardiovascular disease (CVD) accounts for about 17 million deaths a year, nearly one third of the overall (WHO, 2013). Of these, the complication of hypertension account of 9.4 million deaths worldwide every year (Lim SS et al, 2010). Hypertension can also lead to kidney failure, blindness, rupture of blood vessel and cognitive impairment (WHO, 2013).. Physical activity is usually counselled as a crucial lifestyle modification that may aid in the prevention of hypertension (Keith M et al, 2013).. Walking is one of the main activities of daily living, walk tests have been proposed in order to measure the state or the functional capacity (Jaimes Eduardo et al, 2011).

According to the American Thoracic Society, Six-Minute Walk Test (6MWT) is an objective measure of the functional exercise capacity in individuals with moderate and severe impairment of cardiovascular and respiratory conditions, as well as to predict morbidity and mortality In patients with cardio respiratory disease, oxygen consumption at the 6MWT does not significantly differ from the maximum oxygen consumption (VO<sub>2</sub> max) obtained at incremental laboratory tests performed in a cycle ergometer (Trooster et al T, 2002). Thus, it is possible to adequately estimate the (VO<sub>2max</sub>) by the distanced walked at the 6-minute walk test (Victor ZD et al, 2011).

### Material & Methods

The study is A cross sectional study, it was conducted between June 2015 to April 2016 in the Department of Physiology, National Institute of Medical Sciences & Research, Jaipur

After approval of the study from the ethical committee of NIMS Medical College and Hospital, the subjects were selected from NIMS Medical College Hospital with valid consent was taken from all subjects. All the subjects were then subjected to 6minute walk test. Total 120 subjects where included according to the following inclusion criteria: age (30- 60 years), willing to participate, no smoking habit. Subjects having CVD, history of Diabetes Mellitus, Renal disease, Respiratory disease, Stage III hypertension and isolated hypertension

was excluded from the study. These subjects were further subdivided into four groups according to JNC-VII classification i.e. normotensive, pre-hypertensive, stage I hypertensive and stage II hypertensive having 30 subjects each. Anthropometric parameters as Height, Weight, Body mass index (BMI), Waist Circumference (WC), Hip circumference (HC) , Waist- hip ratio (WHR) were assessed at Volunteers were subjected to and familiarized with the procedure of all the tasks. They were asked to report in the morning between 9:00 am and 10:00am preferably without heavy meals and a good sleep.

Blood pressure was recorded using sphygmomanometer and stethoscope. The subjects were allowed to sit comfortably in a chair for 5 minutes before recording the blood pressure. *Assessment of functional capacity of subject was done by six-minute walk test (6MWT)*

The following physiological parameters are studied before and after the test on the subjects.

PRE-TEST	POST-TEST
1. Height	1. Distance covered (6MWD)- recorded
2. Weight	2. Work Done
3. BMI (Body Mass Index)	3. VO <sub>2</sub> max
4. Waist circumference	
5. Hip circumference	
6. Waist hip ratio	
7. Blood pressure and Pulse pressure	
8. Mean arterial blood pressure	

**Calculation of work done in 6 minutes** Body weight (kg) × distance covered (m)/time taken (min)

### Calculation of VO<sub>2</sub> max

$$\bullet \quad \text{Energy expenditure (kcal/min)} = \text{Work done (kgm/min)} * 0.0023$$

Finally, Kcal/min was converted to oxygen consumption by the following equation:-

$$\bullet \quad O_2(L/min) = (kcal/min)/5$$

$$\bullet \quad VO_2\text{max (ml/kg/min)} = [O_2(L/min) \times 1000] / \text{body weight (kg)}$$

### 2.4 Statistical Analysis

SPSS (Statistical Package for the Social Sciences, 17.0 versions for Window) is used for analysis. Of cardiovascular parameters and exercise capacity. One-way Analysis of Variance (ANOVA) test is

used to evaluate the difference between the four groups for the above-mentioned parameters.

### Observation & Results

**Table 1Cardiovascular parameters of the all groups**

**Table 1(a). Cardiovascular parameters of Normotensive Individuals, Control group I (n=30).**

S. No	Parameter	Mean	Range	S.D.
1	PP (mmHg)	39.3	30 – 50	5.59
2	Baseline SBP (mmHg)	111	90–120	8.8
3	Baseline DBP (mmHg)	72.1	58 – 80	7.95
4	Mean Arterial Pressure(mmHg)	85.24	70 – 93.33	7.79

**Table 1(b)Cardiovascular parameters of Prehypertensive individuals, Case group II (n=30).**

S. no	Parameter	Mean	Range	S.D.
1	PP (mmHg)	42.13	22 – 52	6.97
2	Baseline SBP (mmHg)	127.23	102 – 139	10.37
3	Baseline DBP (mmHg)	85.1	68 – 90	6.64
4	Mean Arterial Pressure(mmHg)	99.14	76.67 – 106.33	7.38

**Table 1C. Cardiovascular parameters of Hypertensive I individuals, Case group III (n=30).**

S. no	Parameter	Mean	Range	S.D.
1	PP (mmHg)	53.86	38 – 68	6.65
2	Baseline SBP (mmHg)	146.7	136 – 158	5.80
3	Baseline DBP (mmHg)	92.86	90 – 100	3.25
4	Mean Arterial Pressure(mmHg)	110.82	106.66 – 117.33	2.20

**Table 1(d). Cardiovascular parameters of Hypertensive II individuals, Case group IV (n=30).**

S. no	Parameter	Mean	Range	S.D.
1	PP (mmHg)	63.13	58 – 72	4.05
2	Baseline SBP (mmHg)	176.26	160 – 178	5.35
3	Baseline DBP (mmHg)	104.13	100 – 110	3.79
4	Mean Arterial Pressure(mmHg)	125.18	120 – 132	3.93

**Table 2. Exercise capacity parameters of all the groups**

**Table 2(a). Exercise capacity parameters of Normotensive individuals, Controls group I (n=30).**

S. no	Parameter	Mean	Range	S.D.
1	Mean 6MWD (m)	605.9	498 – 720	64.18
2	Work Done (Kcal/min.)	6665.60	4498 – 9156.6	1052.68
3	Mean Peak VO2 (ml/kg/min.)	47.29	37.48 – 56.23	4.99

**Table 2(b). Exercise capacity parameters of Prehypertensive individuals, Case group II (n=30).**

S. no	Parameter	Mean	Range	S.D.
1	Mean 6MWD (m)	580.96	416 – 745	83.19
2	Work Done (Kcal/min.)	6496.41	4420 – 9312.5	980.19
3	Mean Peak VO2 (ml/kg/min.)	44.54	31.89 – 55.2	6.37

**Table 2C. Exercise capacity parameters of Hypertensive I individuals, Case group III (n=30).**

S. no	Parameter	Mean	Range	S.D.
1	Mean 6MWD (m)	484.96	412 – 620	51.85
2	Work Done (Kcal/min.)	5603.45	3992 – 6860.66	1014.17
3	Mean Peak VO2 (ml/kg/min.)	37.18	31.58 – 47.53	3.97

**Table 2(d). Exercise capacity parameters of Hypertensive II individuals, Case group IV (n=30).**

S. no	Parameter	Mean	Range	S.D.
1	Mean 6MWD (m)	406.5	321 – 503	45.49
2	Work Done (Kcal/min.)	5096.80	3570 – 7157.33	1009.38
3	Mean Peak VO2 (ml/kg/min.)	31.16	24.61 – 38.56	3.49

### DISCUSSION

Hypertension is an important risk factor for cardiovascular events. And that fitness is inversely associated with incident hypertension in persons with and without cardiovascular risk factors such as obesity or an elevated resting blood pressure, suggesting a role for fitness in at-risk populations (Stephen P Juraschek et al, 2014).

The use of the 6MWT is recommended as a complement to the evaluation of patients with pulmonary and cardiovascular diseases. It is a useful test that is accessible, and it represents an accurate and efficient method of quantifying exercise tolerance (James Eduardo et al, 2011).

In this study, 6MWT is lower in prehypertensive (580.96±83.19 meters) and hypertensive group (hypertensive I is 484.6± 51.85 meters; hypertensive II is 406.5±45.49 meters) than normotensive group (605.9±64.18 meters), having statistical significant difference ( $p<0.001$ ). A case-control study by Ramos RA et al (2014) on six minute walk distance as marker of hemodynamic-related functional capacity in hypertension found that, 6MWD was inversely associated with hemodynamic variables and was lower in patients with hypertension compared with healthy control. Wanderley FA et al (2010) in his studies reinforces the idea that a worse cardiovascular profile is related with lower fitness. It further supports the potential of 6MWD to identify adverse outcome such increased systolic blood pressure.

The peak VO<sub>2</sub> max is also significantly lower in pre-hypertensive (44.54±6.37 ml/kg/min) and hypertensive group (i.e. hypertensive I is 37.18±3.97 ml/kg/min; hypertensive II is 31.16±3.49 ml/kg/min) than normotensive group (47.29±4.99 ml/kg/min) with statistical significant difference ( $p<0.001$ ). Work done too was calculated as product of distance and body weight to estimate functional exercise capacity. The total amount of work done in walking 6 minutes by the pre-hypertensive group (6496.41±980.19 kcal/min) and hypertensive group (hypertensive I is 5603.45±1014.17 kcal/min; hypertensive II is 5096.80±1009.38 kcal/min) was significantly lower than the normotensive group (6665.60±1052.68 kcal/min).

Maximum oxygen consumption (VO<sub>2</sub> max) is the most important parameter of individual fitness and an independent parameter of cardiovascular disease prognosis (Weber KT et al, 1982). There is an inverse relationship between VO<sub>2</sub>max values and risk of cardiovascular disease and all-cause mortality (Blair SN et al 1996). A

### 1. CONCLUSION

Although hypertension studies are ongoing, there is an ample amount of research which support that provides clear evidence of the positive effects of exercise on lowering blood pressures in persons with hypertension. The encouragement of regular exercise is not only useful as a treatment method for individuals with hypertension, but should also be advocated as a means for prevention (Gavin C et al, 2007). In fact Franklin BA et al (2007), in his studies suggested that cardiorespiratory fitness should be employed as the ultimate marker for risk stratification and health outcomes.

This study concluded that functional capacity of prehypertensive and hypertensive individuals is less than the normotensive individuals suggesting remedial intervention to increase fitness levels and avoid future cardiovascular risks. 6- Minute walk test is a simple, effective tool to detect the fitness levels in these high risk populations.

Health education, lifestyle modifications in regards to dietary interventions (DASH diet), moderation in salt intake, stress reduction, reducing weight and maintaining it, exercise promotion as the integral component should be adhered and implemented in this group to avoid the risk of developing hypertension and other cardiovascular morbidities.

### REFERENCES

1. ATS (American Thoracic Society) statement: guidelines for the six minute walk test. Am J Respir Crit Care Med. 2002; 166(1):111-117.
2. Franklin, BA. Fitness: the ultimate marker for risk stratification and health outcomes? Prev Cardiol 2007; 10: 42-46.
3. Gavin C, Hillman and Len Kravitz. Hypertension and exercise. Mar 01, 2007. IDEA Fitness Journal.
4. Guibert JJ. The World Health Report 2002 – reducing risk, promoting healthy life. Educ Health (Abingdon);2003; 16(2): 230.
5. Franklin, BA. Fitness: the ultimate marker for risk stratification and health outcomes? Prev Cardiol 2007; 10: 42-46.
6. Jaime Eduardo Morales-Blanbir, Carlos Damián Palafox Vidal, María de Jesús Rosas

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- Romero, Mauro Marcos García Castro, Alejandro Londoño Villegas, Mauro Zamboni. Six-minute walk test: a valuable tool for assessing pulmonary impairment. *J. bras. pneumol.* 2011; vol.37 (1).
7. Keith M. Diaz and Daichi Shimbo. Physical Activity and the Prevention of Hypertension. *NYCurr Hypertens Rep.* 2013; 15(6): 659–668.
  8. Lim SS, Vos T, Flaxman AD, Danaei G. A comparative risk assessment of burden of disease and injury attributable to 67 risk factor cluster in 21 regions, 1990-2010: a systematic analysis for the Global Burden of Disease study 2010. *Lancet*, 2012; 380 (9859): 2224-60.
  9. Ramos RA, Guimaraes FS, Cordovil I, de sa Fetteira A. The six minute walk distance is a maker of hemodynamic- related functional capacity in hypertension: a case- control study. *Hypertens Res.* 2014 Aug; 37(8): 746-52.
  10. Stephen P. Jurascik, MD, PhD; Michael J. Blaha, MD, MPH; Seamus P. Whelton, MD, MPH; Roger Blumenthal, MD; Steven R. Jones, MD; Steven J. Keteyian, PhD; John Schairer, DO; Clinton A. Brawner, PhD; Mouaz H. Al-Mallah, MD. Physical Fitness and Hypertension in a Population at Risk for Cardiovascular Disease: The Henry Ford Exercise Testing (FET) Project. *J Am Heart Assoc.* 2014.
  11. Troosters T, Vilaro J, Rabinovich R, Casas A, Barbera JA, Rodriguez-Roisin R. Physiological responses to the 6-min walk test in patients with chronic obstructive pulmonary disease. *Eur Respir J.* 2002; 20 (3): 564-9.
  12. Victor Zuniga Dourado. Reference Equations for the 6-Minute Walk Test in Healthy Individuals. 2011.
  13. Wanderley FA, Oliveira J, Mota J, Carvalho MJ. Six-minute walk distance (6MWD) is associated with body fat, systolic blood pressure, and rate-pressure product in community dwelling elderly subjects. *Arch Gerontol Geriatr.* 2011; 52(2): 206-10.
  14. Weber KT, Kinasewitz GT, Janicki JS, Fishman AP. Oxygen utilization and ventilation during exercise in patients with chronic cardiac failure. *Circulation.* 1982; 65 (6): 1213-23.
  15. World Health Organisation. A Global brief on Hypertension, World health day 2013. ([www.who.int](http://www.who.int)).