

Six Minute Walk Test in People with Tuberculosis Sequelae

SALMAN LATIF¹, MUHAMMAD SHARYAR², IRAM SHAFEE³, JURAT ALI⁴, ABDUL MANNAN⁵, SALMAN DEEDAR⁶, SADAF WARIS⁷

¹Clinical physiotherapist Riphah international university lahore

²HOD Physiotherapy Department EduCareer Sindh institute sukkur

³Consultant/ Assistant Professor Avicenna Medical and Dental College Lahore

⁴Physical therapy and Rehabilitation Association

⁵Clinical Physical therapist Rex Clinic lahore

⁶Student at Riphah International University Lahore

⁷Senior Lecturer Avicenna Medical and Dental College, Lahore

Correspondence to: Salman Latif, Email: Qazisalmanpt@gmail.com, Cell: 03464092914

ABSTRACT

Background: Tuberculosis often brings about diffuse fibrotic and other changes to lung tissue also consolidation of lung tissue prompting a decrease in generally lung tissue compliance. Following tuberculosis, the functional status of people is reduced e.g., impaired ventilation and gas exchanges leading to shortness of breath, muscular deconditioning, and a functional status decline is seen

Objective: The purpose of this study was to evaluate and compare the six-meter walk distance and physical functional capacity (VO₂ max) in 40 – 65 years people with pulmonary tuberculosis and healthy subjects.

Methods: Forty healthy subjects (20 males and 20 females) and forty subjects with pulmonary tuberculosis (30 males and 10 females) took part in this study. All the subjects underwent a six min walk test. Walk-work was calculated and used for evaluating functional capacity. To examine for significant relationships Pearson product correlation was used

Results: A significant difference was found between the groups in regards to 6MWT distance ($p < 0.05$). For height and body mass index (BMI) Pearson product correlations with 6MWD were significant in normal individual and for the weight and BMI it was significant in the TB sequelae group.

Conclusion: A significant difference was found in functional capacity in terms of VO₂max between healthy and patients with TB was found. TB sequelae individuals' group, 52.6% patients had a VO₂ max under 21 milliliter per kilogram per minute that brought about an impressive effect of TB sequelae on endurance in regards to cardiorespiratory system.

Keywords: functional capacity, hospital, six-minute walk test, tuberculosis

INTRODUCTION

Tuberculosis often brings about diffuse fibrotic and other changes to lung tissue also consolidation of lung tissue prompting a decrease in generally lung tissue compliance. (1, 2) Following tuberculosis, the functional status of people is reduced e.g., impaired ventilation and gas exchanges leading to shortness of breath, muscular deconditioning, and a functional status decline is seen.(3, 4) Tuberculosis (TB) keeps on displaying the most elevated pace of mortality and morbidity among chronic infectious diseases around the world Each year, almost 9 million of new cases & 2 million deaths are enrolled according to WHO 2007. Prevalence of TB in developing nations stays high (5, 6). TB is responsible for impaired ventilation and poor gas exchanges and a decline in functional status along with, respiratory ailments such as TB brings about decline in physical conditioning, muscle deconditioning & debilitated lung capacity and poor gas exchanges .(7)The outcomes of changes in muscular system are reduced tolerance to exercise, decline in day by day proactive tasks and poor quality of life (1, 2). The healthy recovery and follow-up of patients with TB based on, radiographic, clinical & lab assessments, (that is frequently more costly for mostly poor population) or it also based on abstract affirmations concerning a possible improvement of their physical capacities. Albeit, the capacity to move around for a given distance and is a quick easy and economical proportion of physical capacity and a significant portion of quality of life as it mirrors the limit with respect to undertaking every day exercises. (8) Numerous investigations led utilizing cardiopulmonary rehabilitation have shown the efficacy regarding to ADL and functional capacity in TB and post-TB patients. As a result of high danger of infections due to contaminations, little consideration has been given with the impacts of lungs TB regarding functional and physical impairment, while physical performances of such patients ought to give data on the gravity(disease) and efficacy of therapy administered to the patients.(9) There are different modalities available for the evaluation of functional exercise capacity in different population. Some modalities provide complete set of assessment for all the systems which are involved in exercise performance and some provide just very basic information and are easy to perform. Whatever the mobility to be used it

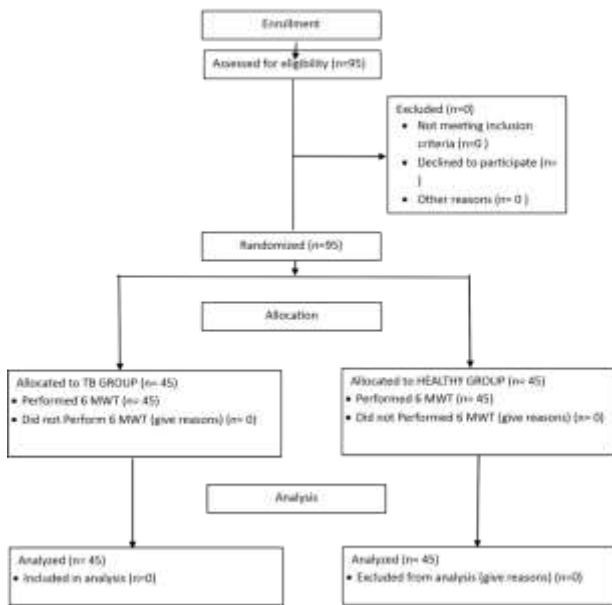
should address the clinical question to be tested. Different tests of different complexities like 6MWT, stair climbing, timed up and go test are available for different population like asthmatic persons, patients with cardiorespiratory problems etc. Cardiac stress testing is one of these. Functional capacity assessment is mostly done by asking questions to patients like: "what number of steps you can walk without getting stressed or how many stairs are you able to climb?" however, patients most of the time answer by over or under estimating her/his capabilities. 6MWT has been set up for clinical reason in different populations. Although initially the test was produced for assessing the persons involved in various physical activities by Balke in 1963 throughout the years of researches has set the utility of 6MWT in different illness conditions including cardiovascular problems, COPD, cerebral paralysis, imputed patients, hereditary problems, for example, Down's syndrome, fibromyalgia and Alzheimer's, disease. There are many evidences that the 6MWT is widely utilized in different clinical scenarios just as in a lab to decide the endurance of an individual. This includes easy method whereby a patient to be tested walks as quick as conceivable to & for a 30 meter long even passageway. (10) The (6MWT) basically measures the all-out distance that an individual can walk as quick as conceivable along a 30-meter hallway in a short time. The test taker endeavor the test is permitted to rest and is self-paced as needed as they walk. It measures the functional capacity evaluated in a clinical setting and supplements the estimation of oxygen take-up peak. The 6MWT is additionally an indicator of mortality and morbidity in cardiovascular problems like heart failure and those with ongoing obstructive illness like (COPD). It has generally adopted being a reliable, protected, reasonable & simple to administered .(11)

MATERIAL AND METHODS

It was a case control study. Data was collected from Sheikh Tayyab Clinic (A Project of Mercy corps). Duration of study was 6 months after the approval of synopsis. Non probability convenient sampling technique was used. Sample size was 90 Subjects, out of them 45 were with tuberculosis sequelae and 45 were healthy subjects. Sample size was calculated from epitool from the reference of a previous study.(12) The patients were reached from

Sheikh Tayyab Clinic (A Project of Mercy corps) while the healthy persons were taken from local community after directing a complete history. Informed consent was taken from both groups. The two groups were surveyed for socioeconomics, essential clinical profile, The Borg perceived exertion scale and six-minute walk test. The information was recorded in patient information form. 40 subjects with diagnosed TB sequelae aged 40-65 years were chosen from Gulab Devi Government Hospital. 40 age-matched healthy individuals from the ordinary population were picked as control group. All subjects with diagnosed TB were clinically stable and were on medicines to deal with their disease. Patients having pneumonic infections of any other kind were not taken for tuberculosis sequelae group. Exclusion criteria also barred the individuals who bit tobacco, smoked cigar, or drank liquor. People with coronary diseases, infarction, heart and stomach surgeries, in the past a half year, fracture history a half year particularly at the spine and hip, joint inflammation, intense ailment or injury upon the arrival of the evaluation day, renal illness, peripheral central vascular diseases, and lower limb deformations were excluded from the two groups. Outcome measuring tool were six-minute walk test and Physical functional capacity (VO₂ max). Borg rating of perceived exertion (RPE) an outcome measure tool is utilized in knowing the intensity of exercises prescription (13). SPSS statistical software 21.0 version was used for statistical analysis of collected data. Descriptive data was calculated and expressed as mean ± standard deviation.

**Consort Flow Diagram
Data Collection Procedure**



RESULTS

Forty healthy; and forty individuals with TB completed the 6MWT. To functionally classify the subjects the VO₂ max values were used as a measure of physical functional capacity. In the TB sequelae individual group, 52% had a VO₂ max under 21 ml/kg/min that brought about an impressive effect of TB sequelae on cardiorespiratory endurance.

Table 1 shows descriptive statistics of each variable. Normality of the data was shown by KOLMOGOROV-SMIRNOV Z TEST. For all the variables significance values of both groups were > 0.05 which indicated a normal distribution. (Table 2).

Mean 6-minute walking distance covered by TB individuals and VO₂ were significantly lower than in healthy older group with p value < 0.001 as shown in Table 3.

For the age and height there found insignificant difference between groups, but for weight individuals with TB sequelae it was found significantly lower than the healthy individuals (Table 3).

Dependent variable was 6MWT and independent variables were age, height, weight, and BMI.

Table 1: shows the descriptive statistics of each variable

variable	normal individuals (n=40)	tb - patients (n=40)
	mean ± sd	mean ± sd
age years	56.37± 6.74	55.70±6.34
height cm	159.68±8.02	155.67±8.59
weight kg	59.19±9.78	58.53 ±10.38
bmi	22.70±3.28	26.0 ±4.28
6mwd meters	477±11.09	434± 10.63
VO ₂ max ml/kg/min	37.75±4.01	32.92 ±3.04

Table 2: Kolmogorov-Smirnov Z Test

Variable	Kolmogorov-smirnov z test (normality)					
	Normal (n=40)			Tb sequelae (n=40)		
	Mean ± sd	Z-value	Significance (2-tailed)	Mean ± sd	Z-value	Significance (2-tailed)
Age (yrs)	56.37± 6.74	0.949	0.342	55.70±6.34	1.10	0.181
Height (cm)	152.19 ±9.69	0.654	0.783	155.29±8.76	.584	0.873
Weight (kg)	56.75± 10.89	1.034	0.245	39.25±7.66	.989	0.284
Bmi	24.62± 4.21	0.780	0.728	16.11±2.97	.873	0.413
6mwd (m)	477±11.09	1.532	0.345	434± 10.63	1.21	0.122
VO ₂ max (ml/kg/min)	34.77± 4.27	1.421	0.567	21.62±6.01	.981	0.284

Table 3: Normal Vs Tb Sequelae

Variable	Normal vs tb sequelae			
	T value	P value	Confidence interval	
			Lower liimt	Upper limit
Age (yrs)	0.927	.355	1.542	2.222
Height (cm)	1.343	.226	1.462	5.479
Weight (kg)	11.061	<.0002	14.784	22.026
Bmi	12.853	<.0002	7.359	10.036
6mwd (m)	14.637	<.0002	154.078	204.423
VO ₂ max (ml/kg/min)	14.676	<.0002	12.259	16.085

DISCUSSION

Studies have shown that Tuberculosis is a very infectious disease influencing the lungs and resulting in fibrotic changes to lung tissue along with poor lung compliance. (14) Thusly, individuals with pulmonary tuberculosis face poor gas exchange and impaired functional capacity(15). The main objective of this study was to compare the 6MWT in healthy individuals with age 40 – 65 years and individuals with pulmonary tuberculosis.

40 healthy subjects and 40 subjects with diagnosed tuberculosis partook in the current study. Subjects went through a 6-minute walk test and then Walk-work was determined and utilized for assessing physical functional capacity VO₂max.

This study demonstrated that in older healthy individuals, the 6MWD was even lower on average. Mean 6 minute walking distance covered by TB individuals and VO₂ were significantly lower than in older healthy group (p < 0.001) For the age and height there found insignificant difference between groups, but for weight individuals with TB sequelae it was found significantly lower than the healthy individuals .For height and body mass index (BMI) Pearson product correlations with 6MWD were found significant in the healthy individual and weight and BMI proved to be significant in patients with TB.

The 12MWT was presented as a manual to evaluate fitness(16) and was subsequently utilized in individuals with

obstructive disease like COPD.(17)It was consequently confirmed that the test timing could be decreased to 6 min.(18)

According to Lancaster, L.H 2018 The 6MWT is a simple test and is very much relevant to performance of patients regarding activities of daily living and also correlates with lung function measures and health related quality of life. However, the results of a 6MWT are affected by numerous factors, including age, body size and comorbidities, and these need to be taken into account in the interpretation of the results. The result of this is in line with the current study where insignificant difference was seen in regard to height and age between groups but for weight individuals with TB significantly lower than the healthy individuals. (19)

According to Cavalheri V, 2016 The validity of 6MWT has been correlated with high oxygen saturation and pulse rate when contrasted with bike ergometry and treadmill tests. A significant difference was seen when this test was administered on two progressive days, 15% improvement in the distance covered by the patients was observed yet this impact was insignificant when utilizing the outcomes as a predictor of future occasions. (20)

CONCLUSION

A significant difference was found in functional capacity in terms of VO₂max between healthy and patients with TB was found. TB sequelae individuals' group, 52.6% patients had a VO₂ max under 21 milliliter per kilogram per minute that brought about an impressive effect of TB sequelae on endurance in regards to cardiorespiratory system. Oxygen saturation should be used in future studies for pulmonary TB population in determining predictive values of VO₂ max.

REFERENCES

- Ravimohan S, Kornfeld H, Weissman D, Bisson GP. Tuberculosis and lung damage: from epidemiology to pathophysiology. *Eur Respir Rev.* 2018;27(147):170077.
- Ravimohan S, Kornfeld H, Weissman D, Bisson GP. Tuberculosis and lung damage: from epidemiology to pathophysiology. *European Respiratory Review.* 2018;27(147).
- Parshall MB, Schwartzstein RM, Adams L, Banzett RB, Manning HL, Bourbeau J, et al. An official American Thoracic Society statement: update on the mechanisms, assessment, and management of dyspnea. *Am J Respir Crit Care Med.* 2012;185(4):435-52.
- Spruit MA, Singh SJ, Garvey C, ZuWallack R, Nici L, Rochester C, et al. An official American Thoracic Society/European Respiratory Society statement: key concepts and advances in pulmonary rehabilitation. *American journal of respiratory and critical care medicine.* 2013;188(8):e13-e64.
- Spruit MA, Singh SJ, Garvey C, ZuWallack R, Nici L, Rochester C, et al. An official American Thoracic Society/European Respiratory Society statement: key concepts and advances in pulmonary rehabilitation. *Am J Respir Crit Care Med.* 2013;188(8):e13-64.
- Walsh TS, Salisbury LG, Merriweather JL, Boyd JA, Griffith DM, Huby G, et al. Increased hospital-based physical rehabilitation and information provision after intensive care unit discharge: the RECOVER randomized clinical trial. *JAMA internal medicine.* 2015;175(6):901-10.
- Torrelles JB, Schlesinger LS. Integrating Lung Physiology, Immunology, and Tuberculosis. *Trends in microbiology.* 2017;25(8):688-97.
- Walsh TS, Salisbury LG, Merriweather JL, Boyd JA, Griffith DM, Huby G, et al. Increased Hospital-Based Physical Rehabilitation and Information Provision After Intensive Care Unit Discharge: The RECOVER Randomized Clinical Trial. *JAMA Intern Med.* 2015;175(6):901-10.
- Jabeen K. Pulmonary infections after tuberculosis. *Int J Mycobacteriol.* 2016;5(1):22.
- Mbatchou Ngahane BH, Nouyep J, Nganda Motto M, Mapoure Njankouo Y, Wandji A, Endale M, et al. Post-tuberculous lung function impairment in a tuberculosis reference clinic in Cameroon. *Respir Med.* 2016;114:67-71.
- Agarwala P, Salzman SH. Six-Minute Walk Test: Clinical Role, Technique, Coding, and Reimbursement. *Chest.* 2020;157(3):603-11.
- Yoneda R. [Tuberculosis sequelae]. *Kekkaku.* 1990;65(12):827-9.
- O'Neil S, Thomas A, Pettit-Mee R, Pelletier K, Moore M, Thompson J, et al. Exercise Prescription Techniques in Cardiac Rehabilitation Centers in Midwest States. *Journal of Clinical Exercise Physiology.* 2018;7(1):8-14.
- Adigun R, Singh R. Tuberculosis.
- Sivaranjini S, Vanamail P, Eason J. Six minute walk test in people with tuberculosis sequelae. *Cardiopulm Phys Ther J.* 2010;21(3):5-10.
- Solway S, Brooks D, Lacasse Y, Thomas S. A Qualitative Systematic Overview of the Measurement Properties of Functional Walk Tests Used in the Cardiorespiratory Domain*. *Chest.* 2001;119:256-70.
- Rennard SI, Drummond MB. Early chronic obstructive pulmonary disease: definition, assessment, and prevention. *Lancet.* 2015;385(9979):1778-88.
- Spruit MA, Burtin C, De Boever P, Langer D, Vogiatzis I, Wouters EFM, et al. COPD and exercise: does it make a difference? *Breathe (Sheff).* 2016;12(2):e38-e49.
- Lancaster LH. Utility of the six-minute walk test in patients with idiopathic pulmonary fibrosis. *Multidisciplinary Respiratory Medicine.* 2018;13(1):45.
- Cavalheri V, Jenkins S, Cecins N, Gain K, Hill K. Comparison of the six-minute walk test with a cycle-based cardiopulmonary exercise test in people following curative intent treatment for non-small cell lung cancer. *Chron Respir Dis.* 2016;13(2):118-27.