

Original Research Article

CORRELATION BETWEEN 6-MINUTE WALK DISTANCE TEST AND THE SEVERITY OF CHRONIC OBSTRUCTIVE PULMONARY DISEASE

Sidla Rehman¹, Aleena Rehman², Wajahat Sultan Baig³, Bushra Amin⁴, Zahid Hussain⁵, Abidain Haider⁶

¹Senior Registrar, Department of Pulmonology, Wah Medical College NUMS, Wah Cantt, Pakistan

²House Officer, Khyber Teaching Hospital, Peshawar, Pakistan

³Assistant Professor, Department of Medicine, Wah Medical College NUMS, Wah Cantt, Pakistan

⁴Senior Registrar, Department of Pulmonology, Islamabad Medical and Dental College, Islamabad, Pakistan

⁵Assistant Professor, Department of Pulmonology, Akhter Saeed Medical College, Islamabad, Pakistan

⁶Assistant Professor, Department of Pulmonology, Wah Medical College NUMS, Wah Cantt, Pakistan

Received : 12/05/2026
Received in revised form : 14/06/2026
Accepted : 19/06/2026

Corresponding Author:

Dr. Wajahat Sultan Baig,
Assistant Professor, Department of
Medicine, Wah Medical College
(NUMS), Wah Cantt, Pakistan.
Email: wajahat_sultan@yahoo.com

DOI: 10.70034/ijmedph.2026.2.750

Source of Support: Nil,

Conflict of Interest: None declared

Int J Med Pub Health
2026; 16 (2); 4596-4600

ABSTRACT

Background: Patients with COPD develop reduced exercise capacity with age, more as compared with healthy individuals. The exercise tolerance in these patients fall significantly with age and related to severity of the disease. The objective is to see the association between 6-minute walk distance test and severity of COPD in our population.

Materials and Methods: We conducted this cross-sectional study, including 125 people after ethical approval and informed consent. Using the consecutive sampling technique, confirmed cases of COPD between age 40 to 70 years, both males and females were added. All patients underwent Spirometry for COPD diagnosis and GOLD staging. All the participants then underwent 6MWD test. Data was collected, coded and entered in the Statistical package for Social Science (SPSS) version 25. Categorical data like gender, smoking status was presented as frequencies and percentages while numerical data like age, BMI, Spirometry findings and 6MW distance was presented as mean and standard deviations.

Results: The severity of COPD showed that stage I patients were 11 (8.8%), stage II patients were 49 (39.2%), stage III patients were 48 (38.4%) and stage IV patients were 17 (13.6%). There was a significant negative correlation between the stages of COPD (FEV1 percent of predicted) and distance covered in a 6 minutes' walk test ($r = -0.429$, $p < 0.01$).

Conclusion: The 6-minute walk distance test is significantly related to the disease severity in COPD and can be used to assess the functional status in these patients.

Keywords: Chronic obstructive pulmonary disease, Severity, 6 minute walk distance

INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is a chronic inflammatory disease that involves small airways of the respiratory tract leading to airflow obstruction that is not fully reversible with bronchodilators. The disease is quite common worldwide and has been predicted to be the third leading cause of mortality worldwide by the year 2030.^[1] According to the 2019 statistics, the worldwide prevalence of COPD between age 30-79

was approximately 10% with more than 390 million people affected,^[2] highest in the western pacific region. In Pakistan, the disease burden of COPD is quite high with approximately 7 million patients with a prevalence of about 26% undiagnosed cases in rural population.^[3] There are 2 phenotypes of COPD, first is Chronic bronchitis characterized by persistent productive cough for at least 12 months and the second type is Emphysema manifested mainly by the shortness of breath with coughing.^[4] Patients with COPD experience a progressive decline in their exercise capacity due to deconditioning and

worsening of dyspnea. The severity of airflow limitation has been categorized by the Global initiative for COPD5 (GOLD) as stage 1-4, FEV1/FVC ≥ 0.60 to < 0.70 , stage 2 FEV1/FVC ≥ 0.50 to < 0.60 , stage 3 FEV1/FVC ≥ 0.40 to < 0.50 , stage 4 FEV1/FVC < 0.40 . FEV1 and the ratio of FEV1/FVC are useful parameters while assessing the risk of COPD and its severity.^[6] The 6-min walking distance (6MWD) test is a useful tool to obtain a measure of functional exercise capacity. It is a simple way to evaluate the functional status and exercise capacity, particularly in people with chronic airway disorders. A meta-analysis showed that 6-minute walk distance is a reliable and useful tool for the assessment of functional status in patients with COPD and the therapeutic measures targeted towards better 6MWD also helped in overall outcomes in COPD patients.^[7] This is particularly useful in resource limited countries where costly tests cannot be done in routine basis so the 6-minute test could serve as a simpler way to assess the disease outcomes in patients with chronic airway disorders. The 6MWD test has already been used as a tool for the evaluation of various therapeutic measures regarding the improvement of dyspnea in COPD cases, highlighting its importance.^[8] The normal average 6MWD ranges between 400-875m in males while in females it ranges between 380-800meters.^[9] It has been observed that the 6MWD declines significantly in people with COPD that could be because of the involvement of both pulmonary and non-pulmonary factors.^[10]

We conducted the current study to determine correlation between FEV1 and exercise capacity as measured by 6-minutes walked distance(6MWD) in our patients with COPD.

MATERIALS AND METHODS

This prospective cross-sectional study was conducted in the department of Pulmonology, Farooq Teaching hospital, Akhter Saeed Medical College, Islamabad Campus after getting the official approval from the institutional ethical committee IRB number IRB-0804. The study was done for 6 months from 01st Nov 2025 to 30th April 2026. A total of 125 participants were enrolled using the following, $r=0.576$, Confidence interval=95%, Power of the test=80%, Sample size =125. Using the consecutive sampling technique, confirmed cases of COPD between age 40 to 70 years, both males and females were added. Patients with all potential confounders i.e recent myocardial infarction, uncontrolled hypertension, active Pneumonia, Pneumothorax, left ventricular failure, Neuromuscular disorders were excluded from our study. Stable COPD patients were taken and the informed consent was obtained before the start of study. All patients underwent Spirometry for COPD diagnosis and GOLD staging. Patient's demographic data, BMI, smoking status and duration of disease was documented. All the participants then

underwent 6MWD test. It was done in a 33-m long and ventilated indoor corridor. Before the beginning of test, the patient's physiological parameters like heart rate and blood pressure were measured, pulse oximetry performed to measure oxygen saturation. Patients was given proper instructions. Patients were properly educated about the test. The aim of test (to cover as much distance as possible during 6 minutes without running or jogging and without any warm up period) properly explained to them. The test walk was stopped if any participant suffered severe chest pain, severe shortness of breath, spasm in lower limb muscles, or if the patient wished to discontinue. At the end of the test all the vitals like pulse BP and oxygen saturation were recorded again, plus distance covered during the test was recorded.

Data was collected, coded and entered in the Statistical package for Social Science (SPSS) version 25. Categorical data like gender, smoking status was presented as frequencies and percentages while numerical data like age, BMI, Spirometry findings and 6MW distance was presented as mean and standard deviations. Spearman's rank correlation coefficients will used to found relation between two variables, severity of COPD and 6MWT. The p-value < 0.05 was considered significant. Effect modifiers like age, gender, BMI, smoking status, duration of COPD was controlled through stratification at data analysis stage. Those patients who had smoked more than 100 cigarettes lifelong will be labeled as smoker. Post stratification Spearman's rank correlation test will applied keeping p-value < 0.05 as significant.

RESULTS

In our 125 patients 52 (41.6%) were male and 73 (58.4%) were females. Current smokers were 2 (1.6%), Non-smokers were 81 (64.8%) and ex-smokers were 42 (33.6%). The severity of COPD showed that stage I patients were 11 (8.8%), stage II patients were 49 (39.2%), stage III patients were 48 (38.4%) and stage IV patients were 17 (13.6%). Mean age was 61.30 ± 10.036 years. Mean weight was 65.76 ± 17.43 kg. Mean height was 2.05 ± 5.22 meter and mean BMI was 25.83 ± 6.49 kg/m². The Mean duration of COPD was 7.83 ± 6.15 years. Mean FEV1 was 1.53 ± 4.66 L and Mean FEV1 predicted was $51.67 \pm 19.68\%$. Mean six minutes' walk distance is 291.38 ± 96.424 meters. Table 1 shows the stratification of age, BMI and duration of COPD. There was no significant difference in the mean of FEV1 predicted in these groups except that the age group > 65 years showed less FEV1 predicted values (49.86 ± 23.35) as compared to age group < 55 years (53.64 ± 16.86), p value of 0.049. Stage II and stage III were more common in female (20.80% and 28% respectively) (p value = 0.023). Stage III was more common in patients with age > 65 years (13.6%) as compared to age group 55-65 years (16.80%) and < 55 years (15.20%) (p value = 0.010). Table 2 showed that comparison of mean of gender, age groups, BMI,

groups, smoking status, and duration of COPD groups patients against distance covered in 6 minutes. Mean of 6-minute walk test was significantly greater in male as compare to female (328 ± 99.55 vs 266 ± 86.49), in age group <55 years and in COPD duration of <7 years (p value <0.01) (Table 2). Table 3 showed the mean and standard deviation of 6 minutes' walk test in different stages of COPD. There was significant difference in the stage II, stage III and stage IV mean value of 6 minutes-walk test which

were 327 ± 91.59 , 264 ± 88.05 and 226 ± 72.34 respectively. There was a significant negative correlation between the stages of COPD (FEV1 percent of predicted) and distance covered in a 6 minutes' walk test ($r = -0.429$, $p < 0.01$). (Spearman's correlation rank test) (Table 3 and 4) Table 5 showed the Spearman's rho correlation coefficient and their significance between baseline variables against 6MWD and severity of COPD.

Table 1: Stratification of BMI, duration of COPD and Age

	N	%
Age (years) <55	39	31.2
55-65	43	34.4
>65	43	34.4
BMI (kg/m ²) <27	85	68
>27	40	32
COPD duration (years) <7	74	59.2
>7	51	40.8

Table 2: Comparison of baseline parameter against distance covered in 6-min

	6MWD (meters)		P value
	Mean	SD	
Gender			
Male	326	99.55	0.000
Female	266	86.49	
Age(years)			
<55	341	98.87	0.004
55-65	279	90.45	
>65	259	83.43	
BMI (kg/m ²)			
<27	290	97.69	0.807
>27	294	94.82	
Smoking			
Smoker	330	93.34	0.433
Non-Smoker	277	94.33	
Ex-Smoker	318	96.69	
COPD Duration (years)			
<7	310	93.06	0.009
>7	264	95.65	

Table 3: Comparison of severity of COPD (predicted FEV1) against distance covered in 6 minutes

	Severity of COPD				P values
	Stage I	Stage II	Stage III	Stage IV	
	Mean $\pm$ SD	Mean $\pm$ SD	Mean $\pm$ SD	Mean $\pm$ SD	
6-minute walk distance meters	353 ± 93.91	327 ± 91.59	264 ± 88.05	226 ± 72.34	0.412(Comparison between Stage I and Stage II) 0.004(Comparison between Stage I and Stage III) 0.000(Comparison between Stage I and Stage IV)

Table 4: Spearman's correlation coefficient of severity of COPD and 6 minutes' walk test.

	6MWD (meters)	Severity of COPD
Spearman's Rho 6MWD Coefficient correlation		-0.429
Sig. (2-tailed)	1.000	0.000
N	125	125
Severity of COPD Coefficient correlation	-0.429	1.000
Sig. (2-tailed)	0.000	125
N	125	

Table 5: Spearman's Rho for various baseline parameter

Variables	Spearman's rho correlation coefficient	Test of significance for spearman's rho two sided p-value
Age		
<55 years	-0.25	0.190
55- 65 years	-0.58	<0.001
>65 years	-0.40	0.006

Gender			
	Female	-0.383	<0.001
	Male	-0.424	<0.001
BMI			
	< 27	-0.49	<0.001
	>27	-0.28	0.075
Duration of COPD			
	< 7 years	-0.56	<0.001
	>7 years	-0.20	0.159
Smoking status			
	Smoker	-1	
	Ex-Smoker	-0.40	0.008
	Non- smoker	-0.44	<0.001

DISCUSSION

Deconditioning and reduced exercise capacity progressively develops with age, however this decline is quicker in patients with chronic airway disorders like COPD. In people with COPD, the factors like physical activity aggravates the reduced exercise tolerance. Those patients with COPD who are physically inactive are more prone to develop reduced exercise tolerance and worsening of dyspnea due to exaggerated inflammatory response triggered by lack of physical inactivity.^[11] Our present study showed that severity of COPD is related to exercise capacity manifested by decline in their 6-minute walk distance(6MWD) based on the stage of COPD. We found that FEV1 and the 6MWD both showed a decline in the elderly group. Rosso A et al,^[12] also found a significant decline in FEV1 of patients with COPD with age similar to our observations. With regard to gender, we found that the 6MWD was more in males, similar observation was noted by Cazzoletti L et Al who found males having better 6 minute walk distance covered compared with females⁹. People with COPD show a significant reduction in 6MWD as compared to normal individuals or those with normal results in Spirometry testing.^[13] This decline is indicative of poor exercise tolerance in patients with COPD, while the 6MWD test is a simple and cost-effective way to evaluate the exercise capacity in these patients. There was a significant negative co relation between COPD stage and 6MWD in our study results, the distance covered in 6-minutes was significantly lower in people with advanced COPD stage or low FEV1. Similar findings were noted in a study conducted in India which showed 6MWD related to FEV1 or severity of COPD.^[14] Spirometry is not readily available particularly in the resource limited countries, hence 6MWD test is the simplest way to monitor the functional capacity in patients with COPD. The 6MWD test was used as a parameter to assess the impact of inspiratory muscle training with biofeedback in COPD patients in a randomized controlled trial conducted in Pakistan,^[15] highlighting the usefulness of this simple but useful tool in these patients. A cross sectional study conducted in Saudi Arabia showed that 6MWD test is a useful tool can be used to assess the functional status in patients with COPD.^[16] Recent studies have shown that 6MWORK test can also be a useful simple parameter in patients with COPD to assess the quality of life and functional

status,^[16] however we can compare that test with conventional 6MWD test in our population to see its usefulness in our settings. Clinicians should utilize the 6MWD test carefully while assessing the functional status due to moderate reliability as found in one study.^[17]

Our study had a few limitations as well. The study design was cross sectional so the exact causal relationship cannot be determined. Keeping in view, the study was single centered so the results cannot be generalized.

CONCLUSION

The 6-minute walk distance(6MWD) test is a simple, cost effective and convenient way to assess the functional status in COPD patients, however further studies, preferably multi-centric using larger samples can be conducted to see the strength of association.

REFERENCES

1. World Health Organization (WHO). <https://www.who.int/news-room/fact-sheets/detail/the-top-10-causes-of-death>. Access: December. 2021.
2. Adeloje D, Song P, Zhu Y, Campbell H, Sheikh A, Rudan I, Unit NR. Global, regional, and national prevalence of, and risk factors for, chronic obstructive pulmonary disease (COPD) in 2019: a systematic review and modelling analysis. *The Lancet. Respiratory medicine*. 2022 May;10(5):447-58. doi: 10.1016/S2213-2600(21)00511-7.
3. Habib FZ, Mahmood SU, Muhammad A, Shah U, Muzaffar S, Naqvi SS. Prevalence of undiagnosed chronic obstructive pulmonary disease (COPD) and asthma in underserved rural sindh, Pakistan. *Chest*. 2023 Oct 1;164(4):A5039. <http://dx.doi.org/10.1016/j.chest.2023.07.3263>
4. Kahnert K, Jörres RA, Behr J, Welte T. The Diagnosis and Treatment of COPD and Its Comorbidities. *Deutsches Arzteblatt international*. 2023 Jun 23;120(25):434-44. doi: 10.3238/arztebl.m2023.027
5. Bhatt SP, Nakhmani A, Fortis S, Strand MJ, Silverman EK, Sciurba FC, Bodduluri S. FEV1/FVC severity stages for chronic obstructive pulmonary disease. *American journal of respiratory and critical care medicine*. 2023 Sep;208(6):676-84. <https://doi.org/10.1164/rccm.202303-0450OC>
6. Jang JG, Kim Y, Shin SH, Min KH, Jung KS, Kim YI, Park S, Na JO, Lee H, Yoo KH. The role of FEV1/FVC in the prediction of acute exacerbation of COPD. *Respiratory Medicine*. 2024 Nov 1;234:107780. <https://doi.org/10.1016/j.rmed.2024.107780>
7. Chae G, Ko EJ, Lee SW, Kim HJ, Kwak SG, Park D, Ra SW. Stronger correlation of peak oxygen uptake with distance of incremental shuttle walk test than 6-min walk test in patients with COPD: a systematic review and meta-analysis. *BMC pulmonary medicine*. 2022 Mar 24;22(1):102. <https://doi.org/10.1186/s12890-022-01897-0>

8. Ferté JB, Boyer FC, Taiar R, Pineau C, Barbe C, Rapin A. Impact of resistance training on the 6-minute walk test in individuals with chronic obstructive pulmonary disease: a systematic review and meta-analysis. *Annals of Physical and Rehabilitation Medicine*. 2022 May 1;65(3):101582. <https://doi.org/10.1016/j.rehab.2021.101582>
9. Cazzoletti L, Zanolini ME, Dorelli G, Ferrari P, Dalle Carbonare LG, Crisafulli E, Alemayohu MA, Olivieri M, Verlato G, Ferrari M. Six-minute walk distance in healthy subjects: reference standards from a general population sample. *Respiratory research*. 2022 Apr 5;23(1):83. <https://doi.org/10.1186/s12931-022-02003-y>
10. Boriek AM, Gordon J, Gwon Y, Adami A, Porszasz J, Rossiter HB, Rambod M, Chandra D, Diaz AA, Kinney GL, Make BJ. Correlates of 5-year decline in 6-min walk distance in the COPDGene cohort. *Thorax*. 2026 Apr 13. <https://doi.org/10.1136/thorax-2025-224183>
11. Maniscalco M. Physical inactivity drives COPD progression beyond airflow limitation. *Acta Physiologica*. 2026 Apr;242(4):e70192. DOI: 10.1111/apha.70192
12. Rosso A, Egervall K, Elmståhl S. Annual decline rate in FEV1s in community-dwelling older adults diagnosed with mild to moderate COPD. *Npj Primary Care Respiratory Medicine*. 2022 Aug 26;32(1):30. <https://doi.org/10.1038/s41533-022-00292-w>
13. Boriek AM, Gordon J, Gwon Y, Adami A, Porszasz J, Rossiter HB, Rambod M, Chandra D, Diaz AA, Kinney GL, Make BJ. Correlates of 5-year decline in 6-min walk distance in the COPDGene cohort. *Thorax*. 2026 Jul;81(7):664-71. doi.org/10.1136/thorax-2025-224183
14. Krishna BS, Mohapatra AK, Behera D, Jagaty SK, Subhankar S, Venkataram R, Dash DP. Six-minute walk test and its correlation with spirometry in stable COPD patients. *Journal of Health and Allied Sciences NU*. 2022 Jul;12(03):280-5. DOI: 10.1055/s-0041-1740331
15. Gondal, S.A., Raza, M., Naseem, N., Hameed, R., Ahmed, A., Hayat, S. and Rizwan, S., 2025. Impact of Inspiratory Muscle Training with Biofeedback vs Traditional Breathing Exercises on Dyspnea and Exercise Tolerance in COPD: A Randomized Controlled Trial: Inspiratory Muscle Training vs Traditional Breathing in COPD. *Allied Medical Research Journal*, 3(04), pp.14-22. DOI: <https://doi.org/10.59564/amrj/03.04/004>
16. Shaphe MA, Alshehri MM, Alajam RA, Ghazwani A, Temehy BF, Sahely A, Husein J Alfaifi B, Hakamy A, Khan A, Aafreen A, Khan AR. Evaluating the physiological responses to treadmill exercise based on the 6-minute walk test in individuals with COPD across severity levels. *Frontiers in Physiology*. 2025 Oct 31;16:1668559. | <https://doi.org/10.3389/fphys.2025.1668559>
17. Resqueti V, Torres-Castro R, Gimeno-Santos E, Cardoso NL, Alsina-Restoy X, Barberà JA, Blanco I. Limitations of 6-minute walk test-based equations in predicting peak oxygen uptake and risk assessment in patients with pulmonary hypertension and COPD. *Respiratory Medicine*. 2026 Feb 27;108738. <https://doi.org/10.1016/j.rmed.2026.108738>