

CORRELATION OF PHYSICAL ACTIVITY AND RESPIRATORY HEALTH IN COPD PATIENTS

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ABSTRACT

COPD has raised researchers' interest in physical activity monitoring studies in the last few decades. Physical activity declines as COPD advances. Patients with COPD often have poor quality of life and advances in medical field have improved the assessment of quality of life in COPD patients by using different instruments.

Objective: Study determine the correlation between person's physical activity and respiratory health.

Methods: Cross-sectional study was conducted to determine the correlation between physical activity level and respiratory health parameters. 154 COPD patients were included in this study from Niazi Medical complex, club road Sargodha, Pakistan. 6-minute walk test and IPAQ long was used to assess physical activity level among patients. Spirometry for FVC, FEV1, FEV1/FVC ration, VC, IVC a PEF was done and respiratory health was assessed. The data was analyzed using SPSS v 25. The normality of the data was assessed by Shapiro-Wills test. Independent sample T test was applied to determine any significant difference across CPOD subjects of different severity. Pearson Correlation were applied to determine the correlation between Physical Activity level and Respiratory parameters of COPD patients.

Results: Expiratory vital capacity and vital capacity showed significant correlation with physical activity level $P < 0.05$. While other parameters of respiratory health which included peak expiratory flow, FEV1/FVC, FVC, FEV1 do not show any correlation with physical activity level $P > 0.05$.

Conclusion: In COPD patients decline in VC and EVC is correlated with level of physical activity as evaluated using IPAQ

Key words: COPD, Respiratory Health, Physical Activity.

I. INTRODUCTION

Global Initiative of Chronic Obstructive Pulmonary Diseases (GOLD) described the chronic obstructive pulmonary disease (COPD) as ordinary, mendable and curable disease which presents as constant pulmonary signs, symptoms and restrictive changes of airway due to alveolar dysfunction. Etiology of COPD is chronic lung inflammation. COPD is characterized by breathlessness, acute exacerbation and reduced exercise capacity.¹ Clinically characterized by airflow obstruction or

chronic air flow limitations, COPD presents as slow irreversible progression and associated inflammatory response of lungs to noxious gases or particles. Low exercise capacity results in reduced ability to perform the activity of daily life which results in sedentary life style and inactivity.²

This dysfunction is produced by major exposure to harmful particles or toxins. For definitive diagnosis of COPD clinical assessments of airways are made and cough and wheeze are gold standard symptoms for COPD.³ COPD is leading case of mortality all over the world and increasing day by day. COPD is heterogenous and multisystem disease with high morbidity and mortality rate. There are different phenotypes of COPD subgroups.⁴

Age related decline in FEV1 among COPD patients is similar among different age groups. COPD can easily be diagnosed at more advance stage by measuring FEV1 rather than early stage.⁵ Most functional impairment occurs at GOLD stage II. Early detection of COPD is mostly based on risk factor rather than functional limitations. GOLD staging of COPD is based on FEV1 measurement and exacerbations and symptoms history.⁶

Lung function test is commonly used to assess respiratory health and when a person has low peak lung function in young age it is indication of poor pulmonary function.⁷ Person with poor pulmonary function will have future pulmonary impairments. In clinical practice Spirometry is recommended by global initiative of respiratory diseases to assess lung function test.⁸ Individual with FEV1/FVC lower than 80% shows they have underlying symptoms of lung impairment Respiratory Function Parameters such as forced expiratory volume in 1 sec is well established to provide the degree of airflow limitation.⁹

COPD has raised researchers' interest in physical activity monitoring studies in the last few decades. Physical activity declines as COPD advances.¹⁰ Patients with COPD often have poor quality of life and advances in medical field have improved the assessment of quality of life in COPD patients by using different instruments. Various studies have assessed quality of life and correlate it with respiratory function parameters.¹¹ The studies that have explored the quality of life and respiratory function parameters strongly supported the use of spirometer to assess respiratory function parameters.¹²

Physical activity is recommended for better exercise tolerance, reducing pulmonary impairment, improving work efficiency, physical well-being and reducing disability among the patients of COPD.¹³

II. Methodology

This was cross-sectional correlational study. Data was collected from Niazi Hospital Sargodha. Study was completed within 10 months. Sampling technique was Non-Probability Convenience Sampling. Patient with smoking history (current or former), aged between 40 to 60 years.¹⁴ Both genders male and female with COPD staging, GOLD 1: Mild COPD, **FEV-1 $\geq 80\%$** , GOLD 2: Moderate COPD, **FEV-1 50-79%**¹⁵, GOLD 3: Severe COPD, **FEV-1 30-49%**, GOLD 4: very severe **less than 30%**¹⁶, Cognitively stable patients MMS >24 were included in history. While patient with any chronic respiratory disease other than COPD, any other Comorbidity e.g. cardiovascular disease¹⁷, limited patient's ability to complete questionnaire and concomitant enrollment in any other clinical trial.¹⁸

A sample of 154 subjects was enrolled in this study. International physical activity questionnaire is applicable for survey among 18 to 65 years to assess level of physical activity along different countries. It is developed in 2 Versions; first is long version (27 items), second is short version (7 items). We used IPAQ long version which consists of job, transport, domestic and leisure time physical activities domains. Moderate and high intensity walking and sitting time activities are addressed in this questionnaire.¹⁹ Metabolic equivalence of task (METs) was calculated separately for each domain. Total weekly physical activity was calculated using separate MET value for each item by using following MET coefficient: Vigorous physical activity= 8 METs, Moderated physical activity= 4METs and walking physical activity= 3.3 METs. Vigorous and moderate physical activities are those lasting for more than 10 minute which doesn't include walking.²⁰

6MWT is most simple clinical outcome measure used to assess functional capacity among different group of patients including pulmonary cases. It measures maximum distance patient is able to walk in 30-m corridor in 6-minutes. It is a valid indicator of maximal or sub-maximal functional capacity.²¹

Portable digital spirometer **Spirodoc S/N W07910** used with **WinspiroPRO 8.2.0-Mod C11** word software were entered anthropometric values; age, gender, height, weight, BMI, and smoking status. Before it given predicted values and then asked the patient to breath for measuring different PFTs listed below and measured best values of the individual. Following parameters was measured using spirometer:

A. Forced expiratory volume in 1 s (FEV1):

Maximum amount of air that a person can exhale during first second following maximum inspiration.²²

B. Forced vital capacity (FVC):

The maximum amount of air that can be exhaled when blowing out as fast as possible.²²

C. FEV1/FVC ratio:

It is proportion of patients vital capacity that can be exhaled in first second of forced exhalation to the full forced vital capacity.²³

D. Vital capacity (VC):

Total amount of air that can be exhaled from lungs by maximum exhalation.²⁴

E. Peak expiratory flow (PEF):

It is maximum speed of exhalation with steady flow.²⁴

F. Expiratory vital capacity (IVC):

The amount of air that can be exhaled with forceful expiration.²⁵

The data was analyzed using SPSS v 25. The normality of the data was assessed by Shapiro-Wills test of normality and uniformity. Independent sample T test was applied to determine any significant difference across CPOD subjects of different severity. Pearson Correlation were applied to determine the correlation between Physical Activity level and Respiratory parameters of COPD patients.

III. Results

154 subjects with COPD were included in study. Male and female gender distribution showed in above table which represented 62.3% (n=96) male COPD patients and 37.7% (n=58) female COPD patients participated in study. Independent sample T- test was applied to determine any significant difference for the respiratory parameters when comparing across Moderate and High Physical Activity groups. There was no significant difference comparing across Moderate and High Physical Activity groups in terms of their respiratory parameters with p value >0.05 . (Table-1) Expiratory vital capacity and vital capacity showed significant correlation with physical activity level $P<0.05$. While other parameters of respiratory health which included peak expiratory flow, FEV1/FVC, FVC, FEV1 do not show any correlation with physical activity level $P>0.05$. (Table-2)

Table-1: Independent sample T test for difference in Respiratory Parameters across Moderate and High PA group:

	Total Mets Category Wise	N	Mean	Std. Deviation	Mean Difference	P value
Six Minute Walk Test (M)	Moderate PA	82	583.1951	66.57854	2.14	0.858
	High PA	71	585.3380	81.24688		
Vital Capacity (L)	Moderate PA	82	2.1517	.07717	0.22	0.068
	High PA	71	2.1290	.07518		
Expiratory Vital capacity (L)	Moderate PA	82	2.1517	.07717	0.22	0.068
	High PA	71	2.1290	.07518		
Peak expiratory Flow (L/S)	Moderate PA	82	6.3590	.40596	0.031	0.614
	High PA	71	6.3270	.37170		
Forced Vital capacity (L)	Moderate PA	82	3.0851	.14862	0.021	0.285
	High PA	71	3.1068	.08854		
Forced Expiratory Volume in 1 Sec (L)	Moderate PA	82	1.9567	.11900	0.023	0.337
	High PA	71	1.9803	.18081		
FEV1/FVC Ratio (%)	Moderate PA	82	65.0244	10.43496	0.531	0.751
	High PA	71	64.4930	10.18384		

IV. Discussion

Table-2: Correlation of Total Mets with Respiratory Parameters

Total METS	Correlation Coefficient	P value
Six Min Walk Test	-0.044	0.585
Vital Capacity	-0.236	0.003
Expiratory Vital Capacity	-0.236	0.003
Peak Expiratory Flow	-0.115	0.156
FEV1/FVC	-0.126	0.119
Forced Vital Capacity	0.082	0.311
Forced Expiratory Volume 1 sec	0.036	0.661

The main objective of the study was to determine the correlation between person's physical activity and respiratory health. 154 COPD patients were included in this study from Niazi Medical Complex, Sargodha Pakistan. Regardless of various methods used to assess group physical activity most useful tool is physical activity questionnaires.²⁶ Another way to assess physical activity is division of time into daily activities of different intensities. But this has high level of variability with 25% variation.²⁷ We used 6-minute walk test and IPAQ long was used to assess physical activity level among patients. Spirometry for FVC, FEV1, FEV1/FVC ratio, VC, IVC a PEF was done and respiratory health was assessed.

Literature supported that physical activity has positive effects on signs and symptoms and prognosis of COPD. Main finding of this study is vital capacity and expiratory vital capacity showed significant ($P < 0.05$) correlation with moderate to high level of physical activity in mild to severe COPD patients. Physical activity is a heterogeneous characteristic in patients with COPD. Correlation of physical activity and respiratory health found after stratification for age

(>18 or <60 years), gender (male or female), BMI (underweight, normal, overweight or obese), GOLD grades (I-IV). Regardless of GOLD stage of disease distance covered during 6-minute walk test is an independent variable.²⁸

Mean best FEV1/FVC ratio is 64.81 with SD 10.26. Expiratory vital capacity and vital capacity showed significant correlation with physical activity level $P < 0.05$. A study found correlation between SGRQ total score and FEV1 and SGRQ showed negative correlation with all respiratory function parameters. It was evaluated that decline in FEV1 is associated with poorer quality of life in COPD patients while our study found parameters of respiratory health which included peak expiratory flow, FEV1/FVC, FVC, FEV1 do not show any correlation with physical activity level $P > 0.05$.²⁹ with advancing COPD self-reported time for physical activity and frequency of work decreased. Patients with moderate to severe chronic obstructive pulmonary disease perform activities of daily life in fewer and shorter bouts.³⁰ Longitudinal relation between physical activity and lung function found a decrease of 5-10L/m in FEV1 and FEV over the period of one year in physically more active smokers compared to physically fewer active non-smokers. Low level of physical activity was not associated with lung function decline.³¹ This observation is concordant with our study that decline in physical activity among COPD patients is not highly associated with lung function decline and this is in contrast with typical theory of decline in lung function have significant correlation with physical activity level.

Limitations: Major limitation of study was participants availability due to COVID-19 pandemic condition. As well as cooperation of participants to record values was one of major problem during 6-min walk test. Future research can be conducted on large scale research on different populations. More physical health parameters can be correlated with respiratory health parameter. Current study findings give basics to many other researcher and clinicians in finding effects of COPD on physical activity.

V. Conclusion

It was concluded that in COPD patients decline in VC and EVC is correlated with level of physical activity as evaluated using IPAQ. In this cross-sectional study level of physical activity has seen to impact patient's respiratory health and decline in physical activity with advancing disease stage.

Conflict of Interest

There was no conflict of interest.

Financial Statement

No fundings were given by any authorities; it was a project thesis of doctor of physical therapy.

Data availability

Data will be provided on the demand by corresponding author.

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