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CORRELATION OF 6 MINUTE WALK DISTANCE AND LUNG VOLUMES IN YOUNG HEALTHY ADULTS

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ABSTRACT

Background: The 6-minute walk test (6MWT) is a widely used, simple, and practical tool to assess functional exercise capacity. understanding its relevance in healthy individuals, especially in relation to lung volumes, can help establish normative values and identify early deviations in respiratory health.

Aim: to investigate the correlation between the 6MWD and lung volumes, including forced vital capacity (FVC), forced expiratory volume in 1 second (FEV_1), and FEV1/FVC, in young healthy adults.

Objective: To assess the correlation between the 6MWD and lung volumes parameters.

Method: This cross-sectional study included 60 young healthy adults aged 18–25 years. All Participants performed the 6MWT according to ATS guidelines and underwent pulmonary function test to assess lung volumes. The correlation between 6MWD and lung volume parameters was analyzed using Pearson's correlation coefficient.

Result: Data was analysed using SPSS V20 keeping the level of significance at 5%. The correlation analysis showed a weak and non-significant relationship between 6MWD and FVC (r=0.014, p=0.91), FEV1 (r=0.004, p=0.97) and FEV1/FVC (r=0.068, P=0.607).

Conclusion: The study found negative correlation between 6-minute walk distance and lung volumes in young healthy adults. This suggest that lung volumes may not be a strong predictor of functional exercise capacity, as measured by 6MWD, in this population. Further research with larger sample sizes and diverse populations may help clarify this association.

Keywords: 6-minute walk test, 6 min walk distance, lung volume, spirometer, pulmonary function test.

INTRODUCTION:

The six-minute walk test is an objective method, to measure the ability to perform daily living activities. It is more often performed, to evaluate the functional status, monitor therapy, or assess the prognosis in patients with cardiac and pulmonary diseases[1]. In comparison to traditional pulmonary exercise test, 6MWT needs less technical support or equipment, making it a simple and inexpensive method to measure functional capacity[1]. The validity and the reliability of 6MWT was studied in different conditions, including obstructive

lung diseases, interstitial lung diseases, pulmonary hypertension, heart failure and peripheral arterial diseases[2].

The distance covered during the 6MWT is called 6 min walk distance (6MWD), that serves as an important prognostic marker, correlating with morbidity, mortality, and overall quality of life. In healthy individuals, the 6-min walk distance (6MWD) ranges from 400 to 700 meters , with gender, age, and height identified as the primary predictor variables [2,3]. The 6 MWT measures the distance that an individual can quickly walk on a flat, hard 30meter surface in a period of 6 minutes, that reflecting the integrated responses of the pulmonary, cardiovascular, circulatory, and muscular systems involved in physical activity [4]. The 6 MWT Originally developed by the American Thoracic Society (ATS) as a standardized method to assess functional exercise tolerance, the 6MWT has become an important tool in both clinical and research settings. The ATS guidelines provide a standardized approach to performing the 6MWT[4]. It is a self-paced test, that assesses the submaximal level of functional capacity [4].

The Society for Adolescent Health and Medicine identifies young adults as those aged 18 to 25, extending up to the 26th birthday [5]. Studying this population provides valuable insights into baseline physiological performance and helps in understanding how various physical activities, such as the 6-minute walk test, influence vital parameters like pulmonary function in healthy individuals

Assessing lung function provides valuable information about respiratory health and helps in the early detection of abnormalities or diseases affecting the lungs[6]. Various pulmonary function tests are used to measure lung volumes and airflow rates, that gives information about how effectively the lungs function under different physiological conditions[6]. One of the most commonly used and accessible methods for evaluating lung function is spirometry. Spirometry measures how well the lungs are working by recording the volume of air or the airflow over time. It is a physiological test that measures the maximal volume of air that an individual can inspire and expire with maximal effort [7]. In the present study, spirometry is used to assess the correlation between the 6MWD and lung volumes parameters., helping to understand the relation of 6MWD with respiratory performance. In this study, we were record pulmonary function parameters such as Forced Vital Capacity (FVC), Forced Expiratory Volume in 1 second (FEV_1), and the FEV_1/FVC ratio.

This study investigates the relationship between the 6-minute walk distance (6MWD) and lung volume parameters in 60 young, healthy adults. However, limited studies have been conducted in young healthy adults. Previous research has also demonstrated a correlation between the six-minute walk distance (6MWD) and pulmonary function test (PFT) parameters in patients with chronic respiratory diseases [8]. The 6MWT correlated with spirometry parameters in those with severe and very severe COPD, that suggesting the 6MWT may serve as a useful tool for monitoring pulmonary function changes in these patients [9].

This study investigates the relationship between the 6-minute walk distance (6MWD) and lung volume parameters in 60 young, healthy adults. Since there is limited research on this group, the aim was to understand how walking affects lung function in people who don't have any heart or lung diseases. This study provide baseline data that can help interpret how lung function responds in healthy individuals compared to those with

medical conditions. The results will also offer useful information for future studies on people with cardio-respiratory problems, showing how walking impacts lung function in a healthy population.

METHODOLOGY

This cross-sectional study included 60 young healthy adults aged 18–25 years were 32 male and 28 female. All Participants performed the 6MWT according to ATS guidelines and underwent pulmonary function test to assess lung volumes.

Study design : Cross- sectional, Observational study

Study setting: Ahmedabad

Participants: Young adults of age 18-25 years

Sample size : 60

INCLUSION CRITERIA

- Subjects willing to Participate
- Apparently normal healthy individuals
- Age :- 18-25 years according to The Society for Adolescent Health and Medicine of both Gender[5]
- Body Mass Index: Normal range:18.5-22.9kg/m^2 according to WHO- ASIAN Classification[10]

EXCLUSION CRITERIA

- Any co-morbidity like major musculoskeletal disorders, neurological problems, cardiovascular disorders, pulmonary disorders or any other pathological condition.
- History of drug abuse or alcohol.
- Smokers.
- Regular exercise or gym going person.

Apparatus:

- PFT machine (Computerized Spirometer with nose clip (RMS helios)
- 30m walkway
- stop watch
- pulse oximeter
- Sphygmomanometer
- Stadiometer
- Weighing scale
- Mouth piece

PROCEDURE

Perform Pulmonary Function Test

Pulmonary Function Tests (PFT) were performed according to ATS guidelines by RMS Helios [11]. measure Baseline pulmonary function parameters such as forced expiratory volume in 1 s (FEV1), forced vital capacity (FVC), and FEV1/FVC ratio, with using Standardization of Spirometry method.

While performing PFT ask the subject seat comfortably on chair and inhaled air maximally through the nose after that wearing nose clip, then placed the spirometer through the mouthpiece in his/her mouth, with lips sealed tightly around the mouthpiece and ask the subject exhale forcefully as long as possible into the spirometer until no air can be exhaled and again inhalation in one breath. The test will repeated three times, the best trial result will be use for analysis, then parameters will be record.

Figure 1: Person performing PFT

Perform 6 minute walk test

Before starting 6MWT, Measure the subject vitals (HR, RR, DBP, SBP, SPO2) , The subject was ask to indicate his / her level of 'effort of breathing' by using modified borg scale (12 point scale from 0-10), which determine intensity of breathing . 0 is 'nothing at all' and 10 is 'very very severe'[12]. subjects were instructed to walk back and forth along a marked 30-meter track for six minutes. They were advised to walk at a comfortable pace while trying to cover as much distance as possible[4]. They were told they could slow down, stop, or rest if needed, but to resume walking as soon as they were able. subjects were also instructed to immediately report any chest pain, shortness of breath, dizziness, or discomfort and to stop the test if such symptoms occurred. During the test, provide time updates and offer encouragement using standard phrases. At the end of six minutes, participants were to stop walking immediately and remain still while the total distance was measured[4]. Post 6MWT Measure the subject vitals again (HR, RR, DBP, SBP, SPO2), dyspnea level using the modified Borg scale will record [12].

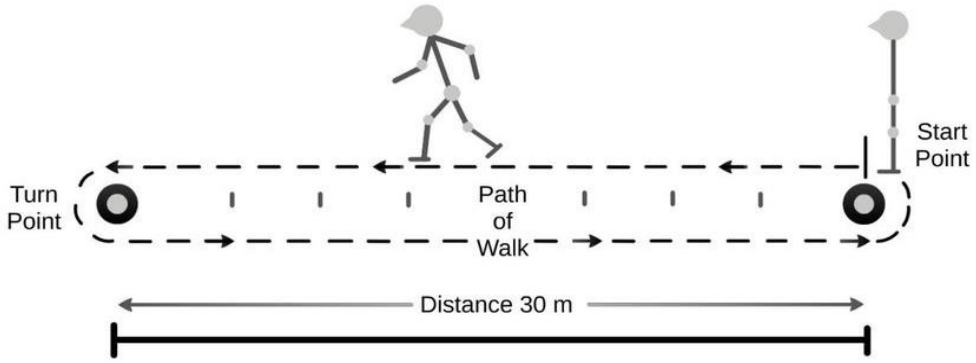
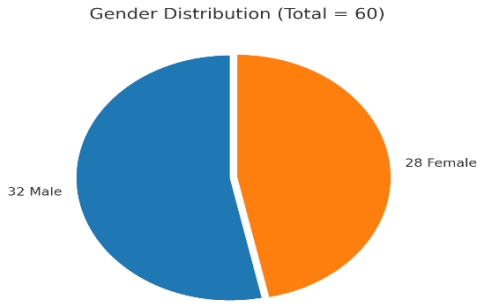


Figure 2: 6-minute walk test

RESULTS:

Among 60 subjects, 32 were male and 28 were female with mean age of years.

Data was analysed using SPSS V20 keeping the level of significance at 5%. The correlation analysis done using Pearson correlation test which showed a weak and non-significant relationship between 6MWD and FVC (r=0.014, p=0.91), FEV1 (r=0.004 p=0.97) and FEV1/FVC (r=0.068, P=0.607).



Graph 1: GENDER DISTRIBUTION

DEMOGRAPHIC DETAILS	MEAN	SD
Age	20.73	1.70
Height	161.6 cm	9.48
Weight	54.68 kg	7.41
BMI	21.11 kg/m^2	1.79

TABLE 1. DEMOGRAPHIC DETAILS

VARIABLES	MEAN	SD
FVC	2.62	0.55
FEV1	2.49	0.51
FVC/FEV1	95.54	6.02
6MWD	565.83	98.27

TABLE 2. VARIABLES

PARAMETERS	p	r
FVC with 6MWD	0.91	0.014
FEV1 with 6MWD	0.97	0.004
FEV1/FVC with 6MWD	0.60	0.68

TABLE 3: SHOWING RELATION BETWEEN PARAMETERS

DISCUSSION

The primary aim of this study was to assess the correlation between the 6-minute walk distance (6MWD) and lung function parameters (FVC, FEV_1, and FEV_1/FVC) in young healthy adults. While the 6MWT is commonly used to assess the functional capacity, that helps in diagnosis and prognosis purpose of the patient, especially patient with cardiopulmonary conditions. findings of this study suggest that lung volumes may not be strongly associated with functional exercise capacity in this population.

The results of this study indicated weak and non-significant correlations between the 6MWD and the pulmonary function test (PFT) parameters (FVC, FEV_1, and FEV_1/FVC). Specifically, the Pearson's correlation coefficients for FVC (r=0.014, p=0.91), FEV_1 (r=0.004, p=0.97), and FEV_1/FVC (r=0.068, p=0.607) all showed negligible associations. These findings suggest that in young healthy adults, lung volume parameters, which are traditionally used to assess lung health and function, may not be reliable predictors of exercise capacity as measured by the 6MWD.

Recent study by Fujimoto H et al (2011) suggest age, IC and DLCO/VA were significantly associated with 6MWD in patients with COPD. Our study suggests weak correlation between 6MWD and lung volume parameters (FVC, FEV1, FVC/FEV1) [13]. Also, another study by Agrawal MB et al (2015) found that 6MWD also correlated with pre and post exercise pO_2.Thus there is significant correlation between 6MWT and spirometry [14]. Oxygen consumption on maximal exercise is moderately reproducible and correlates strikingly with the 6MWT distance. Oxygen desaturation parameters on exercise are associated with unacceptable measurement variation. These data by Eaton T, Young et al (2005) indicate that, in the routine evaluation of fibrotic IIP, the 6MWT has major advantages over maximal exercise testing on reproducibility ground [15].

The weak correlation in this study could also be attributed to the physiological characteristics of healthy young adults. The lungs of young adults are generally well-functioning, and exercise capacity may be more influenced by factors such as systemic oxygen delivery and utilization, rather than by pulmonary limitations. Additionally, the 6MWT primarily assesses functional endurance, which might be more dependent on overall physical conditioning and cardiovascular efficiency than on isolated pulmonary function. Also similarly study done by Karanth MS et al(2017), conclude that 6MWD changes independently and has no correlation with change in spirometry, it is an independent predictor of mortality in Chronic Pulmonary Diseases (CPD) [16]. Given the findings of this study, further research is needed to explore the relationship between the 6MWD

and other physiological and fitness parameters in healthy populations. Larger, more diverse samples, including individuals from various age groups and fitness levels, would help clarify whether the observed weak correlation holds across different demographics.

CONCLUSION

This study found weak and non-significant correlation between 6-minute walk distance and lung volumes in young healthy adults. This result suggest that lung volumes may not be a strong predictor of functional exercise capacity, as measured by 6MWD, in this population. Further research with larger sample sizes and diverse populations may help clarify this association.

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