



## EFFECTS OF CIGARETTE SMOKING ON 6 MINUTE WALK TEST : COMPARISON BETWEEN SMOKERS AND NON-SMOKERS

**Dr. Aditi Singh (PT)** Physiotherapist

**Dr. Sarvesh Shirsat (PT)\*** Assistant Professor, D.Y.Patil University, School of Physiotherapy, Nerul, Navi-Mumbai, Maharashtra \*Corresponding Author

**(ABSTRACT)** **Background** – Cigarette smoking has been shown to impair lung function. The 6-minute walk test is a rapid and low-cost approach to assess respiratory health. Numerous research have examined the effects of cigarette smoking on respiratory health and 6MWT, but comparisons between smokers and non-smokers are scarce, and the same is true for the Indian population.

**Objective** - Compare the 6-minute walk distance (6MWD) and the rate of perceived exertion (RPE) post-test between smokers and non-smokers.

**Methods:** A comparative study with 60 individuals is included in the study. The participants were divided into two groups based on the google form they were given to fill out: smokers and non-smokers. The ATS Statement Guidelines were followed when performing the 6-minute walk test (6MWT). The test parameters (6MWD, RPE) were compared between the two groups.

**Results:** A total of 60 participants participated, with 30 smokers and 30 non-smokers. The rank of smokers' RPE (44.08) was greater than non-smokers' (16.92). The difference ( $U=42.500$  and  $p=0.001$ ) was statistically significant. When compared to non-smokers (6MWD), smokers travelled considerably less distance ( $t_{3,348} = 55.725, p=0.001$ ).

**Conclusion:** The RPE and 6MWD were both affected in smokers.

**KEYWORDS :** 6 Minute Walk Test, Smokers, Non-Smokers, Pulmonary Function Tests, Rate of Perceived Exertion.

### INTRODUCTION

Cigarettes are the most widely used form of tobacco in most parts of the world.<sup>1</sup> In India, 30% of people aged 15 and up smoked or chewed tobacco, totaling about 195 million men and 41 million women.<sup>2</sup> Cigarette smoke comprises two phases: the tar (particle) phase, which contains nicotine, and the gas phase. Nitrogen, oxygen, carbon dioxide, CO, acetaldehyde, methane, hydrogen cyanide, nitric acid, acetone, acrolein, ammonia, methanol, hydrogen sulphide, hydrocarbons, gas-phase nitrosamines, and carbonyl compounds are all found in the gas phase of cigarette smoke. Carboxylic acids, phenols, water, humectants, nicotine, terpenoids, paraffin waxes, tobacco-specific nitrosamines (TSNAs), PAHs, and catechol are among the constituents of the particulate phase.<sup>3</sup> Nicotine is also the primary culprit affecting lung health and immunity, humans find it addictive because a portion of the nicotine molecule is similar to acetylcholine, an important brain neurotransmitter. In addition to addictiveness, nicotine has been shown to be a precursor to carcinogenic TSNAs, among other potentially harmful effects.<sup>(3,4)</sup> Cigarette smoking has been linked to impaired physical functioning and exercise abilities. The six-minute walk test (6MWT) is a simple and inexpensive approach to assess physical function and the capacity to walk for a distance.<sup>5</sup> It has a submaximal design, because most activities of daily living are performed at submaximal levels, it is a good reflection of the functional exercise level for daily physical activities. The distance covered during the test has been used to assess response to therapeutic interventions (pharmacological and non-pharmacological) to detect exertional desaturation and need of long-term oxygen therapy and to predict morbimortality in cardiopulmonary diseases.<sup>6</sup> The total distance walked is the primary measure; supplementary measures include fatigue and dyspnea, which can be quantified using a modified Borg scale. Arterial oxygen saturation can also be measured using pulse oximetry, as long as the oximeter is portable and light.<sup>7</sup>



**Image 1 : Test being performed**

Because smoking has a range of effects on the respiratory system, including affecting pulmonary function tests and has been proven to decrease exercise capacity with increasing age, smokers have a higher reduction in exercise capacity than nonsmokers.<sup>8</sup> As a result, this study aims to compare the findings of the 6-minute walk test to those of nonsmokers in order to analyze the impact of smoking on the test.



**Image 2: Required Equipment**

### METHODS :

A comparative study was carried out between the smokers and non-smokers. The study was approved by the Institutional Ethics and Research Committee at D.Y. Patil University, Navi Mumbai, India. A consent was obtained from the subjects prior to the testing. Individuals were then screened based on the inclusion and exclusion criteria.

#### Inclusion Criteria:

- Individuals aging between 18-40
- current Smokers (Smoked  $\geq 100$  cigarettes, have been smoking for 5 years and are currently smokers),<sup>8</sup>
- Both male and female,<sup>8</sup>
- BMI  $18 \text{ kg/m}^2$  -  $25 \text{ kg/m}^2$ <sup>8</sup>
- Individuals with no comorbidities.<sup>9</sup>

#### Exclusion Criteria

- Unwilling to participate
- discontinued smoking

#### Variables:

- Rate of Perceived Exertion
- 6 Minute Walk Distance

The participants were then divided into groups on basis of their smoking habit; smokers and non-smokers

### 6 Minute Walk Test:

The 6 Minute Walk Test was conducted according to a standardized protocol. A light meal was permitted prior to the test, although the individual was advised to avoid excessive exercise within two hours of beginning the test. There was no "warm-up" period before the test, and the subject sat for at least 10 minutes on a chair near the starting position before the test began. Pulse, oxygen saturation, and blood pressure were all taken throughout this period. Subjects were given 6 minutes to walk from one end of a 100-foot corridor to the other at their own pace, trying to cover as much distance as possible. Subjects were encouraged with the standardized comments "You're doing well" or "Keep up the good work," but no additional expressions were allowed. During the test, subjects were allowed to stop and relax, but they were instructed to start walking as soon as they felt ready. At the conclusion of the walk, participants were also asked if they had experienced any of the following symptoms: dyspnea, chest pain, lightheadedness, or leg pain.<sup>(9,10)</sup>

The subjects' 6MWD and RPE (Modified Borg scale was used to assess dyspnea) post-test results were then recorded and analyzed.

**Table 1 : Shapiro-Wilk Test**

Variable	Groups	Statistic	df	Sig.
Rate of Perceived Exertion (RPE)	Smokers	.766	30	<.001
	Non-smokers	.607	30	<.001
6 Minute Walk Distance (6MWD)	Smokers	.964	30	.386
	Non-smokers	.945	30	.121

**Table 2: Mann Whitney Test**

Variable	Groups	N	Mean Rank	Sum of ranks
Rate of Perceived Exertion (RPE)	Smokers	30	44.08	1322.50
	Non-smokers	30	16.92	507.50

**Table 3 : Independent Sample T-Test**

Variable	t	df	Sig.
6 Minute Walk Distance (6MWD)	-3.348	55.7	.001

### STATISTICAL ANALYSIS:

The statistical analysis was carried out with the help of the statistical package for social sciences (IBM SPSS Statistics 28.0.0.0). The Shapiro Wilk test was performed to determine the data's normality. Mean and standard deviation were used to describe descriptive statistics for the variable RPE. An Independent Sample T-test was used since the variable 6MWD was normally distributed. The non-parametric Mann Whitney test was employed to compare the differences in RPE between the two groups because the data was not normally distributed. The level of statistical significance was fixed at 0.05.

### RESULTS:

A total of 60 people took part, 30 of which were smokers and 30 of those were not. Smokers (N=30) had a higher mean rank (44.08) than Non-Smokers (N=30) with a lower mean rank (16.92). There was a statistically significant difference ( $U=42.500$  and  $p=0.001$ ). The mean distance covered by participants (6MWD) was significantly different between non-smokers and smokers ( $t_{3,348} = 55.725$ ,  $p=0.001$ ).

### DISCUSSION:

The aim of this study was to compare the effects of smoking on the parameters of 6 Minute Walk test.

#### Effect on Rate of perceived exertion (smokers Vs non-smokers):

The RPE values of smokers ( $2.1670 \pm 5921$ ,  $rank=44.08$ ) and nonsmokers ( $0.8330 \pm 3130$ ,  $rank=16.92$ ) differed significantly. As a result, smokers' RPE was substantially greater than that of nonsmokers. This study's findings agreed with Gardner et al. (1999), who found that cigarette smokers had higher RPE scores than nonsmokers.<sup>11</sup>

#### Effect on 6 Minute walk distance (smokers Vs non-smokers):

Total distance covered post-test in meters for smokers had a  $MEAN \pm S.D$   $586.5 \pm 45.978$  whereas for non-smokers it was  $631.0 \pm 56.433$ , P value was 0.001, considered very significant, showing that the smokers walked less distance than non-smokers during the test A study done by Furlanetto, K. C., Mantoani, L. C., Bisca, G., Morita, A. A., Zabatierno, J., Proença, M., ... & Pitta, F. (2014) showed similar results. When compared with non-smokers, smokers walked less in daily life ( $7923 \pm 3558$  vs  $9553 \pm 3637$  steps/day,

respectively), presented worse lung function and functional exercise capacity. Multiple regression analyses identified functional exercise capacity, Borg fatigue, self-reported motivation/physical activity behavior and cardiac disease as significant determinants of number of steps/day in smokers (partial  $r^2=0.10$ , 0.12, 0.16 and 0.05;  $b=15$ ,  $-997$ , 1207 and  $-2330$  steps/day, respectively; overall fit of the model  $R^2=0.38$ ;  $P<0.001$ ), their study concluded that adult smokers without airflow obstruction presented reduced level of daily physical activity.<sup>12</sup>

### CONCLUSION:

The Rate of Perceived Exertion and the 6 Minute Walk Distance were both affected when smokers were compared to non-smokers. Smokers not only covered less distance than non-smokers, but they also had greater RPE than the latter.

### Source Of Funding - None

### Conflict Of Interest- None

### Acknowledgement:

I'd like to use this opportunity to extend my heartfelt gratitude to everyone who helped make this study a big success. First and foremost, I would like to thank my supervisor, Dr. Sarvesh Shirsat (PT), for his unwavering support. I also want to appreciate Mr. Ashish Sharma for his assistance in learning SPSS and SPSS Syntax. Finally, the study's subjects, without whom the study would be incomplete.

### REFERENCES:

- Who.int. 2022. Tobacco. [online] Available at: <<https://www.who.int/news-room/fact-sheets/detail/tobacco>> [Accessed 3 April 2022]
- Rani M, Bonu S, Jha P, Nguyen SN, Jamjoum L. Tobacco use in India: prevalence and predictors of smoking and chewing in a national cross sectional household survey. *Tob Control*. 2003 Dec;12(4):e4. doi: 10.1136/tc.12.4.e4. PMID: 14660785; PMCID: PMC1747786.
- Centers for Disease Control and Prevention (US); National Center for Chronic Disease Prevention and Health Promotion (US); Office on Smoking and Health (US). How Tobacco Smoke Causes Disease: The Biology and Behavioral Basis for Smoking-Attributable Disease: A Report of the Surgeon General. Atlanta (GA): Centers for Disease Control and Prevention (US); 2010. 3. Chemistry and Toxicology of Cigarette Smoke and Biomarkers of Exposure and Harm. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK53014/>
- Nguyen, H. M., Torres, J. A., Agrawal, S., & Agrawal, A. (2020). Nicotine Impairs the Response of Lung Epithelial Cells to IL-22. *Mediators of inflammation*, 2020, 6705428. <https://doi.org/10.1155/2020/6705428>
- Britto, R. R., Probst, V. S., de Andrade, A. F., Samora, G. A., Hernandes, N. A., Marinho, P. E., Karsten, M., Pitta, F., & Parreira, V. F. (2013). Reference equations for the six-minute walk distance based on a Brazilian multicenter study. *Brazilian journal of physical therapy*, 17(6), 556–563. <https://doi.org/10.1590/S1413-3552012005000122>
- Higashi, T., Mai, Y., Noya, Y., Horinouchi, T., Terada, K., Hoshi, A., Nepal, P., Harada, T., Horiguchi, M., Hatate, C., Kuge, Y., & Miwa, S. (2014). A simple and rapid method for standard preparation of gas phase extract of cigarette smoke. *PLoS one*, 9(9), e107856. <https://doi.org/10.1371/journal.pone.0107856>
- Salvi, D., Poffley, E., Orchard, E., & Tarassenko, L. (2020). The Mobile-Based 6-Minute Walk Test: Usability Study and Algorithm Development and Validation. *JMIR mHealth and uHealth*, 8(1), e13756. <https://doi.org/10.2196/13756>
- Chugh, P., Ganai, J., & Dwivedi, S. (2016). Normative data of distance covered, heart rate, blood pressure and rate of perceived exertion during 6-minute walk test on 20-meter-long corridor among smokers. *Int J Pharm Med Res*, 4(6), 388-393.
- A. M. Li, J. Yin, C. C. W. Yu, T. Tsang, H. K. So, E. Wong, D. Chan, E. K. L. Hon, R. Sung. *European Respiratory Journal Jun 2005*, 25 (6) 1057-1060; DOI: 10.1183/09031936.05.00134904
- Enright, P. L., & Sherrill, D. L. (1998). Reference equations for the six-minute walk in healthy adults. *American journal of respiratory and critical care medicine*, 158(5), 1384-1387.
- Arazi, H. (2018). Rating of perceived exertion and sustainability of repetition during resistance exercise in cigarette smoker and non-smoker men. *Archivos de medicina del deporte: revista de la Federación Española de Medicina del Deporte y de la Confederación Iberoamericana de Medicina del Deporte*, 35(185), 168-172.
- Furlanetto, K. C., Mantoani, L. C., Bisca, G., Morita, A. A., Zabatierno, J., Proença, M., ... & Pitta, F. (2014). Reduction of physical activity in daily life and its determinants in smokers without airflow obstruction. *Respirology*, 19(3), 369-375.