VOLUME - 10, ISSUE - 11, NOVEMBER - 2021 • PRINT ISSN No. 2277 - 8160 • DOI : 10.36106/gjra

Original Research Paper

General Medicine

TO STUDY THE EFFECT OF SMOKING ON CHEST EXPANSION, LUNG FUNCTION AND RESPIRATORY MUSCLES IN YOUNG INDIVIDUALS.

Dr. Md. Najiullah* Associate Professor, Dept. of General Medicine, Madhubani Medical college, Madhubani, Bihar, India. *Corresponding Author

Dr. Bashar Imam Ahmad Associate Professor, Dept. of General Medicine, I.Q City Medical college, Durgapur, West Bengal, India.

ABSTRACT

Introduction: Smoking has a direct effect on the respiratory system. The rate of cigarette smoking among young people has continued to increase steadily. In the present era, cigarette smoking is a major but preventable cause of death. Despite being aware of its harmful and hazardous effects, many young adults begin experimenting with cigarettes at a very early age and then adopt it as a regular habit.

Aims And Objectives: The basic objective of our study is to analyze the effects of smoking on lung function, and respiratory muscle strength of in Indian youth in district of Madhubani.

Methodology Of The Study: This study was conducted at Madhubani Medical College, Madhubani, Bihar during January 2019 to December 2019. Youth male subjects aged 25 years to 50 years participated in this cross-sectional study. Socio-demographic values and medical history of the selected patients were recorded clearly. Prior to participation in this study, each subject signed an informed consent form to comply with the ethical guidelines.

Results: Most subjects started cigarette smoking between the ages of 25 to 50 years. The most common duration of cigarette smoking was 15 years. Three major parameters, chest expansion, lung function using Spirometry, and respiratory muscle strength, were compared and these all are high in smokers.

Conclusion: It is concluded that most of the people started smoking in young age due to environmental and social factors. It is also observed that chest expansion is greater in smokers as compared to non-smokers and smokers suffer from respiratory diseases as compared to non-smokers.

KEYWORDS : Respiratory; Lungs, Cigarette Smoking, Pulmonary Function.

INTRODUCTION:

Cigarette smoking is an unhealthy habit that has spread all over the world as an epidemic. Tobacco use in the developing world has dramatically increased in the last decades, and is expected to result in 10 million deaths annually by 2030. Smoking causes a wide range of serious diseases, including chronic obstructive pulmonary disease, coronary artery disease, and many types of cancer [1]. Studies conducted in the Middle East indicate that at least 30"40% of Arab men are regular smokers. In Jordan, 30% of adult men (aged > 18) are smokers, compared with 26% noted for the USA. In addition, more than 50% of the Jordanian population is considered regular smokers and this habit has been cited as the chief cause of deaths in the country [2]. Findings yielded by many studies indicate that smoking has a direct and adverse effect on the respiratory system function by altering lung volume and respiratory muscle strength [3-5]. Moreover, many researchers have demonstrated a link between cigarette smoking and extensive exposure histories and other respiratory system conditions, such as lung cancer, COPD, and asthma [6]. Lungs are directly affected by cigarette smoking.

Various respiratory diseases, including lung cancer, chronic obstructive pulmonary disease and bronchial asthma, are caused and worsened by cigarette smoking. Pulmonary function test (PFT) is typically employed to measure the air volume during individual inhalation or exhalation process. In the present era, cigarette smoking is a major but preventable cause of death. Despite being aware of its harmful and hazardous effects, many young adults begin experimenting with cigarettes at a very early age and then adopt it as a regular habit [7]. Cigarette smoking is an important worldwide health problem. Cigarette smoking carries major health risks with the most cause-specific mortalities being those of respiratory and cardiovascular diseases. Therefore, smoking habits may affect the respiratory function of youths [8]. Earlier reports have indicated that in young adults, relatively small amounts of cigarette smoke can cause deficit in lung functions [9]. Smoking 15 cigarettes per day in males has been associated with 4% decline in forced mid expiratory flow as compared to those who never smoked. Since inhaling cigarette smoke has been shown to produce acute changes in the lung including alterations in resistance to airflow, cough, and irritation of the airway, the early stage of smoking might affect the respiratory function of youths [10]. However, there have been few studies which have investigated the effect of smoking on pulmonary function in adolescents. In previous studies, cigarette smoking was found to influence the lung function of the adolescent boys and girls. Those studies found that FEV1/FVC decreased in adolescent smokers of both sexes. Only the pulmonary function test with a spirometer was measured in those studies [11]. Therefore, to clarify the effect of smoking on the respiratory function of smoking and non-smoking youths, we measured and compared their chest expansion, the lung function test using a spirometer, and respiratory muscle strength to learn more about the dangers of cigarette smoking [12]. This problem is compounded by the fact that the rate of cigarette smoking in young people continues to steadily increase. Cigarette smoking carries major health risks with the most cause-specific mortalities being those of respiratory and cardiovascular diseases [13]. Therefore, smoking habits may affect the respiratory function of youths.

AIMS AND OBJECTIVE:

The basic objective of our study is to analyze the effects of smoking on lung function, and respiratory muscle strength of youth in Madhubani district of Bihar.

MATERIALS AND METHODS:

The objective of the present study was to determine the effects of smoking duration in adult smokers on lung function, as measured by forced vital capacity (FVC), forced expiratory volume in the first second (FEV1) and maximum voluntary ventilation (MVV) tests. Prior to participation in this study, each subject signed an informed consent form to comply with the ethical guidelines. The information on smoking habits was obtained through interviews. Subjects who currently smoked cigarettes were classified as smokers and those without a history of smoking cigarettes were classified as non-smokers.

The respiratory function test consisted of the measurement of chest expansion, the lung function test using Spirometry, and respiratory muscle strength. For chest expansion measurements of circumference and diameter, subjects were instructed to fully inhale and exhale in the standing position.

Sample Size And Smoking Behavior

The study sample comprised of 100 male adults aged 25 to 50 years old who had reported smoking for at least 15 years.

Inclusion Criteria

For participation in this study, the following criteria had to be met:

1. Age ≥ 25 years. 2. Smoking duration 15 years. 3. Cooperative patients.

Pulmonary function tests were carried out by using spirometer to determine FVC, FEV1 and MVV. Subjects had to remain in the straight sitting or standing position throughout the test, with a nose clip that was tightly attached to the nostrils allowing no air to escape during the test. A mouthpiece was placed at least two centimeters into the subject's mouth with lips closed around it. FVC Maneuver: Each subject was asked to inhale completely and rapidly with a pause of < 1 s at total lung capacity (TLC), then exhale as quickly and completely as possible to blow all the air out. This allowed forced vital capacity (FVC) and forced expiratory volume in the 1st second (FEV1) values to be obtained and recorded by the apparatus.

MVV maneuver:

Subjects were tested in the sitting position wearing a nose clip. Each participant was instructed to breathe as rapidly and deeply as possible for 12 seconds after obtaining at least three resting tidal breaths with airtight seal around the mouthpiece.

Statistical Analysis:

The data of respiratory function were compared between the smoker and non-smoker groups using the independent t-test for normally distributed data or the Mann-Whitney U test for other distributions. Differences were considered statistically significant at $p<0.05$.

RESULT:

The predicted values measured by Spirometry that based on patient Specific properties (like age, gender, ethnicity, weight and height) alongside those measured by lung function tests (M ± SD, based on the 100 subjects). The mean predicted FVC, FEV1 and MVV values were 3.83 L ± 0.44, 3.60 L ± 0.64 and 132.80L ± 17.05, respectively. Their corresponding measured values were 2.62 L ± 0.86, 1.55 L ± 0.70 and 81.26 L ± 9.50. All mean predicted values of lung function tests (FVC, FEV1 and MVV) were higher than the measured ones. The study sample had the mean of age of 37.5 years ± 8.45, the mean smoking duration of 15 years ± 5.22, the mean number of cigarettes smoked per day of 15.62 ± 4.86, the mean of height 165.66cm ±0.65 and the mean of weight 80.55 kg ±1.46. The results of the Spearman's rho correlation analysis to determine the correlation between lung function parameters and the number of cigarettes smoked per day, duration of smoking and age. There was a significant correlation between smoking duration and FVC values (rho = -0.226, p = 0.016), as well as FEV1 (rho = -0.224, p = 0.025) and MVV (rho = -0.242, p = 0.015). A significant correlation was also found between age and FVC values (rho = -0.268, p = 0.005), FEV1 (rho = -0.277, p = 0.004) and MVV (rho = -0.276, p = 0.006). These results indicate that a decrease in lung function (FVC, FEV1 and MVV values) is correlated conversely with smoking duration and participant age. On the other hand, non-significant correlation was found between numbers of cigarettes smoked per day and FVC values (rho = 0.066, p = 0.500), FEV1 (rho = -0.026, p = 0.780) and MVV (rho = 0.124, p = 0.232).

The chest expansion of the non-smoker group was significantly greater than that of the smoker group. There were significant differences in the chest circumference at the axilla level.

DISCUSSION:

Comparing this study's observations with some of the others which have found that whereas older symptomatic adult smokers with histories of large numbers of pack years may have lower FVC levels than non-smokers, young adult smokers have FVC levels equivalent to or higher than age equivalent non-smokers [14] . It is possible that at the time they started smoking and then with the subsequent growth maturation years, particularly in the very early twenties, they had developed somewhat larger lungs and thus experienced no discomfort on smoking which led to their smoking on regular basis [15]. In this study also, greater FVC values and the development of greater height in the smokers fortifies the above observation made by these studies. This study also reports that the young adults with subsequent growth maturation developed greater inspiratory and expiratory muscle strength, however with the growth in age this study showed no significant difference when compared with the respiratory pressures [16-18]. In this study, all parameters of chest expansion of the non-smoking youths were greater than those of the smoking youths. Decreased chest circumference at the axillary level was associated with reductions in the AP and ML diameters. This is because chest expansion at the axillary level represents the upper chest breathing pattern, which utilizes a combination of upward and forward chest movements or the pump-handle movement, as well as upward and outward chest movements or the bucket handle movement. This result suggests that cigarette smoking affects the upper chest expansion of smoking youths. A reduction in chest expansion arising from reduced chest wall motion and flexibility would affect the performance and work of breathing, suggesting a vulnerability to dyspnea. Thus, the early stage of smoking among youths does cause reduction in the lung function. Inhaled cigarette smoke has been shown to elicit acute changes in respiratory function including alterations in resistance to airflow, coughing, and irritation of the airways. Investigation of pulmonary function among adults with a history of smoking for at least 15 years showed that means of measured pulmonary function values were below the means of predicted spirometer values that based on patient specific properties (like age, gender, ethnicity, weight and height).

This finding may reflect obstruction of the airways and respiratory muscle weakness. In addition, a significant correlation was found between duration of smoking, participant age and lung function parameters (FVC, FEV1 and MVV values).These results indicate that a decrease in lung function parameters (FVC, FEV1 and MVV values) is correlated conversely with smoking duration and participant age. On the other hand, non-significant correlation was found between number of cigarettes smoked per day and lung function parameters (FVC, FEV1 and MVV values). The above findings suggest that smoking duration and participant age could adversely affect lung capacity by reducing the volume associated with the FVC, FEV1 and MVV test. Aging with smoking history for at least 15 years could affect the respiratory muscles through the influence of free radicals with time on vascular system, leading to a reduction in respiratory muscle blood supply, which adversely impacts respiratory function. Thus, the reduction in FVC of smoker's 40 years old may be explained by the reduction in strength of the respiratory muscles since the FVC test relies on the strength of respiratory muscles.

The above phenomena could also explain the reduction in MVV and FEV1 40 years old due to respiratory muscle reduction and smaller airways in smokers. The above findings

are consistent with those reported by other author [19, 20], thus confirming that smoking compromises lung function. It should be noted, however, that the average age recorded in our study was older compared to that in other studies and duration of cigarette smoking was greater too. Thus, the lower values of lung parameter function test recorded in our study compared to that in other studies may indicate a higher prevalence of chronic obstructive pulmonary disease and other respiratory symptom in older persons with a history of longer smoking duration. Indeed, the health benefits of smoking cessation with regard to the rate of decline in FVC, FEV1 and MVV may appear to be most significant for smokers who quit before 40 years of age.

CONCLUSION:

It is concluded that most of the people started smoking in young age due to environmental and social factors. It is also observed that chest expansion is greater in smokers as compared to non-smokers and smokers suffer ore from respiratory diseases as compared to non-smokers. Investigation of pulmonary function in adults aged 25 to 50 years with a history of 15 years of smoking showed that the pulmonary function values of smokers were decreased compared to the predicted values. In addition, a significant correlation was found between age as well as smoking duration and the decrease in FVC and FEV1 and MVV values. On the other hand, non-significant correlation was found between number of cigarettes smoked per day and lung function parameters (FVC, FEV1 and MVV values). In conclusion, the concept that age and smoking might accelerate the decreasing of pulmonary function test has potential implications for both smoking cessation and research emphasis.

Long-term cigarette smoke exposure is associated with small airway narrowing and impaired diffusion capacity but not with peripheral muscle weakness. The effects of smoking, age, and gender on maximum power output are mediated by reductions in FEV1.

REFERENCES:

1. Das S. Harmful health effects of cigarette smoking. Mol Cell Biochem.; 253(1-2): 159–65 (2003).
2. Kandela P. Jordan starts campaign to tackle high rates of smoking. Lancet. 355(9217): 1800 (2000).
3. Garcia-Aymerich J, Lange P, Benet M, Schnohr P, Anto JM . Regular physical activity modifies smoking-related lung function decline and reduces risk of chronic obstructive pulmonary disease: a population-based cohort study. Am J Respir Crit Care Med. 175(5): 458–63 (2007).
4. Peat JK, Woolcock AJ, Cullen K. Decline of lung function and development of chronic airflow limitation: a longitudinal study of non-smokers and smokers in Busselton, Western Australia. Thorax. 45: 32–37 (1990).
5. Shahar E, Folsom AR, Melnick SL, Tockman MS, Comstock GW, Gennaro V, Higgins MW, Sorlie PD, Ko WJ, Szklo M. Dietary n-3 polyunsaturated fatty acids and smokingrelated chronic obstructive pulmonary disease. Atherosclerosis Risk in Communities Study Investigators. N Engl J Med. 331: 228–33 (1994).
6. Xu X, Weiss ST, Rijcken B, Schouten JP. Smoking, changes in smoking habits and rate of decline in FEV1: new insight into gender differences. Eur Respir J. 7(6):1056–61 (1994).
7. Burchfiel CM, Marcus E, Maclean C, Curb JD, Vollmer WM, et al. (1995) Effects of smoking and smoking cessation on longitudinal decline in pulmonary function. Am J Respir Crit Care Med 151(6): 1778-1785
8. Zamel N, Altose MD, Speir WA (1983) Statement on spirometry: A report of the section of respiratory pathophysiology of the American College of Chest Physicians. J Asthma 20(4): 307-311
9. Walter S, Nancy NR, Collier CR (1979) Changes in the force expiratory spirogram in young male smokers. Am Rev Respir Dis 119(5): 717-724.
10. Emery S, Gilpin EA, White MM, Pierce JP (1999) How adolescents get their cigarettes Implications for policies on access and price. J Nat Cancer Inst 91(2): 184-186
11. Giovino GA, Schooley MW, Zhu BP, Chrismon JH, Tomar SL, et al. (1994) Surveillance for selected tobacco-use behaviors-United States, 1900-1994. MMWR CDC Surveill Summ 43(3): 1-43.
12. Hapman S, Borland R, Scollo M, Brownson RC, Dominello A, et al.(1999) The impact of smoke-free workplaces on declining cigarette consumption in Australia and the United States. Am J Public Health 89(7): 1018-1023.
13. Kenfield SA, Wei EK, Rosner BA, et al.: Burden of smoking on cause-specific mortality: application to the nurses' health study. Tob Control, 2010, 19: 248–254.
14. Ambrose JA, Barua RS (2004) The pathophysiology of cigarette smoking and cardiovascular disease: An update. J Am Coll Cardiol 43(10): 1731- 1737.
15. Fagerstrom KO (1989) Measuring nicotine dependence: A review of the Fagerstrom Tolerance Questionnaire. J Behav Med 12(2): 159-182.
16. Xu X, Dockery D, Ware J, Speizer FE, Ferris BG (1992) Effects of cigarette smoking on rate of loss of pulmonary function in adults: a longitudinal assessment. Am Rev Respir Dis 146(5 Pt 1): 1345-1348.
17. Pierce JP, White MM, Messer K (2009) Changing age-specific patterns of cigarette consumption in the United States, 1992-2002: association with smoke-free homes and state-level tobacco control activity. Nicotine Tob Res 11(2): 171-177.
18. Shiffman S (2009) Light and intermittent smokers: background and perspective. Nicotine Tob Res 11(2): 122-125.
19. Prokhorov AV, Emmons KM, Pallonen UE, Tsoh JY. Respiratory response to cigarette smoking among adolescent smokers: a pilot study. Prev Med. 25: 633–40 (1996).
20. Xu X, Dockery D, Ware J, Speizer FE, Ferris BG Jr. Effects of cigarette smoking on rate of loss of pulmonary function in adults: a longitudinal assessment. Am Rev Respir Dis. 146: 1345–48 (1992).