

Impact of Shisha and Cigarette Smoking on Lung Functions in Young Adults

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ABSTRACT

Objective: To determine the impact of shisha and cigarette smoking on lungs functions and compare the pulmonary function test parameters between shisha, cigarette smokers and non-smokers.

Methodology: This cross-sectional study was conducted at Aziz Fatima Medical and Dental College Faisalabad from January to September 2018. Ethical approval was taken from the Institutional Ethical committee. This study consisted of 100 male college students of age 18 to 25 years. Participants were enrolled on voluntary basis. Prior to study, students of Faisalabad based colleges were invited for study. A detailed interview of subjects was taken. Subjects were questioned regarding the smoking habits using pre designed proforma. Subjects who currently smoked cigarettes were classified as cigarette smokers. Subjects using shisha were categorized as shisha smokers. A third category was formed which included subjects using both shisha and cigarettes, subjects without any type of smoking were non-smokers Anthropometric measurements including height and weight were taken and BMI was calculated by formula weight in kg/ height in m² Pulmonary function tests including forced vital capacity (FVC), forced expiratory volume in first second (FEV1) and FEV1/FVC were performed by digital spirometer. Data was analyzed by SPSS22. Values of FVC, FEV1 and FEV1/FVC were presented as mean \pm SD and compared by ANOVA. P value \leq 0.05 was considered as statistically significant.

Results: Study comprised 100 participants of mean age 20.71 \pm 1.87 years. Out of the total study participants 16(16%) were cigarette smokers, 11(10.3%) were shisha smokers, 22(20.7%) were users of both cigarettes as well as shisha and 51(48,1%) were non-smokers. All three parameters of lung functions including FVC (p value = 0.005), FEV1 (p value = 0.046) and FEV1/FVC (p value = 0.023) were lower in cigarette smokers and significantly different from non-smokers. All three lung parameters of shisha smokers were also lower than non-smokers but statistical difference was found only in FVC values (p value = 0.000). FEV1 (2.73 versus 1.5, p value= 0.66) and FEV1/FVC (63 versus 50.5, p value= 0.449) was higher in shisha smokers as compared to cigarette smokers but the difference was statistically not significant. FVC value of shisha smokers was lower than cigarette smokers (2.42 versus 2.89) but no significant difference was noted (p value =0.59).

Conclusion: Lung function parameters FVC, FEV1 and FEV1/FVC, were reduced in cigarette and shisha smokers as compared to non-smokers. Shisha and cigarette both adversely affect lung functions, however shisha is less harmful than cigarette smoking.

KEYWORDS: Pulmonary function test, shisha smokers, forced vital capacity, forced expiratory volume in first second.

INTRODUCTION

The trend of smoking in youth has become a common part of our modern society. According to World health organization (WHO) South East Asian countries have

the highest rates of tobacco smoking.¹ Prevalence of 47% in both genders of age 15 years and above have been reported by (WHO).¹ The high prevalence of smoking in form of cigarettes, cigars and flavored shisha among teens and college students has been well documented in the literature.² The trend of shisha smoking is continuously increasing not only in the college but also in the school going students. Although men use it more frequently but now a days it is also gaining popularity in young females. Shisha smoking is commonly associated with Middle East, but its use is now increasing globally.³ In Pakistan, prevalence of shisha smoking in young adults is 19-33%.^{3,6}

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Shisha is also known as Narghile, hookah, hubble bubble and water pipe in different societies and countries. It is a way of smoking tobacco in which vapor passes through water before inhalation.⁴ Tobacco smoking using shisha is emerging as a “virulent strain” in the tobacco epidemic. It affects the quality of life by having marked health problems. Additionally, mouthpiece of shisha is often shared between smokers that can be a source of spread of communicable diseases such as tuberculosis.³

Young generation who is the future of the nation are unaware of the hazards of smoking, especially shisha. They have this misconception that shisha is only flavored liquid which does not affect their health,⁴ thus inclining more towards shisha smoking.² Shisha smokers believe that the water filter system in the shisha pipe filters out tobacco-specific carcinogens and is considerably less injurious than smoking cigarettes. However, they are unaware of the fact that shisha smoke has a huge amount of toxic ultrafine particles carrying similar health risks as smoking cigarette.^{2,5} Shisha contains harmful chemicals such as; nicotine, arsenic, methane, butane, cadmium, carbon monoxide, formaldehyde and hydrogen cyanide.⁷ Previous studies show that the smoke from shisha contains more nicotine as compared to that of cigarettes i.e. 2 to 4%, versus 1 to 3% respectively. Shisha smoke also contains three times higher carbon monoxide levels than cigarette smoke.⁸ Presence of carcinogens and tumor promoters makes it a leading cause of morbidity and mortality globally.^{3,6} Shisha liquid comes in fruit flavored tobacco such as plum, mango, apple, coconut, menthol, strawberry etc making shisha more aromatic and thus attractive as compared to cigarettes.⁷ Extremely addictive nature of nicotine in cigarettes makes smoking cessation extremely difficult. Shisha smoking sessions usually last for 30–90 minutes, thus shisha smokers are exposed to smoke for a longer period of time than cigarette smokers.⁹ The shisha smoker inhale approximately 0.15–1 L of smoke by taking 50–200 puffs in one session.⁷ Additionally, the humid and cool nature of shisha smoke makes it more pleasant than dry cigarette smoke thus promoting deeper inhalation of high volume smoke causing potentially increase harmful effects on lungs.⁹ FEV₁ and FVC are the best spirometric parameters to assess the lung functions. Strong evidences are available showing reduction in lung function test leading to subsequently lethal respiratory problems including cancer.⁷ Previous smoking-related studies have generally been focused on traditional cigarettes, while a few researches exist on shisha smoking. Most of the literature searched, addressed the adverse effects of cigarette smoking on

lung functions, while failing to address the impact of shisha on lung function. Similarly, researches are available showing comparison of Pulmonary function test parameters (PFTs) among cigarette smokers or shisha smokers with nonsmokers but data concerning comparison of PFTs among shisha and cigarette smokers is deficient and impact of shisha on lung functions is still hypothesized. This study was designed to determine the impact of shisha and cigarette smoking on lung functions and compare the PFTs between shisha, cigarette smokers and nonsmokers.

METHODOLOGY

This cross-sectional study was conducted at Aziz Fatima Medical and Dental College Faisalabad from January to September 2018. Ethical approval was taken from the Institutional Ethical committee (EC/2018/01). This study consisted of 100 male college students of age 18 to 25 years. Participants were enrolled on a voluntary basis. Prior to study students of Faisalabad based colleges were invited for study. A detailed interview of subjects was taken. Subjects were questioned regarding the smoking habits such as cigarette, Shisha and other tobacco product consumption, age they started smoking, the average duration of smoking, and the average number of cigarettes smoked per day. History of respiratory symptoms including cough, sputum and wheeze were also inquired. All the relevant information was recorded on a pre-designed questionnaire. Female subjects were excluded. Subjects who used to smoke but had since stopped were excluded from study. Additionally, subjects with history of chronic obstructive pulmonary diseases, bronchial asthma, malignancy, chronic history of cough, sputum, breathlessness or chest tightness, abnormal chest wall, history of hemoptysis, drug addiction, cardiovascular disease, history of chest surgery or with history of neuromuscular disorder affecting the respiratory muscle were excluded. Initially, 150 subjects were interviewed, clinical history and examination were conducted. Finally, 100 healthy volunteers were selected. Subjects who currently smoked cigarettes were classified as cigarette smokers. Subjects using shisha were categorized as shisha smokers. A third category was formed which included subjects using both shisha and cigarette. Subjects with no history of any type of smoking were classified as non-smokers. Prior to enrolment informed consent was taken. Anthropometric measurements including height and weight were taken by standard protocols and BMI was calculated by formula $\text{weight in kg} / \text{height in m}^2$.

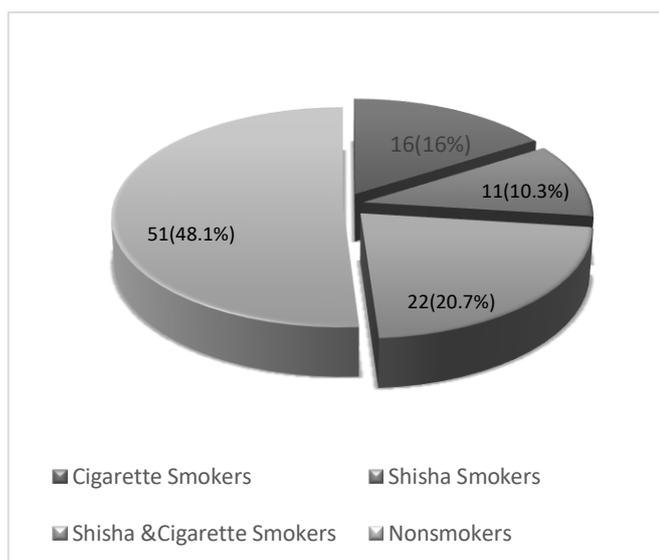
Lung functions were assessed by forced expiratory volume in the 1st second (FEV₁), forced vital capacity (FVC) and FEV₁/FVC. Pulmonary function tests (PFTs) were performed by digital spirometer based on the guidelines recommended by the American Thoracic Society (ATS) and the European Respiratory Society (ERS).⁸ The tests were performed on the subjects in standing position, wearing nose clips. Subjects were asked to perform breathing through a disposable mouthpiece to record normal tidal breathing for 1 to 2 minutes. At the end of a normal tidal expiration, subjects were asked to inhale as deeply as possible and then exhale as deeply as possible to get all the air out of the lungs. Three maneuvers for FEV₁ and FVC were performed to minimize the errors. Highest values were recorded for the data analysis.

Statistical analysis: Data was analyzed using SPSS version 22. The demographic data was evaluated by descriptive statistics. Continuous variables like age, height, weight, BMI, FEV₁ and FVC, were expressed as mean \pm standard deviation (SD). Categorical variables were presented in percentages and frequencies (cigarette, shisha and nonsmokers). Means of parameters between the groups were compared by ANOVA followed by the Post Hoc Tukey test for multiple comparisons. p value \leq 0.05 was considered as statistically significant.

RESULTS

The study consisted of 100 participants of mean age 20.71 \pm 1.87 years. Frequencies and percentages of smokers and nonsmokers are presented in figure 1.

Figure 1: Distribution of Smokers and Nonsmokers



Demographic characteristics of study population are given in table1.

Table 1: Demographic Characteristics of study Population

Demographic Variables	Mean	Standard Deviation
Age (years)	20.71	1.87
Height (meters)	1.17	1.75
Weight in (kilogram)	77.26	17.87
Body mass index (BMI)	25.3	7.1

The results given in the Table 2 shows that the shisha smokers have lowest FVC values followed by cigarette smokers as compared to the subjects using both cigarettes and shisha and also from non-smokers. Significant difference was noted in mean FVC values of smokers and nonsmokers (p value=0.001).

Table 1: Comparisons of Pulmonary Function Test Among Shisha, Cigarettes Smokers and Non-smokers n= (100)

Pulmonary function test (PFT)	Smokers			Non-smokers (n=51)	P values
	Cigarette (n=16)	Shisha (n=11)	Users of both (n= 22)		
Mean \pm Standard Deviation					
FVC (L)	2.89 \pm 1.04	2.42 \pm 1.07	4.2 \pm 0.98	4.50 \pm 0.22	0.001*
FEV1 (L)	1.50 \pm 0.70	2.73 \pm 0.97	2.28 \pm 0.72	4.75 \pm 11.8	0.046*
FEV1/FVC (%)	50.5 \pm 16.7	63 \pm 28.2	63 \pm 22.2	69.67 \pm 25.4	0.040*

Forced vital capacity (FVC), forced expiratory volume in one second (FEV₁). Differences were considered statistically significant at p \leq 0.05.

Multiple comparison by post Hoc Tukey's test indicates that FVC of the shisha smokers are significantly different from the users of both cigarettes and shisha (p value = 0.002) and non-smokers (p value = 0.000). However, FVC values of shisha and cigarette smokers were not significantly different (p value = 0.59). Similarly, FVC of cigarette smokers is

significantly different from those using both cigarettes and shisha (p value = 0.025) and from non-smokers (p value = 0.005). No significant difference in FVC values was observed between nonsmokers and subjects using both shisha and cigarettes (p value=0.73). FEV₁ was significantly lower in cigarette smokers as compared to the other study groups. Multiple comparison of FEV₁ among the study groups shows that mean FEV₁ of cigarette smokers is significantly different from those of non-smokers (p value = 0.046) (Table2). No significant reduction in FEV₁ of shisha users was observed. FEV₁ of Shisha smokers, was not statistically different from nonsmokers (p value = 0.89) and users of both shisha and cigarette (p value = 0.99), FEV₁ of shisha users was higher than cigarette smokers but difference was statistically not significant (p value =0.66).FEV₁/FVC is also lowest in cigarette smokers. Significant difference in mean values of FEV₁/FVC was noted between smokers and non-smokers (p value =0.040) (Table1).Multiple comparisons shows significant difference in mean FEV₁/FVC among cigarette smokers and non-smokers (p value=0.023). Although FEV₁/FVC of shisha smokers were higher than those of cigarette smokers (p value= 0.449) and lower than nonsmokers but the differences was not statistically significant. (p value = 0.87).

DISCUSSION

Shisha and cigarette smoking are major health challenges in Pakistan. Its high prevalence among the youngsters is alarming. This is a matter of immense public health importance as it is a leading cause of cerebrovascular accidents, chronic diseases including atherosclerosis and hypertension. Smoking is also a leading risk for oral, pharyngeal, laryngeal and lung carcinoma etc.⁶ Tobacco smoking is a major cause of decline in lung functions leading to chronic obstructive pulmonary disease (COPD) and its related morbidities and mortalities due to inhaling this poisonous chemical.¹⁰ COPD is the fourth leading cause of death in the world.⁸ Evidence are available showing greater annual rates of decline in forced expiratory volume in 1st second (FEV₁) and greater prevalence of COPD in smokers in contrast to nonsmokers.⁷ Current study was conducted to evaluate the impact of shisha and cigarette smoking on pulmonary functions of the young adults of 22 to 25 years. PFTs including FVC, FEV₁ and FEV₁/FVC are the best parameters for assessing pulmonary function.⁸ The reduction in parameters of pulmonary function test (PFT) reflects the deterioration of pulmonary function prior to clinical symptoms and

it results can be used to recognize subjects at risk of pulmonary diseases.¹¹

In the present study, FVC was significantly lower in cigarette smokers as compared to nonsmokers and subjects using both shisha and cigarettes. However, FVC of cigarette smokers was not significantly different from those of shisha smokers. Significant higher reduction was also noted in FEV₁ and FEV₁/FVC. These changes in the pattern of PFTs reflect COPD in cigarette smokers. The reduction in FVC of the smoker may be due to reduction in strength of the respiratory muscles. Previous literature shows that cigarette smoking affects the respiratory muscles through the influence of free radicals on the vascular system causing reduction in respiratory muscle blood supply which adversely impacts respiratory function.¹¹ Our results concerning FVC in cigarette smokers are in line with the study conducted by Tantisuwat et al in Thailand reporting reduced FVC levels. However concerning FEV₁, this study reported contradictory results and did not find significant difference in FEV₁ among cigarette smokers and nonsmokers.¹¹ Another study conducted in Karachi Pakistan states, decline in, FVC, FEV₁ and FEV₁/FVC in young smokers of age 19-25 years of age compared to the nonsmokers of same age group.¹² Like the cigarette smokers, FVC of the shisha smokers was significantly lower than those of nonsmokers. These results suggest that deep inhalation of shisha smoke due to its humid and cold characteristics affect the lung capacity of shisha smokers. FEV₁ and FEV₁/FVC of shisha smokers were higher than those of cigarette smokers and lower than nonsmokers. Although reduction in these parameters were not statistically significant difference was not found. The results of previous Turkish study is in agreement with current results showing a smaller impact of shisha smoke on lung function as compared to cigarette smoke.¹³ Boskabady et al reported reduction in most of PFTs values except FEV₁ in shisha smokers than nonsmokers and normal inspiration in cigarette smokers.⁸ Contradictory to our results, Raad et al found significant reduction in all three parameters FEV₁, FVC and lower FEV₁/FVC in shisha smokers.¹⁴ A Saudi study conducted for the evaluation of lung functions of young Saudi shisha smokers also reported reduction in FEV₁, FEV₁/FVC in shisha smokers than in the control group.⁷ In subjects using both cigarette and shisha, all parameters of pulmonary function test including forced vital capacity (FVC), forced expiratory volume in one second (FEV₁), FEV₁/FVC are similar to nonsmokers. FVC, FEV₁ values are significantly higher than subjects that use only cigarettes or shisha smoke. FEV₁/FVC are

also higher but the difference was not statistically significant. Possible reasons for PFTs in these subjects might be because of the fact that they use both cigarettes and shisha; hence there are a lesser number of cigarettes which is more harmful than shisha. This is justified by previous research documenting the significant negative relation of PFT values with total amount of smoking.⁸ In addition, other possible cause might be difference in mode of inhalation of cigarette smoke as suggested by Boskabady et al. who stated that cigarette smokers, inhale smokes, during quiet breathing. Thus, they have smaller reduction in pulmonary function, as compared to the deep inspiration of shisha smoke leading to a significant decrease in lung function.⁸

The findings of this study suggest that the lung function is adversely affected by shisha smoke. However, it is less injurious than that of cigarette smoke may be due to the filtration of toxic components of smoke by water pipe. In contrast to our result previous study reported that shisha and deep inspiration cigarette smoking have similar adverse impact on lung function.⁸ Similarly, Meo et al also found a significant worsening in lung function parameters and the pattern of pulmonary function impairment was COPD in shisha smokers. This finding of Meo et al contradicts current results that shisha smoking is less injurious than cigarette.⁷ Public awareness programs in schools, colleges and universities should be arranged to raise awareness and impart health education about the hazardous effects of shisha smoking.

Limitations: In the current study only FVC, FEV1 and FEV1/FVC was evaluated. In addition to these, other parameters of PFTs like peak expiratory flow (PEF), maximal mid-expiratory flow (MMEF) and maximal expiratory flow (MEF) should have been examined to determine the impact of shisha on lung function. In addition to PFTs, respiratory symptoms such as cough, wheeze, chest tightness and production of sputum should be investigated in shisha smokers on a broader scale.

CONCLUSION

Lung function parameters FVC FEV1, FEV1/FVC, were reduced in cigarette and shisha smokers as compared to non-smokers. Shisha and cigarette both adversely affect lung functions, however shisha is less harmful than cigarette smoking.

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Conflicts of Interest: None.

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Author's Contribution:

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|-----------------------------------|--|
| Dr. Muhammad Sarim Mumtaz | Brings the ideas, study design, data collection, supervision of the research project, Revise all content of manuscript and approve it. |
| Dr. Qamar Javaid Pansota | Provides insight for research formulation, data collection, manuscript writing. Revise and approval of final version. |
| Dr. Muhammad Muneeb Majeed | Data collection, data analysis, interpretation of results critically revise and approve the final manuscript. |
| Dr. Mahnoor Mujeeb | Data collection, manuscript writing, revise and approve the final version. |
| Dr. Umar Abdur Rehman | Data collection, manuscript writing, revise and approve the final version. |
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