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Comparison of the Effects of Cigarettes, E-Cigarettes, and Shisha on Pulmonary Function in Young Adults

Tehmina Khalid[1], Tehreem Shabbir[1], Abdur Rehman[2], Nazia Jabeen[3], Hira Muzamil[1]

[1]Department of Medical Laboratory Technology, Minhaj University, Lahore, Punjab, Pakistan.
[2]Riphah International University, Faisalabad, Punjab, Pakistan.
[3]Max Clinics and Max Laboratories, Faisalabad, Punjab, Pakistan.

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Correspondence to: Tehmina Khalid, Department of Medical Laboratory Technology, Minhaj University, Lahore, Punjab, Pakistan.
Email: tehminakhalid120@gmail.com

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ABSTRACT

The trend of smoking in youth has become a standard part of our modern society. According to the World Health Organization (WHO), Southeast Asian countries have the highest rates of tobacco smoking. The WHO has observed a 47% prevalence in both genders among those aged 15 and older. Water pipe smoking, known by a variety of names like Shisha, Narghile, Ghoza, Hubble Bubble, and e-cigarette, has been in vogue for the last many centuries. Its origin from one historical account suggested that it was invented in India by a physician, Hakim Abul Fath, during the reign of Emperor Akbar as a less harmful method of tobacco use. Other studies suggested that it was first used in South Africa, Persia, Ethiopia and other countries. It has been claimed that more than 100 million people worldwide smoke water pipes. It has been a common practice in the Arabian Peninsula, Turkey, India, Pakistan, Bangladesh and China. As the addiction to shisha and cigarette smoking is increasing day by day among youngsters, especially students, we collected data from smokers and non-smokers to know the effect of shisha and cigarette smoking on the lungs and how it affects the lung function. This study provided robust evidence of the detrimental effects of smoking on lung function, with significant reductions in FEV1, FVC, and the FEV1/FVC ratio among smokers compared to non-smokers. These findings are consistent with previous research and highlighted the need for continued efforts in smoking prevention and cessation to improve respiratory health and reduce the burden of smoking-related diseases. Public health initiatives, policy measures, and further research are essential to address the challenges posed by smoking and protect population health.

INTRODUCTION

Smoking is the leading preventable cause of mortality worldwide and a serious health concern. Eighty percent of the world's 1.3 billion smokers reside in developing nations. One in ten adults worldwide are said to have died as a result of cigarettes, making them the second most common cause of death worldwide. By 2030, 8.3 million fatalities are predicted to be attributable to smoking. Smoking poses health risks no matter how it is done. Different smoking methods, such as cigarettes, e-cigarettes, or shisha/e-cigarettes, are available in different parts of the world. Shisha use is quite common in regions like the Middle East, where tobacco use has permeated the culture, particularly among youth. [1].

Originating in China in 2003, electronic cigarettes, commonly referred to as e-cigarettes and e-shisha, are a relatively new means of delivering nicotine [2]. Any electronic device that heats a nicotine-containing solution (e-liquid) to produce an aerosol is referred to as an Electronic Nicotine Delivery System (ENDS). Various chemical components, such as glycol, vegetable glycerin, propylene, ethylene glycol, and polyethylene glycol, combined with varying proportions of nicotine, nicotine metabolites, and related contaminants, are aerosolized by these devices. [3]. Youth use of e-cigarettes is increasing gradually worldwide, particularly in urban and affluent areas [4]. By 2023, the fast-expanding e-cigarette market might overtake the traditional tobacco sector. The estimated value of the global e-cigarette market is already approximately $10 billion, and it is only expected to grow as ENDS become more and more well-known worldwide. Currently, 7,700 e-cigarette flavors and 200 e-cigarette brands are being promoted worldwide [5].

The public's health is increasingly at danger due to the increasing usage of e-cigarettes and other vaping products. The growing popularity of e-cigarettes has generated a lot of debate and conjecture about the possible hazards in both the public and medical spheres. It is impossible to

overlook the potential health risks associated with prolonged e-cigarette use because of the many e-liquid constituents that are inhaled [6].

Waterpipe, narghile, gyoza, berry, shui yan dai, hubble bubble, and e-cigarette smoking are some of the names for shit smoking [7]. Shisha smoking is now widespread in Arab nations and has its origins in Ethiopia, South Africa, India, and Persia [8]. It is often utilized by young people, the wealthy, and people living in cities, particularly in upscale areas. Globally, it has been gradually gaining traction across all age groups, but particularly among teenagers, and in the Middle East, it has become increasingly well-known as Shisha-cafe culture [9].

Lung cancer risk was increased by the carbonic and tar- and PAH-containing substances found in shisha, as well as by formaldehyde and acetaldehyde. Additionally, a person's risk of developing laryngeal cancer is increased by carbonic content [10].

Tests of lung function are frequently used to characterize how restriction or blockage affects lung function. It is a strong diagnostic tool that plays a vital role in identifying early lung injury. It is also used to track the origin of the illness and the therapeutic effectiveness of different treatment plans. Following reports suggesting the FEV1/FVC Ratio, Forced Vital Capacity (FVC), and Forced Expiratory Volume in 1 s (FEV1) are critical for the identification of obstructive and restrictive respiratory illness, the spirometry measures have become increasingly popular [11]. Similarly, a straightforward, secure, trustworthy, and non-invasive method for determining the degree of asthma and pulmonary inflammation is to measure fractional nitric oxide (NO) in exhaled breath (FeNO) [12].

METHODS

Study Design and Duration

This descriptive cross-sectional study was conducted over a period of six months, from November 2023 to April 2024.

Study Setting

Face-to-face interviews were conducted using a standardized consent form following verbal consent. Urdu, the country's official language, was used to develop the consent form. A unique survey was created and completed to gather all the data, such as age, sex, location, and the duration of their cigarette and shisha addiction.

A digital spirometer was then used to perform pulmonary function tests, such as forced vital capacity (FVC), forced expiratory volume in the first second (FEV1), and FEV1/FVC.

Participants and Sampling Approach

Out of the approximately 100 individuals selected, 50 were non-smokers and the remaining 50 were addicted smokers and shisha users. The age range of the participants will be 18 to 25.

Eligibility Criteria

Including

Those between the ages of 18 and 25 who are addicted to cigarettes or shisha are not eligible to participate in the study, nor are those who have lung disorders or are not hooked to smoking. Additionally, individuals younger than 15

Excluding

Those with lung conditions and those without a smoking addiction are excluded.

Ethical Considerations

Ethical approval for this study was obtained from the Research and Ethics Committee of Riphah College of Rehabilitation and Allied Health Sciences, Lahore, Pakistan. Written informed consent was obtained from all participants prior to data collection. Participation was voluntary, and the confidentiality of all personal and clinical information was maintained.

Statistical Analysis

Data was converted into digital (0 and 1) form after being entered into an Excel sheet. SPSS v13 software will be used to do the statistical analysis on the Excel sheet.

RESULTS

One of the most important metrics in pulmonary function tests is FEV1 (Forced Expiratory Volume in One Second). It measures the amount of air that a person can exhale forcibly in a single second. For the diagnosis and ongoing monitoring of lung problems such asthma, chronic obstructive pulmonary disease (COPD), and other breathing-related disorders, this measurement is crucial. While higher FEV1 readings generally indicate greater lung function, lower values imply clogged or limited airways. Forced Vital Capacity (FVC), Forced Expiratory Volume in 1 second (FEV1), and the FEV1/FVC ratio are the three main metrics used in the accompanying table to compare the lung function of smokers with non-smokers.

Table 1

Comparative Analysis of Lung Function Parameters in Smokers and Non-Smokers

	Smoker Non-smoker	N	Mean	Std. Deviation	Std. Error Mean
FEV1 (L)	smoker	50	3.248	.2435	.0344
	non-smoker	50	3.900	.1841	.0260
FVC (L)	smoker	50	4.216	.2469	.0349
	non-smoker	50	4.822	.2359	.0334
FEV1/FVC %	smoker	50	77.034	1.9842	.2806
	non-smoker	50	80.902	1.0512	.1487

FEV1 (L)

• **Smokers**: The average FEV1 for smokers is 3.248 L, with a standard error of 0.0344 L and a standard deviation of 0.2435 L.

• **Nonsmokers:** Nonsmokers have a higher mean FEV1 of 3.900 liters, with a standard variation of 0.1841 liters and a standard error of 0.0260 liters.

FVC (L)

• **Smokers:** Smokers' FVC is 4.216 liters on average, with a standard deviation of 0.2469 liters and a standard error of 0.0349 liters.

• **Nonsmokers:** 4.822 liters is the average FVC for non-smokers, with a standard variation of 0.2359 liters and a standard error of 0.0334 liters.

FEV1/FVC (%)

• **Smokers:** Smokers had an average FEV1/FVC ratio of 77.034%, with a standard error of 0.2806% and a standard deviation of 1.9842%.

• **Nonsmokers:** Nonsmokers have a higher mean FEV1/FVC ratio (80.902%), with a standard deviation of 1.0512% and a standard difference of 0.1487%.

Table 2

Independent t-Test Comparison of Pulmonary Function Parameters Between Smokers and Non-Smokers

		Levene's test for equality of variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	upper
FEVI (L)	Equal variances assumed	2.528	.115	-15.105	98	.000	-.6520	.0432	-.7377	-.5663
	Equal variances not assumed			-15.105	91.217	.000	-.6520	.0432	-.7377	-.5663
FVC (L)	Equal variances assumed	.621	.433	-12.549	98	.000	-.6060	.0483	-.7018	-.5102
	Equal variances not assumed			-12.549	97.795	.000	-.6060	.0483	-.7018	-.5102
FEV1/FVC %	Equal variances assumed	27.598	.000	-12.181	98	.000	-3.8680	.3176	-4.4982	-3.2378
	Equal variances not assumed			-12.181	74.499	.000	-3.8680	.3176	-4.5007	-3.2353

The table compares the means of FEV1 (L), FVC (L), and FEV1/FVC (%) between smokers and non-smokers using the results of an independent samples t-test. According to Levene's Test for Equality of Variances, the t-test results are displayed under two assumptions: assuming and not assuming equal variances.

Levene's Test for Equality of Variances

Levene's test assesses the equality of variances between the two groups (smokers and non-smokers).

- FEV1 (L): F = 2.528, Sig. = 0.115 (p > 0.05) indicates no significant difference in variances.
- FVC (L): F = 0.621, Sig. = 0.433 (p > 0.05) indicates no significant difference in variances.
- FEV1/FVC (%): F = 27.598, Sig. = 0.000 (p < 0.05) indicates a significant difference in variances.

T-test for Equality of Means

The t-test compares the two groups' means under equal and unequal variance assumptions.

FEV1 (L)

- Equal variances assumed: t (98) = -15.105, Sig. (2-tailed) = 0.000
- Equal variances not assumed: t(91.217) = -15.105, Sig. (2-tailed) = 0.000
- Mean Difference: -0.6520 L
- Std. Error Difference: 0.0432 L
- 95% Confidence Interval: [-0.7377, -0.5663]

FVC (L)

- Equal variances assumed: t(98) = -12.549, Sig. (2-tailed) = 0.000
- Equal variances not assumed: t(97.795) = -12.549, Sig. (2-tailed) = 0.000
- Mean Difference: -0.6060 L
- Std. Error Difference: 0.0483 L
- 95% Confidence Interval: [-0.7018, -0.5102]

FEV1/FVC (%)

- Equal variances assumed: t(98) = -12.181, Sig. (2-tailed) = 0.000
- Equal variances not assumed: t(74.499) = -12.181, Sig. (2-tailed) = 0.000
- Mean Difference: -3.8680%
- Std. Error Difference: 0.3176%
- 95% Confidence Interval: [-4.4982, -3.2378]

DISCUSSION

This study compares three key respiratory measures—FEV1 (Forced Expiratory Volume in the first second), FVC (Forced Vital Capacity), and the FEV1/FVC ratio—between two groups: individuals who consume shisha, e-cigarettes, and cigarettes (smokers) and those who do not smoke (non-smokers) (Raad et al., 2011). The analysis includes Levene's Test for Equality of Variances and t-tests for Equality of Means to determine the impact of smoking on these respiratory parameters. The results show a statistically significant decrease in FEV1 among smokers compared to non-smokers (mean difference = -0.6520, 95% CI [-0.7377, -0.5663]). This indicates that smokers have a significantly lower FEV1. FEV1 measures the volume of air that can be forcefully exhaled in the first second of expiration, and a decrease in this value suggests compromised lung function. The significant result, consistent across both variance assumptions, underscores the detrimental effect of smoking on lung function.

Smokers may experience reduced lung capacity and airway obstruction, consistent with existing literature on the adverse effects of smoking on respiratory health. This finding highlights the importance of smoking cessation for preserving lung function(Akhter, Mustafa, Salehin, Yeasmin, & Amin, 2015).

The analysis reveals a significant reduction in FVC among smokers compared to non-smokers (mean difference = -0.6060, 95% CI [-0.7018, -0.5102]). FVC measures the total volume of air that can be exhaled after full inhalation, and a decrease in this measure indicates a reduction in overall lung capacity

The decrease in FVC among smokers further supports the notion that smoking negatively impacts lung capacity. This reduction can be attributed to the damage caused by smoking to the lung tissue and airways, which may lead to conditions such as chronic obstructive pulmonary disease (COPD).

The FEV1/FVC ratio is significantly lower in smokers than in non-smokers (mean difference = -3.8680, 95% CI [-4.4982, -3.2378]). This ratio is a critical indicator of airway obstruction and is used to diagnose obstructive lung diseases. A lower ratio suggests that smokers have a higher degree of airway obstruction than non-smokers.

A reduced FEV1/FVC ratio aligns with the understanding that smoking leads to obstructive changes in the airways, such as inflammation and narrowing, contributing to conditions like asthma and COPD. The significant difference underscores the harmful effects of smoking on airway patency and lung function.

CONCLUSIONS

The findings of this study robustly support the hypothesis that smoking, whether through shisha, e-cigarette, or cigarettes, has a detrimental impact on respiratory health. Smokers exhibit significantly reduced FEV1, FVC, and FEV1/FVC ratio values compared to non-smokers. These results emphasize the harmful effects of smoking on lung function and highlight the urgent need for public health interventions to promote smoking cessation and prevent respiratory diseases.

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